



NUREG-1939, Vol. 1

**Draft Environmental Impact Statement  
for Combined Licenses for  
Virgil C. Summer Nuclear Station  
Units 2 and 3**

**Draft Report for Comment**

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

**Regulatory Division  
Special Projects Branch  
Charleston District  
U.S. Army Corps of Engineers  
Charleston, SC 29403-5107**



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# **Draft Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3**

## **Draft Report for Comment**

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**Division of Site and Environmental Review  
Office of New Reactors  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001**

**Regulatory Division  
Special Projects Branch  
Charleston District  
U.S. Army Corps of Engineers  
Charleston, SC 29403-5107**



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# Abstract

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This environmental impact statement (EIS) has been prepared to satisfy the requirements of the National Environmental Policy Act of 1969, as amended (NEPA). The EIS has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by South Carolina Electric and Gas (SCE&G), acting for itself and for Santee Cooper (the State-owned electric and water utility, formally called the South Carolina Public Service Authority) for combined construction permits and operating licenses (combined licenses or COLs). The proposed actions related to the SCE&G application are (1) NRC issuance of COLs for two new nuclear power reactor units (Units 2 and 3) at the V.C. Summer Nuclear Station (VCSNS) site in Fairfield County, South Carolina, and (2) U.S. Army Corps of Engineers (USACE) permit action on a Department of the Army (DA) Individual Permit application to perform certain activities on the site. The USACE is participating with the NRC in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the analysis by the NRC and USACE staff that considers and weighs the environmental impacts of building and operating two new nuclear units at the VCSNS site and at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. The EIS also addresses Federally listed species, cultural resources, and essential fish habitat issues.

The EIS includes the evaluation of the proposed project's impacts to waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The USACE will base its evaluation of the DA Individual Permit application on the requirements of USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process.

After considering the environmental aspects of the proposed NRC action, the staff's preliminary recommendation to the Commission<sup>(a)</sup> is that the COLs be issued as requested. This recommendation is based on (1) the application, including the Environmental Report (ER), submitted by SCE&G; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE permit decision will be made following issuance of the final EIS.

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(a) The Commission is the NRC body of up to five commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.



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# Executive Summary

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By letter dated March 27, 2008, the U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from South Carolina Electric and Gas (SCE&G), acting for itself and for Santee Cooper (the State-owned electric and water utility, formally called the South Carolina Public Service Authority) for combined construction permits and operating licenses (combined licenses or COLs) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 to be located adjacent to the existing Unit 1 in Fairfield County, South Carolina. The NRC staff's review is based on Revision 1 of the Environmental Report (ER), received February 13, 2009, responses to requests for additional information, and supplemental letters.

On March 2, 2010, SCE&G submitted a joint Federal/State Application for the Department of the Army Individual Permit to the U.S. Army Corps of Engineers (USACE). The USACE application number is SAC 2007-1852-SIR.

The proposed actions related to the VCSNS Units 2 and 3 application are (1) NRC issuance of COLs for construction and operation of two new nuclear units at the VCSNS site, and (2) USACE permit action on a Department of the Army (DA) Individual Permit application pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The U.S. Environmental Protection Agency has the authority to review and veto USACE decisions of Section 404 permits. The USACE is participating collaboratively on the review team. The reactors specified in the application are Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water reactors. The application references Revision 17 of the AP1000 certified design.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA), directs that an EIS be prepared 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. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an environmental impact statement (EIS).

The purpose of SCE&G's requested NRC action is to obtain COLs to construct and operate two baseload nuclear power plants. These licenses are necessary but not sufficient for construction and operation of the units. A COL applicant must obtain and maintain the necessary permits from other Federal, State, and local agencies and permitting authorities. Therefore, the purpose of the NRC's environmental review of the SCE&G application is to determine if two new nuclear power plants of the proposed design can be constructed and operated at the VCSNS site without unacceptable adverse impacts on the human environment. The SCE&G permit

1 application to the USACE is for work to prepare the site and facilities for a nuclear power-  
2 generation station at the existing VCSNS site.

3 The NRC began the environmental review process described in 10 CFR Part 51 by publishing in  
4 the *Federal Register* on January 5, 2009, a Notice of Intent to prepare an EIS and conduct  
5 scoping. Two scoping meetings were held to obtain public input on the scope of the  
6 environmental review. The first meeting was held in Winnsboro, South Carolina, on January 27,  
7 2009. The second meeting was held in Blair, South Carolina, on January 28, 2009. In addition,  
8 NRC held a public informational meeting for the local community on March 28, 2009. The NRC  
9 staff reviewed the comments received during the scoping process and contacted Federal, State,  
10 Tribal, regional, and local agencies to solicit comments.

11 To gather information and to become familiar with the sites and their environs, the NRC and its  
12 contractor, Pacific Northwest National Laboratory, visited the VCSNS site and four alternative  
13 sites in March 2009. During the site visits, the NRC staff and its contractor met with SCE&G  
14 staff, public officials, and the public. Included in this EIS are (1) the results of the review team's  
15 analyses, which consider and weigh the environmental effects of the proposed actions; (2)  
16 potential mitigation measures for reducing or avoiding adverse effects; (3) the environmental  
17 impacts of alternatives to the proposed action; and (4) the NRC staff's recommendation  
18 regarding the proposed action.

19 To guide its assessment of the environmental impacts of a proposed action or alternative  
20 actions, the NRC has established a standard of significance for impacts based on Council on  
21 Environmental Quality guidance. Table B-1 of 10 CFR Part 51, Subpart A, Appendix B,  
22 provides the following definitions of the three significance levels – SMALL, MODERATE, and  
23 LARGE:

24 SMALL – Environmental effects are not detectable or are so minor that they will  
25 neither destabilize nor noticeably alter any important attribute of the resource.

26 MODERATE – Environmental effects are sufficient to alter noticeably, but not to  
27 destabilize, important attributes of the resource.

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

30 Potential mitigation measures were considered for each resource category and are discussed in  
31 the appropriate sections of the EIS.

32 In preparing this EIS, the NRC staff, its contractor staff, and USACE staff, referred to collectively  
33 as the review team, evaluated the applications, including the ER submitted by SCE&G;  
34 consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in

1 NUREG-1555, *Environmental Standard Review Plan* (ESRP; NRC 2000). In addition, the  
2 review team considered the public comments related to the environmental review received  
3 during the scoping process. Comments within the scope of the environmental review are  
4 included in Appendix D of this EIS.

5 The NRC staff's preliminary recommendation to the Commission related to the environmental  
6 aspects of the proposed action is that the COLs be issued as requested. This recommendation  
7 is based on (1) the application, including the ER submitted by SCE&G; (2) consultation with  
8 other Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's  
9 consideration of comments related to the environmental review that were received during the  
10 scoping process; and (5) the assessments summarized in this EIS, including the potential  
11 mitigation measures identified in the ER and this EIS. The USACE will base its evaluation of  
12 the DA Individual Permit application on the requirements of USACE regulations, the Clean  
13 Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process. The  
14 USACE's permit decision will be made after issuance of the final EIS.

15 A 75-day comment period will begin on the date of publication of the EPA Notice of Availability  
16 of the filing of the draft EIS to allow members of the public and agencies to comment on the  
17 results of the environmental review. During this period, the NRC and USACE staff will conduct  
18 a public meeting near the VCSNS site to describe the results of the environmental review,  
19 provide members of the public with information to assist them in formulating comments on this  
20 EIS, respond to questions, and accept public comment. The public meeting also serves as the  
21 USACE public hearing, which means a public proceeding conducted for the purpose of  
22 acquiring information or evidence that will be considered in evaluating a proposed DA permit  
23 action and that affords the public an opportunity to present their views, opinions, and information  
24 on such permit actions or Federal projects. After the comment period, the review team will  
25 consider all the comments received during the comment period. These comments and review  
26 team responses will be included in the final EIS.

27 The NRC staff's evaluation of the site safety and emergency preparedness aspects of the  
28 proposed action will be addressed in the NRC's final Safety Evaluation Report.





1

## Abbreviations/Acronyms

2	7Q10	lowest flow for 7 consecutive days expected to occur once per decade
3	AADT	annual average daily traffic
4	ac	acre(s)
5	ACE	Ashepoo, Combahee, Edisto (river basin)
6	ac-ft	acre feet
7	ACHP	Advisory Council on Historic Preservation
8	A.D.	Anno Domini
9	ADAMS	Agencywide Documents Access and Management System
10	AIS	(South Carolina) Aquatic Invasive Species (Task Force)
11	ALARA	as low as reasonably achievable
12	AP1000	Advanced Passive 1000 pressurized water reactor
13	APE	Area of Potential Effect
14	ASTM	American Society for Testing and Materials
15	AQCR	Air Quality Control Region
16	AQI	Air Quality Index
17		
18	BA	biological assessment
19	BACT	Best Available Control Technologies
20	BEA	Bureau of Economic Analysis
21	BEIR	Biological Effects of Ionizing Radiation
22	BGEPA	Bald and Golden Eagle Protection Act
23	BLS	Bureau of Labor Statistics
24	BMP	best management practice
25	BOD	biochemical oxygen demand
26	BP	Before Present
27	Bq	becquerel(s)
28	BRWMA	Broad River Wildlife Management Area
29	Btu	British thermal unit(s)
30		
31	°C	degree(s) Celsius
32	C&D	construction and demolition debris
33	CAA	Clean Air Act
34	CBS	Carnagey Biological Services
35	CDC	U.S. Centers for Disease Control and Prevention
36	CDF	core damage frequency
37	CEDE	committed effective dose equivalent
38	CEQ	Council on Environmental Quality
39	CFL	compact fluorescent light

1	CFR	Code of Federal Regulations
2	cfs	cubic foot/feet per second
3	CGS	Cope Generating Station
4	Ci	curie(s)
5	cm	centimeter(s)
6	CO	carbon monoxide
7	CO <sub>2</sub>	carbon dioxide
8	COL	combined construction permit and operating license
9	COLA	combined license application
10	CORMIX	Cornell Mixing Zone Expert System
11	CPCN	Certificate of Environmental Compatibility and Public Convenience and
12		Necessity
13	CWA	Clean Water Act (aka Federal Water Pollution Control Act)
14	CWIS	cooling-water intake structure
15	CWS	circulating-water system
16	CY	calendar year
17		
18	d	day(s)
19	DA	Department of the Army
20	DAR	Daughters of the American Revolution
21	dB	decibel(s)
22	dBA	decibel(s) on the A-weighted scale
23	DBA	design basis accident
24	DCD	Design Control Document
25	DOE	U.S. Department of Energy
26	DOT	U.S. Department of Transportation
27	D/Q	deposition factor(s); annual normalized total surface concentration rate(s)
28	DSM	demand-side management
29	DTS	demineralized water treatment
30		
31	EA	environmental assessment
32	EAB	exclusion area boundary
33	EDE	effective dose equivalent
34	EE/DSM	energy efficiency/demand-side management
35	EIA	Energy Information Administration
36	EIS	environmental impact statement
37	ELF	extremely low frequency
38	EMF	electromagnetic field
39	EPA	U.S. Environmental Protection Agency
40	EPACT	Energy Policy Act
41	EPC	Engineer, Procure, Construct (contract)

1	EPRI	Electric Power Research Institute
2	EPT	Ephemeroptera, Plecoptera, and Trichoptera (Index)
3	ER	Environmental Report
4	ESA	Endangered Species Act
5	ESP	Early Site Permit
6	ESRP	Environmental Standard Review Plan
7		
8	°F	degree(s) Fahrenheit
9	FAA	Federal Aviation Administration
10	FES	Final Environmental Statement
11	FEMA	Federal Emergency Management Agency
12	FERC	Federal Energy Regulatory Commission
13	FP&S	Facilities Planning & Siting
14	FPC	Federal Power Commission
15	fps	foot (feet) per second
16	FPSF	Fairfield Pumped Storage Facility
17	FR	<i>Federal Register</i>
18	FSAR	Final Safety Analysis Report
19	FSER	Final Safety Evaluation Report
20	ft	foot/feet
21	ft <sup>2</sup>	square foot/feet
22	ft <sup>3</sup>	cubic foot/feet
23	FWS	U.S. Fish and Wildlife Service
24		
25	µg	microgram(s)
26	g	gram(s)
27	gal	gallon(s)
28	GCRP	U.S. Global Change Research Council
29	GEIS	Generic Environmental Impact Statement
30	GHG	greenhouse gas
31	GI-LLI	gastrointestinal lower large intestine
32	GIS	geographic information system
33	gpd	gallon(s) per day
34	gpm	gallon(s) per minute
35		
36	HLW	high-level waste
37	hr	hour(s)
38	HUC	Hydrologic Unit Code
39	Hz	hertz
40		
41	I	U.S. Interstate

1	IAEA	International Atomic Energy Agency
2	IEA	International Energy Agency
3	ICRP	International Commission on Radiological Protection
4	IEA	International Energy Agency
5	IGCC	integrated gasification combined cycle
6	in.	inch(es)
7	IRP	Integrated Resource Plan
8	IRWST	in-containment refueling water storage tank
9	ISFSI	independent spent-fuel storage installation
10		
11	kg	kilogram(s)
12	km	kilometer(s)
13	km <sup>2</sup>	square kilometer(s)
14	km/hr	kilometer(s) per hour
15	kV	kilovolt(s)
16	kW	kilowatt(s)
17	kW(e)	kilowatt(s) electric
18	kWh	kilowatt-hour(s)
19		
20	L	liter(s)
21	Ldn	day night average sound level
22	LEDPA	least environmentally damaging practicable alternative
23	lb	pound(s)
24	LFG	landfill-based gas
25	LLC	Limited Liability Company
26	LLW	low-level waste
27	LOCA	loss-of-coolant accident
28	LOS	level of service
29	LPZ	low-population zone
30	LTRA	Long-Term Reliability Assessment
31	LWA	Limited Work Authorization
32	LWD	large woody debris
33	LWR	light water reactor
34		
35	m	meter(s)
36	m <sup>2</sup>	square meter(s)
37	m <sup>3</sup>	cubic meter(s)
38	m <sup>3</sup> /s	cubic meter(s) per second
39	mA	milliampere(s)
40	mg	milligram(s)
41	MEI	maximally exposed individual

1	Mgd	million gallon(s) per day
2	mGy	milligray(s)
3	MHW	mean high water
4	mi	mile(s)
5	mi <sup>2</sup>	square mile(s)
6	MIT	Massachusetts Institute of Technology
7	mL	milliliter(s)
8	mm	millimeter
9	MMTCE	million metric tons of carbon equivalent
10	MOU	Memorandum of Understanding
11	MOX	mixed oxides
12	mpg	mile(s) per gallon
13	mph	mile(s) per hour
14	mrad	millirad
15	mrem	millirem
16	msl	mean sea level
17	mSv	millisievert(s)
18	MT	metric ton(nes)
19	MTU	metric ton(nes) uranium
20	MW	megawatt(s)
21	MW(e)	megawatt(s) electric
22	MWh	megawatt-hour(s)
23	MW(t)	megawatt(s) thermal
24	MWd	megawatt-day(s)
25		
26	NA	not applicable
27	NAAQS	National Ambient Air Quality Standard
28	NAVD	Northern American Vertical Datum
29	NCBI	North Carolina Biotic Index
30	NCI	National Cancer Institute
31	NCRP	National Council on Radiation Protection and Measurements
32	NCW&SA	Newberry County Water & Sewer Authority
33	NEI	Nuclear Energy Institute
34	NEPA	National Environmental Policy Act of 1969, as amended
35	NERC	North American Electric Reliability Corporation
36	NESC	National Electrical Safety Code
37	NGVD	National Geodetic Vertical Datum
38	NHPA	National Historic Preservation Act
39	NIEHS	National Institute of Environmental Health Sciences
40	NMFS	National Marine Fisheries Service
41	NO <sub>2</sub>	nitrogen dioxide

1	NO <sub>x</sub>	nitrogen oxides
2	NPDES	National Pollutant Discharge Elimination System
3	NRC	U.S. Nuclear Regulatory Commission
4	NRHP	National Register of Historic Places
5	NSA	New South Associates
6	NSPS	new source performance standard
7	NTU	Nephelometric Turbidity Units
8	NUREG	U.S. Nuclear Regulatory Commission technical document
9	NWI	National Wetlands Inventory
10		
11	O <sub>3</sub>	ozone
12	ODCM	Offsite Dose Calculation Manual
13	OECD	Organization for Economic Cooperation and Development
14	OL	operating license
15	OSHA	Occupational Safety and Health Administration
16	OW	observation well
17		
18	p.	page
19	PAM	primary amoebic meningoencephalitis
20	PARS	Publicly Available Records System
21	PBA	powerblock area
22	pCi	picocurie(s)
23	pH	measure of acidity or basicity in solution
24	PIR	Public Interest Review
25	PIRF	Public Interest Review Factor
26	PK–12	preschool through 12th grade
27	PM	particulate matter
28	PM <sub>10</sub>	particulate matter with an aerodynamic diameter of 10 microns or less
29	PM <sub>2.5</sub>	particulate matter with an aerodynamic diameter 2.5 microns or less
30	pp.	pages
31	ppm	part(s) per million
32	PRA	probabilistic risk assessment
33	PSC	Public Service Commission
34	PSCSC	Public Service Commission of South Carolina
35	PSD	Prevention of Significant Deterioration (Permit)
36	PURPA	Public Utility Regulatory Policies Act
37	PV	photovoltaic
38		
39	QL	quantification limit
40		

1	rad	radiation absorbed dose
2	RAI	Request(s) for Additional Information
3	RCRA	Resource Conservation and Recovery Act of 1976, as amended
4	rem	roentgen equivalent man
5	REMP	radiological environmental monitoring program
6	RFP	Request for Proposal
7	RIMS II	Regional Input-Output Modeling System
8	ROI	region of interest
9	RRS	(SERC's) Reliability Review Subcommittee
10	Ryr	reactor year
11		
12	μS/cm	microsievert(s) per centimeter
13	s or sec	second(s)
14	SACTI	Seasonal/Annual Cooling Tower Impact (prediction code)
15	SAMA	severe accident mitigation alternative
16	SAMDA	severe accident mitigation design alternative
17	Santee Cooper	The State-owned electric and water utility, formally called South Carolina Public
18		Service Authority.
19	SC	South Carolina
20	SCBCB	South Carolina Budget and Control Board
21	SCDAH	South Carolina Department of Archives and History
22	SCDHEC	South Carolina Department of Health and Environmental Control
23	SCDNR	South Carolina Department of Natural Resources
24	SCDOT	South Carolina Department of Transportation
25	SCE&G	South Carolina Electric and Gas
26	SCFC	South Carolina Forestry Commission
27	SCIAA	South Carolina Institute of Archaeology and Anthropology
28	SCORS	South Carolina Office of Research and Statistics
29	SCR	selective catalytic reduction
30	SCS	Santee-Cooper System
31	SER	Safety Evaluation Report
32	SERC	Southeastern Electric Reliability Council
33	SHPO	State Historic Preservation Office (or Officer)
34	SO <sub>2</sub>	sulfur dioxide
35	SO <sub>x</sub>	oxides of sulfur
36	SR	Savannah River (alternative site)
37	SRP	Savannah River Plant
38	SRS	Savannah River Site
39	SSC	structures, systems, or components
40	SU	Standard Unit(s)
41	Sv	sievert(s)

1	SWPPP	stormwater pollution prevention plan
2	SWS	service-water system
3		
4	T	ton(s)
5	TBD	to be determined
6	T&E	threatened and endangered
7	TDEC	Tennessee Department of Environment and Conservation
8	TDS	total dissolved solids
9	TEDE	total effective dose equivalent
10	THPO	Tribal Historic Preservation Officer
11	TLD	thermoluminescent dosimeters
12	TRC	TRC Companies, Inc.
13		
14	UC	University of Chicago
15	UF <sub>6</sub>	uranium hexafluoride
16	UMTRI	University of Michigan Transportation Research Institute
17	UO <sub>2</sub>	uranium dioxide
18	USACE	U.S. Army Corps of Engineers
19	USC	United States Code
20	USCB	U.S. Census Bureau
21	USDA	U.S. Department of Agriculture
22	USFA	U.S. Fire Administration
23	USGS	U.S. Geological Survey
24	US	U.S. (State Highway)
25		
26	VACAR	Virginia-Carolinas (subregion)
27	VCSNS	Virgil C. Summer Nuclear Station
28	VEGP	Vogtle Electric Generating Plant
29	VOC	volatile organic compound
30		
31	Webb	R.S. Webb and Associates
32	Westinghouse	Westinghouse Electric Company, LLC
33	WHO	World Health Organization
34	WWTP	wastewater-treatment plant
35	WY	water year (October 1 through September 30)
36		
37	$\chi/Q$	atmospheric dispersion factor(s); annual average normalized air concentration
38		value(s)
39		



1	yd	yard(s)
2	yd <sup>3</sup>	cubic yard(s)
3	yr	year(s)
4	yr <sup>-1</sup>	per year
5		
6		
7		



# 1.0 Introduction

1

2 By letter dated March 27, 2008, the U.S. Nuclear Regulatory Commission (NRC) received an  
3 application from South Carolina Electric and Gas (SCE&G), acting for itself and for Santee  
4 Cooper (the State-owned electric and water utility, formally called the South Carolina Public  
5 Service Authority), for combined construction permits and operating licenses (COLs) for two  
6 new nuclear reactors at the Virgil C. Summer Nuclear Station (VCSNS) in Fairfield County,  
7 South Carolina (SCE&G 2008). The location of the proposed reactors is approximately 1 mi  
8 south of the existing VCSNS Unit 1 (SCE&G 2009a). The proposed VCSNS Units 2 and 3  
9 would be jointly owned by SCE&G (55 percent) and Santee Cooper (45 percent), and operated  
10 by SCE&G (SCE&G 2009a). VCSNS Unit 1 is also jointly owned by SCE&G (66.7 percent) and  
11 Santee Cooper (33.3 percent), and operated by SCE&G (NRC 2004). With the exception of the  
12 transmission systems needed to route power from the proposed units, all of the construction  
13 and operation related to VCSNS Units 2 and 3 would be completely within the confines of the  
14 VCSNS site (SCE&G 2009b). On March 2, 2010, SCE&G submitted an application to the U.S.  
15 Army Corps of Engineers (USACE) for a Department of the Army (DA) permit to conduct  
16 construction activities that would result in alteration of waters of the United States, including  
17 wetlands.

18 The proposed actions in these two applications are (1) NRC issuance of COLs for constructing  
19 and operating two new nuclear power reactors at the VCSNS site in Fairfield County, South  
20 Carolina, and (2) USACE issuance of permits pursuant to Section 404 of the Federal Water  
21 Pollution Control Act (33 USC 1344), as amended, by the Clean Water Act of 1977  
22 (33 USC 1251 et seq.) (hereafter referred to as the Clean Water Act) and Section 10 of the  
23 Rivers and Harbors Appropriations Act of 1899 (33 USC 403). The USACE is participating in  
24 the preparation of this environmental impact statement (EIS) as a cooperating agency. The  
25 COL and DA permit applications, as well as review processes for the NRC and the USACE, are  
26 described in Section 1.1.1.

## 27 1.1 Background

28 A COL is a Commission<sup>(a)</sup> approval for constructing and operating one or more nuclear power  
29 facilities. NRC regulations related to COLs are found in Title 10 of the *Code of Federal*  
30 *Regulations* (CFR) Part 52, Subpart C.

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(a) The Commission is the NRC body of up to five commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.

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1 Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC  
2 4321 et seq.) directs that an EIS be prepared for major Federal actions that have the potential to  
3 significantly affect the quality of the human environment. The NRC has implemented Section  
4 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the NRC has determined that the  
5 issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

6 According to 10 CFR 52.80(b), an application for a COL must contain an Environmental Report  
7 (ER). The ER provides input that the NRC staff evaluates in preparing the NRC's EIS. NRC  
8 regulations related to ERs and EISs are found in 10 CFR Part 51.

### 9 **1.1.1 Applications and Reviews**

10 The objective of SCE&G's requested NRC action is to obtain two COLs to construct and operate  
11 two baseload nuclear power reactors. In addition to the COLs, SCE&G must obtain and  
12 maintain permits from other Federal, State, and local agencies and permitting authorities. The  
13 objective of SCE&G's requested USACE action is to obtain a DA permit to perform regulated  
14 dredge-and-fill activities that would affect wetlands and other waters of the United States and to  
15 erect overhead transmission lines across navigable waters. Collectively, the NRC staff  
16 (including its contractor staff at Pacific Northwest National Laboratory) and USACE staff who  
17 reviewed the ER and decided on impact levels are referred to as the "review team" throughout  
18 this EIS.

#### 19 **1.1.1.1 NRC COL Application Review**

20 The objective of the NRC environmental review of the SCE&G application is to determine  
21 whether two nuclear reactors of the proposed design can be constructed and operated at the  
22 VCSNS site. SCE&G submitted Revision 1 of its ER on February 13, 2009 (SCE&G 2009a).  
23 The ER focuses on the environmental effects of constructing and operating two Westinghouse  
24 Electric Company, LLC (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water  
25 reactors at the VCSNS site. The NRC standards for review of a COL application are outlined in  
26 10 CFR 52.81. Detailed guidance for conducting the environmental portion of the review is  
27 found in guidance set forth in NUREG-1555, the Environmental Standard Review Plan (ESRP)  
28 (NRC 2000) and recent updates, hereinafter referred to as the ESRP.

29 The SCE&G application references Revision 17 of the Westinghouse AP1000 reactor certified  
30 design (Westinghouse 2008). Subpart B of 10 CFR Part 52 contains NRC regulations related to  
31 standard design certification. An application for a standard design certification undergoes an  
32 extensive review. Revision 15 of the AP1000 design is codified in 10 CFR Part 52, Appendix D.  
33 The NRC staff is currently reviewing Revision 17. Where appropriate, this EIS incorporates  
34 results of the review of Revision 15 and insights from the ongoing review of Revision 17.  
35 (Additional information about design certification is discussed in Section 3.2.1.)

1 In this EIS, the NRC staff evaluates the environmental effects of two Westinghouse AP1000  
2 reactors at the VCSNS site. In addition to considering the environmental effects of the  
3 proposed action, the NRC considers alternatives to the proposed action, including the no-action  
4 alternative and the building and operation of new reactors at alternative sites. Also, the benefits  
5 of the proposed action (e.g., meeting an identified need for power) and measures and controls  
6 to limit adverse impacts are evaluated.

7 After acceptance of the SCE&G application, the NRC began the environmental review process  
8 described in 10 CFR Part 51 by publishing in the *Federal Register* (FR) on January 5, 2009, a  
9 Notice of Intent to prepare an EIS and conduct scoping in compliance with requirements set  
10 forth in 10 CFR Part 51 (74 FR 323). Two scoping meetings were held to obtain public input on  
11 the scope of the environmental review. The first meeting was held in Winnsboro, South  
12 Carolina, on January 27, 2009. The second meeting was held in Blair, South Carolina, on  
13 January 28, 2009. The staff reviewed the comments received during the scoping process and  
14 responses were developed for each substantive comment. Comments and responses for  
15 comment categories that are within the scope of the NRC environmental review are included in  
16 Appendix D. A complete list of the scoping comments and responses is documented in the  
17 *V.C. Summer Combined License Scoping Summary Report* (NRC 2009a).

18 The NRC also held a public informational meeting for the local community on March 28, 2009,  
19 at McCrorey-Liston Elementary School in Blair, South Carolina. The March 28 meeting was an  
20 informal open house at which members of the public could engage NRC staff and ask questions  
21 about the NRC's environmental review process. A meeting summary is available electronically  
22 from ADAMS (NRC 2009b)

23 To gather information and to become familiar with the proposed and alternative sites and their  
24 environs, the review team visited the VCSNS site and four alternative sites in March 2009.  
25 During the VCSNS site visits, the NRC staff met with SCE&G staff, public officials, and the  
26 public. The staff reviewed the comments received during the scoping process and contacted  
27 Federal, State, Tribal, regional, and local agencies to solicit comments. A list of the  
28 organizations contacted is provided in Appendix B of this EIS. Other documents related to the  
29 VCSNS site and alternative sites were reviewed and are listed as references where appropriate.

30 To guide its assessment of the environmental impacts of a proposed action or alternative  
31 actions, the NRC has established a standard of significance for impacts based on Council on  
32 Environmental Quality (CEQ) guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51,  
33 Subpart A, Appendix B, provides the following definitions of the three significance levels  
34 established by the NRC – SMALL, MODERATE, or LARGE:

35 SMALL – Environmental effects are not detectable or are so minor that they will  
36 neither destabilize nor noticeably alter any important attribute of the resource.

## Introduction

1            MODERATE – Environmental effects are sufficient to alter noticeably, but not to  
2            destabilize, important attributes of the resource.

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

5            This EIS presents the review team's analysis, which considers and weighs the environmental  
6            impacts of the proposed action at the VCSNS site, including the environmental impacts  
7            associated with constructing and operating reactors at the site, the impacts of constructing and  
8            operating reactors at alternative sites, the environmental impacts of alternatives to granting the  
9            COLs, and the mitigation measures available for reducing or avoiding adverse environmental  
10           effects. This EIS also provides the NRC staff's preliminary recommendation to the Commission  
11           regarding the issuance of the COLs for proposed VCSNS Units 2 and 3.

12           A 75-day comment period will begin on the date of publication of the U.S. Environmental  
13           Protection Agency (EPA) Notice of Availability of the draft EIS to allow members of the public to  
14           comment on the results of the NRC staff's review. A public meeting will be held near the  
15           VCSNS site during the public comment period. During this public meeting, the staff will describe  
16           the results of the NRC environmental review, provide members of the public with information to  
17           assist them in formulating comments on the draft EIS, respond to questions, and accept  
18           comments. After the comment period, the review team will consider all submitted comments.  
19           Comments within the scope of the environmental review will be addressed in the final EIS.

### 20    **1.1.1.2    USACE Permit Application Review**

21           The USACE role as a cooperating agency in the preparation of this EIS is intended to provide  
22           the environmental information USACE needs to meet its NEPA obligation, complete its review,  
23           and draw conclusions regarding the least environmentally damaging practicable alternative  
24           (LEDPA), public good, and the Public Interest Review Factors (PIRFs) for its permitting  
25           decision. The USACE Record of Decision regarding the aforementioned permit application will  
26           reference those analyses and present any additional information required by USACE to support  
27           its permit decision.

28           In this EIS, the USACE evaluates certain construction and maintenance activities proposed in  
29           waters of the United States, including wetlands that would be affected by the proposed project.  
30           The USACE decision will reflect the national concern for both protection and use of important  
31           resources. The benefit that may reasonably be expected to accrue from the proposal must be  
32           balanced against its reasonably foreseeable detriments.

33           The decision whether to issue a permit will be based on an evaluation of the probable impacts,  
34           including cumulative impacts, of the proposed activity and its intended effect on the public  
35           interest. Evaluation of the probable impacts that the proposed activity may have on the public

1 interest requires a careful weighing of all of the factors that become relevant in each particular  
2 case. A decision by the USACE to authorize this proposal, and if so, the conditions under which  
3 it will be allowed to occur, are therefore determined by the outcome of this general balancing  
4 process. All factors that may be relevant to the proposal must be considered, including the  
5 cumulative effects thereof. The USACE PIRFs are listed and described more fully in  
6 Appendix I.

7 For activities involving discharges regulated by Section 404 of the Clean Water Act, a permit will  
8 be denied if the discharge would not comply with the EPA's 404(b)(1) Guidelines for  
9 Specification of Disposal Sites for Dredged or Fill Material found at 40 CFR Part 230 (hereafter  
10 the 404 (b)(1) Guidelines). Subject to the aforementioned guidelines and any other applicable  
11 guidelines and criteria (see 33 CFR 320.2 and 320.3), a permit will be granted unless the  
12 USACE district engineer determines that it would be contrary to the public interest. The  
13 following general criteria are considered in the evaluation of every application:

- 14 • the relative extent of the public and private need for the proposed structure or work
- 15 • where there are unresolved conflicts about resource use, the practicability of using  
16 practicable and reasonable alternative locations and methods to accomplish the objective of  
17 the proposed structure or work
- 18 • the extent and permanence of the beneficial and/or detrimental effects that the proposed  
19 structure or work is likely to have on the public and private uses to which the area is suited.

## 20 **1.1.2 Preconstruction Activities**

21 In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of  
22 "construction" (10 CFR 50.10 and 51.4) to those activities that fall within its regulatory authority.  
23 Many of the activities required to construct a nuclear power plant are not within NRC's  
24 regulatory authority. Activities associated with building the plant that are not within the purview  
25 of the NRC action are grouped under the term "preconstruction." Preconstruction activities  
26 include clearing and grading, excavating, erecting support buildings and transmission lines, and  
27 other associated activities. These preconstruction activities may take place before the  
28 application for a COL is submitted, during the staff's review of a COL application, after a COL is  
29 granted, or in some cases, concurrently with NRC-regulated construction. Although  
30 preconstruction activities are outside the NRC's regulatory authority, many of them are within  
31 the regulatory authority of local, State, or other Federal agencies, including certain  
32 preconstruction activities that require permits from the USACE.

33 Because the preconstruction activities are not part of the NRC action, their impacts are not  
34 reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction  
35 activities are considered in the context of cumulative impacts. In addition, certain  
36 preconstruction activities that require permits from the USACE are viewed by that agency as

## Introduction

1 direct effects related to its Federal permitting action. Chapter 4 describes the relative magnitude  
2 of impacts related to preconstruction and construction activities.

### 3 **1.1.3 Cooperating Agencies**

4 NEPA lays the groundwork for coordination between the lead agency preparing an EIS and  
5 other Federal agencies that may have jurisdiction by law or special expertise regarding an  
6 environmental issue. These other agencies are referred to as “cooperating agencies.”  
7 Cooperating agencies have the responsibility to assist the lead agency through early  
8 participation in the NEPA process, including scoping, by providing technical input to the EIS and  
9 by making staff support available as needed by the lead agency.

10 Most proposed nuclear power plants require a permit from the USACE, where impacts are  
11 proposed on waters of the United States, in addition to a license from the NRC. Therefore, the  
12 NRC and the USACE concluded that the most effective and efficient use of Federal resources in  
13 the review of nuclear power projects would be achieved by a cooperative agreement. On  
14 September 12, 2008, the NRC and the USACE signed a Memorandum of Understanding (MOU)  
15 regarding the review of nuclear power plant license applications (USACE and NRC 2008).  
16 Therefore, the Charleston District of the USACE is a cooperating agency as defined in  
17 10 CFR 51.14.

18 As described in the MOU, the NRC is the lead Federal agency, and the USACE is a cooperating  
19 agency in the development of the EIS. Under Federal law, each agency has jurisdiction related  
20 to portions of the proposed project. The goal of this cooperative agreement is the development  
21 of one EIS that serves the needs of both the NRC license decision process and the USACE  
22 permit decision process. While both agencies must comply with the requirements of NEPA,  
23 they also have mission requirements that must be met in addition to the NEPA requirements.  
24 The NRC makes license decisions under the Atomic Energy Act, and the USACE makes permit  
25 decisions under the Rivers and Harbors Appropriations Act of 1899 and the Clean Water Act.  
26 The USACE is cooperating with the NRC to ensure that the information presented in the NEPA  
27 documentation is adequate to fulfill the requirements of USACE regulations, the EPA’s Clean  
28 Water Act Section 404(b)(1) Guidelines (40 CFR Part 230), which contain the substantive  
29 environmental criteria used by the USACE in evaluating discharges of dredged or fill material  
30 into waters of the United States, and the USACE public interest review process.

31 As a cooperating agency, the USACE is part of the NRC review team and is involved in all  
32 aspects of the environmental review, including scoping, public meetings, public comment  
33 resolution, and EIS preparation. The USACE refers to public meetings as hearings, but there is  
34 no adjudicatory process involved as there is for NRC hearings conducted by the Atomic Safety  
35 and Licensing Board. For the purposes of assessing environmental impacts under NEPA, the  
36 EIS uses the SMALL, MODERATE, or LARGE criteria discussed in Section 1.1.1.1 of this  
37 chapter; this approach has been vetted by the CEQ. However, for permit decisions under



1 Section 404 of the Clean Water Act, the USACE can only permit the LEDPA and must address  
2 PIRFs. This EIS is intended to provide the information about the environmental impacts  
3 necessary to allow the USACE to address the public interest in the Record of Decision  
4 associated with the permit decision. However, some of the PIRFs not specifically related to  
5 environmental impact, such as mineral needs, are not addressed in this EIS.

6 The timing of the preparation of the EIS compared to the timing of the USACE permit review is  
7 such that the USACE will not have completed its assessment of the LEDPA criterion until it  
8 receives public feedback in the form of public comments on the draft EIS. The USACE will  
9 address whether the LEDPA criterion is met in the Record of Decision. The goal of the process  
10 is for the USACE to have all of the information necessary to make a permit decision when the  
11 final EIS is issued. However, it is possible that the USACE will still need some information from  
12 SCE&G to complete the permit documentation – information that SCE&G could not make  
13 available by the time of final EIS issuance. Also, any conditions required by the USACE, such  
14 as compensatory mitigation, will be addressed in the permit issued by the USACE. Mitigation is  
15 an important aspect of the review and balancing process on many DA permit applications.  
16 Consideration of mitigation will occur throughout the permit application-review process and  
17 includes avoiding, minimizing, rectifying, reducing, or compensating for resource losses.  
18 Losses will be avoided to the extent practicable. Compensation may occur onsite or at an  
19 offsite location.

#### 20 **1.1.4 Concurrent NRC Reviews**

21 In reviews separate from the EIS process, the NRC analyzes the safety characteristics of the  
22 proposed site and emergency planning information. These analyses are documented in a  
23 Safety Evaluation Report (SER). The SER presents the conclusions reached by the NRC  
24 regarding (1) whether there is reasonable assurance that two new reactors can be constructed  
25 and operated along with the existing unit at the VCSNS site without undue risk to the health and  
26 safety of the public; (2) whether the emergency preparedness program meets the applicable  
27 requirements in 10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part 100; and  
28 (3) whether site characteristics are such that adequate security plans and measures can be  
29 developed (10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part 100). The final  
30 SER for SCE&G's COL application is expected to be published as a NUREG document in the  
31 future. Revision 1 of the Final Safety Analysis Report (FSAR) for SCE&G's COL application  
32 was published on July 9, 2009 (SCE&G 2009c).

33 The reactor design referenced in the application is Revision 17 of the AP1000 certified design  
34 (Westinghouse 2008). The amended AP1000 design is currently undergoing review. If the final  
35 design is different from the design considered in the EIS, the staff will determine whether the  
36 changes are significant enough to warrant an additional environmental review.

## 1 **1.2 The Proposed Federal Action**

2 The proposed NRC Federal action is issuance, under the provisions of 10 CFR Part 52, of  
3 COLs for the proposed VCSNS site for two new Westinghouse AP1000 reactors. The proposed  
4 USACE Federal action is issuance of a permit pursuant to the Clean Water Act and Rivers and  
5 Harbors Appropriations Act of 1899 authorizing certain preconstruction activities that could  
6 potentially affect waters of the United States based on evaluation of the probable impacts,  
7 including cumulative impacts of the proposed construction activities on the public interest. The  
8 DA permit would allow the disturbance via permanent filling of approximately 0.26 ac of  
9 wetlands and 774 linear feet of streams regulated as waters of the United States, as well as the  
10 permanent conversion of 224.2 ac of forested wetlands to nonforested wetlands as a result of  
11 required transmission lines to connect the VCSNS to the electrical grid.

12 This EIS provides the NRC and USACE analyses of the environmental impacts that could result  
13 from building and operating two new proposed units at the VCSNS site or at each of the four  
14 alternative sites. These impacts are analyzed by the NRC to determine whether the proposed  
15 site is suitable for the new units and whether any of the alternative sites are considered  
16 obviously superior to the proposed site.

## 17 **1.3 The Purpose and Need for the Proposed Action**

18 The purpose of and need for the proposed NRC and USACE actions are described below.

### 19 **1.3.1 The NRC's Proposed Action**

20 The purpose and need for the proposed NRC action (i.e., issuance of COLs) is to provide for  
21 additional baseload electric generating capacity by 2016 and 2019 within the service territories  
22 of SCE&G and Santee Cooper (SCE&G 2009d). SCE&G has stated this additional capacity is  
23 necessary "...to meet future generating needs for baseload power as such needs may be  
24 determined by state and owner decision makers" (SCE&G 2009a). The need for additional  
25 baseload power is discussed in Chapter 8 of this EIS.

26 Two COLs from the NRC are necessary for constructing and operating the proposed power  
27 plant. Preconstruction and certain long lead-time activities, such as ordering and procuring  
28 certain components and materials necessary to construct the plant, may begin before the COLs  
29 are granted. SCE&G must obtain and maintain permits or authorizations from other Federal,  
30 State, and local agencies and permitting authorities prior to undertaking certain activities. The  
31 ultimate decision whether to build a facility and the schedule for building are not within the  
32 purview of the NRC nor the USACE and would be determined by the license holder if the  
33 authorizations are granted.

### 1 **1.3.2 The USACE Permit Action**

2 The SCE&G permit application to the USACE is for work to prepare the site and facilities for a  
3 nuclear power-generation station at the existing VCSNS site. Defining the project objectives is  
4 critical to the evaluation of any project and to evaluating compliance with the Clean Water Act  
5 Section 404(b)(1) Guidelines. In addition to the NEPA-required purpose and need described  
6 above, the 404(b)(1) Guidelines and subsequent 404(q) guidance require that the USACE  
7 define the “basic project purpose” and the “overall project purpose” to verify appropriate  
8 consideration of alternatives.

9 The basic purpose is the most simple or irreducible objective of the project and is used to  
10 determine whether the applicant’s project is “water dependent” (40 CFR 230.10(a)(3)). The  
11 water dependency test contained in the 404(b)(1) Guidelines creates a presumption that  
12 activities that do not require access to, proximity to, or siting within special aquatic sites to fulfill  
13 their basic project purpose are not water dependent. Therefore, the 404(b)(1) Guidelines state  
14 that practicable alternatives to non-water-dependent activities are presumed to exist, are less  
15 damaging, and are environmentally preferable to alternatives that involve discharges into  
16 special aquatic sites (e.g., wetlands and riffle and pool stream complexes) (40 CFR  
17 230.10(a)(3)). The basic purpose of this project is to generate electricity for additional baseload  
18 capacity. Constructing facilities to create energy supplies is not a water-dependent activity, and  
19 in accordance with the 404(b)(1) Guidelines, practicable alternatives that do not involve  
20 discharges into special aquatic sites are presumed to exist unless clearly demonstrated  
21 otherwise (40 CFR 230.10(a)(3)).

22 In addition to defining the basic project purpose, the USACE must also define the overall project  
23 purpose. The overall project purpose establishes the scope of the alternatives analysis and is  
24 used for evaluating practicable alternatives under the 404(b)(1) Guidelines. In accordance with  
25 the 404(b)(1) Guidelines and guidance from USACE Headquarters, the overall project purpose  
26 must be specific enough to define the applicant’s needs, but not so narrow and restrictive as to  
27 preclude a proper evaluation of alternatives. The USACE is responsible for controlling every  
28 aspect of the 404(b)(1) Guidelines analysis (HQUSACE 1989). In this regard, defining the  
29 overall project purpose for issuance of USACE permits is the sole responsibility of the USACE.  
30 While generally focusing on the SCE&G’s statement, the USACE will in all cases exercise  
31 independent judgment in defining the purpose and need for the project from both SCE&G’s and  
32 the public’s perspectives (33 CFR Part 325; 53 FR 3120).

33 The overall purpose of the project is to construct a power-generating facility to provide for  
34 additional baseload electrical generating capacity to meet the growing demand in the State of  
35 South Carolina. The USACE concurs with the stated project purpose and long-term need to  
36 generate electricity to meet the growing demand in South Carolina.

## 1 **1.4 Alternatives to the Proposed Action**

2 Section 102(2)(C)(iii) of NEPA states that EISs are to include a detailed statement analyzing  
3 alternatives to the proposed action. The NRC regulations for implementing Section 102(2) of  
4 NEPA provide for including in an EIS a chapter that discusses the environmental impacts of the  
5 proposed action and the alternatives (10 CFR Part 51, Subpart A, Appendix A). This EIS  
6 addresses five categories of alternatives to the proposed action: (1) the no-action alternative,  
7 (2) energy source alternatives, (3) alternative sites, (4) system design alternatives, and  
8 (5) onsite alternatives to reduce impacts on natural and cultural resources.

9 In the no-action alternative, the proposed action would not go forward. The NRC could deny  
10 SCE&G's request for the COLs. If the request was denied, the construction and operation of  
11 two new nuclear generating units at the VCSNS site would not occur, nor would any benefits  
12 intended by the approved COLs be realized. The USACE could deny SCE&G's permit request.  
13 If the permit were defined, SCE&G's construction of the two new units would not go forward as  
14 proposed. Energy source alternatives include energy-replacement technologies such as oil-  
15 and gas-fired generation and wind power, focusing on alternatives that could generate baseload  
16 power. System design alternatives include heat-dissipation and circulating-water systems,  
17 intake and discharge structures, and water use and treatment systems. Finally, onsite  
18 alternatives evaluated by the USACE to reduce impacts on wetlands and shoreline resources  
19 are described.

20 In its ER, SCE&G defines a region of interest for use in identifying and evaluating potential sites  
21 for power generation (SCE&G 2009a). In this EIS the NRC staff evaluates the region of  
22 interest, the process by which alternative sites were selected, and the environmental impacts of  
23 construction and operation of new power reactors at those alternative sites using  
24 reconnaissance-level information. Using this process, SCE&G reviewed multiple sites and  
25 identified the suite of candidate sites for this project. The alternative sites included the Fairfield  
26 Unit 1 (FA-1) site, a greenfield site owned by SCE&G on the Broad River in South Carolina; an  
27 existing fossil-fired site owned by SCE&G near Cope, South Carolina; a greenfield site owned  
28 by SCE&G in Saluda County, South Carolina; and the Savannah River Site in Aiken County,  
29 South Carolina (SCE&G 2009a). The objective of the comparison of environmental impacts is  
30 to determine whether any of the alternative sites is environmentally preferable and obviously  
31 superior to the proposed VCSNS site.

32 As part of the evaluation of permit applications subject to Section 404 of the Clean Water Act,  
33 the USACE is required by regulation to apply the criteria set forth in the 404(b)(1) Guidelines  
34 (33 USC 1344; 40 CFR Part 230). These guidelines establish criteria that must be met for the  
35 proposed activities to be permitted pursuant to Section 404. Specifically, these guidelines state,  
36 in part, that no discharge of dredged or fill material shall be permitted if there is a practicable  
37 alternative to the proposed discharge that would have less adverse impacts on the aquatic

1 ecosystem provided the alternative does not have other significant adverse consequences  
2 (40 CFR 230.10(a)). An area not presently owned by the applicant that could reasonably be  
3 obtained, used, expanded, or managed to fulfill the basic purpose of the proposed activity may  
4 be considered if it is otherwise a practicable alternative.

## 5 **1.5 Compliance and Consultations**

6 Before the construction and operation of the proposed new units, SCE&G is required to obtain  
7 certain Federal, State, and local environmental permits, as well as to meet applicable statutory  
8 and regulatory requirements. In its ER (SCE&G 2009a), SCE&G provided a list of  
9 environmental approvals and consultations associated with proposed VCSNS Units 2 and 3.  
10 Potential authorizations, permits, and certifications relevant to the proposed COLs are included  
11 in Appendix H of this EIS. The staff reviewed the list and contacted the appropriate Federal,  
12 State, Tribal, and local agencies to identify any compliance, permit, or significant environmental  
13 issues of concern to the reviewing agencies that may affect the acceptability of the VCSNS site  
14 for the construction and operation of the proposed two Westinghouse AP1000 reactors. A list of  
15 the key consultation correspondence is provided as Appendix F.

## 16 **1.6 Report Contents**

17 The subsequent chapters of this EIS are organized as follows. Chapter 2 describes the  
18 proposed site and discusses the environment that would be affected by the addition of the new  
19 nuclear reactor units. Chapter 3 describes the power plant layout, structures, and activities  
20 related to building and operation that are used as the basis for evaluating the environmental  
21 impacts. Chapters 4 and 5 examine the environmental impacts of building (Chapter 4) and  
22 operating (Chapter 5) proposed VCSNS Units 2 and 3. Chapter 6 analyzes the environmental  
23 impacts of the uranium fuel cycle, transportation of radioactive materials, and decommissioning,  
24 while Chapter 7 examines the cumulative impacts of the proposed action as defined in  
25 40 CFR 1508.7. Chapter 8 addresses the need for power. Chapter 9 discusses alternatives to  
26 the proposed action and analyzes energy sources, alternative sites and systems, and compares  
27 the proposed action with these alternatives. Chapter 10 summarizes the findings of the  
28 preceding chapters and provides a benefit-cost evaluation; it also presents the staff's  
29 preliminary recommendation with respect to the Commission's approval of the proposed site for  
30 COLs based on the NRC staff's evaluation of environmental impacts.

31 The appendices to this EIS provide the following additional information.

- 32 • Appendix A – Contributors to the Environmental Impact Statement
- 33 • Appendix B – Organizations Contacted
- 34 • Appendix C – Chronology of NRC and USACE Environmental Review Correspondence

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- 1 • Appendix D – Scoping Comments and Responses
- 2 • Appendix E – Draft Environmental Impact Statement Comments and Responses
- 3 • Appendix F – Key Combined License Consultation Correspondence Regarding the Virgil C.
- 4 Summer Nuclear Station Units 2 and 3 Combined License Application; and Biological
- 5 Assessments
- 6 • Appendix G – Supporting Documentation for Radiological Dose Assessment
- 7 • Appendix H – Authorizations, Permits, and Certifications
- 8 • Appendix I – U.S. Army Corps of Engineers Public Interest Review Factors
- 9 • Appendix J – Carbon Dioxide Footprint Estimates for a Reference 1000-MWe Reactor

## 10 **1.7 References**

- 11 10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of  
12 Production and Utilization Facilities."
- 13 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental  
14 Protection Regulations for Domestic Licensing and Related Regulatory Functions."
- 15 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses,  
16 Certifications, and Approvals for Nuclear Power Plants."
- 17 10 CFR Part 73. Code of Federal Regulations, Title 10, *Energy*, Part 73, "Physical Protection of  
18 Plants and Materials."
- 19 10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site  
20 Criteria."
- 21 33 CFR Part 320. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*,  
22 Part 320, "General Regulatory Policies."
- 23 33 CFR Part 325. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*,  
24 Part 325, "Processing of Department of the Army Permits."
- 25 40 CFR Part 230. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 230,  
26 "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material."
- 27 40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part  
28 1508, "Terminology and Index."

- 1 53 FR 3120. February 3, 1988. "Environmental Quality; Procedures for Implementing the  
2 National Environmental Policy Act (NEPA)." *Federal Register*. Corps of Engineers, Department  
3 of the Army.
- 4 72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants."  
5 *Federal Register*. U.S. Nuclear Regulatory Commission.
- 6 74 FR 323. January 5, 2009. "South Carolina Electric and Gas Company Acting for Itself and  
7 as Agent for the South Carolina Public Service Company (Also Referred to as Santee Cooper)  
8 Virgil C. Summer Nuclear Station Units 2 and 3; Combined License Application; Notice of Intent  
9 To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal*  
10 *Register*. U.S. Nuclear Regulatory Commission.
- 11 Atomic Energy Act of 1954, as amended. 42 USC 2011 et seq.
- 12 Clean Water Act. 33 USC 1251, et seq. (also referred to as the Federal Water Pollution Control  
13 Act [FWPCA]).
- 14 Federal Water Pollution Control Act. 33 USC 1344. 2008. "Permits for Dredged or Fill  
15 Material." *United States Code*.
- 16 National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.
- 17 Rivers and Harbors Appropriation Act of 1899 Section 403. 33 USC 403 as amended.
- 18 South Carolina Electric and Gas (SCE&G). 2008. *V.C. Summer Nuclear Station Units 2 and 3*  
19 *Project No. 743. Submittal of a Combined License Application for V.C. Summer Nuclear Station*  
20 *Units 2 and 3*. Revision 0, Jenkinsville, South Carolina. NND-08-0004. Accession No.  
21 ML081300460.
- 22 South Carolina Electric and Gas (SCE&G). 2009a. *V.C. Summer Nuclear Station Units 2 and 3*  
23 *COL Application, Part 3, Applicant's Environmental Report – Combined License Stage*.  
24 Revision 1, Jenkinsville, South Carolina. Accession No. ML090510261.
- 25 South Carolina Electric and Gas (SCE&G). 2009b. Letter from Ronald B. Clary (SCE&G,  
26 General Manager, New Nuclear Deployment) to U.S. Nuclear Regulatory Commission dated  
27 May 5, 2009 in response to letters from S.A. Byrne dated March 27 2008 and Ronald B. Clary  
28 dated February 13, 2009, "Subject: V.C. Summer Nuclear Station Units 2 and 3, Docket  
29 Numbers 52-027 and 52-028, Combined License Application – Environmental Report Audit  
30 Information Needs: ALT-1/NP-1, AQ-1, AQ-15, G-5, G-6, G-8, and NRHH-2." NND-09-0110.  
31 Accession No. ML091890158.

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- 1 South Carolina Electric and Gas (SCE&G). 2009c. *V.C. Summer Nuclear Station, Units 2 and*  
2 *3 COL Application, Part 2, Final Safety Analysis Report*. Revision 1, Jenkinsville, South  
3 Carolina. Accession No. ML092170463.
- 4 South Carolina Electric and Gas (SCE&G). 2009d. Letter from Ronald B. Clary (SCE&G,  
5 General Manager, New Nuclear Deployment) to U.S. Nuclear Regulatory Commission dated  
6 May 11, 2009, "Subject: V.C. Summer Nuclear Station Units 2 and 3, Docket Numbers 52-027  
7 and 52-028, Combined License Application – Environmental Report Audit Information Needs:  
8 ACC-11, ALT-3, AQ-5, AQ-6, GW-11, LU-3, and SW-12." NND-09-0126. Accession No.  
9 ML091350104.
- 10 U.S. Army Corps of Engineers, Headquarters (HQUSACE). 1989. Memorandum from Patrick  
11 J. Kelly, USACE Director of Civil Works, to Commander, U.S. Army Engineer District, New  
12 Orleans, regarding "Permit Elevation, Plantation Landing Resort, Inc." April 21, 1989. Available  
13 at <http://www.epa.gov/owow/wetlands/pdf/PlantationLandingRGL.pdf>.
- 14 U.S. Army Corps of Engineers and U.S. Nuclear Regulatory Commission (USACE and NRC).  
15 2008. *Memorandum of Understanding Between U.S. Army Corps of Engineers and U.S.*  
16 *Nuclear Regulatory Commission on Environmental Reviews Related to the Issuance of*  
17 *Authorizations to Construct and Operate Nuclear Power Plants*. Accession No. ML082540354.
- 18 U.S. Nuclear Regulatory Commission (NRC). 2000. *Environmental Standard Review Plan—*  
19 *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG-1555,  
20 Vol. 1, Washington, D.C. Includes 2007 revisions.
- 21 U.S. Nuclear Regulatory Commission (NRC). 2004. *Generic Environmental Impact Statement*  
22 *for License Renewal of Nuclear Plants, Supplement 15, Regarding Virgil C. Summer Nuclear*  
23 *Station, Final Report*. NUREG-1437, Supplement 15, Washington, D.C.
- 24 U.S. Nuclear Regulatory Commission (NRC). 2009a. *Environmental Impact Statement Scoping*  
25 *Process Summary Report, V. C. Summer Nuclear Station Units 2 and 3, Combined License*  
26 *Fairfield County, South Carolina*. Accession No. ML091960347.
- 27 U.S. Nuclear Regulatory Commission (NRC). 2009b. Memorandum from Patricia Vokoun (U.S.  
28 Nuclear Regulatory Commission, Project Manager, Office of New Reactors) to Ryan Whited  
29 (U.S. Nuclear Regulatory Commission, Chief, Office of New Reactors) dated May 5, 1009,  
30 "Subject: Summary of Public Meeting to Discuss Environmental Review Process for the Virgil C.  
31 Summer Nuclear Station Units 2 and 3 Combined License Application" Accession No  
32 ML091140076.
- 33 Westinghouse Electric Company LLC (Westinghouse). 2008. *AP1000 Design Control*  
34 *Document*. APP-GW-GL-700, Revision 17, Pittsburgh, Pennsylvania. Accession No.  
35 ML083230868.



1

## 2.0 Affected Environment

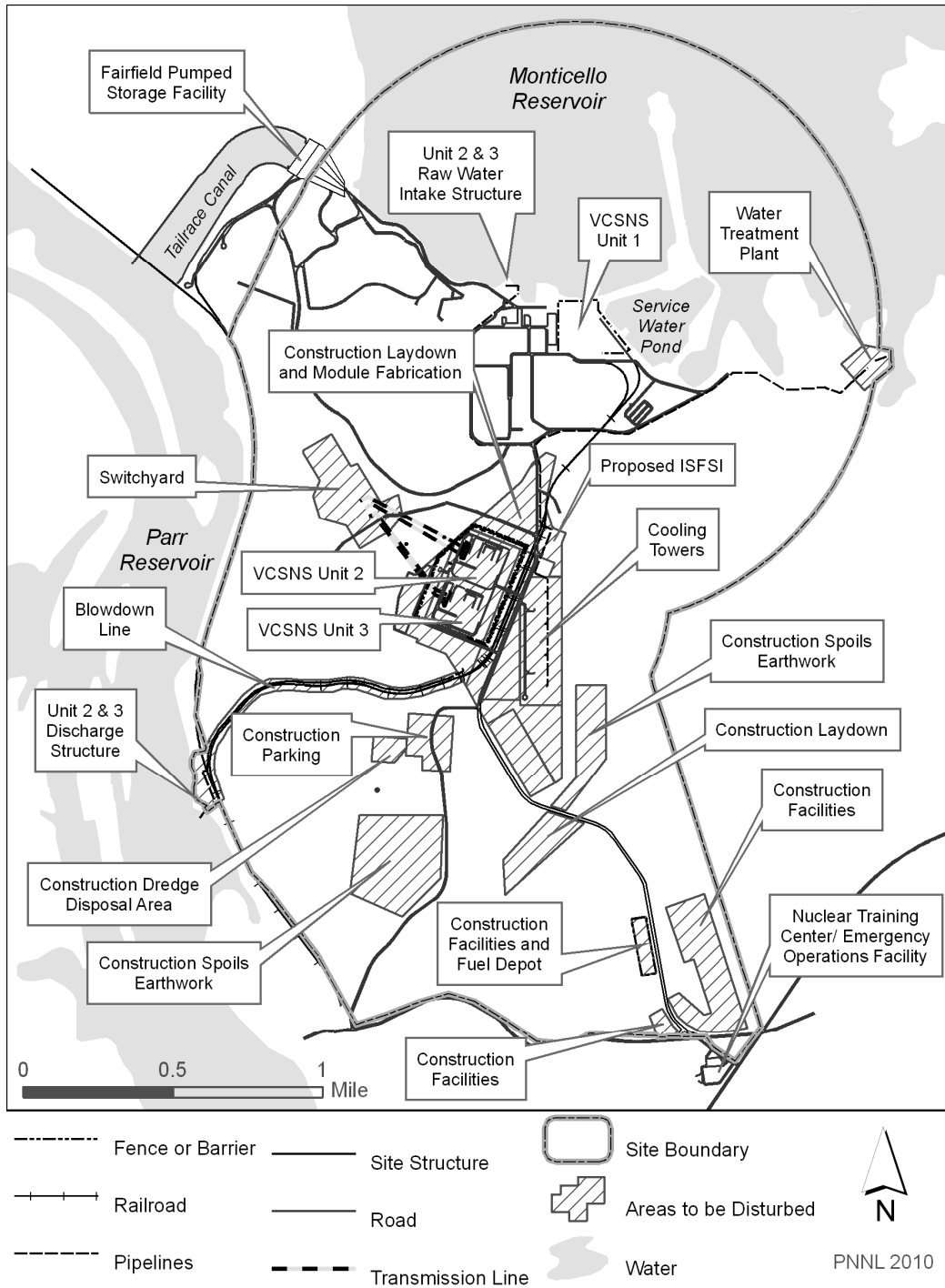
2 The site proposed by South Carolina Electric and Gas (SCE&G) for combined construction  
3 permits and operating licenses (COLs) and a Department of the Army (DA) permit is located in  
4 Fairfield County, South Carolina, 26 mi northwest of the State capital, Columbia, South  
5 Carolina. The proposed Units 2 and 3 would be located approximately 1 mi to the south-  
6 southwest of existing Unit 1 on the Virgil C. Summer Nuclear Station (VCSNS) site. The  
7 location of proposed VCSNS Units 2 and 3 is described in Section 2.1, with the land use, water,  
8 ecology, socioeconomics, environmental justice, historic and cultural resources, geology,  
9 meteorology and air quality, and the radiological environment of the site presented in  
10 Sections 2.2 through 2.11, respectively. Section 2.12 examines related Federal projects and  
11 consultations, and references are presented in Section 2.13.

### 12 2.1 Site Location

13 SCE&G's proposed location for VCSNS Units 2 and 3 is shown in Figure 2-1 (SCE&G 2009b).  
14 The centerline of proposed Units 2 and 3 would be located approximately 4700 ft south and  
15 1800 ft west of the center of the existing Unit 1 containment building (SCE&G 2009a).

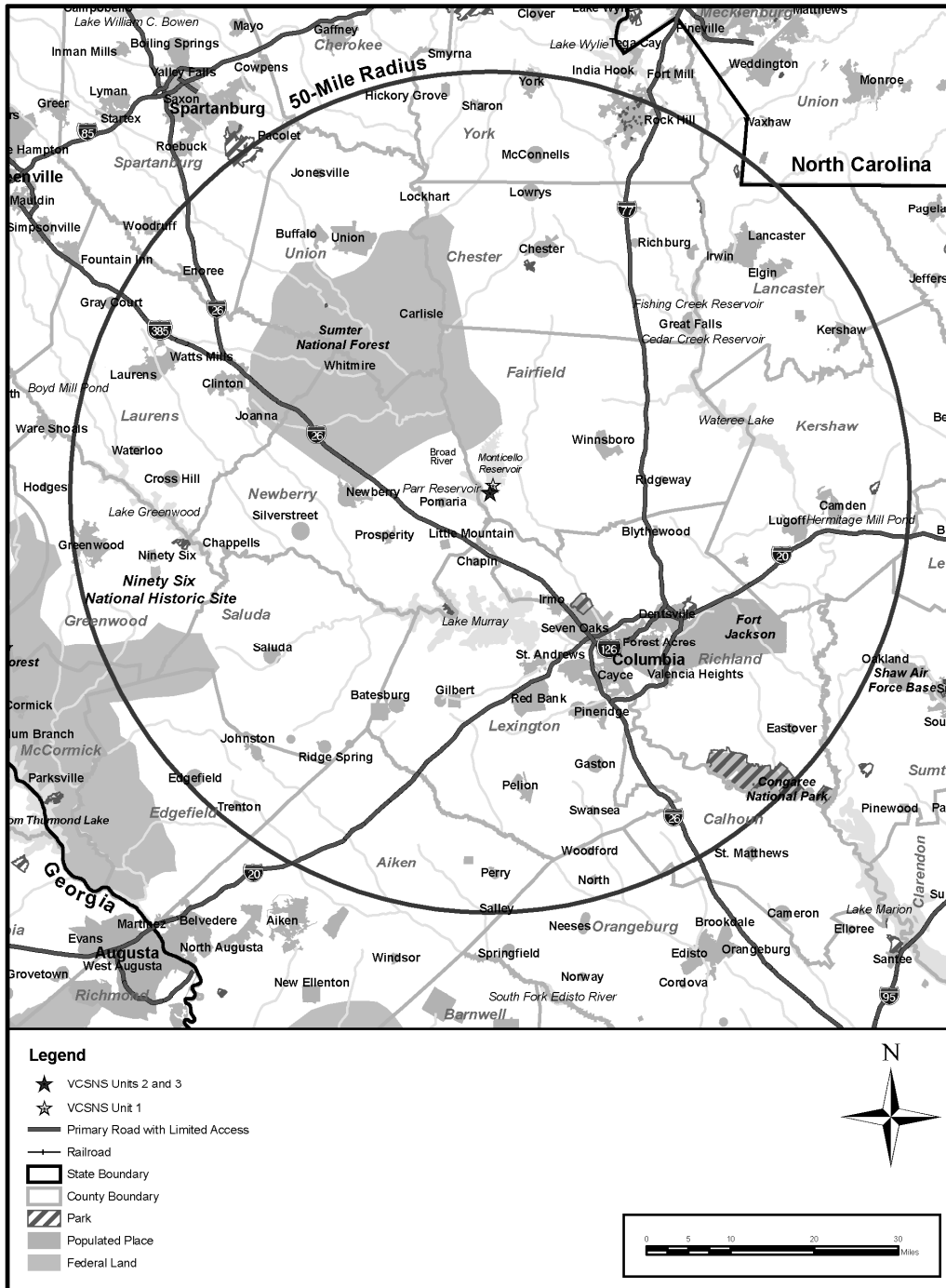
16 The VCSNS site is located in an unincorporated area of Fairfield County, South Carolina. The  
17 nearest population center to the VCSNS site that has more than 25,000 residents is Columbia,  
18 South Carolina, with a population of population 124,818 in 2007 (SCBCB 2009e). Figure 2-2  
19 shows the location of the VCSNS site in relationship to the counties, cities, and towns within a  
20 50-mi radius of the site (SCE&G 2009b). The VCSNS site is generally bounded by the  
21 Monticello Reservoir to the north, with Interstate 26 (I-26) approximately 13 mi due west and  
22 I-77 approximately 18 mi due east. The Broad River is 1 mi west of the site (Figure 2-3).  
23 Access to the site from the south is via State Highway 215 (SC-215; Monticous Road) then west  
24 on County Road 311 (CR-311; Ollie Bradham Boulevard), which enters the site. Although the  
25 Broad River is considered navigable by the State of South Carolina, it is not considered so by  
26 the U.S. Army Corps of Engineers (USACE), and there is no barge access to the site (SCE&G  
27 2009c) but local access points may be used to launch smaller barges and push vessels for  
28 cofferdam work as described in Section 4.3.2.1. Railroad access to the site is from a spur  
29 coming off the Norfolk Southern Railway transportation track from Columbia to Spartanburg  
30 (SCE&G 2009a). Jenkinsville, South Carolina, is the closest community and is located  
31 immediately east and south of the VCSNS site. The closest commercial or public general  
32 aviation airports located within the VCSNS region are the Fairfield County Airport 15 mi to the  
33 east, Newberry County Airport 18.6 mi to the west, Columbia Metropolitan Airport 27 mi to the  
34 south, and Columbia Owens Airport 27 mi south of the site (Maps of the World 2009). The  
35 VCSNS site occupies approximately 3600 ac of land and water within the exclusion area

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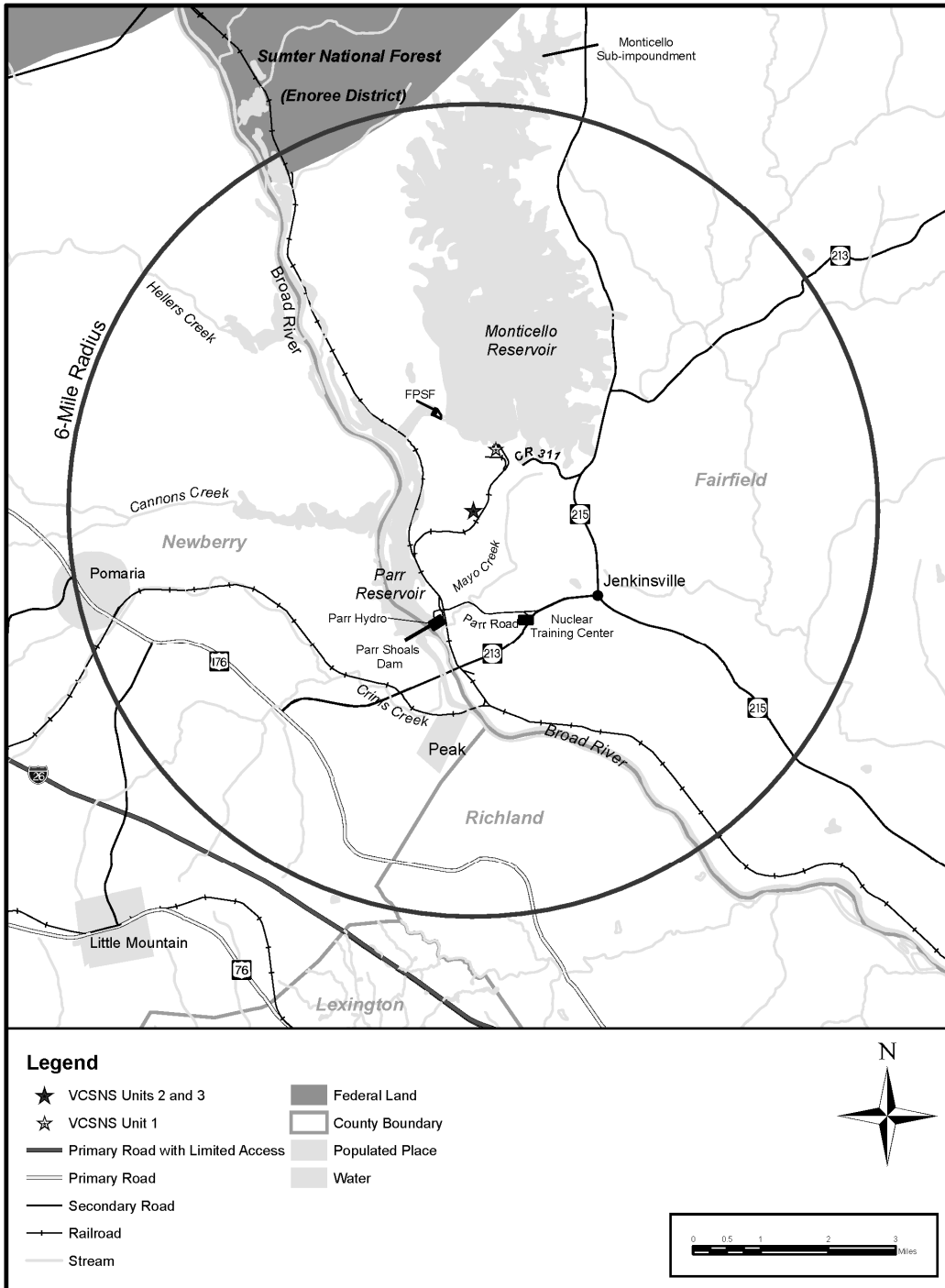
1  
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**Figure 2-1.** SCE&G's Proposed Location for VCSNS Units 2 and 3



1  
 2 **Figure 2-2.** The Location of the VCSNS Site in Relationship to the Counties, Cities, and Towns  
 3 Within a 50-Mi Radius of the Site (SCE&G 2009a)

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**Figure 2-3.** Map of the VCSNS Site and Vicinity Within the 6-mi Radius (SCE&G 2009a)

1 boundary (SCE&G 2009a). The Nuclear Training Facility, which would be used temporarily  
2 during development of the proposed new units, is located on an additional tract of approximately  
3 1000 ac owned by SCE&G south of the site boundary (SCE&G 2009a).

## 4 **2.2 Land Use**

5 This section discusses land-related issues for the VCSNS site. Section 2.2.1 describes the site  
6 and the vicinity within a 6-mi radius of the site. Section 2.2.2 discusses the existing and proposed  
7 transmission-line corridors and offsite areas. Section 2.2.3 discusses the region, defined as the  
8 area within 50 mi of the center point of the VCSNS Units 2 and 3 powerblock footprint.

### 9 **2.2.1 VCSNS Site and Vicinity**

10 The VCSNS site (see Figure 2-3) is located along the western edge of Fairfield County, South  
11 Carolina, on the southern shore of the Monticello Reservoir. It is in the immediate vicinity of four  
12 counties: Fairfield, Lexington, Newberry, and Richland, which together make up the Central  
13 Midlands region of the state.

14 The VCSNS site includes the following components: the existing Unit 1 plant site, part of  
15 Monticello Reservoir, part of the Fairfield Pumped Storage Facility, and the proposed locations  
16 for the Units 2 and 3 powerblocks, cooling towers, switchyard, discharge structures and  
17 blowdown lines, the proposed independent spent-fuel storage installation, and the proposed  
18 support facilities and laydown areas associated with the new units (see Figure 2-1). VCSNS  
19 Unit 1, which is licensed by the U.S. Nuclear Regulatory Commission (NRC), has a net electric  
20 generating capacity of 966 MW(e) (NRC 2004). Unit 1 began commercial operation on  
21 January 1, 1984 (DOE/EIA 2009). The one existing nuclear unit, auxiliary facilities such as the  
22 training center, and transmission-line corridors occupy approximately 492 ac of the VCSNS site.  
23 Another 784 ac extend into the Monticello Reservoir. Most of the remaining VCSNS site area is  
24 mixed forest, some of which is managed for timber production.

25 The VCSNS site is located in a sparsely populated, largely rural area, with forests and small  
26 farms composing the dominant land use. The site is primarily composed of low rolling hills with  
27 elevations ranging from 210 ft to 560 ft above mean sea level (msl). This Piedmont terrain  
28 varies from gently rolling to hilly and includes broad stream valleys. Jenkinsville and Peak are  
29 the closest settlements, although there are also homes built along the Unit 1 access road and  
30 the Monticello Reservoir shoreline. The Broad River flows in a northwest-to-southeast direction  
31 approximately 1 mi west of the site and serves as the boundary between Fairfield County (to the  
32 east) and Newberry County (to the west).

33 Columbia, South Carolina, the State capital, lies approximately 26 mi southeast of the VCSNS  
34 site. Within the 6-mi radius of the site are the towns of Jenkinsville (immediately east and  
35 south), Peak (1.6 mi from the closest point on the VCSNS property boundary and 3.1 mi from

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1 the centerpoint of the site), and Pomaria (4.5 mi to the closest point on the VCSNS property  
2 boundary and 5.5 mi from the site centerpoint). Small communities in the vicinity include  
3 Dawkins (about 5 mi northwest of the site) and Monticello (about 5 mi northeast of the site).  
4 Winnsboro, the County Seat of Fairfield County lies, 15 mi east of the site.

5 VCSNS is co-located with a hydroelectric facility known as the Fairfield Pumped Storage Facility  
6 (FPSF). The general area has been used for energy production since 1914 when this reach of  
7 the Broad River was impounded for the Parr Hydroelectric Generating Station (also Parr  
8 Hydroelectric Plant or Parr Hydro), a small run-of-the-river hydroelectric plant, and Parr  
9 Reservoir was created. Later, a nearby coal-fired power plant operated for decades. Originally  
10 1850 ac in area, the Parr Reservoir was enlarged to approximately 4400 ac in 1977 by raising  
11 the level of the Parr Shoals Dam 9 ft. This modification was necessary to support the  
12 development of the FPSF, which was built on Frees Creek, a small tributary of the Broad River.  
13 Monticello Reservoir was built in the Frees Creek valley to serve as the upper pool for the FPSF  
14 and the source of cooling water for VCSNS Unit 1. Parr Reservoir, which historically had been  
15 the source of water for Parr Hydro, assumed a dual function, providing water for both Parr  
16 Hydro and the FPSF (NRC 2004).

17 Current primary road access to the VCSNS site is via CR-311 (Ollie Bradham Boulevard), a  
18 two-lane paved road (see Figure 2-3). CR-311 intersects SC-215 approximately 1.5 mi east of  
19 Unit 1. SC-215 has a north-south orientation and is used by employees traveling from Richland  
20 and Fairfield Counties. Employees traveling from Richland and Lexington Counties may use  
21 U.S. Highway 176 (US-176) north to SC-213, which intersects SC-215 approximately 2 to 3 mi  
22 south of the VCSNS site. The site is also accessed by a railroad spur connected to the Norfolk  
23 Southern line. There is no direct access to the site via the Broad River. No natural gas lines or  
24 other fuel lines traverse the site.

25 The site is zoned as "industrial," with electricity production and transmission among the  
26 permitted uses (Vismor 1997; Fairfield County 2005). Soil surveys covering the site and  
27 surrounding areas indicated that none of the site contains prime farmland as that term is defined  
28 by the U.S. Department of Agriculture Natural Resources Conservation Service at Title 7 of the  
29 Code of Federal Regulations (CFR) 657.5(a). There is no active farmland on the VCSNS site,  
30 but there are active farms in the vicinity. Most of the site is actively managed for forest  
31 products. No mineral deposits are actively mined on the site, but the vicinity has a significant  
32 blue granite quarrying industry (SCIway 2009).

33 Portions of the Sumter National Forest lay along the Broad River north of the VCSNS site. In  
34 addition, there are several boat launches and the 4400-ac Parr Hydro Wildlife Management Area  
35 in the vicinity of the Monticello Reservoir. Recreational uses in the vicinity include boating,  
36 fishing, hunting, hiking, and bicycling, and are generally associated with the Monticello Reservoir,  
37 Parr Hydro Wildlife Management Area, and Sumter National Forest. While SCE&G owns public  
38 recreation sites around Monticello Reservoir, the VCSNS site is not open to public recreation.

1 Land-use and land-cover statistics for the vicinity and region of the VCSNS site are listed in  
 2 Table 2-1, and are based on U.S. Geological Survey (USGS 2001) geographic information  
 3 system (GIS) data on land cover.

4 **Table 2-1.** Land Use and Land Cover in the Vicinity and Region of the VCSNS Site

Land Use/Land Cover	Site and Vicinity (6 mi)		Region (50 mi)	
	Acres	Percent	Acres	Percentage
Fresh water	10,827	13.95	159,273	3.21
Marsh/emergent wetland	23	0.03	2381	0.05
Pocosin	0	0.00	1472	0.03
Swamp	0	0.00	82,765	1.67
Bottomland/floodplain forest	3145	4.05	284,929	5.74
Wet soil	0	0.00	3200	0.06
Wet scrub/shrub thicket	697	0.90	55,828	1.12
Dry scrub/shrub thicket	3591	4.63	433,269	8.73
Sandy bare soil	0	0.00	2710	0.05
Open canopy/recently cleared forest	10,107	13.02	456,723	9.20
Rock outcrop	3	0.00	486	0.01
Aquatic vegetation	0	0.00	245	0.00
Closed canopy evergreen forest/woodland	20,054	25.83	929,537	18.72
Needle-leaved evergreen mixed forest/woodland	8301	10.69	572,401	11.53
Pine woodland	0	0.00	21,505	0.43
Dry deciduous forest/woodland	409	0.53	45,830	0.92
Mesic deciduous forest/woodland	12,240	15.77	769,774	15.50
Dry mixed forest/woodland	54	0.07	45,931	0.93
Mesic mixed forest/woodland	2399	3.09	88,327	1.78
Grassland/pasture	1171	1.51	124,336	2.50
Cultivated land	3562	4.59	603,971	12.16
Urban development	700	0.90	96,969	1.95
Urban residential	346	0.45	176,845	3.56
Wet evergreen	0	0.00	6284	0.13
<b>Total</b>	<b>77,629</b>	<b>100.00</b>	<b>4,964,993</b>	<b>100.00</b>

Source: USGS 2001

1   **2.2.2   Transmission-Line Corridors**

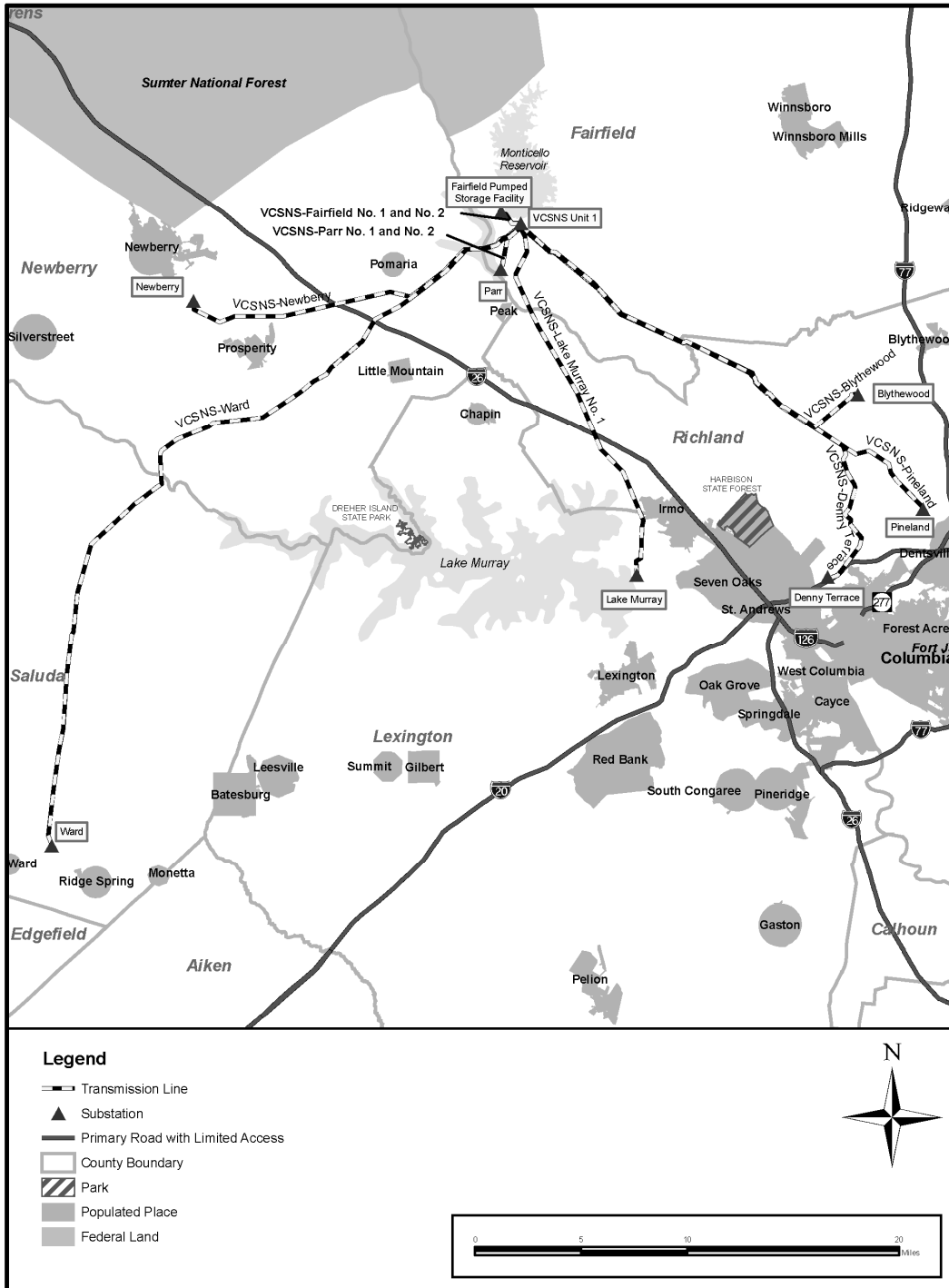
2   The existing transmission system supporting VCSNS Unit 1 has ten 230-kV lines with one  
3   115-kV line connecting the site to the transmission system. In addition, transmission-line  
4   corridors owned by Duke Energy pass to the northwest of the site but are not connected to  
5   Unit 1. The existing transmission systems owned by SCE&G and Santee Cooper (the State-  
6   owned electric and water utility, formally called the South Carolina Public Service Authority) in  
7   the vicinity of the VCSNS site are shown in Figure 2-4.

8   The addition of Units 2 and 3 to the VCSNS site would require six new 230-kV lines (three for  
9   Unit 2, three for Unit 3) (SCE&G 2009a). Three transmission lines would also be required to  
10   connect the Unit 1 switchyard to the switchyards for Unit 2 and Unit 3. Finally, some existing  
11   transmission lines would require upgrading to support transmission for the additional power  
12   through the transmission system. Representative routes for potential new transmission-line  
13   corridors are illustrated in Figure 2-5.

14   The potential routes of the new transmission lines are described as follows (SCE&G 2009a):

- 15   • VCSNS-Killian – This SCE&G line would be routed to the vicinity of Winnsboro and then  
16    generally follow the I-77 corridor to connect to the existing Killian substation near Killian,  
17    South Carolina, southeast of the plant and northeast of Columbia.
- 18   • VCSNS-Flat Creek – This Santee Cooper line would connect to the existing Winnsboro  
19    substation near Winnsboro, then to the existing Richburg switching station near Great Falls,  
20    South Carolina, and finally to the existing Flat Creek substation west of Lancaster, South  
21    Carolina.
- 22   • VCSNS-Lake Murray No. 2 – This SCE&G line would connect to the existing Lake Murray  
23    switchyard for the McMeekin and Saluda Hydro stations near the eastern boundary of Lake  
24    Murray.
- 25   • VCSNS-St. George – This double-circuit SCE&G line would connect to a new substation near  
26    St. George, South Carolina.
- 27   • VCSNS-Varnville – This Santee Cooper line would connect to the existing Sandy Run  
28    substation near Sandy Run, then to the Orangeburg substation in Orangeburg, then to the  
29    St. George substation near St. George, and then to the existing Varnville substation near  
30    Varnville, South Carolina, in Hampton County.

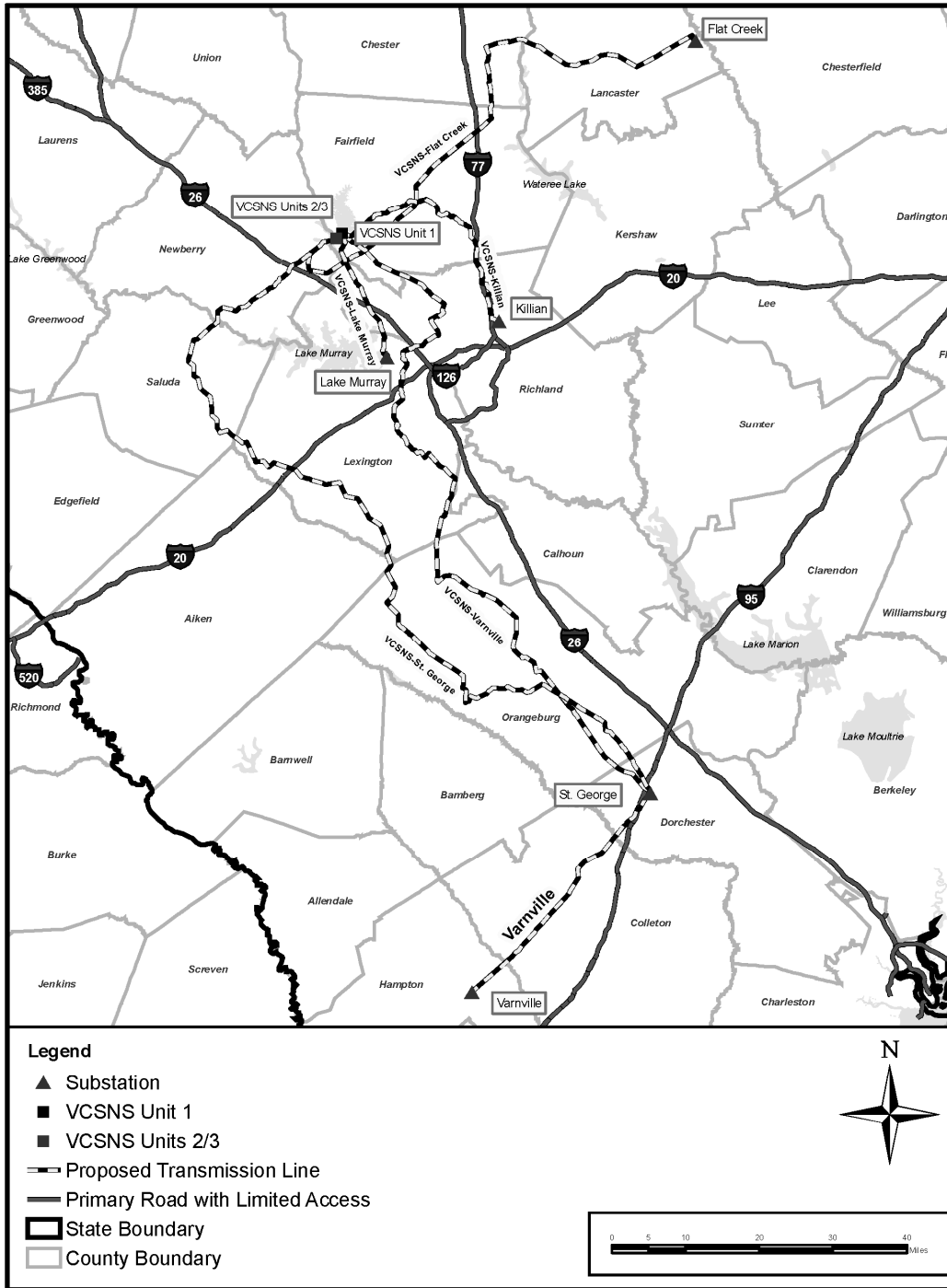




1  
2

**Figure 2-4. Existing Unit 1 Transmission Lines (SCE&G 2009a)**

Affected Environment



1  
2 **Figure 2-5.** VCSNS Units 2 and 3 Representative Routes for Potential New Transmission-Line  
3 Corridors (SCE&G 2009a)

1 Table 2-2 and Table 2-3 characterize the representative land uses in the potentially affected  
2 transmission-line corridors for SCE&G's and Santee Cooper's corridors, respectively. These  
3 values are based on independent siting studies performed on behalf of each utility (FP&S 2008;  
4 MACTEC 2008). The review team used GIS data supplied by SCE&G (the basis of Figure 2-5)  
5 as a starting point for its review of affected land uses in the existing and proposed transmission-  
6 line corridors. The review team used aerial imagery to estimate corridor width for existing  
7 corridors where widths could not be identified from ER references. To determine which existing  
8 corridors would be expanded, the SCE&G-supplied GIS data for existing transmission lines  
9 were overlaid with the SCE&G-supplied GIS data for the proposed transmission line. Based on  
10 the areas where routing appeared to follow the same corridor, the following existing corridor  
11 expansions were assumed (all corridors that would be expanded by proposed transmission lines  
12 were widened by an extra 100 ft, regardless of existing width):

- 13 • Approximately 0.85 mi of the Newberry, Graniteville, Ward, and Parr No. 1 and No. 2 corridor  
14 would be expanded to 500 ft due to the addition of the Varnville and St. George lines.
- 15 • Approximately 5.5 mi of the Newberry, Ward, and Graniteville corridor would be expanded to  
16 300 ft due to the addition of Varnville and St. George lines.
- 17 • Approximately 23 mi of the remaining Ward and Graniteville line would be expanded to 200 ft  
18 due to the addition of the St. George line.
- 19 • All of the Lake Murray No. 1 line would be expanded to 200 ft due to the addition of Lake  
20 Murray No. 2 line.
- 21 • Approximately 17 mi of the Pineland, Blythewood, and Denny Terrace corridor would be  
22 expanded to 340 ft due to the additions of the Flat Creek and Varnville lines.

### 23 **2.2.3 The Region**

24 The region surrounding the VCSNS site is shown in Figure 2-2. The region consists of the area  
25 within the 50-mi radius of the VCSNS site. It includes several heavily populated counties, but  
26 much of the region surrounding the VCSNS has a low population density. Columbia, the State  
27 capital of South Carolina, Newberry, the County Seat of Newberry County, and Winnsboro, the  
28 County Seat of Fairfield County, are shown in Figure 2-2.

29 All or portions of 22 counties are within 50 mi of the VCSNS site, 21 of which are in South  
30 Carolina. The largest cities in the region include Columbia (population 124,818 in 2007) 26 mi  
31 to the southeast, Newberry (population 10,893 in 2007) 14 mi to the west, Lexington (population  
32 14,995 in 2007) 15 mi south, and Winnsboro (population 3564 in 2007) 14 mi east of the site  
33 (SCBCB 2009e). The major interstate highways running near the site are I-20, I-26, and I-77.

Affected Environment

1 **Table 2-2.** Land Use and Land Cover in Potentially Affected SCE&G Transmission-Line  
2 Corridors

Land Use/Land Cover	VCSNS-Killian		VCSNS-St. George		VCSNS-Lake Murray	
	Acres	Percent	Acres	Percent	Acres	Percent
Fresh water	0.89	0.20	51.37	1.55	5.56	1.25
Marsh/emergent wetland	0.22	0.05	10.90	0.33	0.44	0.10
Pocosin	0.00	0.00	2.45	0.07	0.00	0.00
Swamp	0.22	0.05	81.17	2.44	0.00	0.00
Bottomland/floodplain forest	9.79	2.19	317.80	9.56	23.35	5.23
Wet soil	0.00	0.00	0.22	0.01	1.33	0.30
Wet scrub/shrub thicket	2.45	0.55	74.28	2.23	1.78	0.40
Dry scrub/shrub thicket	18.90	4.24	377.18	11.35	23.35	5.23
Sandy bare soil	5.56	1.25	0.00	0.00	0.00	0.00
Open canopy/recently cleared forest	120.76	27.07	269.76	8.11	46.70	10.46
Rock outcrop	0.00	0.00	0.22	0.01	0.00	0.00
Closed canopy evergreen forest/woodland	62.05	13.91	311.57	9.37	78.28	17.53
Needle-leaved evergreen mixed forest/woodland	42.92	9.62	320.69	9.65	80.95	18.13
Pine woodland	0.00	0.00	2.22	0.07	0.00	0.00
Dry deciduous forest/woodland	6.89	1.55	45.81	1.38	1.56	0.35
Mesic deciduous forest/woodland	71.83	16.10	253.97	7.64	78.73	17.63
Dry mixed forest/woodland	0.67	0.15	63.60	1.91	3.34	0.75
Mesic mixed forest/woodland	2.45	0.55	129.43	3.89	32.02	7.17
Grassland/pasture	15.35	3.44	184.81	5.56	13.79	3.09
Cultivated land	39.36	8.82	716.33	21.55	17.79	3.98
Urban development	35.81	8.03	33.36	1.00	13.79	3.09
Urban residential	10.01	2.24	24.91	0.75	23.80	5.33
Wet evergreen	0.00	0.00	52.49	1.58	0.00	0.00
Total acreage	446.1	100.00	3324.6	100.00	446.6	100.00
Linear run (mi)	36.58		134.23		19.06	
Average width (ft)	101		204		193	

Source: USGS 2001

1 **Table 2-3.** Land Use in Potentially Affected Santee Cooper Transmission-Line Corridors

Land Use/Land Cover	VCSNS-Flat Creek		VCSNS-Varnville	
	Acres	Percent	Acres	Percent
Fresh water	11.56	1.18	28.47	1.13
Marine water	0.00	0.00	0.00	0.00
Marsh/emergent wetland	0.00	0.00	55.38	2.20
Pocosin	0.00	0.00	2.45	0.10
Swamp	0.00	0.00	64.94	2.58
Bottomland/floodplain forest	30.91	3.15	185.48	7.37
Wet soil	0.89	0.09	0.00	0.00
Wet scrub/shrub thicket	7.78	0.79	134.10	5.33
Dry scrub/shrub thicket	47.81	4.87	258.20	10.26
Sandy bare soil	1.56	0.16	0.00	0.00
Open canopy/recently cleared forest	300.01	30.54	455.91	18.11
Rock outcrop	5.56	0.57	0.00	0.00
Aquatic vegetation	0.00	0.00	0.00	0.00
Closed canopy evergreen forest/woodland	181.25	18.45	194.37	7.72
Needle-leaved evergreen mixed forest/woodland	79.62	8.11	207.94	8.26
Pine woodland	2.89	0.29	2.67	0.11
Dry deciduous forest/woodland	3.11	0.32	26.24	1.04
Mesic deciduous forest/woodland	149.23	15.19	189.26	7.52
Dry mixed forest/woodland	0.00	0.00	34.47	1.37
Mesic mixed forest/woodland	6.00	0.61	60.49	2.40
Grassland/pasture	43.37	4.41	77.17	3.07
Cultivated land	80.06	8.15	346.27	13.76
Urban development	18.46	1.88	45.81	1.82
Urban residential	12.23	1.25	125.88	5.00
Wet evergreen	0.00	0.00	21.57	0.86
Maritime forest	0.00	0.00	0.00	0.00
Beach	0.00	0.00	0.00	0.00
Total acreage	982.3	100.00	2517.1	100.00
Linear run (mi)		71.71		163.4
Average width (ft)		113		127

Source: USGS 2001

2 The closest commercial or public general aviation airports located within the VCSNS region are  
3 the Fairfield County Airport 15 mi to the east, Newberry County Airport 18.6 mi to the west,  
4 Columbia Metropolitan Airport 27 mi to the south, and Columbia Owens Airport 27 mi south of  
5 the site.

## Affected Environment

1 Table 2-1 characterizes the existing land uses in the affected region. The State of South  
2 Carolina mandates that cities and counties have comprehensive land-use plans to govern  
3 regional growth and associated commercial and residential development. As a result, zoning  
4 ordinances are in effect in all of the affected counties to ensure that new development is  
5 managed and conforms to the intent of the comprehensive plans.

### 6 **2.3 Water**

7 This section describes the hydrologic processes and waterbodies in and around the VCSNS  
8 site, the existing water use, and the quality of water in the proposed Units 2 and 3 environment.  
9 Building activities would make use of or affect local groundwater, surface water, and public  
10 water supplies. During proposed Units 2 and 3 operations, makeup water for cooling and other  
11 plant uses would be drawn from the Monticello Reservoir. Units 2 and 3 liquid effluents, except  
12 for water-treatment plant return flow, would discharge to the Parr Reservoir. The water-  
13 treatment plant return flow would discharge to Monticello Reservoir. The VCSNS site and these  
14 hydrologic features are shown in Figure 2-6.

15 Descriptions of the building impacts, operating impacts, cumulative impacts, and alternative  
16 sites and alternative plant systems are provided in sections of Chapters 4, 5, 7, and 9,  
17 respectively. Sections of these chapters that relate to hydrology draw from information  
18 presented in this chapter and the VCSNS Environmental Report (ER) (SCE&G 2009a).

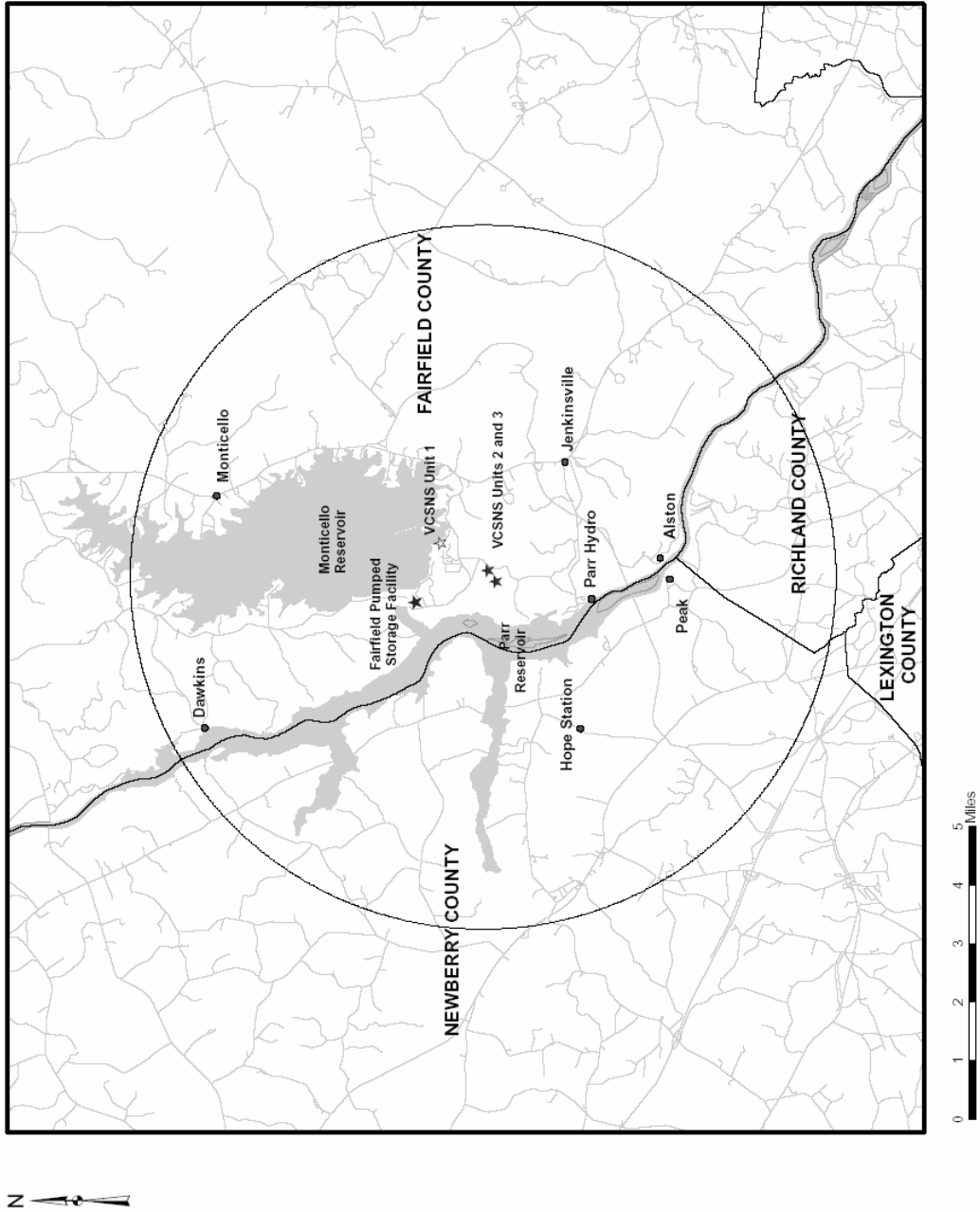
19 Elevations in this environmental impact statement (EIS) are reported based on either the  
20 National Geodetic Vertical Datum of 1929 (NGVD29) or the National American Vertical Datum  
21 of 1988 (NAVD88). In the vicinity of the VCSNS site, the NGVD29 is 0.696 ft lower than the  
22 NAVD88. For example, VCSNS Units 2 and 3 have a design plant grade of 400 ft NAVD88 and  
23 400.696 ft NGVD29.

#### 24 **2.3.1 Hydrology**

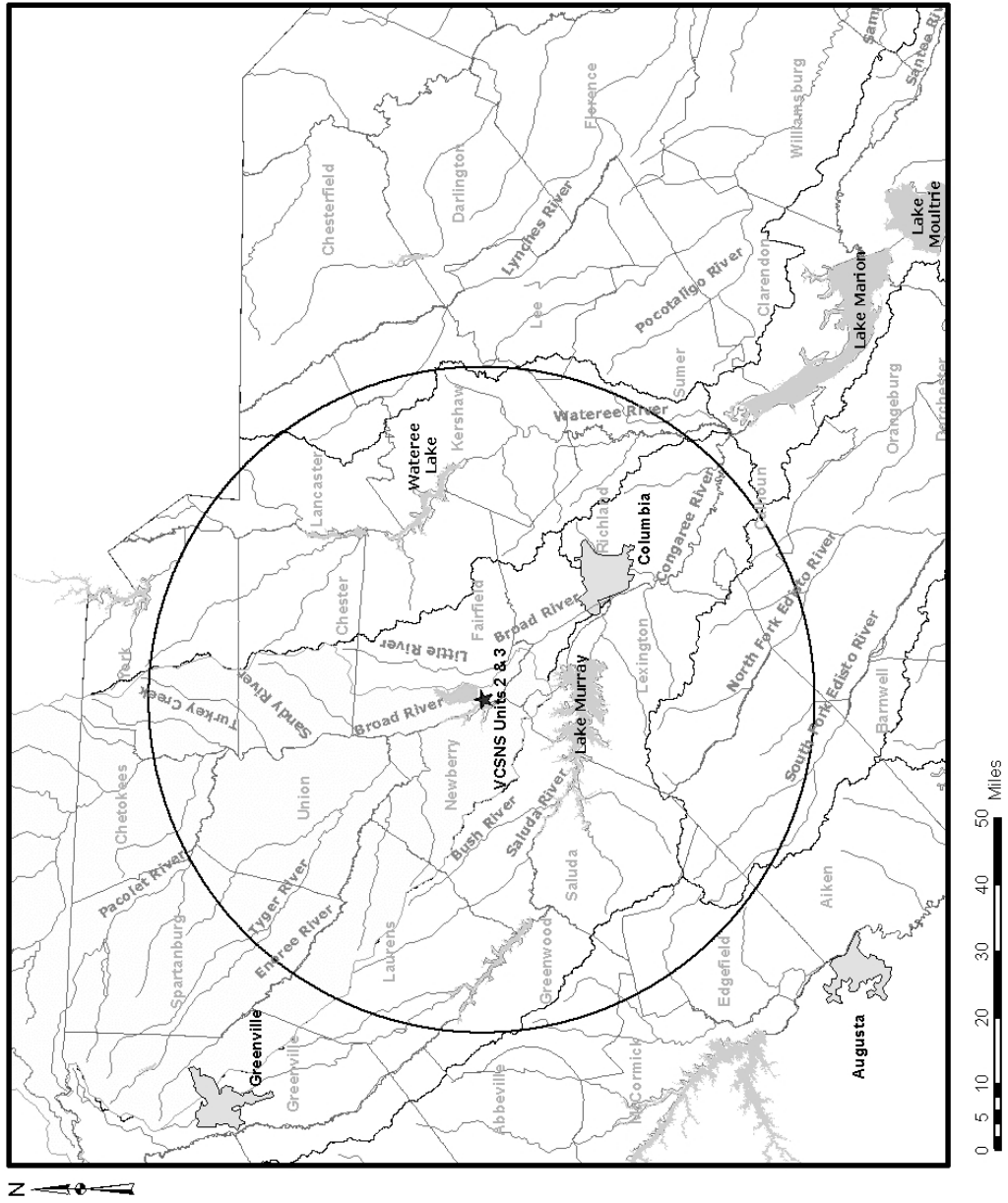
25 This section describes the site-specific and regional hydrologic features that would affect, or be  
26 altered by, construction, preconstruction, and operation of proposed VCSNS Units 2 and 3. The  
27 hydrologic conditions at the proposed location for Units 2 and 3 are described in Section 2.3 of  
28 the VCSNS ER (SCG&E 2009a) and in Section 2.4 of the Final Safety Analysis Report (FSAR)  
29 (SCE&G 2009i).

##### 30 **2.3.1.1 Surface-Water Hydrology**

31 Figure 2-7 and Figure 2-8 show the location of the VCSNS site with respect to the Broad River  
32 and its watershed. The VCSNS site is located approximately 150 mi from the Atlantic Ocean.  
33 The only major river near VCSNS is the Broad River, which is approximately 1 mi west of the

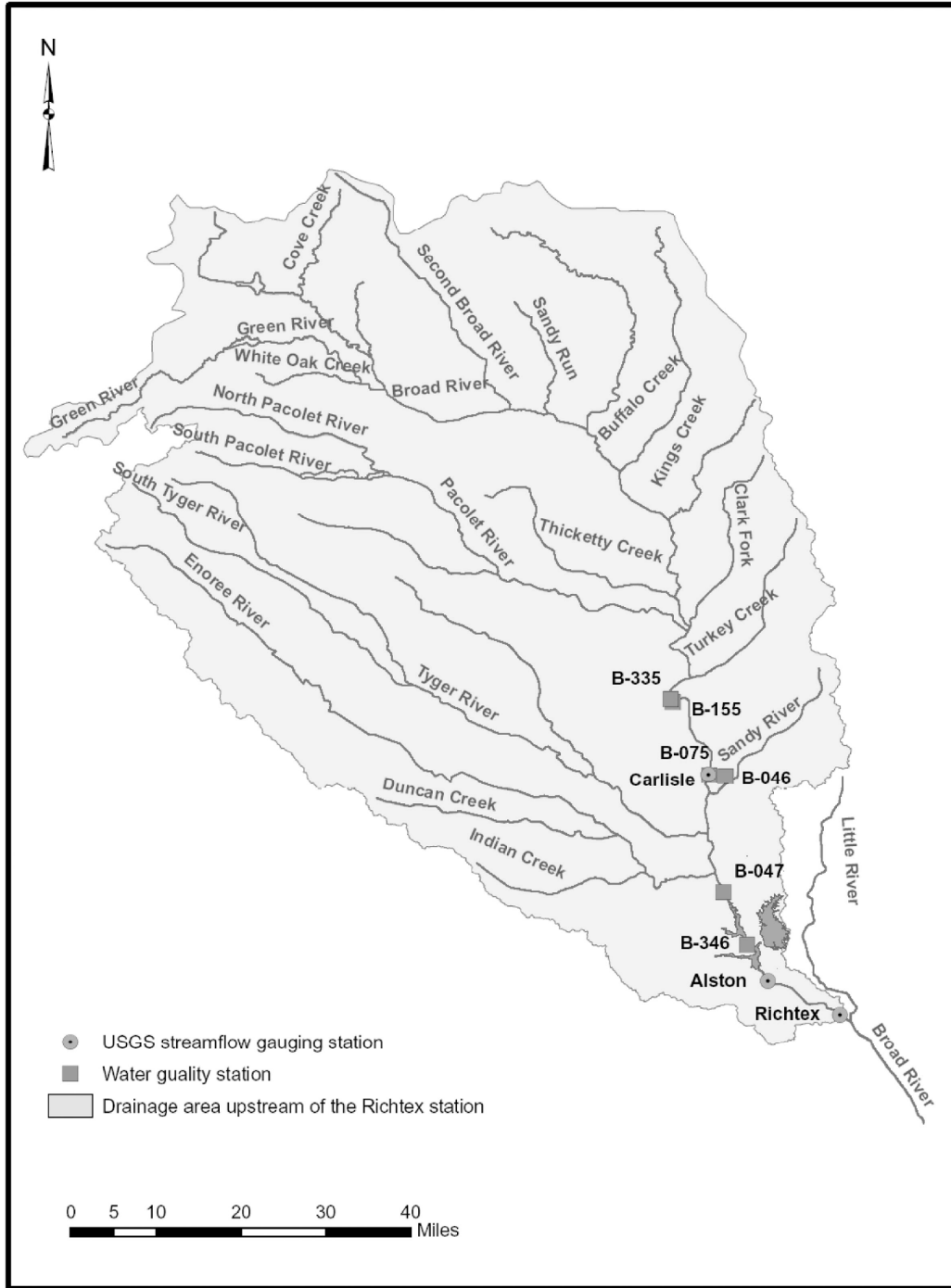


1  
2 **Figure 2-6. Major Hydrologic Features Within the 6-mi Radius of VCSNS Units 2 and 3 (SCG&E 2009a)**



1  
2 **Figure 2-7.** Major Hydrologic Features Within the 50-mi Radius of VCSNS Units 2 and 3 (SCG&E 2009a)





1  
2 **Figure 2-8.** Broad River Basin Upstream of the VCSNS Site, Showing the Nearest Stream-  
3 Flow Gauging Stations (SCG&E 2009a)

Affected Environment

1 proposed location of VCSNS Units 2 and 3. The river reach near the VCSNS site is  
 2 approximately 2000 ft wide and has a maximum depth of about 15 ft. The Broad River is  
 3 impounded by Parr Shoals Dam (Figure 2-3), which is located about 2 mi downstream of the  
 4 proposed locations of the two new units. Above the Parr Shoals Dam, the Broad River  
 5 watershed area is approximately 4550 mi<sup>2</sup> (SCG&E 2009a).

6 The Broad River originates in North Carolina at Lake Lure in the Blue Ridge Mountains. The  
 7 Broad River drainage is mostly composed of forest and agricultural lands. The Broad and the  
 8 Saluda rivers combine to form the Congaree River near Columbia, South Carolina, about 28 mi  
 9 southeast of the site (SCG&E 2009a). The Congaree River combines with the Wateree River to  
 10 form the Santee River, which discharges to the Atlantic Ocean.

11 During the operation of proposed VCSNS Units 2 and 3, makeup water for the circulating-water  
 12 system would be obtained from the Monticello Reservoir whose storage is controlled by  
 13 operation of the FPSF and from withdrawals and exchanges with the Broad River/Parr  
 14 Reservoir. The intake structure for Units 2 and 3 would be located on the southern shore of  
 15 Monticello Reservoir. Characteristics of Parr Reservoir and Monticello Reservoir are listed in  
 16 Table 2-4. Monticello Reservoir was created by four dams (referred to as Dams A, B, C, and D  
 17 as noted in Table 2-4) on Frees Creek at the southern end of the reservoir (SCG&E 2009a).

18 **Table 2-4.** Summary of Reservoir Characteristics

	<b>Parr Reservoir</b>	<b>Monticello Reservoir</b>
Created by	Parr Shoals Dam	Dams A, B, C, and D
Surface Area	4400 ac	6800 ac (including a 300-ac subimpoundment for recreational use) (SCE&G 2009a)
Usable Storage at Crest Elevation	29,000 AF	400,000 AF
Drainage Area	4550 mi <sup>2</sup>	17.4 mi <sup>2</sup>
Evaporation	50 ac-ft/day (25 cfs)	65 ac-ft/day (33 cfs), plus 44 ac-ft/day (22 cfs) from condenser water

19 The existing VCSNS Unit 1 withdraws water from and discharges it to Monticello Reservoir.  
 20 Proposed VCSNS Units 2 and 3 would withdraw water from Monticello Reservoir and discharge  
 21 it to Parr Reservoir. The discharges to Parr Reservoir would include Units 2 and 3 cooling-  
 22 water system blowdown and discharges from the radwaste building. A small discharge from the  
 23 proposed water-treatment plant would be made into Monticello Reservoir (SCG&E 2009a).

24 The two nearest active U.S. Geological Survey (USGS) gauging stations are at Alston  
 25 downstream of the VCSNS site on the Broad River and at Carlisle upstream of the VCSNS site.  
 26 A third nearby gauging station (Richtex), located downstream from the Alston station, was

1 discontinued in 1983. The locations of these stations are shown in Figure 2-8. SCE&G  
 2 summarized flow characteristics for the Broad River at these three gauging stations (SCE&G  
 3 2009a) (see Table 2-5). The summary data reported for Alston and Carlisle in the VCSNS ER  
 4 are consistent with those in *Water Resources Data, South Carolina, Water Year 2005: Water-*  
 5 *Data Report SC-05-1* published by the USGS in 2006 (Cooney et al. 2006). There is  
 6 seasonality in Broad River flows. The review team determined that about 64 percent of the  
 7 annual Broad River flow (at Alston, South Carolina) occurs during the 6 months (December to  
 8 May) while 36 percent occurs during the remaining months. The review team based these  
 9 calculations on data presented by the Cooney et al (2006).

10 **Table 2-5.** Broad River Flow Characteristics at Three Gauges Near the VCSNS Site. All  
 11 values in the table are reported in cubic feet per second.

	<b>Carlisle</b>	<b>Richtex</b>	<b>Alston</b>
Mean Annual Daily Flow	3880	6155	6302
Highest Annual Mean Flow	5977	NA	11,750
Lowest Annual Mean Flow	1255	NA	2153
Annual 7-Day Minimum	220	NA	200
Maximum Mean Daily Flow	114,000	NA	130,000
Instantaneous Maximum Flow	123,000	228,000	140,000

Source: SCE&G 2009a.

12 The reported Broad River flow characteristics are comparable to those independently calculated  
 13 by the review team. The values are based on all data that were available as of June 22, 2009,  
 14 and are presented in Table 2-6. The USGS data sets only reflect daily averages, so the  
 15 maximum instantaneous flows are not included in the following table. Maximum and minimum  
 16 values from the data set were determined from the processed daily values; the minimum 7-day  
 17 average was similarly determined.

18 **Table 2-6.** Broad River Flow Characteristics Calculated by the Review Team (cfs)

	<b>Carlisle</b>	<b>Richtex</b>	<b>Alston</b>
Mean Daily	3767	6228	5950
Highest Monthly Mean	6088	14,209	12,541
Highest Daily Mean	114,000	211,000	130,000
Lowest Daily Mean	44	149	48
Minimum 7-Day Within CY	206	593	200

19 The VCSNS ER reports that the annual precipitation in the region is about 45 in. and runoff is  
 20 reported to be approximately 18 in. These averages are consistent with those reported by the  
 21 South Carolina State Climatology Office (SCSCO 2009). The long-term annual runoff amounts  
 22 for the Broad River as reported by the USGS for Carlisle and Alston are 18.89 in. and 17.78 in.,  
 23 respectively.

## Affected Environment

1 Historical flooding is described in ER Section 2.3.1.1.2. Of the two flood seasons – January to  
2 April and July to December – the latter, associated with the hurricane season, has yielded the  
3 larger floods. The ER references peak flow and water levels at the USGS gauging stations  
4 (SCE&G 2009a). Corresponding flow values for the Broad River at Parr Shoals Dam were  
5 estimated using measured flows at nearby stations and scaling them by the ratios of watershed  
6 areas from gauged sites (Richtex and Alston).

7 Historical low flows are reported for USGS gauging stations located at Alston and Richtex.  
8 SCE&G reported lowest daily means at Richtex and Alston of 149 and 48 cfs, respectively. The  
9 latter value was reported to have been reduced due to active withdrawal by the FPSF at the  
10 time of the measurement; the next lowest daily reported discharge at Alston is 156 cfs, which is  
11 46 cfs below the annual 7-day minimum reported by the USGS. The review team independently  
12 verified that 156 cfs was the second lowest value in the Alston data set and that 149 cfs is the  
13 minimum value in the Richtex data set.

14 SCE&G estimated a 100-year minimum flow at Richtex of 125 cfs. The review team confirmed  
15 this determination.

16 The 7-day low flow estimated at Parr Shoals Dam is 190 cfs using the synthetic record  
17 produced by SCE&G (as previously described). The 100-year daily mean flow estimate was  
18 125 cfs; this estimate was based on annual low daily mean flows. When analysis was repeated  
19 using annual minimum 7-day low flows, the 100-year low flow was estimated to be 430 cfs. The  
20 USGS reported a 7Q10 low flow (lowest flow for 7 consecutive days expected to occur once per  
21 decade) for Alston of 853 cfs (SCE&G 2009a).

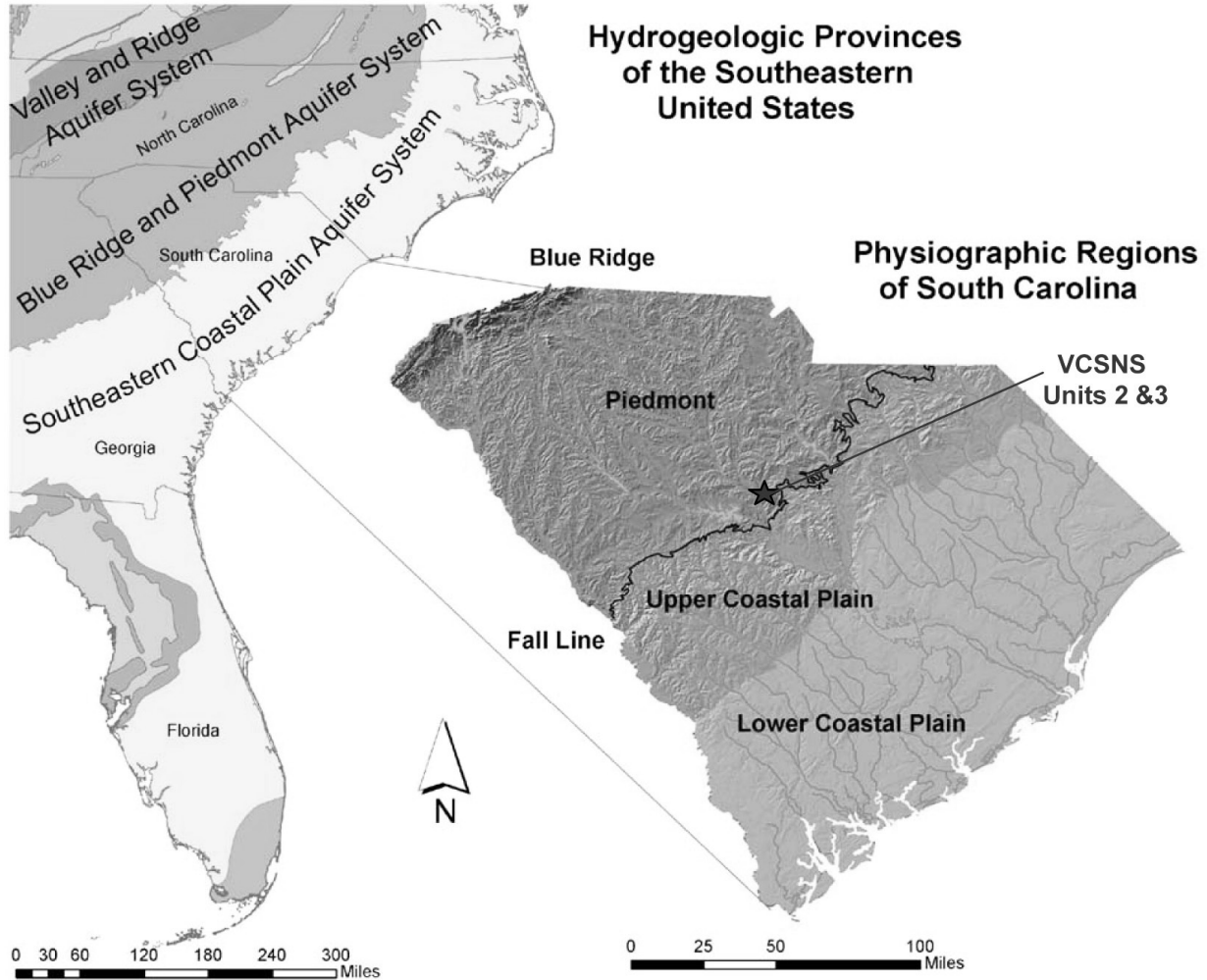
22 The flow of water between Parr Reservoir and Monticello Reservoir is controlled by the FPSF.  
23 The Parr Reservoir pool elevation can vary by as much as 10 ft/day based on FPSF operations;  
24 the average daily fluctuation is about 4 ft. Daily fluctuation in Monticello Reservoir due to FPSF  
25 operations can cause pool elevation to range from 420.5 to 425 ft NGVD29.

26 Bathymetric surveys were made in 2006 in both Parr and Monticello reservoirs to map areas in  
27 the vicinity of the VCSNS Units 2 and 3 discharge outlet and intake structures, respectively.  
28 These surveys indicate that Monticello Reservoir rapidly deepens in front of the proposed  
29 location of the intake structure (by 425 ft within 125 ft of the shore) (SCE&G 2009a,  
30 Figure 2.3-10). The surveys also indicate that the proposed discharge diffuser would extend  
31 into a relatively deep channel along the eastern shore of Parr Reservoir.

### 32 **2.3.1.2 Groundwater Hydrology**

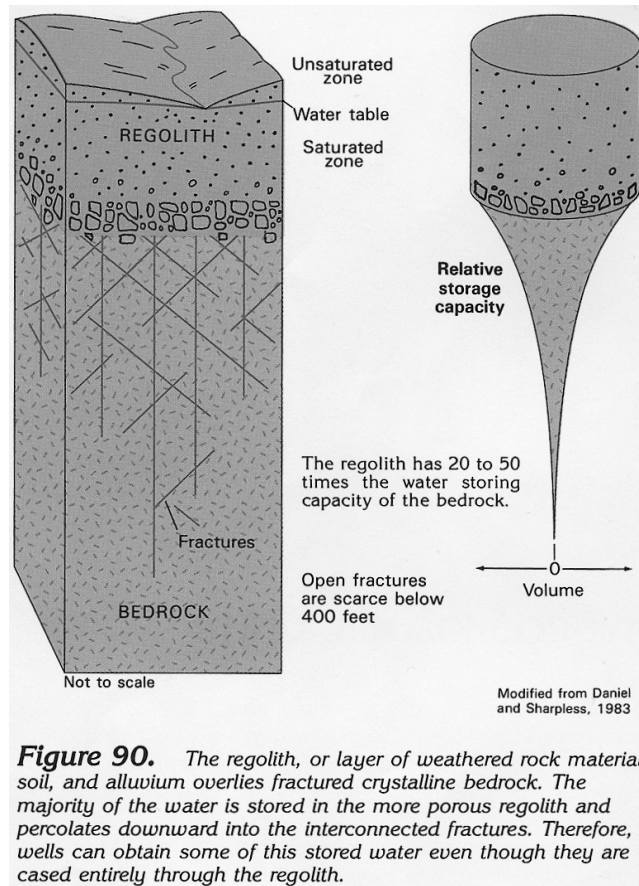
33 Section 2.8 of this chapter briefly describes the geologic setting of the VCSNS site. VCSNS  
34 FSAR Section 2.5 (SCE&G 2009i) provides a detailed description of the geology and geologic  
35 history of the site and surrounding area. As described in Section 2.8, the VCSNS site is located

1 in the Piedmont physiographic province (see Figure 2-9) and has crystalline bedrock  
 2 (predominantly igneous granitic rocks with some metamorphic rocks) mantled by saprolite and  
 3 residual soils. Based on regional descriptions and site characterization in this area (as  
 4 described below), two groundwater zones were identified: an uppermost saprolite/shallow  
 5 bedrock zone (which contains the water table) and a bedrock zone in fractured crystalline rocks  
 6 (see Figure 2-10).



7  
 8 **Figure 2-9.** Physiographic Provinces of South Carolina and Hydrogeologic Provinces of the  
 9 Southeastern United States Showing the VCSNS Site Location (SCE&G 2009a)

## Affected Environment

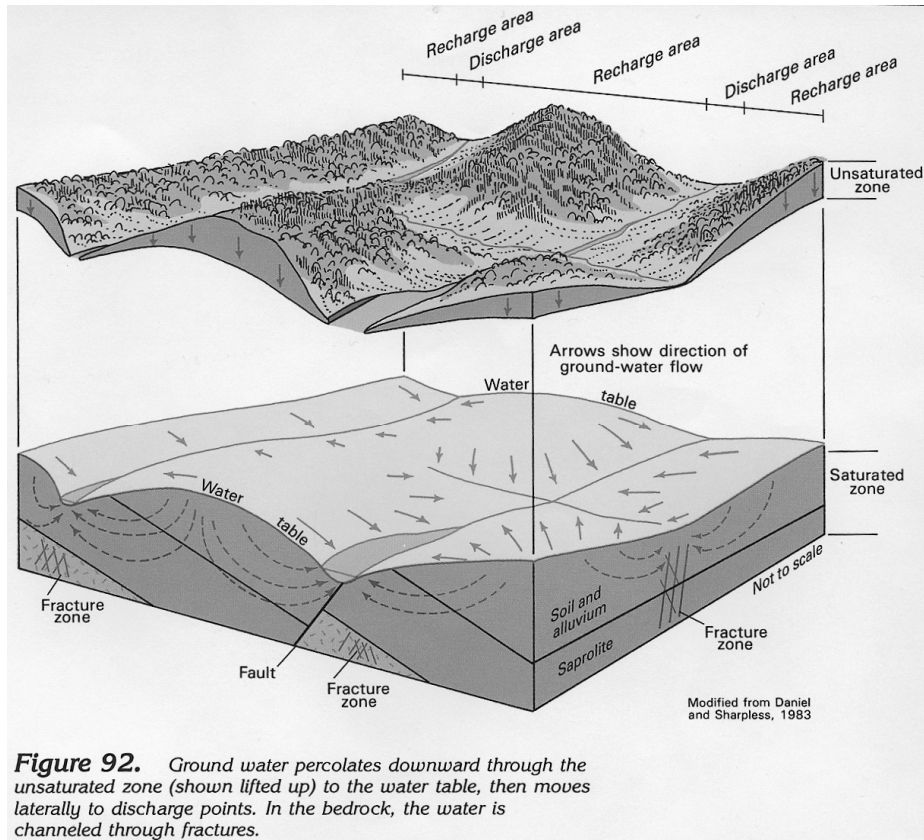


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2 **Figure 2-10.** Diagram of Regolith and Fractured Bedrock Groundwater Zones in the Piedmont  
3 Physiographic Province of the Southeastern United States (USGS 1990)

### 4 **Regional Groundwater Description**

5 The USGS Groundwater Atlas (USGS 1990) provides a regional description (Alabama, Florida,  
6 Georgia, and South Carolina) of the aquifers within the Piedmont physiographic province, which  
7 underlies the VCSNS site. The USGS Groundwater Atlas also provides a generalized  
8 conceptual model of groundwater flow in the Piedmont physiographic province (see Figure 2-11  
9 [from Figure 92 of USGS GW Atlas HA-730G]). The atlas describes the aquifers in the  
10 Piedmont physiographic province as generally unconfined with the water table forming a  
11 “subdued replica of surface topography.” Groundwater recharges on the hilltops and slopes  
12 (everywhere except the lower parts of valleys) and “discharges as springs, seeps, baseflow to  
13 streams, and as seepage to lakes” (USGS 1990).



1  
 2 **Figure 2-11.** Conceptual Model of Groundwater Flow in the Piedmont Physiographic Province  
 3 of the Southeastern United States (USGS 1990)

4 According to the atlas, the crystalline bedrock has “few primary pore spaces, and the porosity  
 5 and permeability of the unweathered and unfractured bedrock are extremely low” (USGS 1990).  
 6 The atlas explains that groundwater from this region is obtained from the regolith (which  
 7 includes the residual soils and saprolite) and fractures in the bedrock (see Figure 2-11). Well  
 8 yields in the Piedmont physiographic province of the southeastern United States are described  
 9 as follows (USGS 1990):

10 Although some wells completed in the Piedmont and Blue Ridge aquifers yield  
 11 almost 500 gallons per minute, the average reported well yield is much less and  
 12 generally is in the range of about 15 to 20 gallons per minute. Yields of large-  
 13 diameter wells drilled for public water supply average about 30 gallons per  
 14 minute. Part of the variation in yield depends upon the type of rock in which the  
 15 well is completed.

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1 The USGS Groundwater Atlas summarizes well yield data from different rock types for one site  
2 located in the Piedmont physiographic province (Greenwood County, South Carolina) (USGS  
3 1990) that range from 0 to 150 gpm; however, the reported median well yields are less than  
4 30 gpm. The USGS Groundwater Atlas describes well yields from the regolith as being related  
5 to the thickness and topography (USGS 1990) with larger volumes (50 gpm or more) occurring  
6 in valleys with regolith thicknesses greater than 50 ft and only “small volumes of water” for wells  
7 on slopes and hills where the regolith is generally thin. In the South Carolina Department of  
8 Health and Environmental Control (SCDHEC) 2006 South Carolina Annual Water Use  
9 Summary, Butler et al. (2007) state that for the Piedmont physiographic province “groundwater  
10 occurs in the fractures of the bedrock and overlying soil and saprolite” and “[t]he saprolite  
11 grades downward through a highly permeable transition zone to unaltered parent bedrock.  
12 Groundwater conditions of the bedrock are dependent on the number of fractures and degree of  
13 interconnection of the fracture systems.” Comparing well yields in the physiographic provinces  
14 of South Carolina (see Figure 2-9), the report also states that, “[i]n general, wells in the Blue  
15 Ridge and Piedmont regions yield little water when compared to wells drilled in the Coastal  
16 Plain owing to the inherently low porosity and permeability of the crystalline rock present in the  
17 upstate.”

18 The South Carolina Department of Natural Resources (SCDNR) South Carolina Water Plan  
19 (Badr et al. 2004) describes the aquifers in the Piedmont physiographic province as follows:  
20 “[t]he storage capacity of fractures and saprolite is very small compared to that of the Coastal  
21 Plain aquifers.” In addition, Badr et al. (2004) state that wells in the fractured bedrock of the  
22 Piedmont physiographic province “typically yield only between 5 and 15 gpm.”

23 According to the U.S. Environmental Protection Agency (EPA) website (EPA 2009a), no sole-  
24 source aquifers are designated in the area.

### 25 ***Onsite Groundwater Description***

26 The hydrogeology of the VCSNS site as described by SCE&G in its ER (SCE&G 2009a) is  
27 consistent with the regional descriptions of the aquifers listed above. Detailed hydrogeologic  
28 characterization was conducted at the site as part of the Unit 1 characterization and  
29 construction and extensive preapplication subsurface characterization for proposed VCSNS  
30 Units 2 and 3 (SCE&G 2009a,i).

31 As part of the groundwater characterization of the proposed VCSNS Units 2 and 3 site, 31  
32 monitoring wells were installed with 22 completed in the saprolite/shallow bedrock zone (see  
33 Figure 2.3-26 in the SCE&G ER [2009a] and Figure 2-10 and Figure 2-9 this chapter) completed  
34 in the deep bedrock zone (see Figure 2.3-27 in the SCE&G ER [2009a] and Figure 2-11 this  
35 chapter). This network contains five adjacent monitoring well pairs for saprolite/shallow bedrock  
36 zone and deep bedrock zone monitoring. Table 2.3-19 of the VCSNS ER (SCE&G 2009a)  
37 provides the observation well details.



1 Groundwater levels were collected monthly for 1 year from this monitoring well network from  
2 June 2006 to June 2007 (see Table 2.3-20 of the ER [SCE&G 2009a]). SCE&G provided trend  
3 plots for the water levels measured in these wells (see Figures 2.3-28 and 2.3-29 of the ER  
4 [SCE&G 2009a]) and prepared four quarterly piezometric surface maps (June 2006, September  
5 2006, December 2007, and March 2007) for the saprolite/shallow bedrock zone and the deep  
6 bedrock zone in the FSAR (SCE&G 2009i, Figures 2.4-237 to 2.4-244). Piezometric surface  
7 maps were also prepared for the last monthly water-level measurements in June 2007 and are  
8 shown in Figures 2.3-30 and 2.3-31 of SCE&G's ER (SCE&G 2009a). The piezometric surface  
9 maps are consistent with the regional conceptual model of groundwater in the Piedmont  
10 physiographic province from the USGS Groundwater Atlas (USGS 1990), described above,  
11 where the water table reflects a subdued version of the surface topography.

12 In general, the trend plots showed that the water levels were relatively constant during the  
13 monitoring period except for three wells that showed large increases. These increases were  
14 interpreted as being caused by slow recovery due to low permeability. One of the observation  
15 wells (OWs), OW-624, was screened in the saprolite/shallow bedrock zone and two wells,  
16 OW-233 and OW-627a, were screened in the deep bedrock zone. One shallow monitoring well  
17 in the network, OW-312, which was screened higher than the water table measured in other  
18 wells in its vicinity, was dry over the entire period.

19 Based on the piezometric surface maps developed from the 2006-2007 water-level monitoring  
20 data at the site and using the most recent measurements to account for well recovery (Shown in  
21 Figures 2.3-30 and 2.3-31 of SCE&G's ER [SCE&G 2009a]), it appears that the groundwater in  
22 the saprolite/shallow bedrock zone flows from the "ridgetops toward the drainage swales, with  
23 the piezometric surface approximately parallel to the topography" (SCE&G 2009i). The  
24 drainage swales include the two unnamed creeks to the northwest and southwest of the location  
25 for proposed VCSNS Units 2 and 3 and Mayo Creek to the east.

26 The vertical gradients from the five shallow and deep well pairs installed at the site for the June  
27 2006 to June 2007 monthly water-level measurements are depicted in VCSNS ER Figure 2.3-32  
28 (SCE&G 2009a). The largest calculated vertical gradients were for the two wells farthest away  
29 from the ridgetops at the proposed locations of VCSNS Units 2 and 3 and indicated a downward  
30 vertical flow direction; however based on the water-level data collected, one well that appeared  
31 to have an upward vertical gradient may not have fully recovered from installation during this  
32 water-level monitoring period (deep bedrock well OW-627a).

### 33 ***Aquifer Material Properties***

34 Field hydraulic testing consisted of slug testing in 29 of the 31 observation wells installed  
35 around the site in both the saprolite/shallow bedrock zone and deep bedrock zone. Packer  
36 tests were conducted on four selected deep bedrock zone boreholes (SCE&G 2009a).  
37 American Society for Testing and Materials (ASTM) procedures were followed when conducting

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1 the slug tests and packer tests (ASTM D4044 and D4630, respectively [SCE&G ER 2009a]).  
2 Slug tests were not conducted on 2 of the 31 observation wells because one well was dry and  
3 the other well was screened in fill and residual soil. The results of 8 of the 29 slug tests were  
4 identified as being invalid or unreliable (SCE&G 2009a). Hydraulic conductivity results, along  
5 with calculated minimum, maximum, and geometric mean values, from the analysis of the slug  
6 tests using the AQTESOLV software are reported in VCSNS ER Table 2.3-21 and updated in  
7 the FSAR Request for Additional Information (RAI) response of May 1, 2009 (SCE&G 2009d);  
8 the packer test analysis results are reported in VCSNS ER Table 2.3-22, also updated in FSAR  
9 RAI response of May 1, 2009 (SCE&G 2009d). For the slug tests, the maximum hydraulic  
10 conductivity result reported for each well was selected based on the highest value of either the  
11 falling head test or rising head test analysis. Overall the hydraulic conductivities measured for  
12 the saprolite/shallow bedrock zone were higher than the deep bedrock zone based on these  
13 tests. A general trend of decreasing hydraulic conductivity with increasing depth was seen from  
14 the slug test and packer test data for the deep bedrock zone (see Figure 2.4-246 of the VCSNS  
15 FSAR [SCE&G 2009i]).

16 Grain size, moisture content, specific gravity, and total porosity measured for residual soil and  
17 saprolite samples from the VCSNS site are listed in Table 2.3-23 of the VCSNS ER (SCE&G  
18 2009a). Porosity measurements for the fractured deep bedrock were estimated using mean  
19 values from a study conducted in the Piedmont physiographic province (SCE&G 2009a, r).

### 20 **Groundwater Pathways**

21 VCSNS Units 2 and 3 would be situated on a hilltop near a groundwater divide, as indicated in  
22 the piezometric surface maps (SCE&G 2009a, Figures 2.3-30 and 2.3-31). Based on the  
23 piezometric surface maps, groundwater flows off the hill toward the drainage swales of the  
24 unnamed creeks to the northwest and southwest of the proposed units and toward Mayo Creek  
25 on the east. Groundwater velocities are estimated from hydraulic gradients, hydraulic  
26 conductivity values based on hydraulic tests, and effective porosity estimates for the two  
27 groundwater zones. SCE&G provided conservative estimates for groundwater velocities and  
28 travel times along the primary and alternate groundwater pathways identified in Section 2.4.13  
29 of the VCSNS FSAR (SCE&G 2009i as updated by SCE&G 2009k, o). The staff's description  
30 and evaluation of groundwater pathways and travel times will be documented in the Safety  
31 Evaluation Report (SER).

### 32 **2.3.2 Water Use**

33 This section describes the current water use in the vicinity of proposed VCSNS Units 2 and 3.  
34 Permitting the use of water resources is regulated by the SCDHEC as part of its Water Quality  
35 Protection Program (SCDHEC 2009a). If the groundwater withdrawals are inside a Capacity  
36 Use Area, such use falls under the SCDHEC Groundwater Use and Reporting Program  
37 (SCDHEC 2005). The VCSNS site is not in a capacity use area. Laws applicable to the use of

1 groundwater near the VCSNS site include the Groundwater Use and Reporting Act (SC Code  
 2 Ann. 49-5 2009). Applicable laws regarding the use of surface water include the South Carolina  
 3 Surface Water Withdrawal and Reporting Act (SC Code Ann. 49-4 2009).

4 **2.3.2.1 Surface-Water Use**

5 Total (surface and ground) water use within South Carolina is reported by SCDHEC (SCDHEC  
 6 2009a). These annual summaries include the previous years' total water use. This use  
 7 includes both consumptive and nonconsumptive water use. The totals are listed in Table 2-7  
 8 below. The data indicate a significant fluctuation in water usage on an annual basis and the  
 9 dominance of surface-water usage.

10 **Table 2-7. Annual Water Use Within South Carolina**

<b>Year</b>	<b>Total (trillion gallons)</b>	<b>Surface (trillion gallons)</b>
2001	11.8	11.7
2002	14.3	14.2
2003	22.9	22.8
2004	18.8	18.7
2005	20.4	20.4
2006	16.4	16.3

Source: SCDHEC 2009a

11 Local surface-water users include hydroelectric and thermal power industries and public water  
 12 suppliers. Several hydroelectric projects use surface water, but not consumptively. Local  
 13 surface-water sources are used by Fairfield, Newberry, and Richland Counties (Table 2-8). The  
 14 total reported water use for these three counties in 2004 was 3.9 trillion gallons (SCE&G  
 15 2009a). Fairfield County represents 83 percent of this use, the majority of which was  
 16 hydroelectric power generation (SCDHEC 2009a). Local users of surface water in Fairfield  
 17 County include the town of Winnsboro and VCSNS Unit 1. At a distance of approximately 28 mi  
 18 along the Broad River from the VCSNS site, the City of Columbia is the closest downstream  
 19 large user of surface water.

20 **Table 2-8. Local and Downstream Surface-Water Users Reported by SCE&G for 2004**

<b>Users</b>	<b>County</b>	<b>Surface-Water Source</b>
Town of Winnsboro	Fairfield	Sand Creek and 192-Acre Lake
VCSNS Unit 1	Fairfield	Broad River transfers to Monticello Reservoir
City of Columbia	Richland	Broad River and Lake Murray
City of Newberry	Newberry	Saluda River
Town of Whitmire	Newberry	Duncan Creek and Enoree River
Parr Shoals Dam	Fairfield	Broad River

Source: SCE&G 2009a

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1 The Federal Energy Regulatory Commission (FERC) establishes a minimum flow through Parr  
2 Shoals Dam. Modification of the FERC license would be necessary to establish use  
3 requirements at Parr and Monticello reservoirs for VCSNS Units 2 and 3 needs.

### 4 **2.3.2.2 Groundwater Use**

5 The SCDHEC 2006 South Carolina Water Use Report (Butler et al. 2007) states “Counties in  
6 the Piedmont and Blue Ridge physiographic provinces depend primarily on the abundant  
7 regional rainfall that recharges lakes, reservoirs and major river systems.” Correspondingly,  
8 these bodies of surface water serve as the main source of water for public supply, industry,  
9 agriculture, and power production in the Piedmont Region.

10 The SCDHEC reports water use annually by county and category (aquaculture, golf course,  
11 industrial, irrigation, mining, water supply, and other) (Butler et al. 2007). Water use for these  
12 categories is reported separately for groundwater and surface water. Table 2.3-26 of the  
13 VCSNS ER (SCE&G 2009a) summarizes groundwater use for counties within a 50-mi radius of  
14 the VCSNS site in 2004 (based on the SCDHEC water-use data) and shows that public water  
15 supplies are the largest users of groundwater reported for this region. The groundwater use in  
16 Fairfield County, reported for 2006 was 71.9 million gallons, which is about 10 percent of the  
17 reported value for water supply from surface water (722 million gallons) for this county (Butler et  
18 al. 2007). Of the groundwater water-use categories in this report, only the “water supply”  
19 category had values reported for groundwater use in Fairfield County in 2006.

20 Public water-supply wells within 6 mi of VCSNS Units 2 and 3 are listed in FSAR Table 2.4-215  
21 (SCE&G 2009i) based on the SCDHEC database and EPA Safe Drinking Water Information  
22 System database for population served (see SCE&G 2009d). The table lists 14 active public  
23 water-supply wells in the area screened in the Piedmont physiographic province bedrock aquifer  
24 with design yields, where known, ranging from 5 to 29 gpm.

25 The ER states that “[g]roundwater within 2 miles of the site is primarily used for domestic  
26 purposes” (SCE&G 2009a). The closest groundwater well to the site is at a private residence  
27 approximately 1 mi east of the site (SCE&G 2009a). Information about pumping rates for  
28 private wells is not available (SCE&G 2009d), but well yields are generally limited in this area by  
29 the relatively low productivity of the aquifers in the Piedmont physiographic province, as  
30 discussed in Section 2.3.1.2 of this chapter. The ER states that “the nearest large groups of  
31 wells are located approximately 1.5 miles east of the site along SC 215 and in Jenkinsville  
32 approximately 2.5 miles southeast of the site” which serve “private residences and stores”  
33 (SCE&G 2009a). The ER also lists the Jenkinsville Water Company that has nine wells, three  
34 wells within 2 mi of the site.

1 Process and domestic water for VCSNS Unit 1 is supplied by Monticello Reservoir  
2 (SCE&G 2009a). Groundwater is pumped from two wells at a total rate of approximately  
3 26 gpm to reduce below-grade seepage in buildings in the protected area around Unit 1  
4 (SCE&G 2009a). Seepage in this area is due to the close proximity of the Monticello Reservoir  
5 (SCE&G 2009a).

### 6 **2.3.3 Water Quality**

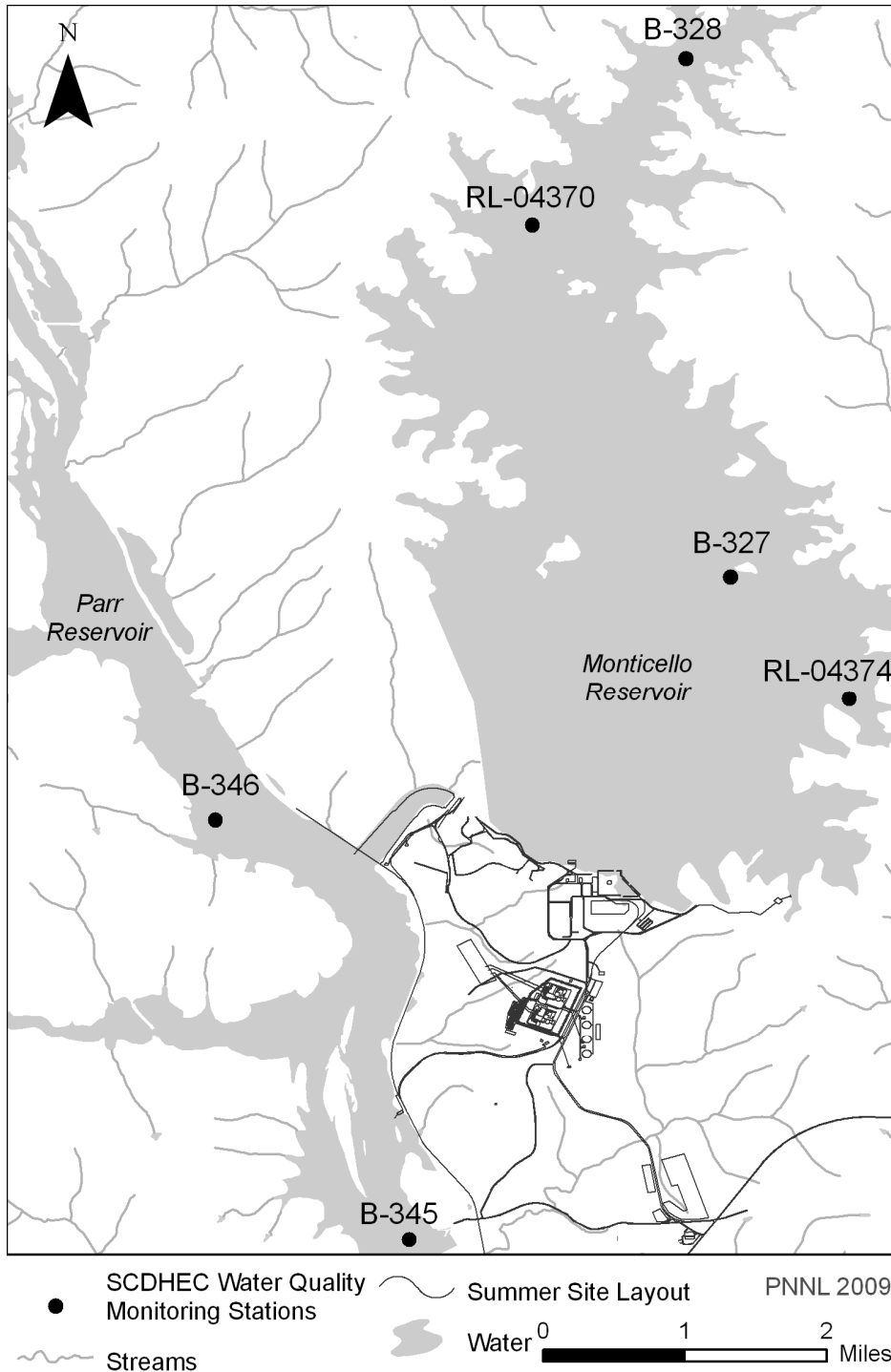
7 The following sections describe the quality of surface-water and groundwater resources in the  
8 vicinity of the VCSNS site.

#### 9 **2.3.3.1 Surface-Water Quality**

10 The bodies of surface water where water quality could be affected by VCSNS Units 2 and 3 are  
11 the Parr Reservoir/Broad River, Monticello Reservoir, and Mayo Creek. Smaller unnamed  
12 creeks on the site could also be affected by stormwater runoff. All VCSNS Units 2 and 3 cooling  
13 water would discharge to Parr Reservoir. A new water-treatment plant would return water to  
14 Monticello Reservoir. Mayo Creek and other unnamed creeks could temporarily receive  
15 discharge from the dewatering system during the VCSNS Units 2 and 3 construction period.  
16 Some surface-water runoff from the proposed Units 2 and 3 site would also drain to Mayo Creek  
17 and other unnamed creeks to the south and west (SCG&E 2009a).

18 Water quality in the Broad River, Parr Reservoir, and Monticello Reservoir has been periodically  
19 evaluated by SCDHEC, SCDNR, and SCE&G. SCE&G has conducted monthly water-quality  
20 monitoring in Monticello Reservoir since 1995 (SCE&G 2009a). The SCDHEC measures  
21 turbidity, dissolved oxygen, biochemical oxygen demand, alkalinity, nitrogen, phosphorous, fecal  
22 coliform, organic carbon, and metals in the Parr Reservoir/Broad River as well as at two stations  
23 in Monticello Reservoir (Figure 2-12). As described earlier in Section 2.3.1, the Parr Reservoir  
24 is a run-of-the-river impoundment of the Broad River adjacent to the VCSNS site. Water is  
25 exchanged between Monticello and Parr reservoirs by the FPSF. Because of this exchange of  
26 water the long-term water quality will be similar between the reservoirs. The range of water-  
27 quality constituent concentrations measured in Monticello and Parr reservoirs in 2004 and 2005  
28 and in Monticello Reservoir in 2006 are shown in Table 2-9, Table 2-10, and Table 2-11.  
29 Monitoring data for the Monticello Reservoir demonstrate that these waters are low in common  
30 ions, hardness, dissolved solids, and conductivity. Analysis of these sampling data sets does  
31 not reveal any atypical values for waterbodies located in the Piedmont region (SCE&G 2009a).

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**Figure 2-12.** The SCDHEC Water-Quality Sampling Locations near the VCSNS Site (SCE&G 2009a)

1

**Table 2-9.** Surface-Water-Quality Data for 2004

Analyzed Parameters	Monticello Reservoir		Parr Reservoir	
	Sample Location B-327	Sample Location B-328	Sample Location B-345	Sample Location B-346
Temperature (°C)/(°F)	9.3°–31.6°C	8.9°–31.2°C	8.0°–29.2° C	7.0°–28° C
	48.7°–88.9°F	48°–88.2°F	46.4°–84.6°F	44.6°–82.4°F
Turbidity (NTU)	3.0–12.0	1.3–4.9	4.6–46	6.4–95
Dissolved Oxygen (mg/L)	6.38–12.72	6.99–13.25	4.95–11.50	Less than QL–11.90
BOD (mg/L)	Less than QL–2.0	All less than QL	All less than QL	All less than QL
pH	7.11–8.68	7.41–8.11	6.95–7.66	7.12–7.68
Alkalinity, Carbonate as CaCO <sub>3</sub> (mg/L)	17–25	23–24	16–26	14–25
Total Nitrogen (NH <sub>3</sub> ) (mg/L)	Less than QL–0.50	Less than QL–0.20	Less than QL–0.20	Less than QL–0.50
Total N (Kjeldahl) (mg/L)	0.22–0.60	0.38–0.74	0.23–0.48	0.14–0.61
Total N (nitrite/nitrate) (mg/L)	0.11–0.46	Less than QL–0.062	0.25–0.51	0.28–0.58
Total Phosphorous (mg/L)	Less than QL–0.039	Less than QL–0.021	Less than QL–0.052	0.030–0.13
Total Fecal Coliform (# cells/100 mL)	Less than QL–7	Less than QL–32	2 – 140	Less than QL–240
Total Organic Carbon (mg/L)	2.4–3.2	4.7–5.2	2.2–2.9	2.0–3.3
Cadmium, Total (µg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Chromium, Total (µg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Copper, Total (µg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Iron, Total (µg/L)	130–600	42–160	220–880	450–1100
Lead, Total (µg/L)	All less than QL	All less than QL	Less than QL	All less than QL
Manganese, Total (µg/L)	Less than QL–18	Less than QL–44	20–40	33–50
Mercury, Total (µg/L)	All less than QL	Less than QL–19	All less than QL	All less than QL
Nickel, Total (µg/L)	All less than QL	All less than QL	All less than QL	All less than QL
Zinc, Total (µg/L)	Less than QL–21	All less than QL	Less than QL–48	All less than QL

Sources: EPA 2006a; SCE&amp;G 2009a

Note: Sample depths 0.3 m

NTU = Nephelometric Turbidity Units; BOD = biochemical oxygen demand; QL = quantification limit; &lt; = less than

**Table 2-10.** Surface-Water-Quality Data for 2005

<b>Analyzed Parameter</b>	<b>Monticello Reservoir Sample Location B-327 Result</b>	<b>Parr Reservoir Sample Location B-345 Result</b>
Temperature (°C)/(°F)	11.4°–32°C 52.5°F–89.6°F	10.6°C–29.3°C 51.1°F–84.7°F
Turbidity (NTU)	2.5–12	6.5–47
Dissolved Oxygen (mg/L)	5.15–10.92	4.32–10.52
BOD (mg/L)	All less than QL	All less than QL
pH (SU)	6.9–8.5	6.7–7.88
Total Nitrogen (NH <sub>3</sub> ) (mg/L)	<QL–0.2	<QL–0.25
Total N (Kjeldahl) (mg/L)	0.21–0.53	0.24–0.56
Total N (nitrite/nitrate) (mg/L)	0.14–0.59	0.27– 0.62
Total Phosphorous (mg/L)	<QL–0.038	0.027–0.083
Hardness, Ca & Mg-Total (mg/L)	14	15
Alkalinity, Carbonate as CaCO <sub>3</sub> , Total (mg/L)	17–24	17–24
Cadmium, Total (µg/L)	All less than QL	All less than QL
Total Organic Carbon (mg/L)	<QL–3.2	3.0–3.9
Chromium, Total (µg/L)	All less than QL	<L–25
Copper, Total (µg/L)	All less than QL	All less than QL
Iron, Total (µg/L)	150–350	330–1800
Lead, Total (µg/L)	All less than QL	All less than QL
Nickel, Total (µg/L)	All less than QL	All less than QL
Zinc, Total (µg/L)	<QL–10	All less than QL
Total Fecal Coliform (# cells/100 mL)	<QL–100	2–480
Enterococcus Group Bacteria, Total (# cells/100 mL)	<QL–12	<QL–310

Sources: EPA 2006a; SCE&G 2009a  
 NTU = Nephelometric Turbidity Units; BOD = biochemical oxygen demand; SU = standard units; QL = quantification limit; < = less than



1

**Table 2-11.** Monticello Reservoir Water-Quality Data for 2006

<b>Analyzed Parameter</b>	<b>Result</b>	<b>Analyzed Parameter</b>	<b>Result</b>
Antimony (µg/L)	<QL	Nickel (µg/L)	<QL
Arsenic (µg/L)	<QL	Potassium (µg/L)	2206
Barium (µg/L)	17.7	Selenium (µg/L)	<QL
Beryllium (µg/L)	<QL	Silver (µg/L)	<QL
Cadmium (µg/L)	<QL	Sodium (µg/L)	10,280
Calcium (µg/L)	3425	Thallium (µg/L)	<QL
Chromium (µg/L)	<QL	Zinc (µg/L)	<QL
Copper (µg/L)	<QL	Silica (µg/L)	8025
Iron (µg/L)	101	Sulfate (mg/L)	4.3
Lead (µg/L)	<QL	Total Dissolved Solids (mg/L)	63
Magnesium (µg/L)	1856	Total Hardness (Calcium) (mg/L)	16.2
Manganese (µg/L)	<QL	Total Suspended Solids (mg/L)	3
Mercury (liquid) (µg/L)	<QL	Turbidity (nephelometric turbidity units)	2.3
Ammonia-N (mg/L)	0.21	Platinum-Cobalt (SU)	15
Chlorophyll a (mg/L)	0.00690	Total Organic Carbon (mg/L)	1.7
Ortho-phosphorous (mg/L)	0.034	Strontium (mg/L)	0.038
Phosphorous (mg/L)	0.021	Chemical Oxygen Demand (mg/L)	<QL
BOD 5-Day (mg/L)	<QL	Cyanide (mg/L)	<QL
Fecal Coliform-MF (# cells/100 mL)	<QL		

Source: SCE&amp;G 2009a

Water sample also analyzed for volatile organics (Method 624), semi-volatile organics (Method 625), and for pesticides/polychlorinated biphenyls (Method 608). All parameter results were below laboratory quantitative limits levels.

< = less than; QL = quantification limit; SU = standard units

2 The SCDHEC regularly assesses water quality in the Broad River, Parr Reservoir, and  
3 Monticello Reservoir and compares results to State water-quality standards (SCDHEC 2008a,  
4 b). The standards are used to assemble a Clean Water Act Section 303(d) list of impaired  
5 waters based on metal concentrations, pH, dissolved oxygen levels, organic elements, fecal  
6 coliform and organism tissue evaluations, and the presence of biota. The variability of pH in the  
7 Monticello Reservoir was such that it was listed as impaired (aquatic life use would not be  
8 supported) (SCDHEC 2008b). Stations B-046 on the Broad River near Carlisle and B-345 in  
9 Parr Reservoir were considered impaired due to elevated copper level and/or potential  
10 degradation of the aquatic life uses standards established by the Clean Water Act and  
11 SCDHEC. Parr Reservoir station B-346 was included in the list as impaired because of  
12 elevated total phosphorus concentrations (SCDHEC 2008b).

13 Monthly water-temperature profiles in Monticello Reservoir have been measured by SCE&G  
14 since 1991 (SCE&G 2009a). Measurement locations were selected to characterize the

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1 circulation and thermal aspects of the reservoir near the VCSNS Unit 1 intake, discharge canal,  
2 and a control site. Other water-quality parameters were also monitored (pH, conductivity,  
3 dissolved oxygen). Monticello Reservoir temperature data are presented in detail in Section 2.3  
4 of the ER (SCE&G 2009a). Most of the reservoir, represented by a station near the Unit 1  
5 intake and a station away from Unit 1 or FPSF influence, can be briefly characterized as varying  
6 from about 50°F in winter months up to 85°F at the surface in summer. Through spring and  
7 midsummer, temperatures at the 50-ft depth were up to 12°F cooler than the surface; other  
8 times of the year, little variation with depth was observed (SCE&G 2009a).

9 Broad River water-temperature data are available from the USGS stations in the area (Richtex,  
10 Alston, and Carlisle) (see Figure 2-8). Analysis of these data sets suggests that the water  
11 temperatures in Parr Reservoir varied seasonally from 38.3°F to 86°F. To independently  
12 characterize the water temperatures in Parr Reservoir, the daily water temperature record at  
13 Carlisle gauging station was examined. This is the closest station to Parr Reservoir with a  
14 recent and long observational record (1983-2009). For each year of data, the daily records  
15 were averaged over a 3-month rolling period. Then monthly statistics (mean, minimum, and  
16 maximum) were computed over all years for each rolling 3-month period. The lowest 3-month  
17 average for February to March was 43°F and the highest for summer (July-August) was 84°F.

18 Sediment transport within the Broad River has not been measured. Changes in land-use  
19 patterns since the 1800s have affected the soil erosion in the watershed (Kovacik and Winberry  
20 1987; NCDWQ 1998). Parr Reservoir bed sediment grain-size analysis was reported in the ER,  
21 Section 2.3.1.1.6 (SCE&G 2009a). The reservoir bed material is primarily clay, clay-silt, sand,  
22 sand-silt; some gravel was also noted. This characterization is consistent with that of the USGS  
23 (USGS 2003). No bedload sediment transport measurements are available for the Broad River.  
24 Measurements of Broad River total suspended solids are reported by SCDHEC once every 2  
25 years. The water-quality sampling stations closest to VCSNS Units 2 and 3 are B-047 (12 mi  
26 upstream of Parr Shoals Dam) and B-046 (21 mi upstream of Parr Shoals Dam), as shown in  
27 Figure 2-8 (SCE&G 2009a).

28 Temperature, pH, dissolved oxygen, and conductivity in Mayo Creek, measured during  
29 macroinvertebrate surveys conducted in 2008 and 2009, are provided in Table 2-12 (CBS  
30 2009b). These data were consistent with earlier measurements made by SCE&G at three  
31 locations in July 2006 and November 2006 (Tetra Tech NUS, Inc. 2007). Water-quality  
32 measurements were within the State standards for Class FW (freshwaters) (SCDHEC 2008a),  
33 and indicated that Mayo Creek water quality was similar to other groundwater-fed streams in the  
34 area (SCE&G 2009a).

35

1

**Table 2-12.** Mayo Creek Water-Quality Data for 2008 and 2009

Date	Station	Temperature (°C)	pH	Conductivity (µmhos/cm)	Dissolved Oxygen (mg/L)
July 2008	1	22.6	7.2	122	6.5
July 2008	2	21.3	7.0	123	7.2
July 2008	3	20.9	7.0	126	6.8
October 2008	1	17.1	7.4	101	12.3
October 2008	2	15.1	7.3	96	10.8
October 2008	3	14.9	7.3	106	8.9
January 2009	1	8.9	7.3	89	11.5
January 2009	2	9.6	7.6	87	9.9
January 2009	3	9.4	7.5	88	11.7
April 2009	1	13.6	7.1	82	9.2
April 2009	2	13.7	7.2	110	9.5
April 2009	3	15.2	7.3	111	9.5

Source: CBS 2009b

### 2 2.3.3.2 Groundwater Quality

3 Baseline nonradiological groundwater quality was established around the proposed VCSNS  
4 Units 2 and 3 location by monitoring that consisted of one round of sampling from nine wells in  
5 late August/early September 2006 for a subset of analyses (SCE&G 2009a) and more detailed  
6 water-quality analyses from eight wells during the second half of 2007. The 2007 water-quality  
7 monitoring consisted of one sampling round for four wells, two sampling rounds for three wells,  
8 and three sampling rounds for one well (SCE&G 2009a, ER Table 2.3-36, which was updated in  
9 SCE&G 2009q with water-quality criteria). The detailed water-quality monitoring results from  
10 2007 were compared to SCDHEC drinking-water standards (SCE&G 2009a, ER Table 2.3-36  
11 updated in SCE&G 2009q). These standards (Class GB) are available in *R.61-68, Water*  
12 *Classifications & Standards* (SCDHEC 2008a). Based on this comparison, the groundwater  
13 exceeded the SCDHEC State Drinking Water standards in at least one well during a sampling  
14 round for the following analyses: sulfates, total dissolved solids, turbidity, total coliform,  
15 cadmium, iron, lead, and pH.

16 Low levels of tritium were detected in two wells located near the proposed VCSNS Unit 3  
17 location during the 2007 monitoring (SCE&G 2009a). The potential source of this tritium was  
18 the permitted disposal of condensate polisher resin in the area in 1994. The results from soil  
19 samples collected and analyzed from this area in 2006 indicated that radiological concentrations  
20 were below the Low Limits of Detection specified in the Offsite Dose Calculation Manual as  
21 described by SCE&G (2009e). Details about the sampling and results are contained in SCE&G  
22 2009e.

1 **2.3.4 Water Monitoring**

2 Surface-water and groundwater monitoring are described in the following sections.

3 **2.3.4.1 Surface-Water Monitoring**

4 Broad River flows are monitored continuously at several USGS gauging stations near the  
 5 VCSNS site (Figure 2-8). Flow information is mostly available for calculation of long-term daily  
 6 average flows. The station name, number, location, and period of record for the three Broad  
 7 River gauging stations closest to VCSNS are summarized in Table 2-13. The USGS also  
 8 records or has recorded Broad River water temperature at these three stations during periods  
 9 listed in Table 2-13.

10 **Table 2-13.** USGS Flow and Temperature Monitoring on the Broad River

Station	Number	Location	Flow Monitoring Period(s)	Temperature Monitoring Period(s)
Carlisle	02156500	21 mi upstream of Parr Shoals Dam	October 1938 to present	1965 to 1965; 1968-1975
Alston	02161000	1.2 mi downstream from Parr Shoals Dam	October 1896 to December 1907, October 1980 to present	November 1971 to July 1972
Richtex	02161500	14 mi downstream from Parr Shoals Dam	October 1925 to September 1983	October 1959 to September 1960; July 1972 to July 1974

Source: SCE&G 2009a

11 Water quality in the Broad River, Parr Reservoir, and Monticello Reservoir continues to be  
 12 periodically monitored by SCE&G and SCDHEC. SCE&G's water-monitoring program for  
 13 VCSNS Unit 1 at Monticello Reservoir has been ongoing since 1995; SCE&G measures  
 14 temperature, dissolved oxygen, pH, and specific conductance monthly at three reservoir  
 15 locations (SCE&G 2009a, Section 2.3.1.1.5). Monitoring locations are (1) near the circulating-  
 16 water intake for VCSNS Unit 1, (2) near the VCSNS Unit 1 thermal discharge, and (3) in the  
 17 northern part of Monticello Reservoir outside of the influence of the FPSF and VCSNS Unit 1.  
 18 SCE&G recorded temperature continuously near the VCSNS Unit 1 circulating-water intake  
 19 during the summer months from 1992 to 1994. SCDHEC monitors water quality statewide,  
 20 cycling through each watershed at least every 5 years for the (SCDHEC 2008b). SCDHEC  
 21 monitors the following suite of water-quality parameters at the stations in the vicinity of VCSNS  
 22 shown in Figure 2-8 and Figure 2-12:

- 23 • temperature, turbidity, dissolved oxygen, biochemical oxygen demand
- 24 • pH and alkalinity

- 1 • total nitrogen, total phosphorus, total fecal coliform, total organic carbon
- 2 • metals, including cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and
- 3 zinc.

4 As described in Section 2.3.3, SCE&G conducted preapplication water-quality monitoring of  
5 Mayo Creek in 2006, 2008, and 2009 (TetraTech NUS, Inc. 2007; SCE&G 2009a; CBS 2009b).

#### 6 **2.3.4.2 Groundwater Monitoring**

7 The results of preconstruction preapplication groundwater monitoring for VCSNS Units 2 and 3  
8 were described previously in Section 2.3.1.2 for hydrologic monitoring (i.e., water levels) and  
9 EIS Section 2.3.3.2 for groundwater-quality monitoring. Hydrologic groundwater monitoring  
10 reported in the ER (see ER Table 2.3-20 [SCE&G 2009a]) consisted of monthly measurements  
11 of water levels from June 2006 through June 2007 from 31 wells around VCSNS Units 2 and 3.  
12 Monitoring of groundwater quality around VCSNS Units 2 and 3 consisted of one round of  
13 sampling of nine wells in late August/early September 2006 for a subset of analyses (see ER  
14 Table 2.3-35, SCE&G 2009a). More detailed water-quality analyses were conducted on water  
15 collected from eight wells during the second half of 2007, with one sampling round for four wells,  
16 two sampling rounds for three wells, and three sampling rounds for one well (see Table 2.3-36  
17 of ER and updated version [SCE&G 2009a, q]).

18 EIS Section 4.2.4 describes the hydrologic and water-quality groundwater monitoring proposed  
19 during facility preconstruction/construction and EIS Section 5.2.4 describes the hydrologic and  
20 water-quality groundwater monitoring proposed during operations. Radiological monitoring of  
21 groundwater is discussed in EIS Sections 2.11 and 5.9.

## 22 **2.4 Ecology**

23 This section describes the terrestrial and aquatic ecology of the site and vicinity, which includes  
24 the biological communities and habitats that might be affected by the building, operation, or  
25 maintenance of proposed VCSNS Units 2 and 3. Sections 2.4.1 and 2.4.2 provide general  
26 descriptions of terrestrial and aquatic environments on and in the vicinity of the VCSNS site as  
27 well as the additional area associated with the proposed six new 230-kV transmission-line  
28 corridors.

29 Detailed descriptions are provided where needed to support the analysis of potential ecological  
30 impacts from the building, operation, or maintenance of new nuclear power-generation facilities  
31 and the associated power-transmission systems. These descriptions also support the  
32 evaluation of mitigation activities identified during the assessment to avoid, reduce, minimize,  
33 rectify, or compensate for potential impacts. Descriptions of terrestrial and aquatic monitoring  
34 programs are also included.

1 **2.4.1 Terrestrial and Wetlands Ecology**

2 The VCSNS site is surrounded by a mosaic of forests and farmland, typical of the Piedmont  
3 physiographic province. This province begins in the southernmost portion of New York State  
4 and stretches in a southwestward direction to approximately mid-Alabama (Godfrey 1980). The  
5 Piedmont region has been heavily farmed and cultivated, thereby altering the pre-settlement  
6 landscape considerably (Kirkman et al. 2007). This section identifies terrestrial ecological  
7 resources and describes species composition and other structural and functional attributes of  
8 biotic communities that might be affected by the construction, operation, and maintenance of  
9 proposed VCSNS Units 2 and 3 and the proposed transmission-line system. It also identifies  
10 important terrestrial resources, as defined by the NRC (NRC 2000) that might be affected by the  
11 proposed action.

12 **2.4.1.1 Terrestrial Resources – Site and Vicinity**

13 The terrestrial communities found on the VCSNS site and vicinity are characteristic of the  
14 Southern Outer Piedmont ecoregion (Griffith et al. 2002). The surrounding landscape  
15 comprises gently rolling hills and valleys dissected by an abundance of streams. Vegetation  
16 communities common in the Southern Outer Piedmont ecoregion include mixed oak forest and  
17 oak-hickory-pine forest. Common tree canopy species consist of white oak (*Quercus alba*),  
18 southern red oak (*Quercus falcata*), black oak (*Q. velutina*), mockernut (*Carya alba*) and pignut  
19 hickories (*C. glabra*), some loblolly pine (*Pinus taeda*), and shortleaf pine (*Pinus echinata*).  
20 Sites that have a moderate amount of moisture (mesic sites) such as riparian areas contain  
21 American beech (*Fagus grandifolia*), northern red oak (*Q. rubra*), tulip poplar (*Liriodendron*  
22 *tulipifera*), and red maple (*Acer rubrum*) (Griffith et al. 2002). The dominant cover in the vicinity  
23 of VCSNS is mixed forest (SCE&G 2009a).

24 The VCSNS site comprises approximately 3600 ac, which includes approximately 784 ac of  
25 open water in the Monticello Reservoir (SCE&G 2009a). The Parr Reservoir lies just west of the  
26 site (SCE&G 2009a). The proposed project site for VCSNS Units 2 and 3 is within the current  
27 nuclear facility boundary just south of existing VCSNS Unit 1, in an area that was cleared and  
28 used for storage, spoils disposal, and laydown areas during the construction of Unit 1 (SCE&G  
29 2009a). The VCSNS site is primarily a human-altered system that has changed dramatically  
30 since the development of VCSNS Unit 1 and the damming of the Broad River and Frees Creek,  
31 which created Parr and Monticello reservoirs, respectively. Historical photographs illustrate the  
32 change on this site since 1938 (see Figure 2-13). Also, see Table 2-14 for the current land-use  
33 categories and acreage on the VCSNS site.

34

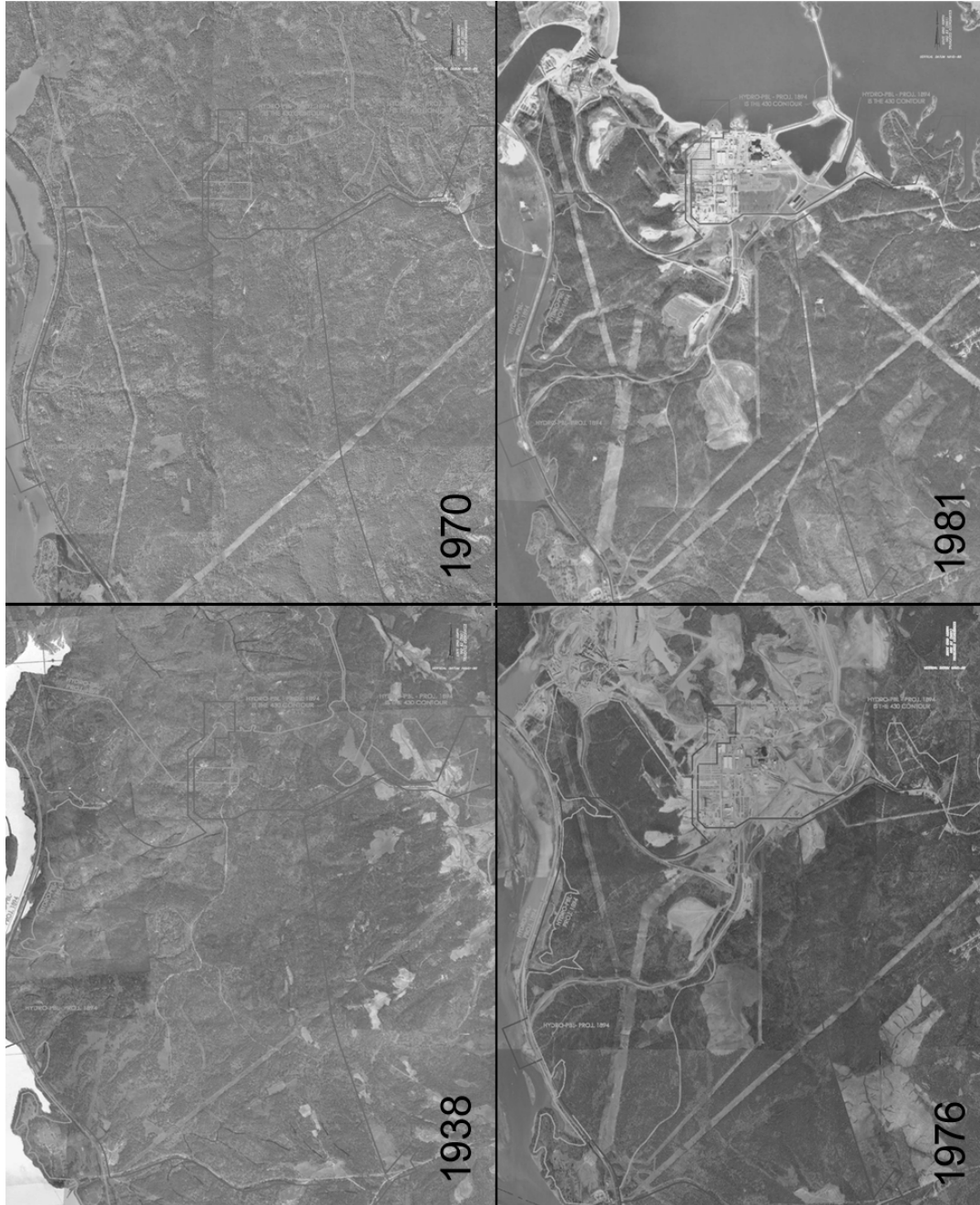


Figure 2-13. Historical Photos Showing How the VCSNS Site Has Changed Since 1938 (SCE&G 2009a)

## Affected Environment

1 **Table 2-14.** Land-Use Categories and Acreage on the VCSNS Site (out of a total of  
2 approximately 3600 ac)

Land-Use Category	Approximate Acreage	Approximate Percent of Site
Mixed Forest	2334	64.8
Open Water	874	24.2
Urban or Developed Land	388	10.7
Wetlands	44	41.2

### 3 ***Existing Terrestrial Cover Types***

4 Forests on the VCSNS site are managed by SCANA Services' Forestry Operations group, but  
5 timber harvests are not common (NRC 2003). A variety of cover types are present including  
6 planted pine forest, naturally vegetated pine forest, mixed pine-hardwood forest, and hardwood  
7 forest. Pine forests are primarily second-growth stands of loblolly pine either natural or planted;  
8 older forests are characterized by the presence of hardwoods such as white oak. Hardwood-  
9 dominant stands occur mainly along streams and side slopes (Figure 2-14) (SCE&G 2009a).

#### 10 Pine Forest

11 Natural and planted pine forests on the VCSNS site (including those most recently harvested  
12 since 2004) consist mostly of naturally vegetated and cultivated loblolly pine. These forests are  
13 early successional, even-aged stands that produce a closed canopy with little to no understory  
14 of either woody or herbaceous cover (FPC 1974). Much of the pine forest consists of planted  
15 pines, which are generally poor wildlife habitat, lacking in both food and cover needed by native  
16 wildlife (SCDNR 2005a).

#### 17 Mixed Pine-Hardwood Forest

18 Mixed pine-hardwood forests occur primarily in the eastern portion of the VCSNS site and  
19 consist of loblolly pine and longleaf pine (*Pinus palustris*), with a variety of other species  
20 including tulip poplar, red maple, winged elm (*Ulmus alata*), persimmon (*Diospyros virginiana*),  
21 eastern redcedar (*Juniperus virginiana*), black gum (*Nyssa sylvatica*), American beech,  
22 American holly (*Ilex opaca*), black cherry (*Prunus serotina*), and sweetgum (*Liquidambar*  
23 *styraciflua*) (SCE&G 2002a; Nelson 2006).

#### 24 Hardwood Forest

25 Hardwood forests make up a small portion of the forested communities on the VCSNS site and  
26 are predominately located along stream bottoms and surrounding ravines (NRC 2004). Typical  
27 canopy species present include white oak, southern red oak, black gum, and some American  
28 beech (Nelson 2007). Flowering dogwood (*Cornus florida*) is a dominant understory





1  
2

**Figure 2-14.** Map of the Cover Types on the VCSNS Site

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1 species and herbaceous species such as Hepatica (*Hepatica americana*), golden alexander  
2 (*Zizia trifoliata*), sanicle (*Sanicula marilandica*), Christmas fern (*Polystichum acrostichoides*),  
3 and little nut-rush (*Scleria oligantha*) are common along small streams (SCE&G 2002a).

### 4 Wetlands

5 Wetlands present on the VCSNS site are typical of those found in the South Carolina Piedmont  
6 and include both palustrine (marshes, bogs, fens, etc.) and lacustrine (on the shores of lakes  
7 and/or reservoirs) wetlands. Most of the wetlands are forested and are associated with small  
8 streams, seeps, and beaver ponds (SCE&G 2009a). Typical species that would be found on  
9 these types of sites include those mentioned above in the mixed pine-hardwood and hardwood  
10 cover types as well as tulip poplar, sweetgum, white ash (*Fraxinus americana*), black cherry,  
11 sedge (*Carex* spp.), and red maple. There is also limited freshwater marsh habitat in shallow  
12 backwaters along Parr Reservoir that contains emergent wetland species, such as cattail  
13 (*Typha latifolia*), bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.),  
14 smartweed (*Polygonum hydropiperoides*), pickerelweed (*Pontederia cordata*), lizard's tail  
15 (*Saururus cernuus*), water primrose (*Ludwigia* spp.), and water pennywort (*Hydrocotyle* spp.)  
16 (SCE&G 2009a).

### 17 **Wildlife**

18 Terrestrial wildlife species found on the VCSNS site are typical of those found in the Southern  
19 Outer Piedmont ecoregion of South Carolina. A variety of species inhabit the forested, wetland,  
20 and open water habitats present, including amphibians, reptiles, birds, and mammals. Recent  
21 biological surveys of the site have been conducted in support of VCSNS Unit 1 license renewal  
22 (SCE&G 2002a) and more recently to provide information regarding potential occurrences of  
23 threatened and/or endangered species on the VCSNS site (Tetra Tech NUS, Inc. 2008, 2009a;  
24 Nelson 2006, 2007). Informal observations of wildlife and vegetation were made during the  
25 surveys. Ecological monitoring data collected in the early 1970s to mid-1980s were also  
26 reviewed to provide additional information regarding the wildlife likely to be observed on the  
27 VCSNS site and vicinity.

### 28 Mammals

29 Mammals that occur on the VCSNS site include those typically found in the Piedmont such as  
30 the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus*  
31 *carolinensis*), eastern cottontail (*Sylvilagus floridanus*), muskrat (*Ondatra zibethica*), bobcat  
32 (*Lynx rufus*), beaver (*Castor canadensis*), opossum (*Didelphis virginiana*), hispid cotton rat  
33 (*Sigmodon hispidus*), eastern mole (*Scalopus aquaticus*), house mouse (*Mus musculus*), white-  
34 footed mouse (*Peromyscus leucopus*), gray fox (*Urocyon cinereoargenteus*), and the eastern  
35 spotted skunk (*Spilogale putorius*) (SCDNR 2005b). Small-mammal trapping was conducted in

1 the early 1970s before construction of VCSNS Unit 1 and then again in 2008 and 2009 with  
2 Sherman™ live traps (Tetra Tech NUS, Inc. 2008).

### 3 Amphibians and Reptiles

4 Several species of reptiles and amphibians are known to occur on the VCSNS site, including  
5 black racer snake (*Coluber constrictor*), ringneck snake (*Diadophis punctatus*), and rat snake  
6 (*Elaphe obsoleta*); lizards such as the Carolina anole (*Anolis carolinensis*), and fence lizard  
7 (*Sceloporus undulates*); and various skinks and toads (FPC 1974; SCE&G 2009a). The  
8 Piedmont of South Carolina is not as rich in herpetofauna as the other parts of the state  
9 (SCDNR 2005a).

### 10 Birds

11 Birds that occur on the VCSNS site include those typically found in the Piedmont. Various  
12 species of dabbling ducks such as mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*),  
13 and green-winged teal (*Anas crecca*) use the freshwater marsh habitat in Parr Reservoir, and  
14 Monticello Reservoir supports a resident population of Canada geese (*Branta canadensis*  
15 *leucopareia*). Bald eagles (*Haliaeetus leucocephalus*) nest near the site and are observed  
16 frequently, and a variety of wading birds, songbirds, birds of prey, and other migratory and  
17 nonmigratory birds occur on the VCSNS site. Table 2-15 lists avian species observed and  
18 recorded on the VCSNS site during other previously described ecological surveys conducted in  
19 2002, 2006, 2007, and 2008. The taxa in bold are species the State of South Carolina have  
20 determined to be Priority Species (SCDNR 2005b).

#### 21 **2.4.1.2 Terrestrial Resources – Transmission Lines**

22 This section describes terrestrial resources known to occur on or in the vicinity of the existing  
23 transmission lines and new transmission-line corridors required to integrate the electrical power  
24 generated at proposed VCSNS Units 2 and 3 into the electrical grid system. As described in  
25 Section 2.1, a total of six new offsite 230-kV transmission lines would be needed to distribute  
26 the power generated by the proposed Units 2 and 3 at the VCSNS site. Santee Cooper would  
27 maintain two of the lines, and SCE&G would maintain the other four in three corridors (one  
28 double-circuit line and two single-circuit lines). Two of the SCE&G transmission-line corridors  
29 have been proposed as viable options, but the final routes have not yet been determined (FP&S  
30 2008; MACTEC 2008; SCE&G 2009a). The proposed transmission-line corridors pass through  
31 forested and agricultural lands typical of central South Carolina; span two ecoregions, the  
32 Southern Outer Piedmont and Sandhills; and two of the planned transmission lines extend  
33 slightly into the Coastal Plain ecoregion (Figure 2-5). Land use along the proposed SCE&G  
34 transmission-line corridors is summarized in Table 2-2.

**Table 2-15.** Avian Species Observed on the VCSNS Site

<b>Wading Birds, Shorebirds, and Other Water Birds</b>	<b>Passerines and Other Birds (continued)</b>
Blue-winged teal ( <i>Anas discors</i> )	Mourning dove ( <i>Zenaida macroura</i> )
<b>Mallard (<i>Anas platyrhynchos</i>)</b>	Blue jay ( <i>Cyanocitta cristata</i> )
<b>Black duck (<i>Anas rubripes</i>)</b>	Yellow-rumped warbler ( <i>Dendroica coronata</i> )
<b>Great egret (<i>Ardea alba</i>)</b>	<b>Prairie warbler (<i>Dendroica discolor</i>)</b>
<b>Great blue heron (<i>Ardea herodias</i>)</b>	Pine warbler ( <i>Dendroica pinus</i> )
Canada goose ( <i>Branta canadensis</i> )	Pileated woodpecker ( <i>Dryocopus pileatus</i> )
Green heron ( <i>Butorides virescens</i> )	<b>Dark-eyed junco (<i>Junco hyemalis</i>)</b>
Killdeer ( <i>Charadrius vociferus</i> )	<b>Loggerhead shrike (<i>Lanius ludovicianus</i>)</b>
<b>Little blue heron (<i>Egretta caerulea</i>)</b>	Belted kingfisher ( <i>Megaceryle alcyon</i> )
Herring gull ( <i>Larus argentatus</i> )	Red-bellied woodpecker ( <i>Melanerpes carolinus</i> )
Double-crested cormorant ( <i>Phalacrocorax auritus</i> )	Wild turkey ( <i>Meleagris gallopavo</i> )
<b>Birds of Prey and Soaring Birds</b>	Song sparrow ( <i>Melospiza melodia</i> )
Cooper's hawk ( <i>Accipiter cooperii</i> )	Northern mockingbird ( <i>Mimus polyglottos</i> )
Red-tailed hawk ( <i>Buteo jamaicensis</i> )	Great crested flycatcher ( <i>Myiarchus crinitus</i> )
Red-shouldered hawk ( <i>Buteo lineatus</i> )	Tufted titmouse ( <i>Parus bicolor</i> )
Turkey vulture ( <i>Cathartes aura</i> )	Carolina chickadee ( <i>Parus carolinensis</i> )
Black vulture ( <i>Coragyps atratus</i> )	Indigo bunting ( <i>Passerina cyanea</i> )
<b>Bald eagle (<i>Haliaeetus leucocephalus</i>)</b>	Downy woodpecker ( <i>Picoides pubescens</i> )
<b>Passerines and Other Birds</b>	Rufous-sided towhee ( <i>Pipilo erythrophthalmus</i> )
Red-winged blackbird ( <i>Agelaius phoeniceus</i> )	Summer tanager ( <i>Piranga rubra</i> )
Ruby-throated hummingbird ( <i>Archilochus colubris</i> )	<b>Golden-crowned kinglet (<i>Regulus satrapa</i>)</b>
Great horned owl ( <i>Bubo virginiana</i> )	Eastern phoebe ( <i>Sayornis phoebe</i> )
Northern cardinal ( <i>Cardinalis cardinalis</i> )	Eastern bluebird ( <i>Siala sialis</i> )
Pine siskin ( <i>Carduelis pinus</i> )	<b>Brown-headed nuthatch (<i>Sitta pusilla</i>)</b>
<b>Northern bobwhite (<i>Colinus virginianus</i>)</b>	Yellow-bellied sapsucker ( <i>Sphyrapicus varius</i> )
Yellow-billed cuckoo ( <i>Coccyzus americanus</i> )	Northern rough-winged swallow ( <i>Stelgidopteryx serripennis</i> )
Northern flicker ( <i>Colaptes auratus</i> )	Barred owl ( <i>Strix varia</i> )
<b>Eastern wood pewee (<i>Contopus virens</i>)</b>	Carolina wren ( <i>Thryothorus ludovicianus</i> )
American crow ( <i>Corvus brachyrhynchos</i> )	American robin ( <i>Turdus migratorius</i> )
White-throated sparrow ( <i>Zonotrichia albicollis</i> )	Brown thrasher ( <i>Toxostoma rufum</i> )
Red-eyed vireo ( <i>Vireo olivaceus</i> )	White-eyed vireo ( <i>Vireo griseus</i> )

Sources: SCDNR 2005a; SCE&G 2009a.

NOTE: Taxa in bold represent South Carolina Priority Species (SCDNR 2005b).

1 The proposed VCSNS-Lake Murray line (SCE&G) and VCSNS-Flat Creek line (Santee Cooper)  
2 would be located entirely within the Southern Outer Piedmont ecoregion. Both lines would be  
3 routed within existing rights-of-way with the exception of a small section of the VCSNS-Flat  
4 Creek line that would require 2.44 mi of new right-of-way next to an existing transmission-line  
5 corridor near the VCSNS site (FP&S 2008; MACTEC 2008). The proposed VCSNS-Killian line  
6 study site lies within Fairfield, Richland, and Lexington Counties and all but approximately 18 mi  
7 of the proposed corridor would be routed in existing right-of-way (FP&S 2008). Because these  
8 three proposed transmission lines would lie entirely within the Southern Outer Piedmont  
9 ecoregion, the habitat types are the same as those described for the VCSNS site in Section  
10 2.4.1.1.

11 The proposed VCSNS-Varnville and VCSNS-St. George transmission lines cross several  
12 counties and ecoregions. Both begin in the Southern Outer Piedmont and cross the Sandhills  
13 into the Coastal Plain ecoregion. Brief descriptions of the habitat types for both ecoregions are  
14 provided below (Griffith et al. 2002). The VCSNS-Varnville line (Santee Cooper) would be  
15 routed entirely within existing transmission-line corridors, while the VCSNS-St. George line  
16 (SCE&G) would require the creation of approximately 68 mi of new right-of-way (MACTEC  
17 2008; FP&S 2008).

18 The Sandhills ecoregion is the inland portion of the Coastal Plain that forms a discontinuous belt  
19 of varying widths of deep sands across the middle of the state (SCDNR 2005a). The sandy  
20 soils create a xeric environment that supports a distinctive vegetation dominated by longleaf  
21 pines and American turkey oaks (*Quercus laevis*). High-frequency, low-intensity fires in the past  
22 created and supported fire-adapted longleaf pine-wiregrass communities, characterized by  
23 longleaf pine and loblolly pine with a midstory of oaks, mostly turkey oak along with blackjack  
24 oak (*Q. marilandica*), upland willow oak (*Q. incana*), and post oak (*Q. stellata*). However, fire  
25 suppression in the last several decades has allowed succession to proceed to oak-hickory  
26 forests similar to those of the Piedmont. Logging activities and fire suppression created large  
27 tracts of even-aged pine plantations and forests that do not provide high-quality wildlife habitat  
28 (SCDNR 2005a). Vegetation community types in the Sandhills ecoregion include grassland and  
29 early successional habitats, Sandhills pine woodland, seepage slopes, ponds and depressions,  
30 blackwater stream systems, and river bottoms. Common wildlife species found in the Sandhills  
31 ecoregion are white-tailed deer, eastern cottontail, gray squirrel, opossum, and raccoon. A  
32 variety of bird species also inhabit the region and include wild turkey (*Meleagris gallopavo*),  
33 northern mockingbird (*Mimus polyglottos*), and several species of warblers. A high diversity of  
34 reptiles and amphibians reside in the various habitats present in this region (SCDNR 2005a;  
35 Griffith et al. 2002).

36 The Coastal Plain, the largest ecoregion in South Carolina, consists of two different landscapes.  
37 The inner portion bordering the Sandhills is largely agricultural, with small patches and  
38 hardwood remnant forests along creeks. The flatwoods make up the outer portion, which is

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1 primarily pine-dominant forest. Large floodplains cross both portions and a majority of them are  
2 forested. The most dominant vegetation habitat types are grassland and early successional  
3 habitats, pine forest, and river bottoms (SCDNR 2005a). The southern floodplain forests  
4 include bottomland hardwood forest consisting of bottomland oaks, red maple, sweetgum, green  
5 ash (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformis*), and cypress-gum swamps  
6 dominated by water tupelo (*Nyssa aquatica*), swamp tupelo (*Nyssa biflora*), bald cypress  
7 (*Taxodium distichum*), and pond cypress (*Taxodium ascendens*) (Griffith et al. 2002). Although  
8 understory vegetation in the cypress-gum swamp community is sparse, a variety of wildlife  
9 species – from amphibians to mammals – use this habitat. Common wildlife species found in  
10 this region include many game species – white-tailed deer, eastern cottontail, gray squirrel,  
11 opossum, raccoon, wild turkey, northern bobwhite (*Colinus virginianus*), mourning dove  
12 (*Zenaida macroura*), red fox (*Vulpes vulpes*), gray fox, wood duck (*Aix sponsa*), mink (*Mustela*  
13 *vision*), otter (*Lontra canadensis*), and beaver (SCE&G 2009a; SCDNR 2005b).

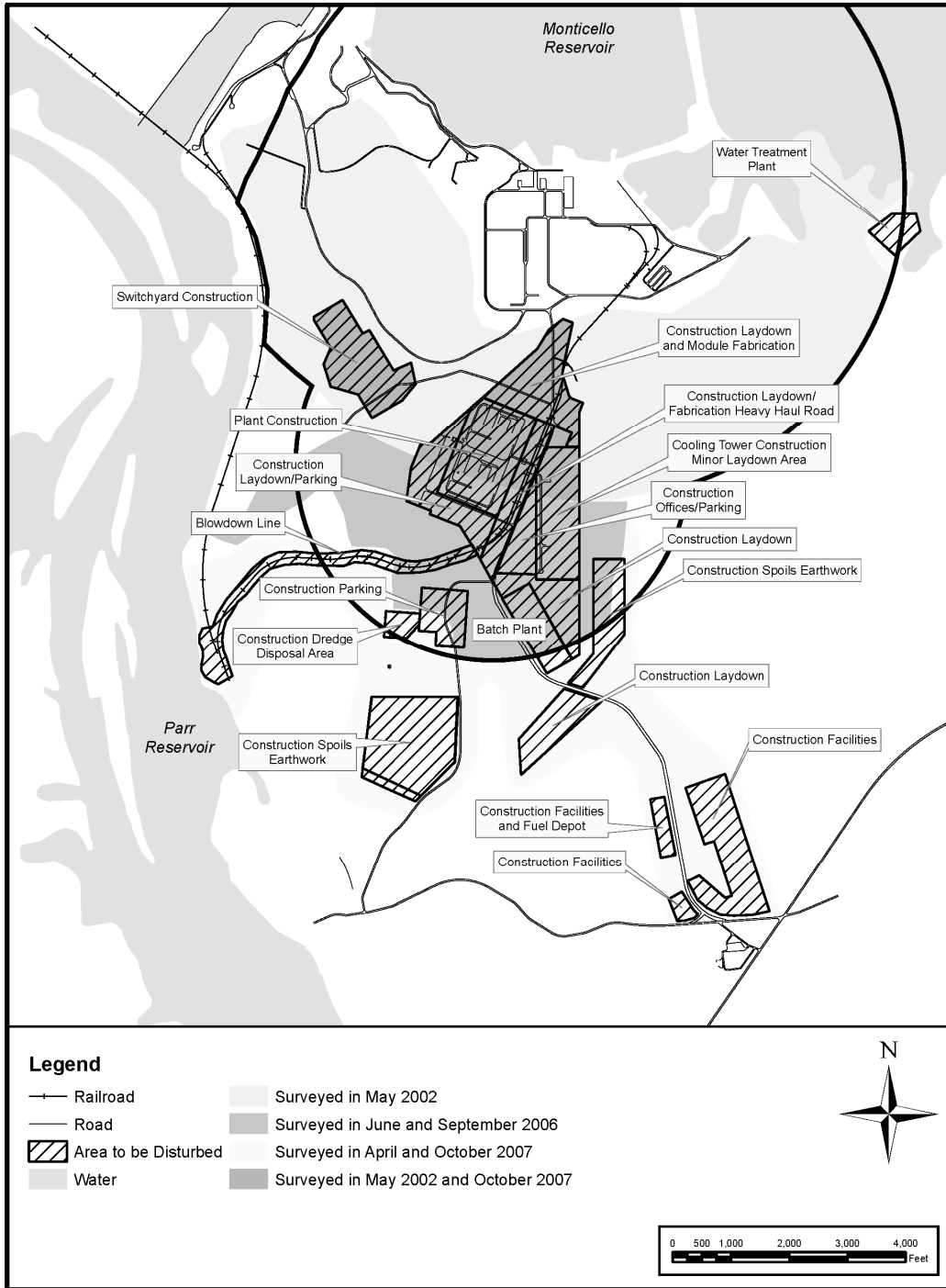
### 14 **2.4.1.3 Important Terrestrial Species and Habitats**

15 The NRC has defined important species as any species that are rare, ecologically sensitive,  
16 play an ecological role, or are relied on by a valuable species, and/or have economic or  
17 recreational value (NUREG-1555 [NRC 2000]). The U.S. Fish and Wildlife Service (FWS)  
18 identifies threatened or endangered species in 50 CFR 17.11 and 50 CFR 17.12. Important  
19 species also include rare species proposed for listing as threatened or endangered, published in  
20 the *Federal Register* as candidates for listing, or listed as threatened, endangered, or species of  
21 concern by the state in which they occur. Biological indicator species that respond to and  
22 indicate environmental change are also classed as important species.

23 No areas designated by FWS as critical habitat exist at the VCSNS site (NRC 2004). SCE&G  
24 conducted surveys for threatened and endangered species at the VCSNS site and found none  
25 (SCE&G 2002a; Nelson 2006, 2007). The locations of ecological surveys conducted on the  
26 VCSNS site are shown in Figure 2-15.

27 Threatened, endangered, and other special-status species that may occur in the vicinity of the  
28 VCSNS site are listed in Table 2-16. This table is composed of listed species with recorded  
29 occurrences in Fairfield, Lexington, Newberry, and Richland Counties in South Carolina (FWS  
30 2008; SCDNR 2006a).

31 The review team's biological assessment of the Federally listed threatened and endangered  
32 terrestrial plant and animal species that potentially could occur at or near the VCSNS site is  
33 provided in Appendix F. Life-history attributes of species pertinent to the review of SCE&G's  
34 application, as well information about the occurrence of these species in the project area, are  
35 summarized this section.



1  
 2 **Figure 2-15.** Threatened and Endangered Species Survey Locations at the VCSNS Site  
 3 (SCE&G 2009)

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1 **Table 2-16.** Federally and State-Listed Terrestrial Species Occurring Within and in the Vicinity  
 2 of the VCSNS Site (within 6 mi of the site)

Scientific Name	Common Name	Federal/State Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	SE	Richland, Aiken
<b>Birds</b>			
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA, SE	Fairfield, Newberry, Richland
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	, Richland
<i>Mycteria americana</i>	Wood stork	FE/SE	Newberry, Richland
<b>Amphibians</b>			
<i>Hyla andersonii</i>	Pine Barrens treefrog	ST	Richland
<b>Plants</b>			
<i>Echinacea laevigata</i>	Smooth coneflower	FE/SE	, Richland
<i>Lysimachia asperulifolia</i>	Rough-leaved loosestrife	FE/SE	Richland
<i>Oxypolis canbyi</i>	Canby's dropwort	FE/SE	Richland

Sources: SCDNR 2006a; FWS 2008

BGEPA = Bald and Golden Eagle Protection Act; FE = Federally listed as endangered; SE = State listed as endangered; ST = State listed as threatened

3 **Threatened and Endangered Species Occurring Within and in the Vicinity of the VCSNS**  
 4 **Site (within 6 mi of the site)**

5 Fauna

6 Rafinesque's big-eared bat (*Corynorhinus rafinesquii*). Rafinesque's big-eared bat is State-  
 7 listed as endangered and is found in forested areas, primarily in pine or mixed pine-hardwood  
 8 stands. This species roosts in a variety of places including hollow trees, under bark, in  
 9 abandoned buildings, and under bridges. The species has been recorded in Aiken and  
 10 Richland Counties, but there are no recorded occurrences at the VCSNS site (NRC 2004).

11 Bald eagle (*Haliaeetus leucocephalus*). The bald eagle was the only Federally listed species  
 12 found on the VCSNS site during the surveys conducted in 2002, 2006, 2008, and 2009 (SCE&G  
 13 2002a; Nelson 2006; Tetra Tech NUS, Inc. 2008, 2009a). The bald eagle was delisted in 2007  
 14 and is not protected under the Bald and Golden Eagle Protection Act and the Migratory Bird  
 15 Treaty Act. Adult and juvenile bald eagles are commonly observed on the VCSNS site, and  
 16 they nest and forage along Monticello and Parr reservoirs. The closest nest is located on the  
 17 north end of the jetty in the Monticello Reservoir, approximately 1.7 mi north of proposed  
 18 VCSNS Units 2 and 3, and another one is located on the west side of the Parr Reservoir  
 19 approximately 1.8 mi northwest of the proposed new reactor units as shown in Figure 2-14  
 20 (SCE&G 2009a).



1 Wood stork (*Mycteria americana*). The wood stork is Federally and State-listed as endangered  
2 and is known to occur in Richland County (FWS 2008). A variety of wetlands are used by this  
3 species for nesting, feeding, and roosting, and in South Carolina, colony sites are surrounded  
4 by extensive palustrine forested wetlands. Wood storks are known to nest in the upper  
5 branches of black gum or cypress trees that are located in standing water (swamps). Shallow,  
6 open water is required for successful foraging (FWS 1986; Murphy 2006).

7 Red-cockaded woodpecker (*Picoides borealis*). The red-cockaded woodpecker is listed as  
8 Federally and State endangered and is known to occur in Lexington and Richland Counties  
9 (FWS 2008). Populations of this species are distributed across the southeastern United States  
10 and managed by distinct recovery units. Red-cockaded woodpeckers are dependent on open,  
11 mature pine forests and savannahs for prime foraging and nesting habitat. The large, old pines  
12 are needed because the birds excavate cavities in the living trees completely within the  
13 heartwood to roost and nest in. The cavity trees must be in homogeneous stands of pine with  
14 little to no midstory present. Red-cockaded woodpeckers require 75 to 200 ac of foraging  
15 habitat (large mature pines) with a well-developed herbaceous layer that includes native  
16 bunchgrasses and forbs. There is no suitable habitat for this species on the VCSNS site  
17 (NRC 2004).

18 Pine barrens treefrog (*Hyla andersonii*). The pine barrens treefrog is State-listed as threatened  
19 and is known to occur in Richland County (SCDNR 2006a). This species inhabits trees in  
20 swamps adjacent to sandhill habitats (NRC 2004). There is no recorded occurrence of this  
21 species on or near the VCSNS site (FPC 1974) and none of the species was encountered  
22 during any of the surveys in 2002, 2006, or 2007 (see Figure 2-15) (SCE&G 2002a; Nelson  
23 2006, 2007).

#### 24 Flora

25 Smooth coneflower (*Echinacea laevigata*). Smooth coneflower is Federally and State-listed as  
26 endangered and is known to occur in Richland County and may possibly occur in Lexington  
27 County (SCDNR 2006a; FWS 2008). This species is found in meadows and open woodlands  
28 on basic or near neutral soils, often with eastern redcedar. Questions remain concerning the  
29 biology and natural distribution of this species in South Carolina (Nelson 2006). It is rare  
30 throughout its range and has sustained significant habitat loss, at least in part due to fire-  
31 suppression activities (Porcher and Rayner 2001). Smooth coneflower was not observed in the  
32 study area during surveys and the likelihood of it being present on the VCSNS site is marginal  
33 due to the lack of appropriate soils (Nelson 2007).

34 Rough-leaved loosestrife (*Lysimachia asperulifolia*). The rough-leaved loosestrife is Federally  
35 and State-listed as endangered and is known to occur in Richland County (FWS 2008; SCDNR  
36 2006a). This perennial herb occurs in ecotones between longleaf pine uplands and pond pine  
37 pocosins (upland swamps) in moist, sandy, or peaty soils with low vegetation. Rough-leaved

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1 loosestrife has also been found to occur in disturbed areas such as roadside depressions,  
2 powerline rights-of-way, firebreaks, and trails (NatureServe 2009a). There is no recorded  
3 occurrence of this species at or near the VCSNS site (NRC 2004) and none of this species is  
4 encountered during surveys conducted in 2006 and 2007 (Nelson 2006, 2007).

5 Canby's dropwort (*Oxypolis canbyi*). Canby's dropwort is Federally and State-listed as  
6 endangered and is known to occur in Richland County (FWS 2008). This perennial herb grows  
7 in wet meadows, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps (NRC  
8 2004). There are no recorded occurrences of this species at or adjacent to the VCSNS site  
9 (NRC 2004; Nelson 2006, 2007).

### 10 ***Important Species***

11 Other important species, as defined in NUREG-1555 (NRC 2000) that occur on the VCSNS site  
12 are game species and Federal and/or State-listed species of concern. The game species  
13 present on the VCSNS site include white-tailed deer, eastern cottontail, northern bobwhite,  
14 mourning dove, wild turkey, and various species of waterfowl. Hunting is allowed and occurs in  
15 the Broad River Wildlife Management Area (BRWMA) that is adjacent to the VCSNS site and is  
16 managed by the SCDNR (SCE&G 2009a; SCDNR 2007). Several species listed as species of  
17 concern by the State of South Carolina are known to occur in Fairfield County and they include  
18 12 plant species and 1 mammal, but none of the species was found on the VCSNS site during  
19 surveys (SCDNR 2006a; Nelson 2007).

### 20 ***Important Habitats***

21 Important habitats include those designated as critical habitats by FWS as well as sanctuaries,  
22 refuges, and/or preserves that have been set aside and protected by State and/or Federal  
23 agencies or organizations. Critical habitats are those that are designated to support Federally  
24 listed threatened or endangered species. There are no areas on or near the VCSNS site that  
25 are designated as critical habitat by the FWS (SCE&G 2009a).

26 Wetlands on the VCSNS site are typically associated with small streams in steep ravines.  
27 Some wetlands on the site were created by beaver activity and could provide habitat for  
28 migratory birds and other avian communities throughout the year (Edwards and Otis 1999).  
29 There is also freshwater marsh habitat along the shores of reservoirs that contains emergent  
30 plants, such as pickerelweed, smartweed, and lizard's tail, which provide food and/or cover for a  
31 variety of wildlife including waterfowl, migratory birds, white-tailed deer, and reptiles and  
32 amphibians (SCE&G 2009a, Table 2.4-4). Interior wetlands, reservoirs, and riverine systems  
33 present on the VCSNS site provide migration and wintering habitat for waterfowl and some  
34 shorebirds (SCDNR 2005a). SCE&G stated that all streamside management zones on the  
35 VCSNS site are protected and managed according to the South Carolina Forestry Commission  
36 best management practices (BMPs) (SCFC 1994).

1 There are two waterfowl management areas on and in the vicinity of the VCSNS site: the  
2 Monticello Reservoir Waterfowl Management Area and the Parr Reservoir Waterfowl  
3 Management Area, and both could be considered wildlife refuges (SCE&G 2009a). SCE&G  
4 refers to the area as Parr Reservoir Waterfowl Management Area and the SCDNR refers to the  
5 same area as the BRWMA. The BRWMA was established in the late 1970s to mitigate for  
6 activities associated with the construction of VCSNS Unit 1 and it is managed by SCDNR. This  
7 area is used by a wide variety of species such as ring-necked duck (*Aythya collaris*), wood  
8 duck, mallard, and green-winged teal. The BRWMA is also widely used for recreational  
9 activities such as hunting, bird watching, fishing, and boating. There is public access most of  
10 the year; however, due to the small size of the area, the BRWMA is closed to the public during  
11 winter months to avoid disturbing migrating waterfowl. Various other wildlife species use the  
12 BRWMA and are present throughout the year, such as wading birds and mammals (including  
13 deer, bobcat, fox, coyote, raccoon, and others). Birds of prey such as the bald eagle can also  
14 be found foraging in the BRWMA and nesting nearby (SCDNR 2007).

#### 15 ***Important Species – Transmission Lines***

16 Federally and State-listed terrestrial species classified as threatened and endangered and  
17 known to occur in the counties crossed by the proposed transmission lines (Aiken, Bamberg,  
18 Calhoun, Chester, Colleton, Dorchester, Hampton, Fairfield, Lancaster, Lexington, Newberry,  
19 Orangeburg, Richland, and Saluda) are listed in Table 2-17. The list was obtained from FWS  
20 county lists for the State of South Carolina and the SCDNR Heritage Trust database (FWS  
21 2008; SCDNR 2006a).

22 Field surveys for threatened and endangered Federally and State-listed species were  
23 conducted during May, June, July, and August of 2002 along existing transmission-line corridors  
24 associated with VCSNS Unit 1 (SCE&G 2002b). A portion of the new lines required for VCSNS  
25 Units 2 and 3 may be routed in the existing corridors (SCE&G 2009a). SCE&G and Santee  
26 Cooper conducted reconnaissance-level studies for each proposed transmission-line corridor  
27 and determined there were three recorded occurrences of protected species (species not  
28 specified) within 100 to 500 ft of the proposed VCSNS-St. George transmission-line corridor  
29 (FP&S 2008; MACTEC 2008). Field surveys were not conducted in the proposed corridors  
30 because the exact corridor routes have not been determined. Once siting studies are updated  
31 and final routes are determined, both SCE&G and Santee Cooper have stated that they would  
32 conduct field surveys along the final routes (FP&S 2008; MACTEC 2008).

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1 **Table 2-17.** Federally and State-Listed Terrestrial Species in Counties Crossed by the Proposed  
2 Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafineque's big-eared bat	SE	Aiken, Bamberg, Colleton, Dorchester, Orangeburg, Richland
<b>Birds</b>			
<i>Charadrius melodus</i>	Piping plover	FT/ST	Colleton
<i>Charadrius wilsonia</i>	Wilson's plover	ST	Colleton
<i>Elanoides forficatus</i>	American swallow-tailed kite	SE	Dorchester
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA/ SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Saluda
<i>Mycteria americana</i>	Wood stork	FE/SE	Aiken, Bamberg, Calhoun, Colleton, Dorchester, Lexington, Richland
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Lexington, Orangeburg, Richland, Saluda
<i>Sterna antillarum</i>	Least tern	ST	Colleton
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT/ST	Colleton
<i>Clemmys guttata</i>	Spotted turtle	ST	Aiken, Bamberg, Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE/SE	Colleton
<i>Gopherus polyphemus</i>	Gopher tortoise	SE	Aiken, Colleton, Dorchester
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE/SE	Colleton
<b>Amphibians</b>			
<i>Ambystoma cingulatum</i>	Flatwoods salamander	FT/SE	Orangeburg
<i>Hyla andersonii</i>	Pine barrens treefrog	ST	Richland
<i>Plethodon websteri</i>	Webster's salamander	SE	Saluda
<i>Pseudobranchius striatus</i>	Dwarf siren	ST	Orangeburg
<i>Rana capito</i>	Gopher frog	SE	Aiken, Dorchester
<b>Vascular Plants</b>			
<i>Amphianthus pusillus</i>	Pool sprite	FT/ST	Lancaster, Saluda
<i>Echinacea laevigata</i>	Smooth coneflower	FE/SE	Aiken, Lancaster, Lexington, Richland
<i>Helianthus schweinitzii</i>	Schweinitz's sunflower	FE/SE	Lancaster, Lexington
<i>Isoetes melanospora</i>	Black-spored quillwort	FE/SE	Lancaster
<i>Lindera melissifolia</i>	Pondberry	FE/SE	Dorchester
<i>Lysimachia asperulifolia</i>	Rough-leaved loosestrife	FE/SE	Richland
<i>Oxypolis canbyi</i>	Canby's dropwort	FE/SE	Bamberg, Colleton, Dorchester, Orangeburg, Richland
<i>Ptilimnium nodosum</i>	Harperella	FE/SE	Aiken, Saluda
<i>Trillium reliquum</i>	Relict trillium	FE/SE	Aiken

Sources: SCDNR 2006a; FWS 2008

FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered;

ST = State listed as threatened

## 1 ***Important Habitats – Transmission Lines***

### 2 Wetlands

3 Palustrine, lacustrine, and riverine freshwater wetlands occur within and around all of the  
4 proposed six new transmission-line corridors and are typical of those found in the various  
5 physiographic regions of South Carolina. Palustrine wetlands make up approximately  
6 70 percent of the total wetland area in the State of South Carolina (Dahl 1999). Palustrine  
7 wetlands include areas commonly referred to as wet pine flatwoods, pocosins, Carolina bays,  
8 beaver ponds, bottomland hardwood forests, swamps (muck peat), and freshwater marshes.  
9 Although they may be seasonally dry and may lack surface connections to stream systems,  
10 Carolina bays provide breeding habitat for numerous amphibians, including the flatwoods  
11 salamander (*Ambystoma cingulatum*), tiger salamander (*Ambystoma tigrinum*), and gopher frog  
12 (*Lithobates capito*) (SCDNR 2005a). Seeps and shrub bogs that occur in xeric longleaf pine  
13 habitat in the Sandhills ecoregion are home to the pine barrens treefrog (SCDNR 2005a).  
14 Lacustrine wetlands include the shallows of permanently flooded lakes and reservoirs and  
15 intermittent lakes. Riverine wetlands are limited to shallow freshwater river and stream  
16 channels or, in the case of deep rivers, to shallow areas along the shore. Palustrine forested  
17 wetlands are the most common wetland type that occurs in South Carolina and in the proposed  
18 transmission-line corridor (FP&S 2008; MACTEC 2008; Dahl 1999).

19 Santee Cooper estimated the extent of wetlands and other waters of the United States in its  
20 proposed transmission-line corridors by consulting available U.S. Department of Agriculture  
21 (USDA) county soil surveys, FWS National Wetlands Inventory (NWI) maps, and USGS  
22 topographic maps (MACTEC 2008). A wetlands delineation was also conducted along the  
23 approximate 2.44 mi of the proposed new transmission-line corridors parallel to existing the  
24 right-of-way near the VCSNS site; however, the USACE has not yet verified the findings  
25 (MACTEC 2008; SCE&G 2009e). SCE&G estimated the extent of wetlands and other waters of  
26 the United States in its proposed transmission-line corridors and/or study areas by consulting  
27 FWS NWI maps (FP&S 2008). Because the VCSNS-Lake Murray line would be routed entirely  
28 within existing transmission-line corridors and the final routes for the VCSNS-Killian and  
29 VCSNS-St. George lines were not determined, no wetlands delineation was conducted on the  
30 proposed lines (FP&S 2008).

#### 31 **2.4.1.4 Terrestrial Ecology Monitoring**

32 Many ecological studies were conducted on or near the VCSNS site before and since the  
33 construction of Unit 1, including a baseline biotic survey for the Broad River Study Area by  
34 Dames and Moore (1974), the final EIS for the Parr Hydroelectric Project by the Federal Power  
35 Commission in 1974 (FPC 1974), an environmental monitoring report for the VCSNS site  
36 prepared by Dames and Moore for SCDHEC and NRC (Dames and Moore 1985), and as  
37 recently as 2002, a threatened and endangered species survey of the site and transmission-line

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1 corridors in support of license renewal (SCE&G 2002b). Targeted studies were conducted in  
2 2006 and 2007 to survey for threatened and endangered species and small mammal trapping  
3 was conducted in 2008 and 2009 (Nelson 2006, 2007; Tetra Tech NUS, Inc. 2008, 2009a). No  
4 ecological monitoring beyond reconnaissance-level analysis has occurred in the proposed new  
5 transmission-line corridor associated with proposed VCSNS Units 2 and 3; however, SCE&G  
6 has stated it would conduct field studies once exact corridor routes have been determined.

7 The review team evaluated the available information relative to the terrestrial ecological  
8 monitoring program and the data collected by the program. The review team concludes that the  
9 program provides adequate data to characterize and track impacts on the terrestrial ecological  
10 environment for the VCSNS site in support of the acceptance criteria outlined by the NRC (NRC  
11 2000). However, more information about the proposed transmission system would be required  
12 to provide adequate data to characterize and track terrestrial ecological impacts associated with  
13 specific transmission-line corridor routes.

### 14 **2.4.2 Aquatic Ecology**

15 The major aquatic environments within the vicinity of proposed VCSNS Units 2 and 3 include  
16 the Broad River, Monticello and Parr reservoirs, and Mayo Creek (Figure 2-3). Mayo Creek is  
17 the largest stream within the site vicinity and it receives drainage from several small seasonal  
18 tributary channels. The Monticello and Parr reservoirs are the largest waterbodies near the site.  
19 The proposed VCSNS Units 2 and 3 would withdraw water from Monticello Reservoir and  
20 discharge it to Parr Reservoir.

#### 21 **2.4.2.1 Aquatic Resources – Site and Vicinity**

22 Aquatic resources on or in the vicinity of the VCSNS site include the river, reservoirs, and creek  
23 mentioned previously. There are no aquatic sanctuaries or preserves that could be affected by  
24 the proposed action, and no habitats are present that could be defined as critical habitat for an  
25 aquatic species.

#### 26 ***Broad River***

27 The Broad River basin encompasses approximately 2400 mi<sup>2</sup> and 27 watersheds within the  
28 State of South Carolina and includes almost 2800 mi of streams and more than 14,500 ac of  
29 lakes. The basin falls within the boundaries of seven counties in the state: Cherokee,  
30 Spartanburg, York, Union, Chester, Fairfield, and Richland (SCDHEC 2007). Within the State of  
31 South Carolina, the Broad River basin is entirely within the Piedmont ecoregion. The Piedmont  
32 is characterized by gently rolling to hilly terrain, with relatively confined stream valleys, and  
33 elevations ranging from 375 to 1000 ft above msl. Major tributaries of the Broad River basin  
34 include the Tyger and Enoree rivers, which intersect the Broad River from the west (SCE&G  
35 2009a). Of the 1.5 million ac associated with the basin, more than 60 percent are forested, with

1 approximately 24 percent used for agriculture, and less than 10 percent classified as urban  
2 development (SCDHEC 2007). As shown in Figure 2-3, the Broad River flows south along the  
3 Sumter National Forest and flows to the west of the VCSNS site. A run-of-the-river  
4 impoundment along the Broad River near the vicinity of the VCSNS forms the Parr Reservoir.

### 5 ***Parr Reservoir***

6 As described by SCE&G (2009a), the Parr Reservoir was created in 1914 by installing a 2000-  
7 ft-long dam across the Broad River at Parr Shoals (Figure 2-3). The purpose of the dam was to  
8 provide a pool for the original Parr Hydroelectric Plant. Before 1977, the surface area of the  
9 reservoir was 1850 ac. In 1977, the reservoir level was raised 9 ft, which increased the surface  
10 area to approximately 4400 ac, to accommodate the operation of the FPSF (SCE&G 2009a).  
11 Parr Reservoir is approximately 7 mi long and has an average water depth of 15 ft (SCE&G  
12 2009a). Because of the operation of the FPSF, hydrologic patterns in the Parr Reservoir are  
13 variable. Generally, water from the Monticello Reservoir is released through the FPSF into Parr  
14 Reservoir throughout the day and early evening to provide hydroelectric power at Parr Shoals  
15 Dam, resulting in a net southward flow in Parr Reservoir. During the night, when electrical  
16 demand is lower, water from Parr Reservoir is pumped upward into the Monticello Reservoir,  
17 reversing the flow to the north in Parr Reservoir (SCE&G 2009a).

18 As described by SCE&G (2009a), the flow conditions and 4-day retention time of water in Parr  
19 Reservoir generally promote high dissolved oxygen levels and turbid conditions. As noted in  
20 Section 2.3, there are two SCDHEC water-quality monitoring stations in Parr Reservoir  
21 (Figure 2-12). The upstream station (B-346) is above the intake/discharge canal for the FPSF.  
22 The downstream station (B-345) is in the forebay near the Parr Shoals Dam. Fecal coliform  
23 concentrations at these stations were deemed low enough to support recreational  
24 (e.g., swimming) uses (SCDHEC 2007). According to SCDHEC (2007) water-monitoring  
25 results, water conditions were not optimal to support aquatic life at the two stations on Parr  
26 Reservoir. The total phosphorus concentrations at the upstream monitoring station above the  
27 intake/discharge canal for the FPSF were found to exceed the standards for supporting use by  
28 aquatic life. At the downstream station, elevated copper concentrations were deemed to  
29 exceed the aquatic life criterion, and therefore were not optimal to support aquatic life at this  
30 location (SCDHEC 2007). There are no fish consumption advisories in Parr Reservoir  
31 (SCDHEC 2009c).

32 Following commencement of operation at the VCSNS Unit 1, aquatic monitoring efforts in Parr  
33 Reservoir included an evaluation of the fish community composition by means of gillnetting and  
34 boat electroshocking. During 1983 and 1984, 27 species were sampled from Parr Reservoir  
35 (Dames and Moore 1985). Eight species of centrarchids accounted for 44 percent of the entire  
36 catch and two species of clupeids (gizzard shad [*Dorosoma cepedianum*] and threadfin shad  
37 [*D. petenense*]) accounted for 43 percent of the catch. The remaining catch included taxa that  
38 each contributed less than 10 percent of the total catch: ictalurids (6.5 percent), catostomids

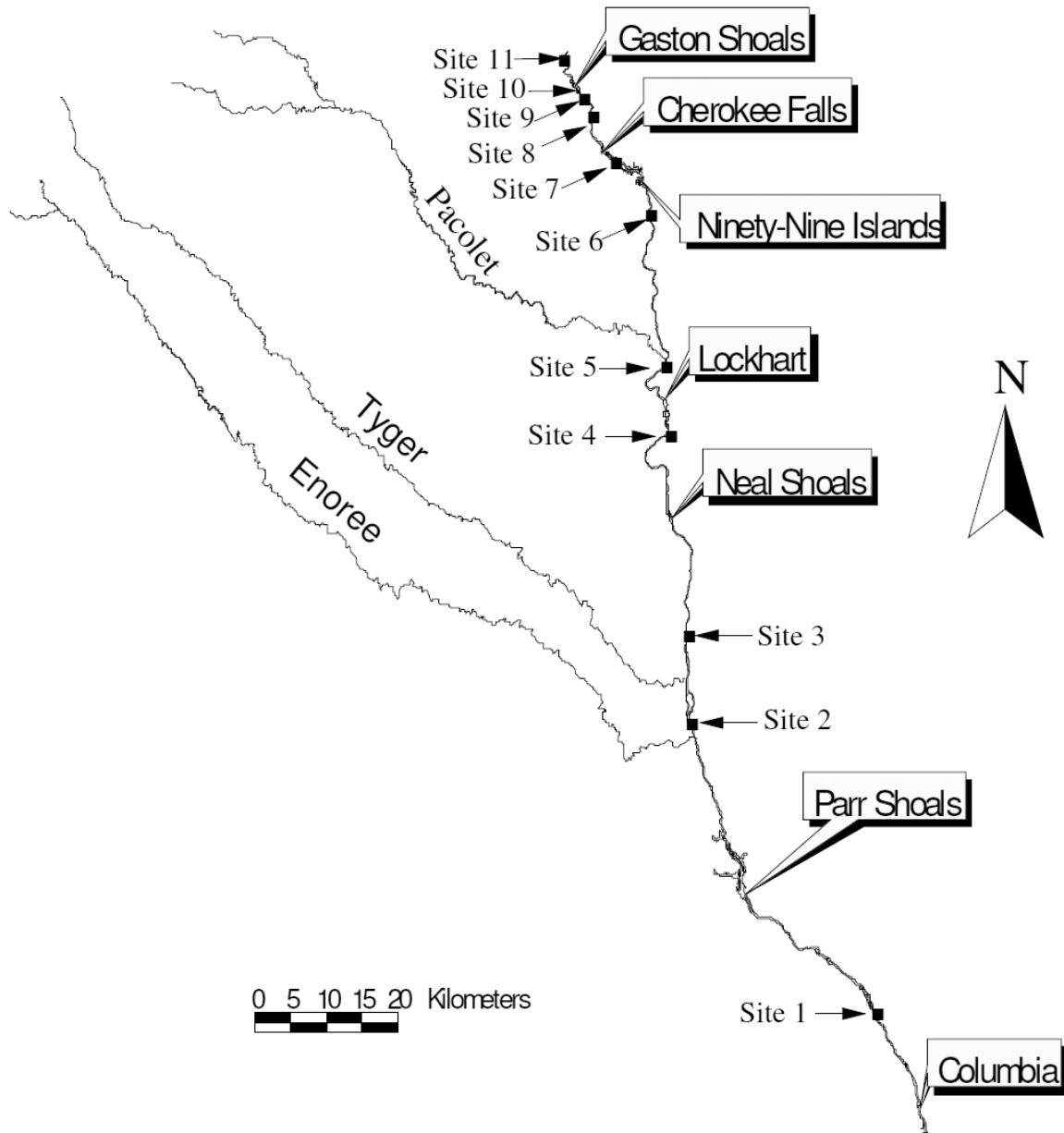
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1 (3.3 percent), moronids (0.9 percent), cyprinids (0.9 percent), percids (0.7 percent), lepisosteids  
2 (0.2 percent), and esocids (0.02 percent) (Dames and Moore 1985).

3 During 2001 and 2002, SCDNR conducted an inventory of fishes in the Broad River. Using boat  
4 and backpack electroshocking methods, a total of 44 fish species were sampled throughout  
5 27 km of the Broad River at stations both upstream and downstream of Parr Reservoir  
6 (Bettinger et al. 2003). The most dominant species sampled throughout the study included  
7 redbreast sunfish (*Lepomis auritus*), bluegill (*L. macrochirus*), and notchlip redhorse  
8 (*Moxostoma collapsum*). These three fish species made up 50 percent of the total catch. Other  
9 commonly encountered taxa in the Broad River included gizzard shad, whitefin shiner  
10 (*Cyprinella nivea*), sandbar shiner (*Notropis szepticus*), and brassy jumprock (*Moxostoma cf.*  
11 *lachneri*). A quantitative evaluation of the data set derived from electroshocking efforts  
12 indicated that the presence of impoundments along the Broad River did not result in  
13 fragmentation of the community composition of fishes; however Bettinger et al. (2003) suggest  
14 "...a different community composition might exist in the absence of dams." The Bettinger et al.  
15 (2003) study did not include a sampling station within the vicinity of the VCSNS site. However  
16 two stations between the Parr and Neal Shoals dams were included in the study (Figure 2-16);  
17 station 2 was located upstream of the confluence of the Enoree River, 22 km above Parr Shoals  
18 Dam and station 3 was located upstream of the Tyger River confluence. Taxa comprising more  
19 than 10 percent of the total combined catch at the sampling stations nearest the VCSNS site  
20 (i.e., stations 2 and 3) included gizzard shad, whitefin shiner, greenfin shiner  
21 (*Cyprinella chloristia*), spottail shiner (*Notropis hudsonius*), sandbar shiner, notchlip redhorse,  
22 snail bullhead (*Ameiurus brunneus*), white perch (*Morone americana*), margined madtom  
23 (*Noturus insignis*), redbreast sunfish, bluegill, redear sunfish (*L. microlophus*), and Piedmont  
24 darter (*Percina crassa*) (Bettinger et al. 2003).

25 Between 2006 and 2009, SCE&G conducted intermittent inventories of fish community  
26 composition near the vicinity of the VCSNS site. The sampling efforts used a combination of  
27 boat electrofishing, gillnets, and hoop nets and documented 28 species of fish in Parr Reservoir  
28 (Table 2-18; Normandeau 2007, 2008, 2009a; Quattlebaum 2008a). Similar to the species  
29 composition determined during the 1983-1984 study year, the Normandeau (2007, 2008,  
30 2009a) and Quattlebaum (2008a) sampling efforts found that clupeids and centrarchids  
31 comprised the largest percentages of catch in Parr Reservoir; 31 and 24 percent, respectively.  
32 Ictalurids (five species) accounted for 18 percent of the total abundance during the 2006-2009  
33 effort, which represents an increase from the 1983-1984 Dames and Moore (1985) results.  
34 Gizzard shad, representing over 18 percent of the total catch, was the most abundant species  
35 sampled during the 2006-2009 Parr Reservoir sampling effort. Other predominant species  
36 included bluegill (15 percent of the total catch), threadfin shad (12 percent of the total catch),  
37 channel catfish (*Ictalurus punctatus*; 12 percent of the total catch), and white perch (11 percent  
38 of the total catch) (data derived from Normandeau 2007, 2008, 2009a; Quattlebaum 2008a).





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**Figure 2-16.** Broad River Basin and Impoundments (after Bettinger et al. 2003).

**Table 2-18.** Fish Species Sampled from 2006-2009 Survey Efforts in Mayo Creek and Parr and Monticello Reservoirs

Family	Common Name	Scientific Name	Relative Abundance (percent) <sup>(a)</sup>				Species Status <sup>(b)</sup>
			Mayo Creek	Parr Reservoir	Monticello Reservoir		
Catostomidae	Brassy jumprock	<i>Moxostoma cf. lachneri</i>	4.43	0.590	0.00	--	
	Highfin carpsucker	<i>Carpionodes velifer</i>	0.00	0.147	0.00	Highest Priority	
	Northern hogsucker	<i>Hypentelium nigricans</i>	0.6	0.00	0.194	--	
	Notchip redhorse	<i>Moxostoma collapsum</i>	0.00	2.06	0.824	Moderate Priority	
	Quillback	<i>Carpionodes cyprinus</i>	0.00	0.811	0.048	High Priority	
	Robust redhorse	<i>Moxostoma robustum</i>	0.00	0.147	0.00	Highest Priority	
	Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	0.00	5.16	1.45	--	
	Black crappie	<i>Pomoxis nigromaculatus</i>	0.00	0.147	2.28	--	
	Bluegill	<i>Lepomis macrochirus</i>	0.795	15.0	29.2	--	
	Largemouth bass	<i>Micropterus salmoides</i>	0.227	6.78	5.67	--	
Centrarchidae	Pumpkinseed	<i>Lepomis gibbosus</i>	0.00	1.11	1.36	--	
	Redbreast	<i>Lepomis auritus</i>	15.4	0.074	0.582	--	
	Redear sunfish	<i>Lepomis microlophus</i>	0.3	1.03	0.630	--	
	Smallmouth bass	<i>Micropterus dolomieu</i>	0.00	0.295	0.194	--	
	Warmouth	<i>Lepomis gulosus</i>	0.00	0.00	0.291	--	
	Gizzard shad	<i>Dorosoma cepedianum</i>	0.00	18.4	25.3	--	
	Threadfin shad	<i>Dorosoma petenense</i>	0.00	12.1	0.00	--	
	Bluehead chub	<i>Nocomis leptocephalus</i>	29.6	0.00	0.00	--	
	Creek chub	<i>Semotilus atromaculatus</i>	7.83	0.00	0.00	--	
	Eastern silvery minnow	<i>Hybognathus regius</i>	0.00	0.516	0.388	--	
Cyprinidae	Golden shiner	<i>Notemigonus crysoleucas</i>	0.00	0.590	0.00	--	
	Greenfin shiner	<i>Cyprinella chloristia</i>	0.681	0.00	0.00	Moderate Priority	
	Sandbar shiner	<i>Notropis scepcticus</i>	10.8	0.147	0.00	--	
	Spottail shiner	<i>Notropis hudsonius</i>	0.00	3.76	1.02	--	
	Whitefin shiner	<i>Cyprinella nivea</i>	0.00	0.221	1.60	--	
	Yellowfin shiner	<i>Notropis lutipinnis</i>	26.4	0.00	0.00	--	
	Blue catfish	<i>Ictalurus furcatus</i>	0.00	5.38	12.6	--	

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Table 2-18. (contd)

Family	Common Name	Scientific Name	Relative Abundance (percent) <sup>(a)</sup>				Species Status <sup>(b)</sup>
			Mayo Creek	Parr Reservoir	Monticello Reservoir		
	Channel catfish	<i>Ictalurus punctatus</i>	0.00	11.6	3.73	--	
	Flat bullhead	<i>Ameiurus platycephalus</i>	0.114	0.00	0.485	Moderate Priority	
	Margined madtom	<i>Noturus insignis</i>	0.114	0.00	0.00	--	
	Snail bullhead	<i>Ameiurus brunneus</i>	0.00	0.074	0.048	Moderate Priority	
	White catfish	<i>Ameiurus catus</i>	0.00	0.884	1.60	Moderate Priority	
Lepisosteidae	Longnose gar	<i>Lepisosteus osseus</i>	0.00	0.295	0.00	--	
Moronidae	White bass	<i>Morone chrysops</i>	0.00	0.00	0.097	--	
	White perch	<i>Morone americana</i>	0.00	11.2	9.94	--	
Percidae	Piedmont darter	<i>Percina crassa</i>	0.114	0.00	0.00	High Priority	
	Seagreen darter	<i>Etheostoma thalassinum</i>	1.02	0.00	0.00	High Priority	
	Tessellated darter	<i>Etheostoma olmstedii</i>	2.38	0.00	0.00	--	
	Yellow perch	<i>Perca flavescens</i>	0.00	1.33	0.485	--	
Poeciliidae	Eastern mosquitofish	<i>Gambusia holbrooki</i>	0.00	0.147	0.00	--	

Sources: Data were derived from Normandeau (2007, 2008, 2009a), Tetra Tech NUS, Inc. (2007, 2009b), and Quattlebaum (2008a, b).

(a) Relative abundance was calculated as the total number of individuals (within a taxon) caught divided by the total number of individuals (among all taxa) within a particular waterbody. Note: survey approaches often included more than one sample method.

(b) The species status is a priority conservation rank designated by the South Carolina Department of Natural Resources (SCDNR 2005b).  
 -- = No conservation status assigned

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1 SCDNR (2005b) designated priority conservation species throughout the state. Designations  
2 were focused on species that are rare or at risk of imperilment and also included consideration  
3 for species that may be at risk in locations outside the state boundaries. The SCDNR (2005b)  
4 assessment identified 56 freshwater fishes, 6 diadromous fishes, 26 freshwater mussels, and 4  
5 freshwater snails. Species were ranked according to conservation priority, which included three  
6 categories: highest, high, and moderate. Of the 28 fish species collected during the 2006-2009  
7 Parr Reservoir sampling effort (Normandeau 2007, 2008, 2009a; Quattlebaum 2008a), 6 are  
8 included in the SCDNR priority conservation species list. Designation of these six species  
9 ranges from moderate to highest priority (Table 2-18).

10 To examine the benthic community in Parr Reservoir, Carnagey Biological Services (CBS)  
11 collected benthic invertebrates near the proposed location of the discharge structure for Units 2  
12 and 3 (approximately 1 km upstream of Parr Shoals Dam) and at an upstream control station  
13 approximately 9 km upstream of Parr Shoals Dam. Seasonal (e.g., quarterly) monitoring  
14 occurred for one year between 2008 and 2009 (CBS 2008a, c; CBS 2009c, d). Results were  
15 evaluated using a combination of bioassessment metrics and analyzed using statistical  
16 comparison techniques. The bioassessment metrics included taxa richness, various biotic  
17 indices (e.g., Ephemeroptera, Plecoptera, and Trichoptera [EPT] index, North Carolina Biotic  
18 Index [NCBI]), and comparisons of functional groups and abundances described by Plafkin et al.  
19 (1989) in *Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic*  
20 *Macroinvertebrates and Fish*. The survey efforts yielded at least 22 different taxa from 8 orders  
21 (CBS 2008a, c; CBS 2009c, d). A temporally complete evaluation indicated that overall  
22 bioassessment metrics were not significantly different through time. These results indicate few  
23 differences in benthic community and water-quality conditions between the reference station  
24 and the proposed discharge location (CBS 2009d).

25 Aquatic vegetation provides structural and functional ecosystem services to aquatic  
26 communities. Structurally, aquatic vegetation stabilizes sediments, can reduce flow velocities,  
27 and provides habitat for aquatic biota. Functionally, aquatic vegetation facilitates nutrient  
28 cycling in aquatic communities through growth and addition of biomass to the system, which can  
29 contribute to the base of the aquatic food web. SCE&G implemented an investigation of the  
30 aquatic vegetation community of Parr Reservoir during October 2008 by qualitatively assessing  
31 the occurrence of vegetation along 11 transects throughout the reservoir. Eleven plant species  
32 were identified during the survey. Two invasive species, alligatorweed (*Alternanthera*  
33 *philoxeroides*) and water primrose were observed at all locations (Quattlebaum 2008c). Other  
34 species noted by Quattlebaum (2008c) included smooth beggartick (*Bidens laevis*), bulrush,  
35 coon's tail (*Ceratophyllum demersum*), lizard's tail, marsh pennywort (*Hydrocotyle umbellata*),  
36 pickerelweed, smartweed (*Polygonum persicaria*), cattail, and rushes.

## 1 **Monticello Reservoir**

2 The Monticello Reservoir was formed in 1977 by damming Frees Creek, a small tributary of the  
3 Broad River that flowed into Parr Reservoir approximately 1 mi upstream from the Parr Shoals  
4 Dam (SCE&G 2009a; NRC 2004). Monticello Reservoir is hydraulically connected to the Parr  
5 Reservoir via the FPSF, and it serves both as an upper pool for the FPSF and as a cooling pond  
6 for VCSNS Unit 1 (NRC 2004) (Figure 2-2). To the northeast, the reservoir contains a  
7 subimpoundment which is a 300-ac area owned by SCE&G and co-managed by SCE&G and  
8 SCDNR (SCE&G 2009a, SCDNR 2002). The subimpoundment fishery is managed differently  
9 from the main reservoir in that SCDNR regulates lower allowable fishery catch limits, restricts  
10 fishing effort to 2 days per week, and limits boat operations to electric motors (SCDNR 2002).  
11 The Monticello Reservoir, excluding the subimpoundment, is approximately 6 mi long with a  
12 total surface area of 6500 ac. The average water depth is 59 ft and the maximum depth is  
13 approximately 126 ft (SCE&G 2009a).

14 Between 2000 and 2004, the SCDHEC evaluated the water quality in the Broad River basin to  
15 assess the overall health and condition of aquatic areas throughout the basin. There are four  
16 SCDHEC stations in Monticello Reservoir as shown in Figure 2-12). Stations B-328 and B-327  
17 were sampled monthly. At station B-328, located in the Monticello subimpoundment, water-  
18 quality parameters (e.g., dissolved oxygen, pH, toxins, turbidity, nutrients) met the compliance  
19 criteria and standards for supporting aquatic life and recreational uses. Throughout the 5-year  
20 monitoring period, this station yielded indications of improving conditions via a reduction in  
21 5-day biochemical oxygen demand, turbidity, fecal coliform, and total nitrogen and phosphorus  
22 concentrations (SCDHEC 2007). Approximately 3.5 mi southwest of the subimpoundment  
23 station, water conditions were suboptimal to support aquatic life due to an exceedance of pH  
24 criteria at station B-327. Recreational use was not restricted at this mid-lake location (SCDHEC  
25 2007). Two randomly selected stations on Monticello Reservoir were monitored monthly for 1  
26 year during 2004. The first station (RL-04370) was approximately 1.5 mi southwest of the  
27 subimpoundment station, and the second station (RL-04374) was approximately 1 mi southeast  
28 of the mid-lake station. Station RL-04370 yielded benzoic acid, cadmium, DDD and DDE  
29 (metabolites of DDT) in the sediment sample. Station RL-04374 yielded benzoic acid,  
30 cadmium, nickel, chromium, copper, zinc, bis(n-octyl) phthalate, DDT, and DDE in the sediment  
31 sample. Despite the occurrence of these chemical constituents, recreational use was not  
32 restricted and water conditions were optimal for aquatic life near both stations (SCDHEC 2007).  
33 Based on analysis of fish tissue, there are no consumption advisories on Monticello Reservoir  
34 (SCDHEC 2007).

35 Following commencement of operation at the VCSNS Unit 1, aquatic monitoring efforts in  
36 Monticello Reservoir included an evaluation of the fish community composition by means of  
37 gillnetting and boat electroshocking. During 1983 and 1984, 32 taxa representing 8 families  
38 were sampled from Monticello Reservoir (Dames and Moore 1985). Ten species of

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1 centrarchids made up 55 percent of the entire catch and two species of clupeids (gizzard shad  
2 and threadfin shad) made up 28 percent of the catch. Dames and Moore (1985), reported the  
3 remaining catch in Monticello Reservoir to include ictalurids (7 percent), catostomids  
4 (5 percent), percids (3 percent), cyprinids (2 percent), moronids (<1 percent), and lepisostids  
5 (<1 percent).

6 Cove rotenone studies conducted by SCDNR in 1987, 1988, 1995, and 1996 collected 29  
7 species of fish in Monticello Reservoir (Christie and Stroud 1996, 1997). Between 1988 and  
8 1995, the community composition of fish in the Monticello Reservoir remained stable. The  
9 predominant species were gizzard shad, channel catfish, white bass (*Morone chrysops*), and  
10 bluegill. In 1996, a shift in community structure was noted by a decrease in the standing stocks  
11 of white bass and a dramatic increase in the standing stocks of blue catfish (*Ictalurus furcatus*)  
12 (Christie and Stroud 1997).

13 Seasonal creel surveys were conducted by SCDNR from 1997 to 1999. Fish targeted by  
14 anglers include ictalurids (blue catfish, channel catfish), centrarchids (bluegill, black crappie  
15 [*Pomoxis nigromaculatus*], largemouth bass (*Micropterus salmoides*), cyprinids (carp [*Cyprinus*  
16 *carpio*]), and moronids (white bass, white perch). In Monticello Reservoir, ictalurids were  
17 targeted 46 percent of the time. Bluegill and largemouth bass were also popular fish targeted  
18 by anglers (Christie and Stroud 1999). While fishing efforts in Monticello Reservoir were found  
19 to be lower compared with other reservoirs, an increasing trend in fishing effort within Monticello  
20 Reservoir was noted (Christie and Stroud 1999).

21 Between 2006 and 2009, SCE&G initiated inventories of fish community composition near the  
22 vicinity of the VCSNS site. The sampling effort used a combination of boat electrofishing,  
23 gillnets, and hoop nets and documented 24 fish species in Monticello Reservoir, excluding the  
24 subimpoundment (Table 2-18; Normandeau 2007, 2008, 2009a). Similar to the trends noted by  
25 Dames and Moore (1985), centrarchids (comprising seven species) contributed the largest  
26 proportion (40 percent) of the total catch and clupeids (e.g., gizzard shad) were secondary in  
27 abundance (25 percent) during the 2006-2009 sampling effort. As noted in the fish community  
28 trends in Parr Reservoir, the abundance of ictalurids in Monticello Reservoir appears to have  
29 increased (18 percent of the total 2006-2009 catch) since the early 1980s (Normandeau 2007,  
30 2008, 2009a). The most predominant species captured in the Monticello Reservoir between  
31 2006 and 2009 included bluegill (29 percent of the total catch), gizzard shad (25 percent), blue  
32 catfish (13 percent), and white perch (10 percent).

33 To examine the benthic community in Monticello Reservoir, CBS collected macroinvertebrate  
34 samples at three stations in the reservoir. The reference station was located approximately 3 mi  
35 northwest of the VCSNS site. Two additional stations were located at the south end of the  
36 reservoir near the proposed Units 2 and 3 water-treatment intake and raw-water intake  
37 structures, respectively (CBS 2009d). Seasonal (e.g., quarterly) monitoring occurred from July  
38 2008 to April 2009 (CBS 2008a, c; CBS 2009c, d). Results were evaluated using a combination

1 of bioassessment metrics and analyzed using statistical comparison techniques. The survey  
2 efforts yielded at least 15 different taxa from 11 orders (CBS 2008a, c; CBS 2009c, d). The  
3 general trends in benthic community structure at the control station and the two water-intake  
4 stations do not indicate disparate conditions (CBS 2008a, c; CBS 2009c, d).

5 SCE&G conducted an investigation of the aquatic vegetation community of Monticello Reservoir  
6 on November 6, 2008 at six locations, including the proposed raw-water and water-treatment  
7 intakes. Biologists used a viewing tube to facilitate observations in shallow-water locations and  
8 used a rake for sampling in deep water areas. No aquatic plants were observed in the shallow  
9 water at the six sampling locations. Only stoneworts (*Nitella* spp.) branched multicellular algae,  
10 were collected from a deeper-water area offshore of the public boat landing on the eastern  
11 shore of Monticello Reservoir (SCE&G 2009a).

## 12 **Onsite Streams**

13 There are 49,288 linear feet of streams within the VCSNS site boundary. Most of the onsite  
14 streams are seasonal (see Table 2-19, Figure 4-2). Mayo Creek is the primary perennial stream  
15 located on the VCSNS site. Tetra Tech NUS, Inc. (2007) describes Mayo Creek as a typical  
16 Piedmont stream characterized by flowing through a mixed hardwood forest, almost completely  
17 shaded by tree canopy. The creek originates 0.5 mi southeast of VCSNS Unit 1, and flows  
18 approximately 3.6 mi southwest before draining into the Broad River, downstream of the Parr  
19 Shoals Dam (Figure 2-3). The Mayo Creek drainage area is approximately 6 mi<sup>2</sup> and  
20 encompasses mixed hardwood forests that may mitigate surface-water temperatures during  
21 warm summer months (Tetra Tech NUS, Inc. 2007; SCE&G 2009a, s). In addition to Mayo  
22 Creek, there are intermittent and seasonal stream channels within the VCSNS site vicinity. Fish  
23 have been noted in residual pools associated with intermittent tributary channels, but there may  
24 be insufficient water to maintain connectivity between habitats to perpetuate aquatic biota (Tetra  
25 Tech NUS, Inc. 2007).

26 Aquatic biota rely on the overall quality of water within a particular habitat for survival and  
27 sustainability. The results of water-quality parameters measured in conjunction with four  
28 seasonal sampling events that occurred between July 2006 and July 2009 indicate that all  
29 sampling stations in Mayo Creek met the SCDHEC quality standards for temperature and  
30 dissolved oxygen in freshwater habitats (Tetra Tech NUS, Inc. 2007, 2009b; Quattlebaum  
31 2008b; CBS 2008b, 2009a, b). The SCDHEC freshwater classification standards, which are  
32 approved by the EPA (in accordance with Section 303(c) of the Clean Water Act and 40 CFR  
33 Part 131), indicate the suitability of a waterbody for various purposes including the sustainability  
34 of aquatic biota (SCDHEC 2004). One metric, pH, did not meet the SCDHEC freshwater  
35 standards at one or more stations during the 2009 winter and spring sampling events which may  
36 have been due to a faulty water quality meter (Tetra Tech NUS, Inc. 2009b). During the 2006  
37 summer and fall aquatic surveys, pH values met the criterion, but were detected at the minimum  
38 threshold value for the freshwater standard (Tetra Tech NUS, Inc. 2007; SCDHEC 2004).

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1 Increased acidity has been linked to environmental and biological conditions (organic content  
 2 and phytoplankton production) within specific geographic regions (SCDHEC 2009d), but  
 3 changes in increased acidity can impose adverse impacts on the growth and survival of critical  
 4 early life stages of aquatic organisms (Fuiman 2002; Houde 2002).

5 **Table 2-19.** VCSNS Onsite Stream Characteristics

Stream Name	Linear Feet	Average width (ft)	Average depth (ft)	Substrate	Tributary Stream Order	Flow Regime
C	3656	20	0.83	sand, gravel	--	--
F	6850	12	<1	silt, sand	First	seasonal
G	1778	15	4	silt	Second	seasonal
H	1426	15	4	silt	Second	seasonal
K	9517	25	6	silt, sand	Third	seasonal
L	2342	12	4	sand	Second	seasonal
M	9364	15	--	--	--	Perennial
N	5454	12	0.25-3	silt, sand, gravel	First	seasonal
P	2044	10	0.25-3	silt, sand, gravel	First	seasonal
T	6857	10	0.25-3	silt, sand, gravel	First	seasonal

Data Source: USACE 2009  
 -- = Information not available

6 Fish surveys were conducted in Mayo Creek throughout the lower, middle, and upper stream  
 7 segments and within a tributary channel of the creek. Methods for fish sampling included  
 8 minnow traps (unbaited and left to fish overnight) and backpack electrofishing (single-pass  
 9 sampling transects ranging from 166 to 205 ft in length) (Tetra Tech NUS, Inc., 2007, 2009b;  
 10 Quattlebaum 2008b). A total of 16 taxa were sampled during the 2006-2009 fish survey efforts  
 11 (Table 2-18). While there were similarities in the type of taxa encountered throughout the  
 12 various stream reaches, species abundances were not distributed similarly within Mayo Creek.  
 13 The most predominant species encountered during the Mayo Creek sampling efforts included  
 14 the yellowfin shiner (*Notropis lutipinnis*), bluehead chub (*Nocomis leptoccephalus*), sandbar  
 15 shiner, and redbreast sunfish.

16 Benthic macroinvertebrates were sampled seasonally from three stations in Mayo Creek  
 17 between July 2008 and April 2009. The intent of the sampling was to evaluate the community of  
 18 macroinvertebrates and assess stream condition (CBS 2008b, d; CBS 2009a, b). The first  
 19 station was the most upstream station sampled on Mayo Creek and located approximately 1 mi  
 20 upstream of Parr Road. The second station was approximately 0.12 mi upstream of Parr Road  
 21 on Mayo Creek, and the third station was located 164 ft downstream of Parr Road (CBS 2009b).  
 22 Results were evaluated using a combination of 12 bioassessment metrics and analyzed using  
 23 statistical comparison techniques. The bioassessment metrics included taxa richness, various  
 24 biotic indices (e.g., EPT index, NCBI, community loss index, etc.), and comparisons of



1 functional groups and abundances described by Plafkin et al. (1989) in *Rapid Bioassessment*  
2 *Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish*.

3 Based on the qualitative assessment of the composition of benthic macroinvertebrates in Mayo  
4 Creek, CBS concluded that the community was under duress, which may have been explained  
5 by drought conditions observed during the July 2008 sampling event (CBS 2008b). The  
6 October 2008 sampling event resulted in similar conclusions with regard to a community of  
7 benthic macroinvertebrates that demonstrated signs of stress. CBS (2008d) noted drought  
8 conditions persisted throughout much of the summer, which may partially explain the results,  
9 although no data were provided to support this supposition. According to the SCDHEC  
10 bioclassification rating system (e.g., the mean of the NCBI and EPT indices), conditions at the  
11 most upstream station improved slightly following the January 2009 sampling to achieve a score  
12 of “good” yet the remaining two downstream stations only achieved ratings of “good/fair,”  
13 indicating partial impairment (CBS 2009a). The April 2009 results indicated that conditions  
14 within Mayo Creek improved as all stations yielded “good” bioclassification scores. Throughout  
15 the study period, water quality (pH, conductivity, and dissolved oxygen) was measured in  
16 conjunction with macroinvertebrate collections. Despite a range of benthic community  
17 conditions (e.g., stressed, impaired, good), water-quality metrics were within the SCDHEC  
18 freshwater quality standards (CBS 2009b). During the survey efforts at least 43 taxa were  
19 encountered, representing 14 orders (CBS 2008b, d; CBS 2009a, b). Mayfly (*Caenis* sp.) and  
20 caddisfly (*Cheumatopsyche* sp.) were the most predominant.

#### 21 **2.4.2.2 Aquatic Resources – Transmission Lines**

22 The delivery of power associated with VCSNS Units 2 and 3 would require upgrading existing  
23 transmission-line corridors, and clearing new corridors, transmission lines, and substations.  
24 Two entities, SCE&G and Santee Cooper, are responsible for identifying the proposed locations  
25 associated with new and upgraded transmission lines. In total, six new 230-kV lines are  
26 proposed for the transmission of electricity associated with proposed VCSNS Units 2 and 3  
27 (Figure 2-5) (FP&S 2008; MACTEC 2008). Systematic aquatic surveys are not included as part  
28 of the transmission-line site-selection process. In the absence of empirical data,  
29 reconnaissance-level information pertaining to species designated as endangered, threatened,  
30 or species of concern associated with the counties in which the transmission lines would occur  
31 was derived from FWS (2008) and SCDNR (2006a) and is provided in Table 2-20.

#### 32 **Santee Cooper Transmission Lines**

33 The following descriptions of the proposed actions associated with the Santee Cooper  
34 transmission lines were derived from the MACTEC (2008) transmission-line siting study.  
35 Santee Cooper proposed the addition of 235 mi of transmission lines with nearly all  
36 (98.9 percent) of the additions occurring within existing transmission-line corridors (Figure 2-5).  
37 The Flat Creek line, extending 72 mi northeast from the VCSNS site to the existing Flat Creek

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1 **Table 2-20.** Aquatic Species Designated as Threatened, Endangered, or Species of Concern  
 2 in the Transmission-Line Siting Studies

Scientific Name	Common Name	Status	County
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead sea turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT	Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	Colleton
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE	Colleton
<b>Fish</b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	FE/SE	Aiken, Calhoun, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
<i>Etheostoma collis</i>	Carolina darter	FC/SC FC/ST	Fairfield, Richland
<i>Etheostoma hopkinsi</i>	Christmas darter	SC	Saluda
<i>Fundulus diaphanus</i>	Banded killifish	SC	Richland
<i>Moxostoma robustum</i>	Robust redhorse	FC	Aiken
<i>Notropis chiliticus</i>	Redlip shiner	SC	Richland
<i>Rhinichthys atratulus</i>	Blacknose dace	SC	Richland
<i>Semotilus lumbee</i>	Sandhills chub	SC	Lancaster
<b>Mollusks</b>			
<i>Alasmidonta varicosa</i>	Brook floater	FC/SC	Lancaster
<i>Anodonta couperiana</i>	Barrel floater	SC	Hampton
<i>Elliptio congareae</i>	Carolina slabshell	SC	Orangeburg
<i>Elliptio lanceolata</i>	Yellow lance	SC	Newberry, Lancaster, Saluda
<i>Lampsilis splendida</i>	Rayed pink fatmucket	SC	Saluda
<i>Lasmigona decorata</i>	Carolina heelsplitter	FE/SE	Chester, Fairfield, Lancaster, Richland, Newberry, Saluda, Lexington
<i>Pyganodon cataracta</i>	Eastern floater	SC	Fairfield, Lancaster, Orangeburg, Saluda
<i>Strophitus undulatus</i>	Squawfoot	SC	Lancaster, Richland, Saluda
<i>Toxolasma pullus</i>	Savannah lilliput	SC	Saluda
<i>Utterbackia imbecillis</i>	Paper pondshell	SC	Orangeburg, Saluda
<i>Villosa constricta</i>	Notched rainbow	SC	Lancaster
<i>Villosa delumbis</i>	Eastern creekshell	SC	Chester, Colleton, Fairfield, Lancaster, Orangeburg, Richland, Saluda
<i>Elimia catenaria</i>	Gravel elimia	SC	Richland
<b>Crustacean</b>			
<i>Distocambarus youngineri</i>	Saluda crayfish	FC/SC	Newberry
<b>Aquatic Vegetation</b>			
<i>Myriophyllum laxum</i>	Piedmont water-milfoil	RC	Aiken, Orangeburg, Richland, Lexington
<i>Potamogeton confervoides</i>	Algae-like pondweed	FC/SC	Richland
<i>Potamogeton foliosus</i>	Leafy pondweed	SC	Orangeburg

Sources: FP&S 2008; MACTEC 2008; FWS 2008; SCDNR 2006a  
 FE = Federally Endangered, SE = State Endangered, FT = Federally Threatened, RC = Regional species of concern

1 substation, is located within the Piedmont ecoregion of the state. This line crosses 55 perennial  
2 streams and 13 watersheds within the Broad, Catawba, and Pee Dee river basins. The  
3 Varnville line, extending 163 mi south from the VCSNS site to the existing Varnville substation,  
4 is located within the Piedmont and Coastal Plain ecoregions of the state. The Varnville line  
5 crosses 85 perennial streams within 23 watersheds and falls within the Salkehatchie, Edisto,  
6 Saluda, and Broad river basins.

7 The largest water crossings associated with the Flat Creek line occur at an unnamed  
8 impoundment near Winnsboro (1200 ft wide) and the Fishing Creek Reservoir (1300 ft wide).  
9 The Varnville line crosses the Saluda River (240 ft wide) and the Broad River at two discrete  
10 locations (475 ft and 500 ft wide). The installation of transmission lines across waterbodies  
11 would be done in accordance with SCDHEC consultation and permitting. The 2.44 mi of new  
12 right-of-way proposed by Santee Cooper that runs across Parr Reservoir would require a 100-ft-  
13 wide transmission-line corridor (MACTEC 2008).

#### 14 ***SCE&G Transmission Lines***

15 The following summary of proposed activities associated with the SCE&G transmission lines  
16 was obtained from the Facilities Planning & Siting (FP&S 2008) transmission-line siting study.  
17 SCE&G has outlined a plan to install or expand approximately 111 mi of new transmission lines  
18 and corridors as well as upgrade 17.6 mi of line within an existing corridor. The final location for  
19 the new lines has not been established, but SCE&G considers the potential routes identified  
20 through the siting study to be representative of the final routes. Once the site-selection process  
21 has ended and a final route for transmission lines has been identified, SCE&G would complete  
22 environmental surveys within the corridor to identify the occurrence of important biota.  
23 Determination of final routing is anticipated to commence between 2011 and 2016 (FP&S 2008).

24 The new transmission-line corridors would be segregated into two lines: the Killian line and the  
25 St. George line. The Killian line is estimated to extend 25 mi to an existing substation near  
26 Columbia, South Carolina. Drainages associated within the Killian line would be primarily within  
27 the Piedmont ecoregion and include various streams within the Lower Broad River, Wateree  
28 River, and Congaree River watersheds (FP&S 2008). The St. George line is estimated to  
29 extend 86 mi to a new substation near St. George, South Carolina. A small portion of the  
30 St. George line would be located within the Piedmont ecoregion, but the majority of the  
31 transmission-line corridor would fall within the Coastal Plain ecoregion. The St. George line  
32 would encompass the drainage areas of the following systems: Lower Broad, Saluda,  
33 Congaree, Edisto (North & South Forks), and Salkehatchie rivers, and Four Hole Swamp  
34 (FP&S 2008).

35 In addition to the two new lines, SCE&G proposes to upgrade 17.6 mi of existing corridor to an  
36 existing Lake Murray substation. The footprint of this corridor falls within a previously cleared  
37 right-of-way and is associated with the Piedmont ecoregion (FP&S 2008).

1    **2.4.2.3    Important Aquatic Species**

2    The NRC has defined important species as any species that are rare, ecologically sensitive,  
3    play an ecological role, are relied on by a rare or valuable species, and/or have commercial or  
4    recreational value (NUREG-1555 [NRC 2000]). The FWS identifies threatened or endangered  
5    species in 50 CFR 17.11 and 50 CFR 17.12. Important species also include rare species  
6    proposed for listing as threatened or endangered; published in the *Federal Register* as  
7    candidates for listing; or listed as threatened, endangered, or species of concern by the state in  
8    which they occur. Biological indicator species that respond to and indicate environmental  
9    change are also classed as important species. The following section includes recreationally  
10   important species, invasive species, important species, and protected species that have been  
11   documented at the VCSNS site, or are thought to occur in the vicinity of the site or in the  
12   counties proposed for transmission-line siting. The Comprehensive Wildlife Conservation  
13   Strategy developed by the SCDNR identifies conservation priority species (SCDNR 2005b),  
14   some of which are known to occur at the VCSNS site. Numerous aquatic taxa are State  
15   species of concern within the site and vicinity, including the counties proposed for the siting of  
16   transmission lines. The species specific to the proposed transmission line corridors are listed in  
17   Table 2-20. No commercially important aquatic species are known to occur in the vicinity of the  
18   VCSNS site. No Federally listed threatened or endangered aquatic species are known to occur  
19   at the VCSNS site, but there are listed species present within counties that are proposed for  
20   transmission-line siting.

21    ***Recreationally Important Species***

22    The identification of species deemed to be recreationally important was derived from published  
23    creel surveys (Christie and Stroud 1998, 1999) and game fish outlined in the SCDNR freshwater  
24    fishing rules and regulations document (SCDNR 2009a). Table 2-21 is a compilation of  
25    recreationally sought-after fish that are known to occur in the Parr and Monticello reservoirs.

26    In South Carolina, largemouth bass are among the most sought-after sportfish (Bulak and  
27    Crane 2009). While largemouth bass occur within waters near the VCSNS site and accounted  
28    for 15 to 19 percent of the fishing effort in Monticello Reservoir during the late 1990s, SCDNR  
29    creel surveys indicate that the fishing effort in Monticello Reservoir was primarily directed at  
30    channel catfish and blue catfish (Christie and Stroud 1998, 1999). Qualitative data pertaining to  
31    fishing effort do not exist for Parr Reservoir, but efforts purportedly target catfish species in this  
32    reservoir as well (Hayes 1999).

**Table 2-21. Summary of Recreational Fish Species Known to Occur in Parr or Monticello Reservoirs**

Family	Common Name	Scientific Name	Percent abundance <sup>(a)</sup>	State Distribution	Habitat	Thermal tolerance	Size	Diet	Notes
Largemouth Bass <sup>(b)</sup>		<i>Micropterus salmoides</i>	Parr: 6.8 Monticello: 5.7	Found in waters throughout the state	Streams, lakes, reservoirs, ponds. Warm, clear, backwaters.  Tolerant of turbidity, and warm-water temps for short periods	Can tolerate warm water temp (36°C) for short periods  Spawning: 16-24°C	120-650 mm; adults	Plankton, insects, small fish, crayfish, amphibians and mammals	Native to SC; though information on native distribution within the state is conflicting
			Parr: 0.3; Monticello: 0.2	Occurs in the Broad, upper Saluda, and Savannah river tributaries	Lakes, reservoirs, streams  Prefers cold, clear water	Spawning: 16-24°C	200-686 mm; adults	Microcrustaceans, aquatic insects, fish larvae, other fish, crayfish	Non-native species Males guard nest
			Parr: 0.1; Monticello: 2.3	Found in waters throughout the state	Backwater areas in rivers, reservoirs, and ponds.  Associates with vegetation, LWD, and cool, clear waters	Range: 4-33°C  Spawning: 15-20°C	130-490 mm; adults	Microcrustaceans, insects, larval fish, small fish including gizzard and threadfin shad	Native to SC. Highly fecund. Pelagic larvae.
Bluegill <sup>(b)</sup>		<i>Lepomis macrochirus</i>	Parr: 15; Monticello: 29	Found in waters throughout the state	Rivers, streams, lakes, ponds, reservoirs; pools, low-velocity waters, aquatic vegetation	Range: 5-35°C. Critical thermal max: 37-41°C  Spawning: 19-25°C	178-410 mm; adults	Insects, microcrustaceans, crayfish, mollusks, and small fish	Native to SC, but widely stocked throughout the state. Commonly referred to as bream. Tolerant of many environmental conditions. Native to SC.
			Parr: 0.1; Monticello: 0.6	Found in waters throughout the state	Streams, rivers, reservoirs; low velocity water; deep pools and backwaters; LWD and undercut banks	Spawning: 16-31°C	60-240 mm; adults	Insects, crayfish, mollusks, arthropods, some fish	
Redbreast Sunfish <sup>(b)</sup>		<i>Lepomis auroitus</i>							

Centrarchidae

Table 2-21. (contd)

Family	Common Name	Scientific Name	Percent abundance <sup>(a)</sup>	State Distribution	Habitat	Thermal tolerance	Size	Diet	Notes
Centrarchidae	Redear Sunfish <sup>(b)</sup>	<i>Lepomis microlophus</i>	Parr: Monticello: 0.6	Found in waters throughout the state	Streams, rivers, lakes, reservoirs, ponds, swamps  Associated with vegetation and backwaters	Spawning: 16-24°C	134-381 mm; adults	Invertebrates, zooplankton, aquatic insects, gastropods, and mollusks	In SC, native south of Savannah River; introduced in other drainages. Molariform pharyngeal teeth
	Pumpkinseed <sup>(b)</sup>	<i>Lepomis gibbosus</i>	Parr: 1.1; Monticello: 1.4	Found in waters throughout the state	Backwaters of streams, rivers, ponds, and reservoirs  Associated with vegetation	Range: 5-33°C  Spawning: 16-27°C	78-381 mm; adults	Microcrustaceans, aquatic insects, gastropods, clams, some fish and aquatic vegetation	Native to SC. Molariform pharyngeal teeth
Ictaluridae	Blue Catfish <sup>(b)</sup>	<i>Ictalurus furcatus</i>	Parr: 5.4; Monticello: 13	Found in most major drainages	Rivers and reservoirs  Deep, swift, turbid water	Spawning: 21-24°C	508-1650 mm; adults	Fish, crayfish, aquatic insects, vegetation, mollusks, crayfish, fish including threadfin and gizzard shad	Non-native to SC
	Channel Catfish <sup>(b)</sup>	<i>Ictalurus punctatus</i>	Parr: 12; Monticello: 3.7	Found in most major drainages; often stocked in ponds	Small-to-large rivers, tributaries, reservoirs, ponds; deep pools with structure/cover; tolerates warm and turbid water	Spawning: 21-30°C	267-1270 mm; adults	Fish, crayfish, mollusks, aquatic insects, and aquatic vegetation	Unclear if this species is native to SC
Percidae	Yellow perch <sup>(b)</sup>	<i>Perca flavescens</i>	Parr: 1.3; Monticello: 0.5	Found in most major drainages	Rivers, streams, lakes, reservoirs.  Can tolerate a range of temperatures; cool to warm	Spawning: 2-19°C	152-400 mm; adults	Insects, microcrustaceans, crayfish, fish	In SC, native range occurs south to the Santee River basin  Introduced elsewhere

Table 2-21. (contd)

Family	Common Name	Scientific Name	Percent abundance <sup>(a)</sup>	State Distribution	Habitat	Thermal tolerance	Size	Diet	Notes
	White Bass <sup>(b)</sup>	<i>Morone chrysops</i>	Parr: 0.0; Monticello: 0.1	Occurs in river basins within the Piedmont and Coastal Plains	Mainstream rivers and deep areas within reservoirs; low velocity water, aquatic vegetation and other structure	Spawning: 15-17°C	275-450 mm; adults	Zooplankton, aquatic insects, crayfish, fish	Non-native to SC
Moronidae	White perch <sup>(b)</sup>	<i>Morone americana</i>	Parr: 11; Monticello: 10	Found in most major drainages	Initially associated with estuarine and brackish waters, but has established in freshwater environments	Spawning: 10-16°C	100-350 mm; adults	Microcrustaceans, shrimp, crab, crayfish, worms, fish	Info on native range in SC is conflicting  Some reports indicate its native range extends south as far as the Pee Dee

Percent abundance was determined based on total number of individuals sampled during the 2006-2009 (Normandeau 2007, 2008, 2009, and Quattliebbaum 2008a) aquatic surveys of Parr and Monticello reservoirs.  
 Sources: Rohde et al. 2009; Marcy et al. 2005; Jenkins and Burkhead 1994  
 Sources: Rohde et al. 2009; Jenkins and Burkhead 1994  
 LWD = large woody debris, SC = South Carolina

1 ***Invasive Species***

2 While some circumstances may result in economical or ecological benefits from non-native  
3 species, biological invasions by non-native species are primarily associated with adverse  
4 impacts (OTA 1993; Strayer et al. 2006; Vitousek et al. 1996). The decline of native taxa,  
5 especially species at risk of imperilment, has been linked to the introduction of non-native  
6 species throughout the United States (Wilcove et al. 1998). There are many mechanisms by  
7 which non-native species affect native taxa. At the species level, the presence of invasive  
8 species can affect the growth and behavioral patterns of native species, and lead to increased  
9 competition. At the ecosystem level, large-scale effects of invasive species can induce changes  
10 in abundance and community structure and alteration of structural and functional integrity of  
11 habitats (Parker et al. 1999; Vitousek et al. 1996). Detriment from non-native species also  
12 includes economic impacts. Non-native vegetation can clog waterways by altering hydrologic  
13 flow and increasing sedimentation (OTA 1993). Invasive mollusks, including Asian  
14 clams (*Corbicula fluminea*), zebra mussels (*Dreissena polymorpha*), and quagga mussels  
15 (*D. bugensis*), clog water systems associated with power-generation facilities and at a national  
16 level can cost \$1 billion/year to manage (OTA 1993; Pimentel et al. 2005).

17 The South Carolina Aquatic Invasive Species (AIS) Task Force, represented by Federal, State,  
18 and nongovernmental entities, has developed a management strategy aimed at minimizing  
19 adverse impacts imposed by aquatic invasive species. The AIS Task Force has identified AIS  
20 as species that are nonindigenous to South Carolina and may be capable of asserting adverse  
21 impacts on aquatic ecosystems or presenting economic constraints. Of the list of invasive  
22 species considered to be a management concern within South Carolina, two plant species, two  
23 fish species, and one mollusk species are known to occur in the vicinity of the VCSNS site  
24 (Table 2-22).

25 Ecologically Important Species

26 Species that occupy a role critical to the function of the local ecosystem are also considered  
27 important, in addition to species that may serve as biological indicators of environmental change.

28 Bluehead Chub (*Nocomis leptcephalus*)

29 The bluehead chub is an ecologically important species because of its role as an ecosystem  
30 engineer in freshwater habitats. The male bluehead chub facilitates spawning activities by  
31 constructing a nest from stream gravel. The nest structures are used by other species such as  
32 blackbanded darter (*Percina nigrofasciata*), yellowfin shiner, and rosyface chub (*Hybopsis*  
33 *rubrifrons*). The attribute of manipulating substrate, which provides structure beneficial to other  
34 fish, has resulted in the designation of bluehead chub as a keystone species (Rohde et al. 2009;  
35 Marcy et al. 2005). Wallin (1992) documented a symbiotic spawning relationship between



1 bluehead chub and yellowfin shiner and suggested that yellowfin shiner cannot spawn in the  
 2 absence of their symbiotic counterpart.

3 **Table 2-22.** Aquatic Invasive Species Documented to Occur in the Vicinity of the VCSNS Site

Common Name	Scientific Name	Type	Invasive Attributes	Occurrence at the VCSNS Site
Alligatorweed	<i>Alternanthera philoxeroides</i>	Freshwater plant	Aggressive, rapid colonizing plant, affects flow and uptake of water	Parr Reservoir
Water primrose	<i>Ludwigia uruguayensis</i>	Freshwater plant	Rhizomatous, chokes shorelines, affects water use and access, decreases flow, clogs water-intake structures	Parr Reservoir
Blue catfish	<i>Ictalurus furcatus</i>	Freshwater fish	Can tolerate a range of environmental conditions, piscivorous, competes for prey resources with native catfish	Parr Reservoir, Monticello Reservoir
White perch	<i>Morone americana</i>	Freshwater fish	Competes with recreationally important fish such as white bass and crappie	Parr Reservoir, Monticello Reservoir
Asian clam	<i>Corbicula fluminea</i>	Freshwater clam	Competes with native mollusks for food and space, alters substrate conditions; high densities clog water-intake structures	Parr Reservoir

Sources: SCDNR 2008; SCE&G 2009a

Survey efforts included multiple sample methodologies and spanned multiple spatial and temporal scales

4 The bluehead chub is commonly found in the Piedmont ecoregion of South Carolina (Rohde et  
 5 al. 2009). It was the most abundant species encountered during surveys in Mayo Creek (Tetra  
 6 Tech NUS, Inc. 2007, 2009b). The diet of bluehead chub consists of aquatic and terrestrial  
 7 insects as well as crustaceans, clams, and algae (Rohde et al. 2009).

8 Eastern Creekshell (*Villosa delumbis*)

9 The eastern creekshell maintains a global status rating of secure; however, the State-level  
 10 status of this freshwater mussel is undetermined within South Carolina (NatureServe 2009b). It  
 11 has been identified as a species of moderate conservation priority (SCDNR 2005b) and is listed  
 12 as a species of concern within Fairfield County (SCDNR 2006a). This species occurs in  
 13 streams and rivers in benthic conditions ranging from mud to coarse substrates and is often  
 14 associated with tree roots near the edges of aquatic habitats. The eastern creekshell is thought  
 15 to be sensitive to alterations of aquatic habitats (e.g., modifications, sedimentation, water  
 16 quality), but empirical evidence to support these suppositions is lacking (SCDNR 2006b). It is  
 17 unknown whether this species occurs at the VCSNS site.

## Affected Environment

### 1 Eastern Floater (*Pyganodon cataracta*)

2 At the global and national scales, the eastern floater, a freshwater mussel, has been designated  
3 as secure, yet the overall status of this species within the State of South Carolina is  
4 undetermined (NatureServe 2009b). In Fairfield County, the eastern floater is listed as a South  
5 Carolina species of concern (SCDNR 2005b). Eastern floaters commonly occur throughout  
6 drainages of the Atlantic Ocean. They are reportedly tolerant of a range of environmental  
7 conditions and are found within a variety of aquatic environments, including lakes, streams, and  
8 large rivers (NatureServe 2009b). The eastern floater is characterized by an easily penetrable  
9 thin shell, making it a preferred prey resource by other aquatic biota (PDCNR 2007). One  
10 individual of this species was collected near the proposed raw-water intake in April 2009 (CBS  
11 2009c, d).

### 12 Yellow Lance (*Elliptio lanceolata*)

13 This freshwater mussel is designated as being globally imperiled to vulnerable (NatureServe  
14 2009b) and is a species of concern in Newberry County, South Carolina (SCDNR 2005b).  
15 Precise population assessments are difficult to achieve due to questions regarding the  
16 taxonomic classification of *Elliptio* sp. As such, there are few detailed accounts of life-history  
17 information pertaining to the yellow lance. It occurs in association with sandy sediments and  
18 appears to be intolerant of fine sediments and chemical pollutants (NatureServe 2009b). It is  
19 unknown whether this species occurs at the VCSNS site.

### 20 Broad River Spiny Crayfish (*Cambarus spicatus*)

21 The Broad River spiny crayfish is relegated to a narrow distribution within the States of North  
22 and South Carolina. Little is known about the life-history characteristics of this crayfish  
23 (NatureServe 2009b; SCDNR 2006b). This species has been classified as vulnerable at both  
24 global and national scales. In South Carolina, the Broad River spiny crayfish is considered  
25 vulnerable and has been designated as a species with the highest ranked conservation priority  
26 (SCDNR 2006b; SCDNR 2005b). Fairfield County is one of three counties in which the Broad  
27 River spiny crayfish has been documented. Habitat associations include areas characterized by  
28 sand deposits, log jams, and debris (SCDNR 2006b). No spiny crayfish were collected during  
29 sampling efforts and it is unknown whether this species occurs at the VCSNS site (Tetra Tech  
30 NUS, Inc. 2007, 2009b).

### 31 Crayfish (*Distocambarus youngineri*)

32 *Distocambarus youngineri*, also commonly known as the Saluda crayfish (FWS 2008) and the  
33 Newberry burrowing crayfish (Taylor et al. 2007), is a species of crayfish that is listed as  
34 critically imperiled at global, national, and State levels due to its very limited distribution  
35 (NatureServe 2009). This species has been encountered in few locations in South Carolina; all

1 occurrences have been limited to Newberry County and only one occurrence has been  
2 documented within the Broad River (SCDNR 2006b). The crayfish is designated as a South  
3 Carolina species with the highest conservation priority (SCDNR 2005b). It burrows in moist  
4 sediments and leaf litter and is associated with headwater or seasonal streams characterized by  
5 a mixed-hardwood overstory (SCDNR 2006b). No Saluda crayfish were collected during  
6 sampling efforts and it is unknown whether this species occurs at the VCSNS site (Tetra Tech  
7 NUS, Inc. 2007, 2009b).

#### 8 Flat Bullhead (*Ameiurus platycephalus*)

9 While populations of this species are thought to be stable in South Carolina, the flat bullhead  
10 has become threatened by land-use practices and species interactions with non-native  
11 freshwater catfish (ictalurids) in other southern regions and is listed as a moderate conservation  
12 priority by SCDNR (Bettinger 2006b). The flat bullhead is distributed in all drainages of South  
13 Carolina, but is more commonly associated with the upper Catawba, Broad, and Savannah  
14 rivers (Rohde et al. 2009; Marcy et al. 2005). The largest populations of flat bullhead in South  
15 Carolina are thought to reside within the Broad River (Bettinger 2006b), yet these fish made up  
16 less than 1 percent of the overall catch during electrofishing efforts within the Broad River  
17 (Bettinger et al. 2003) and 0 to 7 percent of the catch among several Broad River tributary  
18 streams (Bettinger et al. 2006). Flat bullhead have been encountered in Mayo Creek  
19 (0.1 percent of the total abundance) (Tetra Tech NUS, Inc. 2007, 2009b) and Monticello  
20 Reservoir (0.5 percent of the total abundance), but none was captured during recent Parr  
21 Reservoir sampling efforts (Normandeau 2007, 2008, 2009a; Quattlebaum 2008a). Juvenile  
22 fishes are associated with small, clear streams, while adults tend to reside in the slow-moving,  
23 soft-bottom habitats of rivers. Flat bullhead are omnivorous; food items include aquatic insects,  
24 small fish, mollusks, bryozoans, and vegetation (Rohde et al. 2009; Marcy et al. 2005).

#### 25 Greenfin Shiner (*Cyprinella chloristia*)

26 The greenfin shiner is a South Carolina species of moderate conservation priority (SCDNR  
27 2005b). Its distribution is relegated to the Piedmont ecoregion within the Santee and Pee Dee  
28 drainages; it is endemic to the Carolinas (Rohde et al. 2009; Bettinger 2006a). Greenfin shiners  
29 were encountered during sampling efforts in Mayo Creek (2006-2009) where their abundance  
30 represented approximately 1 percent of the total catch (Tetra Tech NUS, Inc. 2007, 2009b).  
31 Current populations appear to be stable in South Carolina, but the ability of this species to  
32 perpetuate within a fairly limited geographic region is unknown (Bettinger 2006a). Greenfin  
33 shiners are typically found in large creeks, medium-sized rivers, and sometimes in reservoirs.  
34 They tend to be associated with pools, slow-moving, cool, clear waters, and substrates that  
35 range from sand to rocks. They are crevice spawners, and as such, require coarse substratum  
36 for egg deposition (Rohde et al. 2009; Bettinger 2006a). Prey items include terrestrial insects,  
37 benthic insect larvae (chironomid, caddisfly, stonefly, and beetle larvae), and dragonfly nymphs  
38 (Rohde et al. 2009).

## Affected Environment

### 1 Notchlip Redhorse (*Moxostoma collapsum*)

2 The notchlip redhorse was formerly described as a race of the silver redhorse (*Moxostoma*  
3 *anisurum*), but is currently recognized as a distinct species (Marcy et al. 2005; Jenkins and  
4 Burkhead 1994). Because of this former taxonomic classification, existing knowledge pertaining  
5 to life-history attributes of the notchlip redhorse likely encompasses attributes of the silver  
6 redhorse. Categorized as a South Carolina species of moderate conservation priority, the  
7 notchlip redhorse is documented to occur within the Broad, Pee Dee, Santee, and Savannah  
8 rivers (Sessions et al. 2006; Rohde et al. 2009). The notchlip redhorse has been captured in  
9 aquatic surveys in the Parr and Monticello reservoirs. Data from these surveys indicate that the  
10 notchlip redhorse comprised 2 and 0.8 percent of the total catch in the Parr and Monticello  
11 reservoirs, respectively (Normandeau 2008, 2009a; Quattlebaum 2008a). Population declines  
12 of the notchlip redhorse have been noted in several rivers in North Carolina; and the status of  
13 this species is being reviewed in South Carolina, where this species is thought to be affected by  
14 land-use activities that increase siltation in waterways (Sessions et al. 2006). Aquatic habitat for  
15 the notchlip redhorse includes large rivers and tributary channels (Sessions et al. 2006; Rohde  
16 et al. 2009). Adults and juveniles are associated with pool habitats, but adults are found in  
17 pools with greater depths and larger flows, while juveniles reside in pools found in backwaters.  
18 The notchlip redhorse is found in benthic conditions that range from silt to rocky (Rohde et al.  
19 2009).

### 20 Snail Bullhead (*Ameiurus brunneus*)

21 Snail bullheads are found throughout the State of South Carolina and are common in the  
22 Santee and Savannah river watersheds (Rohde et al. 2009). Snail bullheads are thought to  
23 maintain stable populations in South Carolina; however, this species is experiencing declines in  
24 many drainages throughout its range. Furthermore, non-native flathead catfish  
25 (*Pylodictis olivaris*) and blue catfish pose a threat to the sustainability of snail bullhead  
26 populations. For these reasons, the snail bullhead is a species of moderate conservation  
27 priority in South Carolina (Bettinger 2006b). During 2006-2009 aquatic surveys at the VCSNS  
28 site, one snail bullhead was captured in each of the two reservoirs (Parr and Monticello)  
29 (Normandeau 2007, 2008, 2009a; Quattlebaum 2008a). Dames and Moore (1985) also  
30 captured this species in Parr (1978, 1982-1984) and Monticello reservoirs (1979-1984). The  
31 Broad River is said to maintain some of the largest populations of snail bullhead (Bettinger  
32 2006b). Snail bullheads occupy moderate-sized rivers and can tolerate warm water  
33 temperatures. These fish are associated with runs and riffle habitat and rock substratum  
34 (Jenkins and Burkhead 1994; Rohde et al. 2009). Snail bullheads are omnivores. Their diet  
35 includes insect larvae, snails, fish, algae, and aquatic vegetation (Rohde et al. 2009).

1 White Catfish (*Ameiurus catus*)

2 The white catfish is considered stable throughout much of its range, including South Carolina.  
3 However, the link between introductions of non-native species (flathead and blue catfish) and  
4 localized population declines of white catfish has resulted in this fish being designated as a  
5 species of moderate conservation priority in South Carolina (Sessions et al. 2006). The white  
6 catfish is distributed throughout all watersheds of South Carolina (Rohde et al. 2009; Sessions  
7 et al. 2006). In the Parr Reservoir and Monticello reservoirs, this species accounted for  
8 0.9 percent and 1.6 percent of the respective catches during the 2006-2009 surveys at the  
9 VCSNS site (Normandeau 2007, 2008, 2009a; Quattlebaum 2008a).

10 White catfish reside in rivers of medium-to-large size and are associated with low-velocity, turbid  
11 waters. Their occupation of small streams is reportedly rare; however, white catfish can occur  
12 in reservoirs, warm-water ponds, and brackish waters (Jenkins and Burkhead 1994; Rohde et  
13 al. 2009). Benthic habitat associations include substrates of small grain-size fractions; i.e., sand  
14 or silt. White catfish prey on a diversity of items, including gizzard and threadfin shad, herring,  
15 bream, other catfishes, mayfly nymphs, and vegetation (Rohde et al. 2009). The diet of juvenile  
16 white catfish consists primarily aquatic insects. Adults are omnivorous and their diet includes  
17 aquatic invertebrates, fish, and vegetation (Jenkins and Burkhead 1994).

18 Highfin Carpsucker (*Carpionodes velifer*)

19 The populations of highfin carpsuckers in the upper Santee River basin are thought to be stable,  
20 but because populations of this species in other river systems are imperiled, conservation of this  
21 species in South Carolina is thought to be integral to the preservation of highfin carpsuckers at  
22 larger spatial scales. Distribution of the highfin carpsucker is limited to the Broad, Congaree,  
23 Santee, and Savannah rivers (Self and Bettinger 2006; Rohde et al. 2009). There are historical  
24 accounts of this species in the Pee Dee River, but current knowledge suggests that the highfin  
25 carpsucker may have been extirpated from this drainage. Due to the limited distribution of the  
26 highfin carpsucker in South Carolina, this species has been deemed a State species of highest  
27 conservation priority (Self and Bettinger 2006). The highfin carpsucker was encountered during  
28 the 2006-2008 aquatic surveys in Parr Reservoir (0.1 percent of the total catch); however, none  
29 was collected from Monticello Reservoir. Survey efforts during the late 1970s to early 1980s  
30 noted the presence of this species in both reservoirs (Dames and Moore 1985).

31 The highfin carpsucker resides in river habitats characterized by clean water and moderate  
32 current velocities. Substrate conditions range from sand to gravel (Marcy et al. 2005; Rohde et  
33 al. 2009). Compared to other carpsucker species, the highfin appears less tolerant of siltation  
34 (Pflieger 1997). Food items are derived from the benthos and include algae, insect larvae, and  
35 mollusks (Rohde et al. 2009).

## Affected Environment

### 1 Piedmont Darter (*Percina crassa*)

2 The Piedmont darter is a South Carolina species of high conservation priority (SCDNR 2005b).  
3 Information pertaining to this species is sparse (Rohde et al. 2009). While it is often  
4 encountered during aquatic inventories, knowledge pertaining to the overall abundance of  
5 Piedmont darters in streams is limited. In addition, its conservation status stems from the  
6 limited global distribution, which reportedly identifies South Carolina as making up one-third of  
7 the spatial extent of Piedmont darter habitat (Hayes and Bettinger 2006a). In South Carolina,  
8 Piedmont darters have been documented to occur between the Blue Ridge, Piedmont, and  
9 Inner Coastal Plain ecoregions (Rohde et al. 2009). They are associated with riffle habitats  
10 where stream temperatures vary from cool to warm. Known prey items include caddisfly and  
11 dipteran larvae, as well as stonefly and mayfly nymphs. During the 2006-2009 aquatic surveys  
12 only one Piedmont darter was captured and this occurred in Mayo Creek (Tetra Tech NUS, Inc.  
13 2007, 2009b; Quattlebaum 2008b).

### 14 Quillback (*Carpoides cyprinus*)

15 Populations of quillback are thought to be stable throughout its geographic range. In South  
16 Carolina, quillback are distributed across South Carolina within the Coastal Plain and Piedmont  
17 ecoregions (Rohde et al. 2009). The upper Santee and Savannah watersheds purportedly  
18 sustain ample populations. However, the quillback has been designated as a State species of  
19 high conservation priority because taxonomic data indicate that the quillback found along the  
20 Atlantic slope may be distinct from those found in other regions (Lamprecht and Bettinger 2006).  
21 Jenkins and Burkhead (1994) suggest that while the quillback is a widely distributed species, its  
22 abundance is difficult to assess because this fish is rarely encountered during aquatic survey  
23 efforts due in part to its association with large deep pools, which are difficult to adequately  
24 sample. Few quillback were captured during 2006-2008 sampling efforts in Parr and Monticello  
25 reservoirs, where they accounted for 0.8 and 0.1 percent of the total catches, respectively  
26 (Normandeau 2007, 2008, 2009a; Quattlebaum 2008a). Quillback were also encountered  
27 during 1978-1984 survey efforts in Parr and Monticello reservoirs (Dames and Moore 1985).  
28 Quillback can occupy a range of aquatic habitats from rivers to reservoirs and lakes. They are  
29 typically found in association with low river velocities and a range of substrate types (Jenkins  
30 and Burkhead 1994; Pflieger 1997). Quillback migrate into smaller, tributary streams to spawn  
31 (Rohde et al. 2009). Their diet includes algae, detritus, insects, and mollusks (Jenkins and  
32 Burkhead 1994; Pflieger 1997).

### 33 Robust Redhorse (*Moxostoma robustum*)

34 The robust redhorse is a large riverine catostomid (sucker) whose taxonomy was in dispute until  
35 1991 when it was collected from the Oconee River, Georgia. Originally thought to have  
36 inhabited the Atlantic slope drainages from the Pee Dee River in North Carolina to the Altamaha  
37 River in Georgia, remnant populations of the robust redhorse are known to exist in the Oconee

1 and Ocmulgee rivers in Georgia, the Savannah River of Georgia and South Carolina, and the  
2 Pee Dee River of North and South Carolina (Nichols 2003). Once the rediscovery of this lost  
3 species was confirmed, efforts to document the existing robust redhorse indicated the need for  
4 conservation efforts. During 1995, in lieu of designating a Federal listing of this species through  
5 the Endangered Species Act, a Memorandum of Understanding between State and Federal  
6 agencies as well as industrial partners was instituted in the form of the Robust Redhorse  
7 Conservation Committee. While this species is listed as endangered in Georgia, the robust  
8 redhorse does not maintain a legal status for protection in the Carolinas; it is listed as a South  
9 Carolina species of highest conservation priority (Self and Bettinger 2006). The Robust  
10 Redhorse Conservation Committee has implemented efforts to reintroduce this native species to  
11 river basins such as the Broad River by stocking rivers with robust redhorse fingerlings (Self and  
12 Bettinger 2006; Rohde et al. 2009). In 2008, SCDNR caught two robust redhorse while  
13 electrofishing for smallmouth bass (*Micropterus dolomieu*) in Monticello Reservoir (NRC 2009a).  
14 Aquatic surveys in the vicinity of the VCSNS site resulted in the capture of two robust redhorse  
15 in the Parr Reservoir, representing 0.1 percent of the total catch (Quattlebaum 2008a;  
16 Normandeau 2008).

17 Robust redhorse have been found in mainstream river habitats that include riffles, runs, and  
18 pools. These fish have been noted to associate with deep water pools and in-stream habitat  
19 structures such as woody debris. Prey items include mollusks, which the species crushes with  
20 pharyngeal teeth that resemble molars (Self and Bettinger 2006; Rohde et al. 2009). Spawning  
21 reportedly occurs in areas with coarse substrate (Rohde et al. 2009).

## 22 Seagreen Darter (*Etheostoma thalassinum*)

23 In South Carolina, the seagreen darter is found in tributaries of the Santee River and is  
24 commonly encountered within the upper Santee drainage (Rohde et al. 2009). Populations of  
25 the seagreen darter are considered stable in South Carolina, but it has been listed as a State  
26 species of high conservation priority because half of the global distribution of this darter  
27 purportedly occurs within the state. Furthermore, the overall distribution of this species is  
28 constrained to a small geographic region (Hayes and Bettinger 2006a).

29 The seagreen darter is associated with large creeks and small rivers. Habitat use includes  
30 riffles characterized by moderate to swift currents (Hayes and Bettinger 2006a; Rohde et al.  
31 2009). This species can tolerate a range of thermal and turbid conditions (Rohde et al. 2009).  
32 The seagreen darter was encountered during the 2006-2009 Mayo Creek aquatic surveys  
33 where it accounted for 1 percent of the total catch (Tetra Tech NUS, Inc. 2007).

## 34 **Critical Habitats**

35 No areas designated by FWS as critical habitat exist at the VCSNS site (NRC 2004). However,  
36 critical habitat for the Carolina heelsplitter (*Lasmigona decorata*) is present in waterbodies

## Affected Environment

1 proposed for transmission-line crossing in Chester and Lancaster Counties. This is discussed  
2 in the following section.

### 3 ***Federally and State-Listed Species***

4 Seven Federally or State-listed threatened or endangered aquatic species are currently listed  
5 for counties relevant to the VCSNS Units 2 and 3 and associated transmission-line corridors in  
6 South Carolina.

#### 7 Carolina Darter (*Etheostoma collis*)

8 The Carolina darter, a Federal species of concern, is listed as a State threatened species for  
9 Richland County (SCDNR 2009b) and a State species of concern for Fairfield County (SCDNR  
10 2006a;) and is also classified as a species of high conservation priority in South Carolina  
11 (SCDNR 2005b). While there are reported accounts pertaining to the distribution of the Carolina  
12 darter within the Piedmont ecoregion, the overall abundance of this species is unknown (Hayes  
13 and Bettinger 2006b). Bettinger et al. (2006) suggest that the Carolina darter does not exist  
14 within the Broad River drainage, yet Rohde et al. (2009) refer to accounts of this species in the  
15 upper and lower Broad River. This disparate information may be confounded by the taxonomic  
16 status of the Saluda darter (*E. saludae*) because debate continues regarding the separation of  
17 the two fish at the subspecies level or at the species level (NatureServe 2009b; Rohde et al.  
18 2009; Jenkins and Burkhead 1994).

19 The Carolina darter was not documented during the SCDNR 2000-2004 Broad River drainage  
20 aquatic surveys, but the Saluda darter was captured at several stream stations during the study  
21 (Bettinger et al. 2003, 2006). Neither of these darters was encountered during the 2006-2009  
22 aquatic surveys within the vicinity of the VCSNS site (Tetra Tech NUS, Inc. 2007, 2009b;  
23 Quattlebaum 2008a, 2008b; Normandeau 2007, 2008, 2009a), nor was either captured during  
24 the 1978-1984 survey efforts within Parr and Monticello reservoirs (Dames and Moore 1985).

25 The Carolina darter resides in small streams within the Piedmont ecoregion characterized by  
26 slow current velocities. Habitat associations include in-stream structure, such as large woody  
27 debris and a range of substrate conditions: mud, sand, and rock. The diet of the Carolina  
28 darter includes chironomid larvae, ostracods, copepods, and amphipods (Rhode et al. 2009).

#### 29 Carolina Heelsplitter (*Lasmigona decorata*)

30 The Carolina heelsplitter is the sole freshwater mussel within South Carolina that maintains a  
31 designation as a Federally endangered species, and it is designated as a State species of  
32 highest conservation priority. The six known populations of the Carolina heelsplitter within the  
33 state are defined by geographic location: (1) Savannah River tributaries in Edgefield and  
34 McCormick Counties; (2) Cuffeytown Creek in Greenwood and McCormick Counties; (3)



1 Lynches River and Flat Creek in Chesterfield, Kershaw, and Lancaster Counties; (4) Gills Creek  
2 in Lancaster County; (5) Fishing Creek in Chester County; and (6) Bull Run Creek in Chester  
3 County (SCDNR 2006b; 67 FR 44502).

4 Historic distribution of this species in South Carolina included the Pee Dee and Savannah  
5 drainages and possibly the Saluda drainage. Historic associations included freshwater habitats  
6 ranging from small-to-large streams and rivers. The Carolina heelsplitter has been noted to occur  
7 in association with substrate ranging from fine to coarse grain size fractions. Occurrences of the  
8 Carolina heelsplitter have been correlated in stream habitat complexity characterized as shaded,  
9 stable stream banks, and the presence of undercut banks, root wads, and large woody debris.

10 Designated critical habitat includes 103.2 km of streams and rivers in South Carolina that occur  
11 in conjunction with the known populations. The lateral boundaries of the critical habitats for the  
12 Carolina heelsplitter are denoted by the ordinary high-water mark along channel edges (67 FR  
13 44502). Designated critical habitats for the Carolina heelsplitter do not occur in the vicinity of  
14 the VCSNS site, and the species has never been found in the Parr and Monticello reservoirs or  
15 in onsite creeks and streams. However, the routing of transmission-line corridors for VCSNS  
16 Units 2 and 3 is proposed to occur within two South Carolina counties that contain critical  
17 habitat for the Carolina heelsplitter: Chester and Lancaster Counties. Further discussion of life-  
18 history attributes and potential for impacts on the Carolina heelsplitter is presented in Appendix  
19 F in a biological assessment prepared for FWS.

#### 20 Shortnose Sturgeon (*Acipenser brevirostrum*)

21 The shortnose sturgeon was initially listed as a Federally endangered species in 1967 and is  
22 designated as a species of highest conservation priority by SCDNR (McCord 2006; NMFS  
23 2009). This amphidromous species uses freshwater, estuarine, and marine habitats to  
24 complete its life cycle (Rohde et al. 2009; McCord 2006; NMFS 2009). In South Carolina,  
25 populations of shortnose sturgeon exist in the Ashepoo, Combahee, and Edisto rivers (flowing  
26 to St. Helena Sound), the Pee Dee, Waccamaw, and Black rivers (flowing to Winyah Bay), and  
27 the Savannah, Cooper, and Santee rivers. There is also a small landlocked population of  
28 shortnose sturgeon in the Santee-Cooper Lake system (Collins et al. 2003).

29 In freshwater habitats, shortnose sturgeon are associated with soft bottom substrates in deep  
30 water. Spawning occurs in freshwaters characterized by low-to-moderate velocities and over  
31 substrates that include clay, sand, gravel, and woody debris (Rohde et al. 2009; McCord 2006).  
32 Eggs are adhesive and survival is reportedly dependent on water with little turbidity  
33 (McCord 2006).

34 The shortnose sturgeon has not been reported to occur in the vicinity of the VCSNS site, but the  
35 routing of transmission-line corridors for VCSNS Units 2 and 3 is proposed to occur within eight  
36 South Carolina counties that are associated with the occurrence of shortnose sturgeon: Aiken,

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1 Calhoun, Colleton, Hampton, Dorchester, Lexington, Orangeburg, and Richland Counties.  
2 Further discussion of life-history attributes and the potential for impacts is presented in  
3 Appendix F in a biological assessment prepared for the National Marine Fisheries Service  
4 (NMFS).

### 5 **Sea Turtles**

6 Four Federally listed species of sea turtles exist in South Carolina. The loggerhead (*Caretta*  
7 *caretta*), green (*Chelonia mydas*), sea turtles are listed as threatened whereas the leatherback  
8 (*Dermochelys coriacea*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles are listed as  
9 endangered (see Table 2-20) (FWS 2008). The loggerhead sea turtle is also listed as a State  
10 threatened species for Colleton County (SCDNR 2006a). All sea turtles have certain life-history  
11 similarities in that females swim ashore to sandy beaches and deposit eggs in nesting pits that  
12 are covered to allow incubation. Juveniles hatch, struggle out of the sandy nest, and make their  
13 way to their respective ocean habitats (Carr et al. 1982). Colleton County sandy shoreline on the  
14 Atlantic coast is habitat where it is possible for sea turtle nesting to occur. The siting of the  
15 Varnville transmission line is projected to run to the west of I-95, which is well over 50 mi from the  
16 coastline, and does not cross any marine habitats (SCE&G 2009a, Section 4.1.2). Therefore,  
17 although the four species of sea turtles occur in Colleton County, no activities associated with  
18 VCSNS Units 2 and 3 would affect these species, and they are not discussed further.

### 19 **2.4.2.4 Aquatic Monitoring**

20 The aquatic ecology near the vicinity of the VCSNS site has been described through various  
21 monitoring programs since the 1970s (e.g., Dames and Moore 1985; Christie and Stroud 1998,  
22 1999; Hayes 1999). Recent monitoring efforts were implemented to document the condition of  
23 aquatic ecology in Mayo Creek and Monticello and Parr reservoirs as part of the preparation of  
24 the SCE&G COL application (e.g., Normandeau 2007, 2008, 2009a, b; Quattlebaum 2008a, b;  
25 Tetra Tech NUS, Inc. 2007, 2009b; CBS 2008a, b, c, d; CBS 2009a, b, c, d). These recent  
26 (2006-2009) efforts summarized fish community composition, benthic resources, and  
27 submerged aquatic vegetation at select locations near the vicinity of the VCSNS.

## 28 **2.5 Socioeconomics**

29 This section describes the socioeconomic baseline of the proposed VCCNS project site. It also  
30 describes the characteristics of the region surrounding the VCSNS site, including population  
31 demographics and density, and uses the data to form the basis for assessing the potential  
32 social and economic impacts from the construction and operation of the proposed VCSNS Units  
33 2 and 3. Unless otherwise specified, the information presented in this section is based on the  
34 VCSNS ER (SCE&G 2009a), and has been confirmed by the review team.

35 Socioeconomic impacts may occur in the region surrounding the proposed site. This discussion  
36 emphasizes the socioeconomic characteristics of Fairfield, Newberry, Lexington, and Richland

1 Counties, although it considers the entire region within the 50-mi radius of the site.<sup>(a)</sup> The scope  
2 of the review of site-specific community characteristics is guided by the magnitude and nature of  
3 the expected impacts of construction, maintenance, and operation of the proposed project.

4 The population data for the region are based on the 2000 U.S. Census or more recent estimates  
5 and population projections from the South Carolina Budget and Control Board (SCBCB) as  
6 noted. In addition, the review team analyzed the economic, employment, and population trends  
7 for the region using additional U.S. Census data sets and population projections from the  
8 SCBCB.

9 The region is a 50-mi circle centered on the proposed powerblock and covers all or a portion of  
10 21 counties in South Carolina, including Aiken, Calhoun, Cherokee, Chester, Edgefield,  
11 Fairfield, Greenwood, Kershaw, Lancaster, Laurens, Lee, Lexington, McCormick, Newberry,  
12 Orangeburg, Richland, Saluda, Spartanburg, Sumter, Union, and York. The region also covers  
13 a portion of Union County, North Carolina. Figure 2-2 shows a map of the region.

## 14 **2.5.1 Demographics**

15 For the purposes of this analysis, the review team divided the total population within the  
16 analytical area into three major groups: residents who live permanently in the area, transients  
17 who may temporarily live in the area but have a permanent residence elsewhere, and migrant  
18 workers who travel into the area to work and then leave after their job is done. Transients and  
19 migrant workers are not fully characterized by the U.S. Census, which generally captures only  
20 resident populations.

### 21 **2.5.1.1 Resident Population**

22 In its ER (SCE&G 2009a), SCE&G reports that, based on the 2000 U.S. Census, 111 people  
23 live within 2 mi of the center of the VCSNS Units 2 and 3 powerblock, about 289 within 3 mi,  
24 12,209 within 10 mi, 151,925 within 20 mi, and 1,028,075 within 50 mi. The population density  
25 for the 50-mi region surrounding the VCSNS site is approximately 131 persons/mi<sup>2</sup>. Table 2-23  
26 presents population trends and projections for the region and various subset areas.

27 The population growth rates shown in Table 2-23 were calculated for each county based on  
28 county projections obtained from the SCBCB. The SCBCB presents annual population  
29 projections by county for the 2010-2035 period using standard population cohort-component  
30 methods.

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(a) For the purposes of this EIS, the relevant region is limited to the area necessary to include social and economic base data for (1) the county in which the proposed facility would be located and (2) the specific portions of surrounding counties and urbanized areas (generally, up to 50 mi from the VCSNS site) from which the construction/operations workforce would be principally drawn, or that would receive stresses to community services by a change in the residence of construction/operations workers.

**Table 2-23. Historical and Projected Populations for Counties in the VCSNS Region**

County	1970 <sup>(e)</sup>	1980 <sup>(e)</sup>	1990 <sup>(a)</sup>	2000 <sup>(a)</sup>	2007 <sup>(b)</sup>	2010 <sup>(c)</sup>	2020 <sup>(c)</sup>	2030 <sup>(c)</sup>	2040 <sup>(d)</sup>	2050 <sup>(d)</sup>	2060 <sup>(d)</sup>
Aiken	91,023	105,625	120,940	142,552	152,307	158,120	177,510	196,500	216,243	237,970	261,880
Calhoun	10,780	12,206	14,753	15,185	14,777	15,210	16,660	17,980	19,272	20,657	22,142
Cherokee	36,791	40,983	44,506	52,537	54,015	55,800	61,760	67,350	72,976	79,072	85,678
Chester	29,811	30,148	32,170	34,068	32,531	33,020	34,620	36,000	37,280	38,605	39,978
Edgefield	15,692	17,528	18,375	24,595	25,435	26,560	30,270	33,520	36,692	40,164	43,964
Fairfield	19,999	20,700	22,295	23,454	23,333	23,760	25,190	26,610	28,058	29,584	31,193
Greenwood	49,686	57,847	59,567	66,271	68,259	69,770	74,840	79,750	84,770	90,106	95,778
Kershaw	34,727	39,015	43,599	52,647	58,168	60,370	67,700	74,810	82,135	90,177	99,006
Lancaster	43,328	53,361	54,516	61,351	73,393	74,800	79,480	83,940	88,402	93,101	98,050
Laurens	49,713	52,214	58,092	69,567	69,582	72,040	80,220	87,660	95,073	103,113	111,833
Lee	18,323	18,929	18,437	20,119	19,988	20,270	21,180	22,060	22,937	23,849	24,797
Lexington	89,012	140,353	167,611	216,014	243,270	255,100	294,510	333,180	373,865	419,518	470,746
McCormick	7955	7797	8868	9958	10,098	10,450	11,590	12,720	13,880	15,146	16,527
Newberry	29,273	31,242	33,172	36,108	37,633	38,390	40,900	43,400	45,942	48,633	51,482
Orangeburg	69,789	82,276	84,803	91,582	89,952	91,450	96,400	100,700	104,784	109,033	113,455
Richland	233,868	269,735	285,720	320,677	357,734	366,550	395,920	425,960	457,424	491,212	527,496
Saluda	14,528	16,150	16,357	19,181	18,748	19,150	20,470	21,570	22,580	23,637	24,744
Spartanburg	173,724	201,861	226,800	253,791	275,534	283,530	310,220	336,810	364,459	394,377	426,751
Sumter	79,425	88,243	102,637	104,646	103,943	106,180	113,630	121,160	128,954	137,250	146,080
Union	29,230	30,751	30,337	29,881	27,770	27,640	27,190	26,570	25,861	25,171	24,499
York	85,216	106,720	131,497	164,614	208,827	218,990	252,860	287,970	326,022	369,102	417,875
Union, NC <sup>(e)</sup>	54,714	70,380	84,211	123,677	181,652	210,069	304,688	399,306	493,924	588,542	683,160
50-mi Region	1,266,607	1,494,064	1,657,263	1,932,475	2,146,949	2,237,219	2,537,808	2,835,526	3,141,533	3,468,019	3,817,114
Annual Average Growth Rate	NA	1.8%	1.1%	1.7%	1.2%	1.4%	1.3%	1.2%	1.1%	1.0%	1.0%
South Carolina	2,590,516	3,121,820	3,486,703	4,012,012	4,407,709	4,549,150	5,020,400	5,488,460	5,975,731	6,506,262	7,083,894
Annual Average Growth Rate	NA	2.1%	1.2%	1.5%	1.1%	1.1%	1.0%	0.9%	0.9%	0.9%	0.9%
North Carolina <sup>(e)</sup>	5,084,411	5,880,095	6,632,448	8,049,313	9,041,821	9,572,644	11,272,964	12,935,056	14,597,148	16,259,240	17,921,332
Annual Average Growth Rate	NA	1.6%	1.3%	2.1%	1.4%	2.0%	1.8%	1.5%	1.3%	1.1%	1.0%
(a) SCBCB 2009b											
(b) SCBCB 2009c											
(c) SCBCB 2009d											
(d) Extension of the SCBCB 2025-2035 trend											
(e) North Carolina data from the following sources: USCB 1995; USCB 2009a; NCOSBM (2009a, b, c);											

1 Data in Table 2-23 indicate that the region has been growing and is projected to continue to  
 2 grow at a slightly faster rate than the State of South Carolina as a whole for the foreseeable  
 3 future. The majority of the population distribution is to the east and south of the VCSNS site.  
 4 Significant population centers are shown in Table 2-24. The distribution of the 2000 resident  
 5 population in the 50-mi region by age and gender is shown in Table 2-25.

6 **Table 2-24.** Selected 2007 Population Centers in the VCSNS Region

City	Population
Columbia	124,818
Lexington	14,995
West Columbia	13,907
Cayce	12,556
Irmo	11,542
Newberry	10,893
Chester	6040
Winnsboro	3564
Blythewood	1299

Source: SCBCB 2009e

7 **Table 2-25.** 2000 Age and Gender Distribution Near the VCSNS Site

Age Group	Fairfield		Lexington		Newberry		Richland		South Carolina	
	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population
Under 18	6128	26.1	56,313	26.1	8701	24.1	77,609	24.2	1,009,641	25.2
18 to 24	2019	8.6	17,874	8.3	3551	9.8	44,135	13.8	407,851	10.2
25 to 44	6520	27.8	68,334	31.6	9977	27.6	101,459	31.6	1,185,955	29.6
45 to 64	5693	24.3	51,504	23.8	8556	23.7	65,999	20.6	923,232	23.0
65 and over	3094	13.2	21,989	10.2	5323	14.7	31,475	9.8	485,333	12.1
Totals	24,545		216,014		36,108		320,677		4,012,012	

Source: SCE&G 2009a

8 The combined resident population of the four counties closest to the VCSNS site could be  
 9 characterized as being predominately Caucasian (62.8 percent compared to 68.4 percent  
 10 Caucasian in the State of South Carolina), although Fairfield County had a higher percentage of  
 11 African American residents than the region as a whole (57.7 percent compared to 34.2 percent  
 12 state-wide) (SCBCB 2009a). Median family income in the Columbia Metropolitan Statistical  
 13 Area (including Richland, Fairfield, Lexington, Calhoun, and Saluda Counties) in 2009 was  
 14 \$62,100, compared to the State median family income of \$55,000 (HUD 2009). Newberry  
 15 County's 2009 median family income was \$50,500 and is reported separately because the  
 16 county is not part of a metropolitan area.

1 **2.5.1.2 Transient Population**

2 Transients include people who work in or visit large workplaces, schools, hospitals and nursing  
 3 homes, correctional facilities, hotels and motels, or work at recreational areas or special events  
 4 where there may be seasonal and workday variations in population. The VCSNS 50-mi region  
 5 includes a number of facilities, venues, and recreational areas that attract transient populations  
 6 in substantial numbers.

7 Outdoor recreation opportunities in the VCSNS 50-mi region include a number of parks and  
 8 water-based and forest-based recreational opportunities. Several large lake-based recreation  
 9 areas in the four closest counties to the site are accessible to relatively large numbers of annual  
 10 visitors. These parks provide locations for a range of activities, including fishing, camping,  
 11 biking, horse-riding, picnicking, and hiking. Table 2-26 summarizes the overnight capacity and  
 12 recent visitation trends for these resources.

13 **Table 2-26. High-Capacity Recreation Areas in the Region**

Recreation Site	Camp Sites <sup>(a)</sup>	2004-5 Campers <sup>(b)</sup>	2004-5 All Visitors <sup>(b)</sup>	2006-7 Campers <sup>(c)</sup>	2006-7 All Visitors <sup>(c)</sup>
Chester State Park	31	6411	29,166	6324	36,675
Dreher Island State Recreation Area	112	30,577	206,948	38,410	154,749
Lake Greenwood State Recreation Area	145	51,125	139,152	53,840	151,233
Lake Wateree State Recreation Area	72	32,435	133,008	32,011	156,580
Sesquicentennial State Park	89	9641	105,672	18,795	105,648

(a) SCBCB (2007)  
 (b) SCBCB (2009f)  
 (c) SCBCB (2009g)

14 The Sumter National Forest is located north of the VCSNS site and offers a wide range of  
 15 recreational activities, including camping, fishing, hiking, and hunting. The region features many  
 16 other developed recreation sites, including parks, wildlife management areas, historic sites,  
 17 forests, and recreation areas, but the sites listed in Table 2-26 represent most of the capacity  
 18 among all recreation sites in the region.

19 The Fort Jackson military base is within the 50-mi analytical region, located about 30 mi east of  
 20 the VCSNS site. Fort Jackson employs 4000 civilians and is the largest and most active Initial  
 21 Entry Training Center in the Army, training 19,000 new soldiers each year.

22 The largest and greatest number of hotels and motels in the area are concentrated primarily in  
 23 the larger cities, and hence, are at some distance from the VCSNS site. However, there are  
 24 several motels in the vicinity of the site. The greater Columbia area has more than 10,334 hotel  
 25 rooms spread over 110 separate properties (SCBCB 2008).

### 1 **2.5.1.3 Migrant Labor**

2 The U.S. Census Bureau (USCB) defines a migrant laborer as someone who is working  
3 seasonally or temporarily and moves one or more times from one place to another for seasonal  
4 or temporary employment. During VCSNS scheduled refueling outages, there is an influx of  
5 construction-related migrant laborers to the area who are hired by VCSNS to carry out fuel-  
6 reloading activities, equipment maintenance, and other projects associated with the outage.  
7 VCSNS employs an average of about 655 contract employees during refueling outages, which  
8 occur every 18 months for each unit (NRC 2004), and approximately 90 percent of those  
9 employees come from outside the 50-mi region.

10 Migrant farm workers are defined as those whose employment requires travel that prevents the  
11 worker from returning to his/her permanent place of residence the same day. Migrants tend to  
12 work short-duration, labor-intensive jobs, such as harvesting fruits and vegetables. The 2007  
13 Census of Agriculture indicates that the reported migrant population in the region is  
14 approximately 200 (USDA 2007a). The number is approximate because of differences between  
15 the county- and State-level reporting requirements (USDA 2007b).

### 16 **2.5.2 Community Characteristics**

17 The VCSNS site is located in a rural area of western Fairfield County. The site itself is on the  
18 Monticello Reservoir, which is surrounded by wetlands and pine forest, with sparse residential  
19 development. The site is near metropolitan Columbia, the Richland County Seat and capital of  
20 South Carolina. However, Fairfield County is much more rural than Richland County; and is  
21 governed from the County Seat of Winnsboro.

22 An unincorporated residential area surrounds the VCSNS site, although it remains sparsely  
23 populated. The land surrounding the site is also zoned for low-density residential development.  
24 To the west, I-26 passes the site, although the site itself is only accessible by State and county  
25 roads, or by a railroad spur. Besides Columbia, the VCSNS site is not near other large  
26 population centers.

27 The characteristics of the populations of the four most local counties vary widely around the  
28 State averages for minority proportion and the proportion living below the poverty level. Fairfield  
29 County, the host county for the new nuclear units, has nearly double the minority proportion of  
30 the state as a whole and a proportion of individuals living in poverty that is 22 percent higher  
31 than the State average. The other three counties all have poverty proportions that are lower  
32 than the State average and closer to the national average. Lexington County, composed mostly  
33 of suburbs of Columbia, is more than 80 percent Caucasian, which differs significantly from the  
34 rest of the area. The four-county local area is described in terms of racial characteristics and  
35 income level in Table 2-27.

1 **Table 2-27.** Minority and Low-Income Populations

<b>Location</b>	<b>Percentage Minority</b>	<b>Percentage Below Poverty</b>
United States	30.9	13.3
South Carolina	32.7	15.6
Fairfield	60.4	20.0
Lexington	18.5	11.8
Newberry	37.6	13.4
Richland	50.6	13.5

Source: Adapted from USCB 2005-2007 American Community Survey (USCB 2009b, c, d, e, f)

2 Further discussion of the demographic composition of the local area can be found under  
 3 Environmental Justice (see Section 2.6). The remainder of this section addresses community  
 4 characteristics, including the regional economy, transportation networks and infrastructure,  
 5 taxes, aesthetics and recreation, housing, community infrastructure and public services, and  
 6 education.

7 **2.5.2.1 Economy**

8 As the economic hub of the Central Midlands, the City of Columbia is the center of government  
 9 and industry for a wide area in central South Carolina. Relatively recently, the I-26 corridor has  
 10 seen significant commercial and residential development in the areas of West Columbia and  
 11 Irmo. The University of South Carolina and several regional medical facilities have attracted a  
 12 well-educated workforce to this area. Fort Jackson, a large military installation in Columbia, is  
 13 supported by nearly 4000 civilian employees.

14 The principal economic centers within the region are found in Columbia (Richland and Lexington  
 15 Counties), Newberry (Newberry County), Clinton (Laurens County) and Union (Union County).  
 16 However, the economy of the Central Midlands is dominated by Columbia.

17 The construction of Unit 1 provides context for what the potential impacts of constructing the  
 18 new units would be. The NRC was completing its Final Environmental Statement (FES) for the  
 19 Operating License (OL) for VCSNS Unit 1 just as final construction of that unit was winding  
 20 down over the 1979-1981 period. As such, the OL FES provides a glimpse of the observed  
 21 socioeconomic impacts from that construction project. The review team noted that at that time  
 22 the construction contractor commissioned a workforce survey to ascertain information such as  
 23 the residence pattern of the construction workers. Of the approximately 2400 workers  
 24 surveyed, 1913, or about 80 percent came from within the VCSNS region, and 927, or nearly  
 25 50 percent came from either Lexington or Richland Counties (NRC 1981). The review team  
 26 also observed that more than 70 percent of the workers came from the Central Midlands area,  
 27 with the remainder coming from outside the region.



1 The VCSNS site currently employs approximately 635 full-time operations employees (SCE&G  
 2 2009e), with an average of 740 additional contract workers over two recent maintenance  
 3 outages (SCE&G 2009a). About 95 percent of the current operating workforce resides in  
 4 Fairfield, Lexington, Newberry, and Richland Counties (see Table 2-28). Therefore, this four-  
 5 county area is considered to be the economic impact area when discussing employment,  
 6 income, and output impacts from construction and operations. The review team used the  
 7 distribution of VCSNS employees as the basis for several demographic assumptions in its  
 8 economic impact assessment, which is discussed in Chapters 4 and 5 of this EIS.

9 Table 2-29 shows the unemployment rates for all counties in the 50-mi region for the 2005-2008  
 10 period. Over the last 4 years, the four-county economic impact area has remained relatively  
 11 stable. However, unemployment in Fairfield County has risen significantly as a result of  
 12 economic conditions similar to those seen elsewhere in the country associated with the current  
 13 economic downturn. The four-county economic impact area's unemployment rate is  
 14 significantly lower than the national unemployment rate. The Central Midlands and Columbia,  
 15 specifically, have been able to avoid impacts of the national economic downturn. The increase  
 16 in unemployment is largely tied to manufacturing-based industries.

17 Table 2-30 shows the occupational characteristics of residents of Fairfield, Lexington, Newberry,  
 18 and Richland Counties. Richland County is the center of retail and health care industries in the  
 19 Central Midlands. In addition, because Columbia, the capital of South Carolina, is in Richland  
 20 County, government and government enterprises play a large role in the local economy.  
 21 Lexington County has become a suburb of Columbia. State government employment accounts  
 22 for 16.7 percent of nonfarm employment in Richland County. Nearly 30 percent of employment  
 23 in Newberry County is in manufacturing industries. Table 2-31 illustrates the occupational  
 24 makeup of construction employment in the Columbia metropolitan area. The metropolitan area  
 25 appears to support healthy levels of the construction trades, which could be expected to be  
 26 needed for the development of the VCSNS units.

27 **Table 2-28. VCSNS Unit 1 Operations Employment by County and State**

<b>County or Summary Level</b>	<b>2006 Employment</b>	<b>Percent</b>
Fairfield County	58	9.1
Lexington County	219	34.5
Newberry County	115	18.1
Richland County	209	32.9
Economic Impact Area	601	94.6
Other Counties	34	5.4
VCSNS Operations Employment	635	100.0

Source: After SCE&G 2009e

**Table 2-29.** Employment Trends in the Region

County or Summary Level	Labor Force				Unemployment Rate			
	2005	2006	2007	2008	2005	2006	2007	2008
Aiken	69,850	70,462	70,579	70,640	5.9	6.3	5.3	5.9
Calhoun	6567	6585	6466	6478	7.3	7.0	6.2	7.7
Cherokee	22,920	23,234	23,609	23,198	7.9	7.5	6.7	9.3
Chester	14,425	14,550	13,826	13,383	9.2	10.0	10.8	12.3
Edgefield	10,358	10,229	10,282	10,291	7.2	7.6	6.2	6.8
Fairfield	10,424	10,401	10,176	10,195	7.8	8.8	8.4	10.8
Greenwood	29,562	29,259	28,913	28,014	9.1	7.8	6.8	7.9
Kershaw	27,075	27,769	28,053	28,103	6.6	6.2	5.3	6.6
Lancaster	27,219	27,884	27,009	26,016	8.4	8.8	9.5	11.8
Laurens	30,956	31,203	30,948	31,270	6.7	6.8	7.1	7.4
Lee	7511	7601	7489	7331	9.5	9.4	8.1	9.6
Lexington	121,271	124,747	126,165	126,391	4.9	4.6	4.1	4.9
McCormick	3152	3216	3159	3057	11.2	10.8	9.8	11.1
Newberry	16,425	16,831	17,060	17,207	7.0	6.3	5.5	7.2
Orangeburg	36,630	36,590	37,160	36,633	9.6	9.0	8.0	10.5
Richland	160,746	165,869	170,132	170,437	6.0	5.7	5.2	6.1
Saluda	8648	8791	8634	8650	6.6	6.1	5.2	5.9
Spartanburg	121,762	124,974	126,527	128,179	7.5	6.5	5.6	6.9
Sumter County	42,470	42,218	41,479	39,420	8.5	7.7	7.0	8.6
Union County	11,293	10,985	10,637	10,455	10.8	10.7	8.9	11.1
York County	89,815	94,695	99,019	99,076	6.7	6.2	5.3	7.2
Region	869,079	888,093	897,322	894,424	6.9	6.5	5.9	7.1
Economic Impact Area	308,866	317,848	323,533	324,230	5.7	5.4	4.9	5.9
South Carolina	1,927,674	1,976,649	2,006,179	2,004,244	6.7	6.3	5.6	6.9

Source: Adapted from the Bureau of Economic Analysis (BEA) 2006-2009 (BLS 2009c).

1

**Table 2-30.** 2007 Local Employment by Industry in Four Local Counties

Industry	Fairfield	Lexington	Newberry	Richland
Total employment	8735	140,579	18,046	273,583
Wage and salary employment	6779	105,478	15,302	244,897
Proprietors employment	1956	35,101	2744	28,686
Farm proprietors employment	209	962	621	398
Nonfarm proprietors employment	1747	34,139	2123	28,288
Farm employment	229	1213	812	451
Nonfarm employment	8506	139,366	17,234	273,132
Private employment	6788	120,756	14,563	207,517
Forestry, fishing, related activities, and other	D	316	400	D
Mining	D	193	D	D
Utilities	D	560	D	2246
Construction	519	13,408	1,258	12,163
Manufacturing	865	12,176	5,004	11,560
Wholesale trade	604	7328	389	9467
Retail trade	827	17,242	1775	26,263
Transportation and warehousing	D	6670	D	2870
Information	D	1166	70	D
Finance and insurance	95	5265	298	19,970
Real estate and rental and leasing	342	9707	326	10,973
Professional, scientific, and technical services	D	6198	D	16,167
Management of companies and enterprises	D	711	D	3290
Administrative and waste services	434	8435	906	19,787
Educational services	D	1302	398	4,795
Health care and social assistance	D	9569	1225	27,148
Arts, entertainment, and recreation	91	2291	189	3389
Accommodation and food services	294	9730	732	18,330
Other services, except public administration	575	8489	892	D
Government and government enterprises	1718	18,610	2671	65,615
Federal, civilian	46	587	112	8547
Military	98	1019	158	11,354
State and local	1574	17,004	2401	45,714
State government	241	1766	245	32,075
Local government	1333	15,238	2156	13,639

Source: After table in BEA 2009

D = Data not disclosed

Affected Environment

1 **Table 2-31.** 2006-2008 Construction Industry Occupational Employment in the Columbia  
 2 Metropolitan Area

Occupation Title	2006	2007	2008
Construction and Extraction Occupations	15,780	18,170	16,880
First-Line Supervisors/Managers of Construction Trades and Extraction Workers	1850	2120	2140
Brickmasons and Blockmasons	490	450	310
Carpenters	1810	2450	2180
Tile and Marble Setters	120	D	D
Cement Masons and Concrete Finishers	410	280	340
Construction Laborers	1650	1860	1740
Paving, Surfacing, and Tamping Equipment Operators	180	370	370
Operating Engineers and Other Construction Equipment Operators	1140	1120	1130
Drywall and Ceiling Tile Installers	520	710	670
Electricians	1470	1830	1670
Glaziers	100	D	D
Insulation Workers, Mechanical	D	130	260
Painters, Construction and Maintenance	620	700	600
Pipelayers	220	210	270
Plumbers, Pipefitters, and Steamfitters	1230	1790	1490
Reinforcing Iron and Rebar Workers	60	60	D
Roofers	260	290	300
Sheet Metal Workers	320	320	340
Structural Iron and Steel Workers	110	40	40
Helpers – Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	370	250	150
Helpers – Carpenters	510	470	400
Helpers – Electricians	550	560	540
Helpers – Painters, Paperhangers, Plasterers, and Stucco Masons	D	D	110
Helpers – Pipelayers, Plumbers, Pipefitters, and Steamfitters	490	490	420
Helpers, Construction Trades, All Other	170	280	180
Construction and Building Inspectors	300	280	160
Hazardous Materials Removal Workers	160	100	130
Septic Tank Servicers and Sewer Pipe Cleaners	80	70	D
Helpers – Extraction Workers	50	D	D

Sources: BLS 2008, 2009a, b  
 D = Data not revealed by BLS for disclosure reasons

1 Table 2-32 shows median family income information covering the four-county economic impact  
 2 area based on the 2000 census and 2009 Housing and Urban Development estimates. In  
 3 general, family incomes in the four-county region grew faster than the South Carolina pace but  
 4 lagged behind the rest of the country. Family incomes in Newberry County appear to be  
 5 noticeably below the State and national averages in 2009, while family incomes across the  
 6 Columbia metropolitan area appear to be about equal to the national average. The Columbia  
 7 metropolitan area family median income is about 13 percent higher than the statewide average.

8 **Table 2-32.** Annual Median Family Income (Current Dollars) by County for the Four-County  
 9 Economic Impact Area

County	2000 Median Family Income	2009 Median Family Income	2000 to 2009		
			Percent Change	2009 Index Versus SC	2009 Index Versus US
Fairfield	49,269	62,100	26.0	1.129	0.970
Lexington	49,269	62,100	26.0	1.129	0.970
Newberry	40,582	50,500	24.4	0.918	0.789
Richland	49,269	62,100	26.0	1.129	0.970
South Carolina	44,227	55,000	24.4	1.000	0.859
United States	50,046	64,000	27.9	1.164	1.000

Source: HUD 2009

10 **2.5.2.2 Taxes**

11 For tax assessment purposes, the VCSNS site is located in Fairfield County. SCE&G would  
 12 pay all of its property taxes to Fairfield County. Table 2-33 illustrates recent trends in property  
 13 tax payments SCE&G has made, attributable to the current VCSNS facility and SCE&G lands.  
 14 These revenues currently represent about 37 percent of the Fairfield County property tax  
 15 collections. This share has declined slightly over time as Fairfield County's tax base has grown  
 16 modestly over the last 10 years – most significantly in the last 3 to 4 years. Property tax  
 17 revenues are distributed primarily into education, human services, and capital and debt, with the  
 18 rest being distributed among several other categories (sheriff, community services, and general  
 19 administration). Santee Cooper also contributes a minor amount of fee-in-lieu-of-taxes to  
 20 Fairfield County, but this amount represents only a negligible source of revenue. Of note,  
 21 SCE&G is the single largest property tax payer in Fairfield County.

22 SCE&G also pays sales and use taxes on the in-state purchases of goods and services made in  
 23 support of VCSNS Unit 1 operations; however, for Unit 1 operations, these revenues are not  
 24 significant revenue sources for the State. Additional sales taxes would be raised by the  
 25 additional purchases and consumption from new workers associated with VCSNS Units 2 and 3  
 26 (SCE&G 2009a). Tax impacts from construction and operations are discussed in Sections  
 27 4.4.3.2 and 5.4.3.2 of this EIS.

1 **Table 2-33.** 2003-2008 Property Tax Revenue Trends Related to VCSNS Unit 1 (dollars)

Year	VCSNS-Related Property Taxes Paid to Fairfield County	Other SCE&G-Related Property Taxes Paid to Fairfield County	Total SCE&G-Related Tax Revenue Accrued to Fairfield County	Fairfield County Total Property Tax Revenue (all sources)	VCSNS Percent of Fairfield County Property Tax Revenue
1999	12,529,680	4,952,021	17,481,701	27,772,061	45.1
2000	12,272,620	4,984,243	17,256,863	29,604,792	41.5
2001	12,273,100	4,898,955	17,172,055	28,801,287	37.6
2002	12,199,280	4,912,241	17,111,521	32,624,790	37.4
2003	12,903,760	5,157,484	18,061,244	32,225,887	40.0
2004	12,711,245	5,173,217	17,884,462	32,381,035	39.3
2005	13,564,310	5,565,492	19,129,802	32,527,833	41.7
2006	14,209,970	5,065,878	19,275,848	37,733,947	37.7
2007	14,295,100	5,730,027	20,025,127	37,988,361	37.6
2008	14,280,560	5,714,524	19,995,084	38,649,841	36.9

Sources: SCE&G 2009n; SCORS 2009

2 **2.5.2.3 Transportation**

3 The VCSNS 50-mi region has a well-developed transportation network of Federal, State, and  
 4 county highways, a primary freight railroad service, a primary commercial airport, and 11  
 5 smaller public airports that provide ready access to the population centers of the region.

6 The major interstate highways near the VCSNS site include I-26, which links the regional  
 7 population center of Columbia to the VCSNS site and neighboring counties; I-77, which links  
 8 Columbia to Charlotte, North Carolina; and I-20, which links Columbia to Atlanta, Georgia.  
 9 Fairfield County is linked to Columbia via US-321 to Winnsboro, while SC-215 connects  
 10 Jenkinsville with Columbia and provides primary access to the VCSNS site.

11 Primary road access to the VCSNS site from the greater Columbia area to the southeast uses  
 12 I-20 to US-176, which connects to SC-213. SC-213 connects to SC-215 in Jenkinsville, and  
 13 SC-215 runs north to the current site access road. The roads providing primary access from  
 14 I-20 to the site are two-lane highways. There are no alternate routes that would provide the  
 15 majority of the workforce with efficient access to the site. Hence, the local highways (SC-213  
 16 and SC-215) currently exhibit heavy traffic volumes during shift change time periods at existing  
 17 VCSNS Unit 1. Table 2-34 provides current traffic volume data for routes in the vicinity of the  
 18 VCSNS site compared to the rated capacity of those roadways in terms of “level of service”  
 19 (LOS).

1 **Table 2-34.** 2008 Annual Average Daily Traffic (AADT) for Selected Routes in the Vicinity of the  
 2 VCSNS Site

Route	Route Location	2008 AADT	LOS "C" Capacity
SC-213	Newberry County Line to SC-215	2400	8600
SC-213	US-176 to Fairfield County Line	1700	8600
SC-215	Richland County Line to SC-213	1600	10,800
SC-34	Newberry County Line to SC-215	1600	16,800
SC-34	SC-215 to US-321	2300	16,800
SC-34	I-26 to Fairfield County Line	2200	16,800
US-176	Newberry County Line to I-26	5900	16,800

Sources: SCDOT 2009a, b

3 The review team assessed whether projects funded under the American Recovery and  
 4 Reinvestment Act of 2009 might affect transportation routes in the vicinity of the site. Although  
 5 many projects are planned within South Carolina, none is in the vicinity of the VCSNS site. The  
 6 review team did not identify any transportation planning documents that address the routes  
 7 listed in Table 2-34. In South Carolina, the accepted standard for two-lane rural roadways is  
 8 LOS "C" (SCDOT 2009c).

9 The only airport in the region with scheduled commercial air service is the Columbia  
 10 Metropolitan Airport. Eleven other public general aviation airports are in the region. These  
 11 include Lexington County, Columbia Owens (Richland County), Newberry County, Trenton  
 12 Younce Field (Edgefield County), Saluda County, Greenwood County, Laurens County, Aiken  
 13 Municipal (Aiken County), Chester Catawba Regional (Chester County), Woodward Field  
 14 (Kershaw County), and Fairfield County airports. Over the last 10 years, the Columbia  
 15 Metropolitan Airport has averaged about 58,000 commercial flight operations per year  
 16 (SC Aeronautics 2009).

17 Railroad service in the vicinity is provided by two freight rail carriers, CSX Transportation and  
 18 Norfolk Southern Railway (SCE&G 2009a). Passenger railroad service from Amtrak is only  
 19 available from Columbia. The Norfolk Southern Railway serves the northern half of the state with  
 20 lines connecting Columbia to the Greenville/Spartanburg area and to Charlotte (SCE&G 2009a).  
 21 VCSNS has a railroad spur that connects to the Norfolk Southern line on the east side of the  
 22 Broad River that runs through Columbia and Spartanburg (NRC 2004).

23 A high-speed railroad corridor is being planned along a northeast corridor that would link  
 24 Columbia and Raleigh, North Carolina. A second corridor would connect Atlanta, Georgia, to  
 25 Greenville/Spartanburg, South Carolina, and then link to Charlotte and Greensboro, North  
 26 Carolina (SCE&G 2009a). As currently envisioned, the Raleigh line would run through central  
 27 Fairfield County.

1    **2.5.2.4    Aesthetics and Recreation**

2    The VCSNS site is on a plateau south of Monticello Reservoir and is surrounded by forests.  
3    When observed from on land, the site is largely concealed by the surrounding forest. From  
4    Monticello Reservoir the view toward VCSNS Units 2 and 3 would be somewhat obscured by  
5    Unit 1. The site has already been altered with the construction of original Unit 1, and the  
6    proposed expansion would add two new cooling towers and associated plumes. The multiple  
7    high-voltage transmission lines associated with the VCSNS site at the Unit 1 containment  
8    building are the dominant manufactured visual features in the surrounding landscape.

9    Fairfield County offers a wide array of outdoor activities around Monticello Reservoir and the  
10   surrounding woodlands ranging from hiking, camping, fishing, boating, horseback riding, and  
11   hunting. The region includes many opportunities for outdoor activities, in addition to those found  
12   at Monticello Reservoir. Other major lakes within the region include Lake Wateree, Lake  
13   Murray, and Lake Greenwood. Outdoor activities in the region include backpacking, climbing,  
14   camping, hunting, hiking, boating, fishing, and swimming, among others. There are a number of  
15   public historic sites and the Congaree Swamp National Monument preserves the largest  
16   remnant of old-growth floodplain forest remaining in North America (NPS 2009).

17   Within the immediate vicinity of the VCSNS site, hunting, fishing, and pleasure boating are  
18   among the most popular recreational activities. Fairfield County operates a recreation site on  
19   the shore of Monticello Reservoir, in the immediate area of Jenkinsville. SCE&G provides  
20   recreation sites and boat launch facilities around the reservoir, which are managed by SCDNR.  
21   The nearby Sumter National Forest offers opportunities for many forms of outdoor recreation,  
22   including hunting, fishing, camping, and hiking, among others.

23   **2.5.2.5    Housing**

24   Within the region of the VCSNS site are a number of communities ranging from the urban center  
25   of greater Columbia to the smaller cities and towns of Newberry, Winnsboro, Batesburg,  
26   Camden, Clinton, Lancaster, and smaller towns and rural, unincorporated areas such as  
27   Jenkinsville, Peak, Ridgeway, and Chester. The communities in Fairfield, Lexington, Newberry,  
28   and Richland Counties, where the majority of in-migrating labor is expected to live, are  
29   connected by an extensive highway, county road, and railroad system that support the area  
30   surrounding the VCSNS site. Many of the residential areas in the immediate vicinity of the  
31   VCSNS site are outside the jurisdictional boundaries of cities and towns. Rental property is  
32   available in the larger communities such as Newberry, Chapin, Irmo, and West Columbia.  
33   There also are several hotels/motels in the vicinity of the site.

34   The greater Columbia metropolitan area has grown significantly since the 2000 U.S. Census.  
35   The USCB (2009g) estimates showed a total of 10,913 housing units in Fairfield County in  
36   2008. Assuming that the vacancy rate remains relatively constant, 1692 of the units would be



1 vacant and available when construction begins. Over the 2000-2008 period, the housing stock  
 2 in the four-county economic impact area grew by 18.3 percent, with the addition of more than  
 3 33,300 new units (USCB 2009g). Housing stock growth in Richland County has significantly  
 4 outpaced that of the other three counties – 20.9 percent for Richland County compared to  
 5 11.8 percent elsewhere since 2000.

6 Recent residential development principally has been focused in the adjacent communities of  
 7 Irmo, West Columbia, and Lexington, to support population growth in the Columbia metropolitan  
 8 area as a whole. While three new housing developments are planned or awaiting construction  
 9 in the Jenkinsville area bordering the Monticello Reservoir, the land surrounding the VCSNS site  
 10 remains sparsely populated. Table 2-35 provides a snapshot of the real estate market in the  
 11 counties closest to the VCSNS site.

12 **Table 2-35. 2000 Census Housing Characteristics in the Vicinity of the VCSNS Site**

	Fairfield	Lexington	Newberry	Richland	Four- Counties	South Carolina
Total Housing Units	10,383	90,978	16,805	129,793	247,959	1,753,670
Total Occupied Units	8774	83,240	14,026	120,101	226,141	1,533,854
Owner-Occupied	6794	64,265	10,776	73,757	155,592	1,107,617
Renter-Occupied	1980	18,975	3250	46,344	70,549	426,237
Total Vacant Units	1609	7738	2779	9692	21,818	219,816
Percent Total Vacant Units	15.5	8.5	16.5	7.5	8.8	12.5
Median Value (single- family owner occupied)	\$69,900	\$106,300	\$78,000	\$98,700	\$98,880	\$94,900
Percent Change 1990 to 2000 in Commuter	18.9	34.7	16.3	18.5	23.8	24.3
Mean Travel Time to Work, Minutes	28.3	26	25.3	21.7	NA	24.3

Source: SCE&G 2009a  
 NA = Not applicable

13 **2.5.2.6 Public Services**

14 The political jurisdictions providing public services in the region include State, county, and  
 15 municipal agencies and school districts. The review team expects that the public service  
 16 impacts from the proposed action would be largely proportional to where the workers would  
 17 reside. Therefore, the four-county area would likely bound the extent of such impacts, and the  
 18 review team would not expect any significant public service impacts beyond the four-county  
 19 economic impact area. The ensuing discussion of baseline conditions is confined to just the

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1 four-county area. As part of its evaluation, the review team visited the region and the economic  
2 impact area to meet with local officials regarding the potentially affected public services and to  
3 validate SCE&G's assertions in its ER.

### 4 ***Water Supply and Waste Treatment***

5 In the Central Midlands region, water systems draw from surface water (i.e., rivers, lakes, and  
6 streams) or groundwater. The fall line, a line marking the transition between the Piedmont and  
7 the Coastal Plain physiographic ecoregions, approximately follows I-20 and splits the Central  
8 Midlands. VCSNS site is in the Piedmont, north of the fall line. Two of the four counties  
9 (Fairfield and Newberry) of interest lie entirely in the Piedmont. Approximately one-third of  
10 Lexington and Richland Counties lies in the Piedmont, with the remainder in the Coastal Plain.

11 The Piedmont is characterized by a limited groundwater supply due to the dense, crystalline  
12 rock substrate. Most of the large municipal systems in the Central Midlands north of the fall line  
13 obtain water from the Broad or Saluda rivers or one of their impoundments. However, some  
14 smaller municipalities have wells that can adequately meet water demands.

15 Currently, water-supply facilities have excess capacity. According to local planning officials,  
16 water supply in the region is not a concern. Communities are adequately served by the current  
17 water supplies and planners estimate that the counties have adequate supply through current  
18 planning periods (SCE&G 2009a). Table 2-36 and Table 2-37 describe water suppliers in the  
19 four-county economic impact area, their current capacities, and their average daily production.

20 Wastewater treatment in the region is provided by local jurisdictions. Municipalities determine  
21 treatment methods based on needs and available technologies, within budget constraints.  
22 Currently, the municipalities in the four counties are able to meet projected wastewater-  
23 treatment needs (SCE&G 2009a). Table 2-38 provides public wastewater capacities and  
24 average daily production. Rural areas of each county use septic systems.

### 25 ***Police, Fire, and Medical Services***

26 The Fairfield County Emergency Management Office is the lead agency responsible for  
27 emergency management planning in Fairfield County. It coordinates planning with both the  
28 Governor's Division of Emergency Management and SCE&G when responding to emergencies.  
29 Table 2-39 and Table 2-40 provide police and fire information for the four-county economic  
30 impact area, respectively. Emergency management officials consider current police and fire  
31 protection to be adequate at this time (SCE&G 2009a).

1 Scoping comments indicated that crime in the vicinity of the VCSNS site is a concern, and the  
 2 review team's visits to the area confirmed that during Unit 1 construction, the presence of a  
 3 large number of construction workers in the area contributed to noticeable increases in crime,  
 4 such as assaults and drug- and alcohol-related misdemeanors. The review team compiled  
 5 baseline crime statistics for the region from 2006 State-reported data (SCLED 2009).  
 6 Table 2-41 lists the most recent detailed county-level arrest data reported in the State. Of note,  
 7 the rate of violent crime in Lexington and Richland Counties was noticeably lower than the more  
 8 rural local counties and the State in the 2007 report. The overall arrest rate in Fairfield County  
 9 is about equal to the State arrest rate.

10 **Table 2-36.** Public Groundwater Supply Resources Near the VCSNS Site<sup>(a)</sup>

Groundwater System Name	System Number	Treatment Capacity (Mgd)	Reported Annual Average Withdrawal (Mgd)	Population Served
<b>Fairfield County</b>				
Jenkinsville Water District [9 wells and purchased from Midcounty]	2020001	NA	0.15	1969
Midcounty Water District #1 [4 wells <sup>a</sup> and purchased from Winnsboro]	2020002	NA	0.083	1487
Town of Ridgeway [1 well and purchased from Winnsboro]	2010002	NA	0.056	950
<b>Lexington County</b>				
Gaston Rural Water District [7 wells]	3220002	NA	0.46	6756
Gilbert Summit [7 wells and purchased from Lexington Co. Joint]	3220001	NA	0.41	4518
<b>Newberry County</b>				
Town of Prosperity [3 wells]	3610005	NA	0.058	1347

Source: After SCE&G 2009a

(a) Includes community water systems of 3 million gallons per month or greater; smaller systems are not required to report groundwater withdrawal.

NA = Not applicable

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1 **Table 2-37.** Public Surface-Water Supply Resources by County in the Economic Impact Area  
 2 of the VCSNS Site<sup>(a)</sup>

Surface-Water System Name	Treatment Capacity (Mgd)	Reported Annual Average Withdrawal (Mgd)	Population Served	Excess Capacity (Mgd)
<b>Fairfield County</b>				
Town of Winnsboro [Sand Creek and 192-ac Lake]	3.1	1.54	8303	1.56
<b>Lexington County</b>				
Town of Batesburg-Leesville [Lightwood Knot Creek, Duncan Creek]	2.4	1.1	7652	1.3
City of Cayce [Congaree Creek and purchased from Lexington Co. Joint, Lexington, and Columbia] <sup>(a)</sup>	6.0	3.1	15,250	2.9
City of West Columbia [Saluda River and Lake Murray and purchased from Cayce]	20	9.8	29,763	10.2
Lexington Co. Joint Municipal Water System [Lake Murray and purchased from West Columbia]	4.3	2.3	12,264	2.0
Town of Lexington [purchased from West Columbia and Lexington Co. Joint]	4.5	1.8	7659	2.7
<b>Newberry County</b>				
City of Newberry [Saluda River]	8.1	5.1	10,145	3.0
Town of Whitmire [Enoree River, Duncan Creek]	1.0	0.64	2755	0.36
<b>Richland County</b>				
Fort Jackson (US Army) [purchased from Columbia]	6.6	2.2	32,841	4.4
City of Columbia [Lake Murray and Columbia Canal (Broad River)]	126	65	223,660	61

Source: SCE&G 2009a

(a) Includes community water systems of 3 million gallons per month or greater.

1 **Table 2-38.** Public Wastewater-Treatment Systems by County in the Economic Impact Area of  
 2 the VCSNS Site<sup>(a)</sup>

<b>System Name</b>	<b>Maximum Treatment Capacity (Mgd)</b>	<b>Average Daily Wastewater Processed (Mgd)</b>	<b>Estimated Excess Wastewater-Treatment Capacity (Mgd)<sup>(b)</sup></b>
<b>Fairfield County</b>			
Winnsboro/Jackson Creek Plant	1.5	Not Provided	Unknown
<b>Lexington County</b>			
Cayce Wastewater Treatment Facility (WWTF)	9.5	5.5 to 6.0	3.5 to 4.0
Town of Chapin	5.0 (proposed)	0.58	4.4 (proposed)
Batesburg-Leesville WWTF	2.5	1.3 to 1.5	1.0 to 1.2
Lexington-Coventry Woods Wastewater Treatment Plant	1.95	1.0	0.95
<b>Newberry County</b>			
City of Newberry/Bush River Wastewater Treatment Plant	3.22	2.5	0.7
Town of Whitmire	1.0	0.5 to 0.6	0.4 to 0.5
<b>Richland County</b>			
Columbia Metro Wastewater Treatment Plant	60	35	25
East Richland County Public Service District/Gills Creek	16.0	Not Provided	Unknown
Richland County/Broad River WWTF	6.0	1.2	4.8

Source: SCE&G 2009a

(a) Includes major facilities with a capacity of 1 million gpd or more

(b) Estimate assumes entire maximum treatment capacity is available to treat wastewater flow that is above average.

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1 **Table 2-39.** Law Enforcement Personnel 2005 by County in the Economic Impact Area of the  
 2 VCSNS Site

<b>Political Jurisdiction</b>	<b>Total Law Enforcement Employees</b>	<b>Total Police Officers<sup>(a)</sup></b>	<b>Total Civilians<sup>(b)</sup></b>
<b>Fairfield County</b>			
Fairfield County	47	45	2
Winnsboro	27	26	1
Ridgeway	2	2	0
Total	76	73	3
<b>Lexington County</b>			
Lexington County	376	214	162
Cayce	74	61	13
West Columbia	56	45	11
Lexington	38	33	5
Batesburg-Leesville	25	20	5
Irmo	21	19	2
Springdale	9	8	1
Swansea	7	7	0
Chapin	6	6	0
Pelion	3	3	0
Total	615	416	199
<b>Newberry County</b>			
Newberry County	94	46	48
Newberry	29	25	4
Prosperity	4	4	0
Total	127	75	52
<b>Richland County</b>			
Richland County	490	453	37
Columbia	339	301	38
Eastover	4	4	0
Total	833	758	75
<b>Total All Counties</b>	<b>1651</b>	<b>1322</b>	<b>329</b>

Sources: FBI 2006a, b

(a) Individuals who ordinarily carry a badge and a firearm and have full arrest powers.

(b) Personnel such as clerks, radio dispatchers, stenographers, jailers, and mechanics.

**Table 2-40. Fire Protection Personnel by County in the Economic Impact Area of the VCSNS Site<sup>(a)</sup>**

Fire Dept Name	Number of Stations	Active Firefighters (Career)		Active Firefighters (Volunteer)		Active Firefighters (Paid per Call)		Non Firefighting (Civilian)	Non Firefighting (Volunteer)	Total Personnel
		Firefighters	Firefighters	Firefighters	Firefighters	Firefighters	Firefighters			
<b>Fairfield County</b>										
Winnsboro Public Safety	1	22	0	9	0	2	0	0	0	33
Fairfield Community Volunteer Fire Department	2	0	25	0	0	0	0	0	0	25
Dutchman Creek Volunteer Fire Department	1	0	16	0	0	0	0	0	2	18
Jenkinsville Volunteer Fire Department	1	0	9	0	0	0	0	0	6	15
Greenbrier-Bethel Volunteer Fire Department	2	0	9	0	0	0	0	0	2	11
<b>Lexington County</b>										
Lexington County Fire Service	24	134	380	0	0	0	0	0	0	514
Voridian Fire & Rescue	1	14	0	70	0	5	0	0	0	89
Cayce Fire Department	1	48	2	0	0	12	2	0	0	64
Batesburg-Leesville Fire Department Station 25	2	3	38	0	0	0	0	0	0	41
Irmo Fire District	2	31	0	6	0	0	0	0	0	37
Pine Grove Fire Station	1	6	0	25	0	0	1	0	0	32
Oak Grove Fire Station	1	9	8	8	0	0	0	0	0	25
West Columbia Fire Department	1	24	0	0	0	0	0	0	0	24
South Congaree Fire Station	1	8	8	3	0	0	0	0	0	19
Gaston Fire Station	1	4	12	0	0	0	0	0	2	18
Sandy Run - Calhoun Volunteer Fire Department	1	0	16	0	0	0	0	0	0	16
Columbia Metropolitan Airport Fire/Rescue	1	15	0	0	0	0	0	0	0	15
<b>Newberry County</b>										
Consolidated Volunteer Fire Department	2	0	42	0	0	0	0	0	10	52
Fairview Volunteer Fire Department	2	0	27	0	0	1	15	0	0	43
City of Newberry Fire Department	1	19	18	0	0	1	1	0	1	39

Table 2-40. (contd)

Fire Dept Name	Number of Stations	Active Firefighters (Career)	Active Firefighters (Volunteer)	Active Firefighters (Paid per Call)	Non Firefighting (Civilian)	Non Firefighting (Volunteer)	Total Firefighters
Newberry City Fire Department	2	19	18	0	1	1	39
Prosperity Fire Department	2	0	35	0	0	0	35
Silverstreet Volunteer Fire Department	1	0	28	0	0	0	28
Whitire Fire Department	1	0	25	0	0	0	25
Chappells Volunteer Fire Department Station #10	1	0	18	0	0	6	24
Pomaria Fire Department	1	0	19	0	0	0	19
<b>Richland County</b>							
Columbia Fire Department	31	385	107	0	23	5	520
McEntire Air National Guard Fire Department	1	52	0	0	0	0	52
<b>Total All Counties</b>	<b>89</b>	<b>793</b>	<b>860</b>	<b>121</b>	<b>45</b>	<b>53</b>	<b>1872</b>

Source: USFA 2008

(a) Data are from the U.S. Fire Administration (USFA) National Fire Department Census. Responses are voluntary and the USFA estimates that, as of 2008, approximately 85 percent of the nation's fire departments have responded.



1 **Table 2-41.** 2007 Arrests per 1000 for Fairfield, Lexington, Newberry, and Richland Counties

<b>Offense Category</b>	<b>Fairfield</b>	<b>Lexington</b>	<b>Newberry</b>	<b>Richland</b>	<b>South Carolina</b>
Alcohol-related	9.09	6.27	15.20	6.43	8.08
Drug-related	9.04	6.82	12.49	8.66	8.56
Family offenses	0.09	0.09	0.13	0.04	0.37
Fraud and related	1.11	1.99	7.55	7.10	4.92
Juvenile-related	0.13	0.56	0.11	0.53	0.54
Nuisance-related	8.40	3.50	11.48	3.88	5.62
Personal (abductions, intimidation, extortion)	0.39	0.17	0.48	0.20	0.53
Property destruction	3.90	1.11	4.46	1.86	2.43
Thefts	4.80	2.96	6.62	4.58	5.87
Vice (sex, gambling, weapons offenses)	0.56	0.33	0.85	1.38	0.94
Violent (murder, rape, assault)	8.40	4.51	8.56	5.31	7.40
All Other (traffic, etc.)	5.23	3.19	67.44	2.46	6.68
Total arrests per 1000	45.90	28.30	67.92	39.97	45.27
2006 Population	23,333	243,270	37,633	357,734	4,407,709

Source: SCLED 2009

2 Table 2-42 presents hospital use and medical practitioner data by county. Hospitals in Richland  
 3 County include five general hospitals (with one under construction) and one military hospital.  
 4 More than 8000 people are employed in the medical industry in Richland County. Fairfield,  
 5 Lexington, and Newberry Counties each have one general hospital and Lexington County is  
 6 adding a second smaller hospital (SCE&G 2009a).

7 **Table 2-42.** Hospital Data for Fairfield, Lexington, Newberry, and Richland Counties

<b>County</b>	<b>2000 Population</b>	<b>Hospital Beds</b>	<b>Hospital Beds per 1000 population</b>	<b>Physicians</b>	<b>Physicians per 1000 population</b>
Fairfield	23,454	50	2.1	19	0.81
Lexington	216,014	376	1.7	337	1.6
Newberry	36,108	103	2.9	52	1.4
Richland	320,677	1533	4.8	1330	4.2
Total	596,253	2062	3.5	1738	2.9

Source: SCE&G 2009a

8 All four counties have health departments that are available to residents regardless of their  
 9 ability to pay. Services offered include child and adolescent health programs, women's health  
 10 programs, immunizations, laboratory services, teen pregnancy prevention programs, scoliosis  
 11 screening, parasite screening, diabetes screening, health education and counselling,

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1 homemaker services for the elderly, prenatal services, and sexually transmitted disease  
2 prevention and education (SCE&G 2009a).

3 Social services in the four-county economic impact area are provided by State and local  
4 governmental and nongovernmental organizations. The United Way helps support many  
5 organizations in the four counties. The primary State-level organization that provides social  
6 services is the South Carolina Department of Social Services, which oversees numerous  
7 programs and services, similar to other such departments in other states (SCE&G 2009a).

### 8 **2.5.2.7 Education**

9 Fairfield, Lexington, Newberry, and Richland school districts are generally identified by county.  
10 However, there are five districts in Lexington County and two districts in Richland County.  
11 Table 2-43 lists the total 2008 student enrollment, teachers, student-to-teacher ratio, and  
12 number of schools in each county. Of note, the Fairfield School District shows considerably  
13 higher eligibility for free and reduced school lunch programs than the other districts in the four-  
14 county economic impact area. Within the Fairfield district, the closest school to the VCSNS site  
15 is McCrorey Liston Elementary. Table 2-44 presents the school-by-school free and reduced  
16 meal program eligibility in Fairfield County.

17 All of the school districts that are likely to feel some impact from an influx of students associated  
18 with the development of the VCSNS site have been growing in recent years and making  
19 accommodations to manage that growth. Each district has a facilities plan that provides a  
20 roadmap for addressing enrollment increases. Currently, all of the districts have been  
21 addressing increased enrollments either through new revenue generation or the increased tax  
22 base that is attributable to population growth and property development (SCE&G 2009a).

23 **Table 2-43.** School Characteristics in the VCSNS Economic Impact Area

<b>Public School District</b>	<b>2008 Enrollment</b>	<b>Free and Reduced Lunch Participation Percent</b>	<b>Number of Schools</b>	<b>Student/Teacher Ratio</b>
Fairfield	3719	83.8	8	11.3
Lexington 01	20,421	30.6	23	13.7
Lexington 02	9378	55.6	16	13.4
Lexington 03	2092	61.8	4	13.6
Lexington 04	3567	68.2	5	14.7
Lexington 05	16,929	25.1	19	13.5
Newberry	6146	63.6	11	13.1
Richland 01	24,600	62.2	49	12.4
Richland 02	24,008	39.2	27	13.7
Totals	110,860	46.2	162	13.3

Source: SCDOE 2009

1 **Table 2-44.** Fairfield County Public School Free and Reduced Meal Eligibility

<b>Public School</b>	<b>2008 Enrollment</b>	<b>Percent of Students Eligible for Free and Reduced Lunch</b>
Fairfield Central High School	980	73.47
Fairfield Intermediate	572	82.17
Fairfield Middle School	510	86.47
Fairfield Primary	539	92.95
Geiger Elementary	391	86.96
Gordon Odyssey Academy	156	89.74
Kelly Miller Elementary	305	92.79
McCrorey Liston Elementary	266	83.46
District Total	3719	83.81

Source: After SCDOE 2009

2 Table 2-45 lists the colleges and universities found in the region. The local community colleges  
 3 are partnering with the VCSNS site-development team to develop training curricula that would  
 4 produce qualified local technicians and construction workers for the jobs at the VCSNS site.

5 **Table 2-45.** Colleges and Universities in the VCSNS Region

<b>Institution</b>	<b>City</b>	<b>County</b>	<b>Highest Degree Offered</b>
<b>Public Senior Institutions</b>			
University of South Carolina	Columbia	Richland County	Doctoral Degrees
Lander University	Greenwood	Greenwood County	Master's Degrees
Winthrop University	Rock Hill	York County	Master's Degrees
<b>Other Public Institutions</b>			
University of South Carolina – Lancaster	Lancaster	Lancaster County	Associates Degrees
University of South Carolina – Union	Union	Union County	Associates Degrees
<b>Public Technical Colleges</b>			
Midlands Technical College	Columbia	Richland County	Associates Degrees
York Technical College	Rock Hill	York County	Associates Degrees
<b>Private Senior Institutions</b>			
Allen University	Columbia	Richland County	Baccalaureate Degrees
Benedict College	Columbia	Richland County	Baccalaureate Degrees
Columbia International University	Columbia	Richland County	Doctoral Degrees
Columbia College	Columbia	Richland County	Master's Degrees
Lutheran Theological Seminary	Columbia	Richland County	Doctoral Degrees
Newberry College	Newberry	Newberry County	Baccalaureate Degrees
Presbyterian College	Clinton	Laurens County	Baccalaureate Degrees

Source: SCE&G 2009a

## 1 **2.6 Environmental Justice**

2 Environmental justice refers to a Federal policy established by Executive Order 12898 (59 FR  
3 7629) under which each Federal agency identifies and addresses, as appropriate,  
4 disproportionately high and adverse human health or environmental effects of its programs,  
5 policies, and activities on minority or low-income populations.<sup>(a)</sup> The Council on Environmental  
6 Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997).  
7 Although it is not subject to the Executive Order, the Commission<sup>(b)</sup> has voluntarily committed to  
8 undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy  
9 statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

10 This section describes the existing demographic and geographic characteristics of the proposed  
11 site and its surrounding communities. It offers a general description of minority and low-income  
12 populations within the region surrounding the site. The characterization in this section forms the  
13 analytical baseline from which potential environmental justice effects would be determined. The  
14 characterization of populations of interest includes an assessment of “populations of particular  
15 interest or unusual circumstances,” such as minority communities exceptionally dependent on  
16 subsistence resources or identifiable in compact locations such as American Indian settlements.

17 The racial population is expressed in terms of the number and/or percentage of people that are  
18 minorities in an area, and, in this discussion, the sum of the racial minority populations is  
19 referred to as the aggregate racial minority population. Persons of Hispanic/Latino origin are  
20 considered an ethnic minority and may be of any race. The review team did not include  
21 Hispanics in its aggregate race estimate because the Federal government considers race and  
22 Hispanic origin to be two separate and distinct concepts (USCB 2001). Table 2-46 shows the  
23 overall representation of the populations of interest in the VCSNS 50-mi region and the State of  
24 South Carolina as a whole.

- 
- (a) Minority categories are defined as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; or Hispanic ethnicity; “other” may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty measure. To see the U.S. Census definition and values for 2000, visit the U.S. Census website at <http://ask.census.gov/>.
- (b) The Commission is the body of up to five NRC commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.

1 **Table 2-46.** Regional Minority and Low-Income Populations by Census Block Analysis Results

Category	Number of Blocks (out of 864 Total)	Percent of Total
African American	225	26.0
Aggregate Minority	240	27.8
Hispanic	0	0.0
American Indian or Alaskan Native	1	0.1
Asian	1	0.1
Native Hawaiian or Other Pacific Islander	0	0.0
Persons Reporting Some Other Race	0	0.0
Aggregate Minority plus Hispanic	0	0.0
Low-Income Population	54	6.3

Source: Review team U.S. Census data analysis.

2 **2.6.1 Methodology**

3 The review team first examines the geographic distribution of minority and low-income  
4 populations within 50 mi of the VCSNS site, using a GIS and the 2000 U.S. Census to identify  
5 minority and low-income populations. The review team then verifies its analysis by conducting  
6 field inquiries of numerous agencies and groups (see Appendix B for list of organizations  
7 contacted).

8 The first step in the review team's environmental justice methodology is to examine each  
9 census block group that is fully or partially included within the 50-mi region to determine for  
10 each minority or low-income population whether it should be considered a population of interest.  
11 If either of the two criteria discussed below identifies a census block group, that census block  
12 group was considered a population of interest. The two criteria are whether

- 13 • the population of interest exceeds 50 percent of the total population for the census block  
14 group, or
- 15 • the population of interest is 20 percentage points (or more) greater than the same  
16 population's percentage in the census block group's state or county.

17 The identification of census block groups that meet the above two-step criterion is not sufficient  
18 for the review team to conclude that a disproportionately high and adverse impact exists.  
19 Likewise, the lack of census block groups meeting the above criteria cannot be construed as  
20 evidence of no disproportionate and adverse impacts. To reach an environmental justice  
21 conclusion, starting with the identified populations of interest, the review team must investigate  
22 all populations in greater detail to determine if there are potentially significant environmental  
23 impacts that may have disproportionately high and adverse impacts on minority or low-income

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1 populations. To determine whether disproportionately high and adverse effects may be present,  
2 the review team considers the following:

### 3 • Health Considerations

- 4 1. Are the radiological or other health effects significant or above generally accepted  
5 norms?
- 6 2. Is the risk or rate of hazard significant and appreciably in excess of the general  
7 population?
- 8 3. Do the radiological or other health effects occur in groups affected by cumulative or  
9 multiple adverse exposures from environmental hazards?

### 10 • Environmental Considerations

- 11 4. Is there an impact on the natural or physical environment that significantly and adversely  
12 affects a particular group?
- 13 5. Are there any significant adverse impacts on a group that appreciably exceed or [are]  
14 likely to appreciably exceed those on the general population?
- 15 6. Do the environment effects occur in groups affected by cumulative or multiple adverse  
16 exposure from environmental hazard? (NRC 2007b).

17 If this investigation in greater detail does not yield any potentially high and adverse impacts on  
18 populations of interest, the review team may conclude that there are no disproportionately high  
19 and adverse impacts. If, however, the review team finds any potentially disproportionate and  
20 adverse impacts, the review team would fully characterize the nature and extent of that impact  
21 and consider possible mitigation measures that may be used to lessen that impact. The  
22 remainder of this section discusses the results of the search for potentially affected populations  
23 of interest.

24 The review team estimated that in the 2000 U.S. Census, 864 census block groups were wholly  
25 or partially within the 50-mi region. Using the individual comparison criteria (comparing the  
26 block group to the state and to the county in which it is located), GIS analysis found 225 block  
27 groups that have African American populations, 1 with American Indian or Alaskan Native  
28 populations, 1 with Asian populations, and none with Hispanic ethnicity that are 20 percent  
29 greater than the State or the County average. There are 240 block groups with aggregate  
30 minority populations that were 20 percent or greater than the State or the County average, with  
31 217 of the blocks groups having a minority population of 50 percent or greater. There were no  
32 blocks with Hispanic ethnicity, minority populations of Hawaiian or other Pacific Islander, or  
33 multi-racial groups exceeding either the 20-percent or 50-percent criterion. Fifty-four blocks  
34 were identified as having low-income households that are 20 percent or greater than the State  
35 or County average, 14 of which have 50 percent or more low-income households.

1 Figure 2-17 and Figure 2-18 illustrate the findings of the analysis of the 2000 U.S. Census data.  
2 None of the identified low-income census block groups with populations of interest are located  
3 within the 6-mi vicinity of the VCSNS site. However, the review team identified three African  
4 American census block groups within the site vicinity. Upon further investigation, local officials  
5 within and near Jenkinsville revealed that not only was the local population comprised almost  
6 exclusively of African Americans, but it also included a high proportion of low-income  
7 populations. The review team also noted that the Fairfield County School District exhibits a  
8 proportion of free and reduced lunch participation that is significantly greater than the other area  
9 districts (see Section 2.5.2.7). Based on the information in the VCSNS ER, public input, and the  
10 review team's outreach and analysis, the review team determined that because there are  
11 minority and low-income communities within the site vicinity, impacts on these communities  
12 must be considered in greater detail, as discussed in Section 2.6.2. The result of the review  
13 team's analyses can be found in Sections 4.5 and 5.5 of this EIS.

#### 14 **2.6.2 Scoping and Outreach**

15 The review team interviewed local, State, and county officials, business leaders, and key  
16 members of minority communities within the economic impact area to assess the potential for  
17 disproportionately high and adverse socioeconomic effects that may be experienced by minority  
18 and low-income communities during construction and operation of a project with the magnitude  
19 of the proposed new VCSNS units. The NRC staff issued an advanced notice of public  
20 meetings for EIS scoping purposes in accordance with the NRC's guidance (see Appendix D).  
21 The review team also contacted local Tribal governments to determine historic or cultural uses  
22 in the region (see Section 2.7.4). It was through this scoping and outreach process that the  
23 review team determined that the populations within the vicinity of the VCSNS site included a  
24 percentage of low-income families not captured by the two-step assessment of census block  
25 groups. The review team was also made aware of anecdotal information about local  
26 subsistence fishing by the members of the communities of Jenkinsville, Dawkins, and Blair.

#### 27 **2.6.3 Subsistence and Communities with Unique Characteristics**

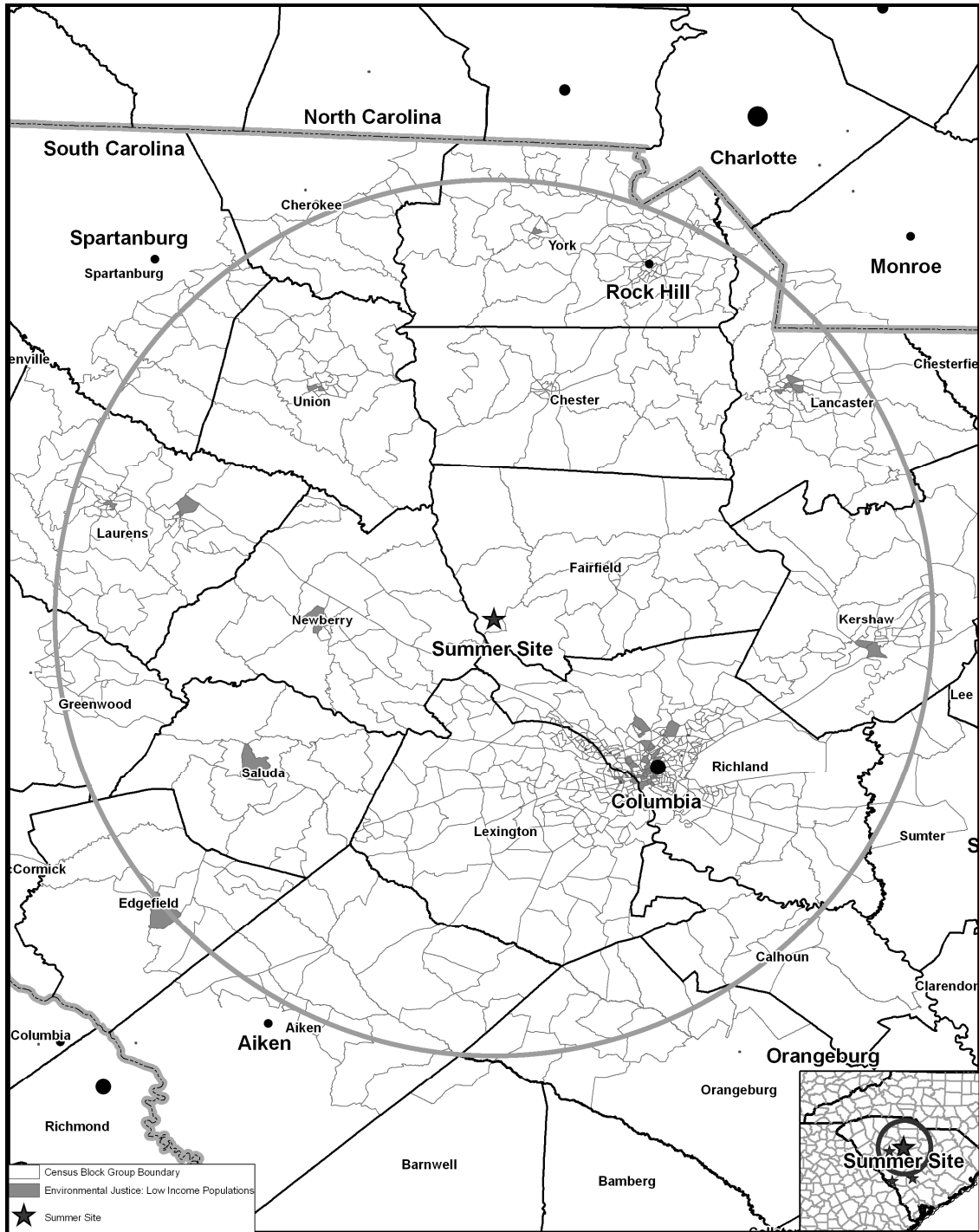
28 For each of the identified low-income and minority populations, it is necessary to determine if  
29 any of the populations appears to have a unique characteristic at the population level that would  
30 cause an impact to disproportionately affect them. Examples of unique characteristics might  
31 include lack of vehicles, sensitivity to noise, location within the site vicinity, subsistence  
32 activities, or lack of basic healthcare, but such unique characteristics need to be demonstrably  
33 present in the population and relevant to the potential environmental impacts of the plant. If the  
34 impacts from the proposed action would appear to affect an identified minority or low-income  
35 population more than the general population because of one of these or other unique  
36 characteristics, then a determination would be made about whether the impact is  
37 disproportionate when compared to the general population. Through its review of the  
38 applicant's ER, its own outreach and research, and through scoping meeting comments, the

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1  
2 **Figure 2-17.** Aggregate Minority Populations in Block Groups That Meet the Environmental  
3 Justice Selection Criteria (SCE&G 2009a)





1  
2 **Figure 2-18.** Aggregate Low-Income Populations in Block Groups That Meet the Environmental  
3 Justice Selection Criteria (SCE&G 2009a)

## Affected Environment

1 review team identified potentially unique community characteristics for further consideration:  
2 location along access roads that may become congested, subsistence fishing and hunting in the  
3 lands near the VCSNS site, and a common practice of home vegetable gardening to  
4 supplement diets. The review team assesses these unique characteristics and practices of this  
5 population in Sections 4.5 and 5.5 of this EIS.

### 6 **2.6.4 Migrant Populations**

7 The USCB defines a migrant worker as an individual employed in the agricultural industry in a  
8 seasonal or temporary nature and who is required to be absent overnight from his/her  
9 permanent place of residence. From an environmental justice perspective, there is a potential  
10 for such groups, such as outdoor workers, to be disproportionately affected by emissions in the  
11 environment. Although Richland County and immediately adjacent counties are urban  
12 population centers, there are a number of farms within the region. Based on agricultural census  
13 data, these farms do not hire an especially large number of migrant workers, and none is  
14 located within the 6-mi vicinity of the VCSNS site (see Section 2.5.1.3).

### 15 **2.6.5 Environmental Justice Summary**

16 The review team found low-income, African American, and aggregated minority populations that  
17 exceed the percentage criteria established for environmental justice analyses within the 50-mi  
18 region. Further, several of these minority census block groups are clustered in the vicinity of the  
19 VCSNS site and displayed a high concentration of low-income populations not evident at the  
20 census block group level. Therefore, the review team performed additional analyses before  
21 making a final environmental justice determination. The results of the analyses can be found in  
22 Sections 4.5 and 5.5.

## 23 **2.7 Historic and Cultural Resources**

24 In accordance with 36 CFR 800.8(c), the staff has elected to use the National Environmental  
25 Policy Act (NEPA) process to comply with the obligations found under Section 106 of the  
26 National Historic Preservation Act, as amended (NHPA). The NRC has determined that the  
27 physical and visual Area of Potential Effects (APE) for the COL review is the area at the VCSNS  
28 Units 2 and 3 site and the immediate environs that may be affected by land-disturbing activities  
29 associated with construction and operation of the new VCSNS Units 2 and 3. The USACE also  
30 considers the transmission line corridors to be within the APE for its permit review.

31 USACE regulations at 33 CFR Part 325, Appendix C, describe the USACE obligation to comply  
32 with the regulations of the NHPA (36 CFR Part 800). In addition to any specific conditions  
33 regarding known cultural resources coordinated with the Tribal Historic Preservation Officer  
34 (THPO) or South Carolina State Historic Preservation Office (SHPO), every USACE DA permit  
35 includes a general condition that advises and requires the permittee to immediately notify

1 USACE if any previously unknown resources are encountered during activities that would  
2 constitute preconstruction and construction.

3 This section discusses the historic and cultural background in the VCSNS site region. It also  
4 details the efforts that have been taken to identify cultural resources in the APE and the  
5 resources that were identified. A description of the consultation efforts accomplished to date is  
6 also provided. The assessments of effects from the proposed building and operation are found  
7 in Sections 4.6 and 5.6, respectively.

### 8 **2.7.1 Cultural Background**

9 This section provides an overview and summary of the cultural history of the VCSNS site and  
10 region based on documentation provided in the Supplemental EIS for renewal of the VCSNS  
11 Unit 1 Operating License (NRC 2004, Section 2.2.9), Revision 1 of the ER (SCE&G 2009a), and  
12 the first cultural resources survey report completed by SCE&G's cultural resources contractor,  
13 New South Associates (NSA 2007a) submitted by SCE&G (2009b). The area in and around the  
14 VCSNS site has a rich cultural history and a substantial record of significant cultural resources  
15 associated with the prehistoric and historic periods. This part of southern South Carolina has a  
16 cultural sequence that extends back to about 12,000 years Before Present (BP).

17 Prehistoric occupation of the area is generally grouped into four periods: Paleo-Indian (12,000  
18 to 10,000 BP), Archaic (10,000 to 3000 BP), Woodland (3000 BP to 800 BP) and Mississippian  
19 (A.D. 1100–1640) (NSA 2007a). Settlement during the early prehistoric period is characterized  
20 by mobile groups exploiting big game and the presence of the Clovis projectile point.  
21 Subsistence on multiple resources including smaller game and plants as well as more sedentary  
22 settlement patterns particularly along rivers, characterize the Archaic period. Reliance on  
23 shellfish and the development of pottery occurred during the late Archaic period. Ceramic  
24 typology, use, and function evolved and diversified during the Woodland period with an increase  
25 in sedentary settlement patterns and a reliance on agriculture in the Mississippian period. Two  
26 significant Mississippian period archaeological sites are located in the vicinity of the VCSNS  
27 site; the Blair Mound and the McCollum Mound (NSA 2007a).

28 The contact period is the transitional period between the prehistoric and historic periods when  
29 Euro-American settlers and explorers first visited the area in the mid-16th century (NSA 2007a;  
30 NRC 2004). Several groups of American Indians lived in South Carolina during this time, many  
31 of which became extinct or merged with other groups due to non-American Indian  
32 encroachment by Spanish, French, and British explorers and settlers by the mid-1700s. The  
33 largest groups were the Catawba and the Cherokee who likely used the Broad River region for  
34 resource gathering (SCE&G 2009a). Several Tribal groups and descendants of earlier groups  
35 are present today in South Carolina (descendants of the Cherokee, the Catawba, Pee Dee,  
36 Chicora, Edisto, Santee, and Chicora-Waccamaw Tribes) (NRC 2004). In 1838, the Cherokee  
37 were forced to leave the eastern United States and resettle in Oklahoma (NRC 2004). Today,  
38 the Catawba are the only Federally recognized Tribe in the State of Carolina, but there are

## Affected Environment

1 several other non-Federally recognized groups that have an interest in South Carolina and are  
2 officially recognized by the State of South Carolina (SCE&G 2009a).

3 The historic period overlaps with the contact period and begins with the arrival of Euro-American  
4 settlers. The European colonization of South Carolina began in the early 1600s. South  
5 Carolina was established in 1670 with the founding of Charleston (NSA 2007a) and was divided  
6 into South and North Carolina in 1710 (NRC 2004). Permanent European settlement did not  
7 occur in the Fairfield County area until the early 1740s with settlement occurring along the  
8 Broad River. During the American Revolution, many settlers in the area were divided between  
9 the British and Patriot sides, which resulted in several skirmishes. With the culmination of the  
10 war during the nearby Battle of Cowpens, the British eventually withdrew from Charleston in  
11 1782 (NSA 2007a; SCE&G 2009a).

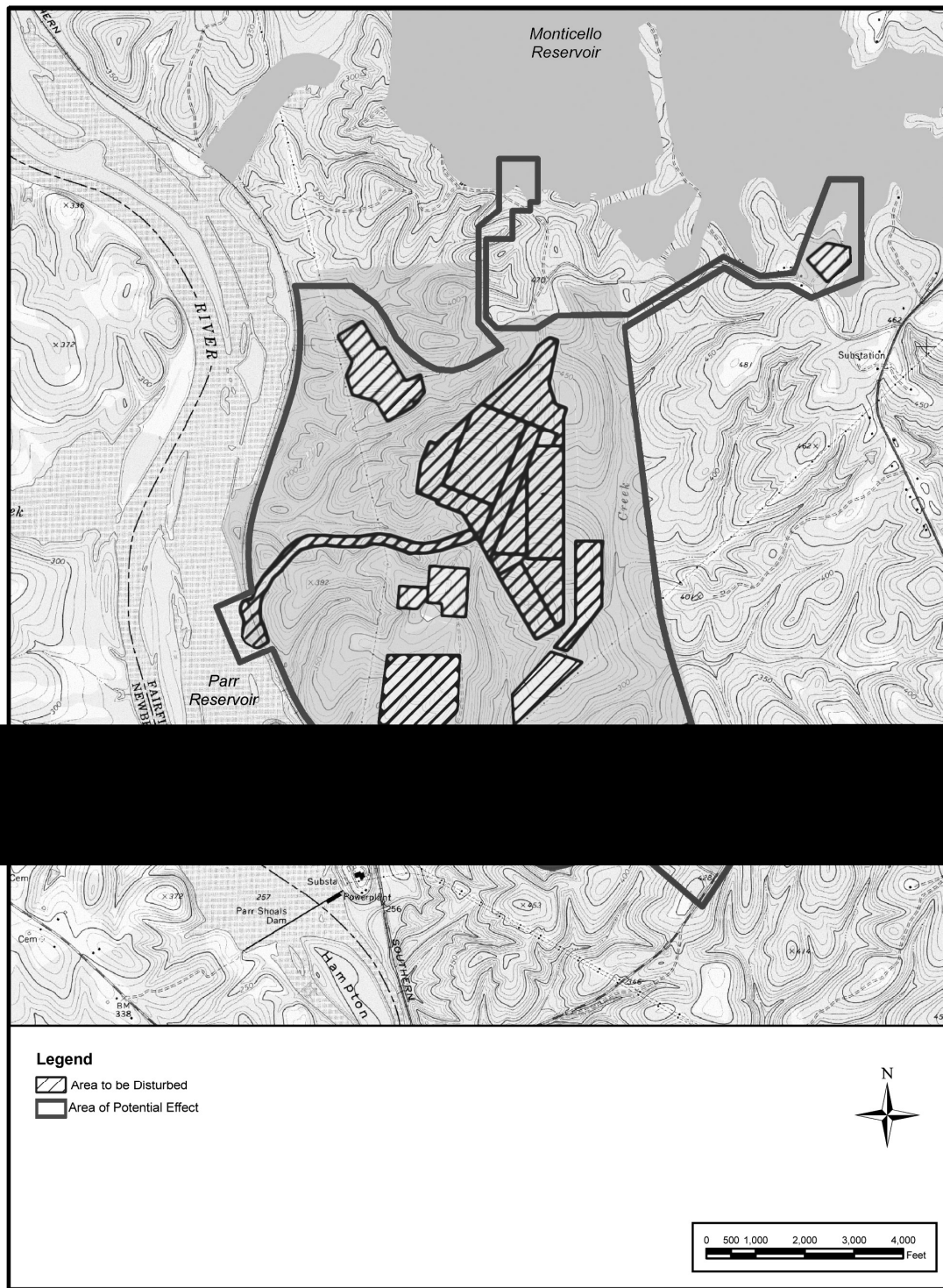
12 Cotton production and plantations were established in the area in the 1800s and increased  
13 during the 1850s. An increase in slave populations accompanied the increase in cotton  
14 plantations in the area (SCE&G 2009a; NSA 2007a). During the late 19th century, the Civil War  
15 and Reconstruction period resulted in major economic social adjustments in the area. Cotton  
16 production ceased in the 1930s as a result of hard economic times, the boll weevil, and  
17 depletion of the area's topsoil (NRC 2004; NSA 2007a; SCE&G 2009a). Camp Pearson, a  
18 Civilian Conservation Corps camp was established in 1933 as a soil erosion camp at Parr,  
19 which is located just south and west of the VCSNS site (NSA 2007a; SCE&G 2009a).

### 20 **2.7.2 Historic and Cultural Resources at the Site**

21 This section describes cultural resources that may be affected by building and operating the  
22 proposed VCSNS Units 2 and 3. The direct effects APE, which takes into account physical  
23 impacts on known resources resulting from constructing and operating VCSNS Units 2 and 3,  
24 has been defined by SCE&G (2009c) as "the area where ground disturbing activities could  
25 potentially occur and was selected to encompass SCE&G property lines, all of the water-intake  
26 locations, the northern boundary of the switchyard, rework along Parr Road, the northern edge  
27 of Fairfield Hydro Road and the Norfolk Southern Railroad" (SCE&G 2009f) (see Figure 2-19).  
28 The APE is based on property boundaries and not on areas to be affected by building activities  
29 (SCE&G 2009h). A visual effects APE was not defined because the proposed project activities  
30 would be located in rolling terrain that is forested and not visible from major roads or nearby  
31 public property (SCE&G 2009a, c, g).

32 Transmission lines leaving the site would be visible in places (SCE&G 2009g). The South  
33 Carolina SHPO has concurred with the APE definitions identified by each of the individual  
34 surveys completed for the COL activities that are summarized below.

35



1  
2

**Figure 2-19.** Area of Potential Effect for the VCSNS Site Units 2 and 3

## Affected Environment

1 Previous cultural resources investigations occurred in the vicinity of and within the VCSNS site  
2 APE indicating that the region was used during prehistoric times, particularly during the Middle  
3 Archaic period and Mississippian period (Teague 1979; SCDHPT 1984). Six prehistoric sites  
4 were recorded in these areas by the South Carolina Institute of Archeology and Anthropology  
5 (SCIAA) in 1972, and reported by Teague in 1979, as part of an archaeological survey  
6 conducted for the Parr Hydroelectric Project, which was constructed in part to supply cooling  
7 water for VCSNS Unit 1 (NRC 2004; SCE&G 2009a; NSA 2007a). Six archaeological sites  
8 consisting of lithic material, but lacking in any intact archaeological deposits as a result of  
9 erosion, transmission-line maintenance activities, and agricultural practices (38FA30, 38FA38,  
10 38FA39, 38FA40, 38FA44, 38FA47), were located on SCE&G property (Teague 1979; SCE&G  
11 2009a; NSA 2007a). None of the sites was formally evaluated for eligibility for listing in the  
12 National Register of Historic Places (NRHP or the National Register) (Teague 1979; SCE&G  
13 2009a). Teague's report indicates that the 38FA30 site was not located again and most of the  
14 archaeological artifacts (lithic tools and debris associated with the Middle Archaic period) at the  
15 remaining five sites were collected (Teague 1979). In Teague's report, sites 38FA38, 38FA39,  
16 and 38FA40 are depicted as being within SCE&G's APE, but outside of areas to be disturbed by  
17 VCSNS Units 2 and 3 building activities (NSA 2007a and South Carolina Department of  
18 Archives and History [SCDAH] records). Archaeological site 38FA164 is located outside of the  
19 APE and consists of a prehistoric lithic scatter and one historic artifact; the site was recorded on  
20 SCE&G property in 1984 and was recommended as not eligible for listing in the National  
21 Register (SCDHPT 1984; NSA 2007a; SCE&G 2009a; and SCDAH records).

22 Between 2006 and 2009, SCE&G contracted with R.S. Webb and Associates (Webb) and New  
23 South Associates (NSA) to conduct archaeological investigations for proposed VCSNS Units 2  
24 and 3; the investigations resulted in extensive archaeological survey of the project APE (Webb  
25 2006; NSA 2007a, b; NSA 2008; NSA 2009a, b). Areas not surveyed include areas previously  
26 disturbed during Unit 1 building activities such as the raw-water intake and pipeline route and  
27 the location of the New Nuclear Deployment Office (SCE&G 2009p).

28 In 2006, Webb completed an archaeological inventory of the land around the site of the  
29 proposed meteorological tower for SCE&G. Webb identified archaeological site 38FA322, a  
30 multi-component site containing prehistoric archaeological material and domestic debris  
31 associated with the early 19th to mid-20th century. Early 19th century historic maps indicate  
32 that General John Pearson's house may have been located in the vicinity of site 38FA322. The  
33 presence of early 19th century artifacts and foundation stones discovered by Webb's  
34 archaeological investigation at 38FA322 resulted in Webb's conclusion that these materials may  
35 be associated with the location of General Pearson's house (Webb 2006 submitted by SCE&G  
36 [2009p]). Webb recommended that the site was ineligible for listing in the National Register due  
37 to lack of integrity. On August 16, 2006, the South Carolina SHPO sent a letter concurring that  
38 archaeological site 38FA38 is not eligible for the National Register (SCDAH 2006b). It was later  
39 confirmed that this letter mistakenly referred to site 38FA38, which was corrected by a new

1 letter sent to the NRC issued on October 20, 2009 further clarifying that it is site 38FA322 that  
2 has been determined to be ineligible for the National Register not site 38FA38 (SCDAH 2009b).

3 On July 27, 2006, the South Carolina SHPO requested that additional testing be conducted at  
4 site 38FA322 to evaluate it for National Register eligibility (SCDAH 2006a). Webb (2006)  
5 completed 26 shovel tests recovering artifact assemblages associated with the Middle Archaic  
6 period and domestic-related artifacts associated with the 19th to mid-20th century (Webb 2006).  
7 Webb concluded that because historic maps indicate that General Pearson's house was located  
8 in the area, the foundation remnants at site 38FA322 "may have been General Pearson's  
9 house" (Webb 2006). However, Webb recommended that 38FA322 was ineligible for listing in  
10 the National Register due to lack of integrity of the multiple components of the site as a result of  
11 heavy disturbance by historic agriculture activities and modern silviculture activities (Webb  
12 2006). The report was revised accordingly. The South Carolina SHPO concurred with this  
13 recommendation and that the proposed meteorological tower would not result in direct or visual  
14 effects on historic properties (SCDAH 2006a).

15 In 2006, NSA delineated the boundary of and recorded site 38FA330, a cemetery associated  
16 with General John Pearson whose grave is marked by a monument installed by the Daughters  
17 of the American Revolution (DAR) (NSA 2006 submitted by SCE&G (2009p). Also in 2006,  
18 NSA completed an archeological survey of 428 ac of 515 ac of land planned for improvements  
19 associated with the proposed VCSNS Units 2 and 3 (NSA 2007a) locating seven new  
20 archaeological sites (38FA323–38FA330) and six isolated finds consisting of lithic and ceramic  
21 material and historic debris (Table 2-47). Eighty-seven acres of land were not surveyed  
22 because the area had been used by SCE&G in the past for fill for Unit 1 and was extensively  
23 disturbed (NSA 2007a). None of the newly recorded sites or isolates was recommended as  
24 eligible by NSA due to the lack of integrity of the sites resulting from soil disturbance from  
25 historic logging activities in the area (NSA 2007a). The 2007 report also evaluated the National  
26 Register eligibility of 38FA330 (the Pearson Cemetery) and the DAR monument recommending  
27 both as being eligible (NSA 2007a).

28 In 2007, NSA conducted additional field surveys of approximately 1311 ac of SCE&G land also  
29 planned for improvements associated with proposed VCSNS Units 2 and 3 (NSA 2007b),  
30 recording 19 new archaeological sites (38FA331–38FA349) and 24 isolated finds consisting of  
31 prehistoric lithic flakes, ceramics, and historic ceramics, and horseshoes (NSA 2007b)(see  
32 Table 2-47). None of the newly recorded sites or isolates was recommended as eligible by NSA  
33 due to the lack of integrity of the sites resulting from soil disturbance from historic logging  
34 activities in the area (NSA 2007a). However, site 38FA349 (a historic tree carving associated  
35 with the Civilian Conservation Corps camp at Parr), was recommended for preservation. None  
36 of the newly recorded sites or isolates was recommended as eligible by NSA (NSA 2007a). On  
37 April 9, 2007, SCE&G sent a letter to the South Carolina SHPO (SCE&G 2007d) indicating that  
38 three Phase 1 surveys had been completed for proposed VCSNS Units 2 and 3 (referring to  
39 Webb 2006 and the two surveys completed by NSA [2007a, b]). In the letter, SCE&G

**Table 2-47. VCSNS Archaeological Sites Identified – Phase I/II Investigations**

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA		SHPO Concurrence/ comment <sup>(a)</sup>
				Recommended NRHP Status	Location	
38FA30	Unknown.	Unknown	Phase 1	Not intact or relocated	Outside APE.	None
38FA38	Located at base of transmission- line tower. Lithic flakes and tools all of which were collected.	Middle	Phase 1	Not intact or relocated	Inside APE but outside areas to be disturbed. Exact location is unknown and was not relocated.	None
30FA39	Located along dirt access road. Lithic flakes and projectile point. Projectile point was collected.	Middle Archaic	Phase 1	Not intact or relocated	Inside APE but outside areas to be disturbed. Exact location is unknown and was not relocated.	None
30FA40	Located at base of transmission- line tower. Lithic flakes and projectile point. Projectile point was collected.	Middle Archaic	Phase 1	Not intact or relocated	Inside APE but outside areas to be disturbed.	None
38FA44	Located on a knoll. 12 lithic flakes, 9 were collected.	Unknown	Phase 1	Not intact	Outside APE.	None
38FA47	Located on a hilltop. 12 lithic flakes, 5 were collected.	Unknown	Phase 1	Not intact	Outside APE.	None
38FA164	Lithic scatter and one historic ceramic fragment	Unknown	Phase 1	Not eligible	Outside APE.	None
38FA322	Multicomponent site. Prehistoric lithic debris, and historic domestic debris. Former homestead of General Pearson	Middle Archaic, Mississippian, mid- 19th/Early 20th Century	Phase 1	Not eligible. No effect on historic properties	Within APE and inside areas to be disturbed.	Concur. No effect on historic properties. No further work needed



Table 2-47. (contd)

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA		SHPO Concurrence/ comment <sup>(a)</sup>
				Recommended NRHP Status	Location	
38FA323	Prehistoric Scatter/House Site	Unknown Prehistoric/ Early to Late 19th Century	Phase I	Not eligible. No effect on Historic Properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA324	Prehistoric Scatter/House Site	Unknown Prehistoric/ Early to Late 19th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA325	Isolated Prehistoric Find/Historic Scatter	Unknown Prehistoric/ Mid-19th to early 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA326	Unidentified Historic Structure	Unknown Historic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA327	Prehistoric Scatter/Historic Scatter	Late Archaic- Woodland/ Early 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA Recommended NRHP Status	Location	SHPO Concurrence/ comment <sup>(a)</sup>
38FA328	House Site	Late 19th to Early 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA329	Lithic Scatter	Late Archaic- Early Woodland	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA330	General Pearson Cemetery	Early to Late 19th Century	Phase I and delineation of cemetery boundary.	Eligible	Within APE but outside areas to be disturbed. Site would be avoided and protected.	Concur. No adverse effect on historic properties. Recommend protective covenant.
38FA331	Historic House Site/Prehistoric Lithic Scatter	19th–20th Century/ Late Archaic	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA332	Historic Artifact Scatter	19th–20th Century/	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA		SHPO Concurrence/ comment <sup>(a)</sup>
				Recommended NRHP Status	Location	
38FA333	Prehistoric Lithic Scatter	Unknown Prehistoric	Phase I	Not eligible. No effect on Historic Properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA334	Prehistoric Artifact Scatter/Historic Isolate	Late Archaic to Middle Woodland/ 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA335	Prehistoric Artifact Scatter	Unknown Prehistoric	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA336	Prehistoric Lithic Scatter/Historic House Site	Middle Archaic/ 19th–20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA337	Prehistoric Sherd Scatter	Unknown Prehistoric	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA338	Prehistoric Lithic Scatter/Historic Isolate	Middle Archaic/17th 18th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	Recommended NRHP Status	Location	SHPO Concurrence/comment <sup>(a)</sup>
38FA339	Prehistoric Lithic Scatter/Artifact Scatter	Middle Archaic/19th–20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA340	Prehistoric Artifact Scatter/Historic Isolate	Late Paleo-Indian–Late Archaic/19th–20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA341	Historic House Site	19th–20th Century	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA342	Prehistoric Lithic Scatter/Isolate	Late Pale-Indian-Early Archaic/20th Century	Phase I	Not eligible. No effect on Historic Properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA343	Prehistoric Lithic Scatter	Early–Middle Archaic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA344	Prehistoric Lithic Scatter	Early Woodland	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA		SHPO Concurrence/ comment <sup>(a)</sup>
				Recommended NRHP Status	Location	
38FA345	Prehistoric Lithic Scatter	Early-Middle Archaic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA346	Prehistoric Lithic Scatter	Unknown Prehistoric	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA347	Historic House Site	19th-20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No Further Work Needed
38FA348	Historic Stone Piles	Unknown Historic	Phase I	Not eligible. No effect on Historic Properties	Within APE but outside areas to be disturbed.	Concur. No effect on Historic Properties. No Further Work Needed
38FA349	Historic Tree Carving	20th Century	Phase I	Not eligible, but recomm preservation.	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed above and beyond the recommended preservation.

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	SCDHPT/Teague/ Webb/NSA		SHPO Concurrence/ comment <sup>(a)</sup>
				Recommended NRHP Status	Location	
38FA359	Historic Home Site	Early to Mid- 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA360	Prehistoric Ceramic Scatter	Middle Woodland	Phase I and Phase II	Eligible.	Within APE but outside areas to be disturbed. Site would be avoided and protected from road improvements	Concur. No adverse effect to historic properties if the site is avoided.
38FA361	Prehistoric Lithic Scatter	Early to Middle Archaic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA362	Prehistoric Lithic Scatter	Late Archaic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA363	Historic Home Site	Late 19th to Early 20th Century	Phase I	Not eligible. No effect on historic properties	Within APE and within areas to be disturbed.	Concur. No effect on historic properties. No further work needed

Table 2-47. (contd)

Site	Site Type	Age	Work Effort	Recommended NRHP Status	Location	SHPO Concurrence/comment <sup>(a)</sup>
38FA364	Historic Home Site	Early to Mid Twentieth Century	Phase 1	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA365	Prehistoric Lithic Scatter	Middle Archaic	Phase I	Not eligible. No effect on historic properties	Within APE but outside areas to be disturbed.	Concur. No effect on historic properties. No further work needed
38FA366	Prehistoric Lithic Scatter	Unknown	Phase I	Potentially eligible. Site would be avoided.	Within APE but outside areas to be avoided.	Concur. No effect on historic properties. No further work needed

(a) See Section 4.6 for a discussion on SHPO consultation  
 APE = Area of Potential Effect  
 NSA = New South Associates  
 NHRP = National Register of Historic Places  
 SCDHPT = South Carolina Department of Highways and Public Transportation

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1 expressed concurrence with NSA's and SCE&G's recommendation for National Register  
2 eligibility of site 38FA330 (the Pearson Cemetery) and the associated DAR monument, their  
3 decision to protect the Pearson cemetery, and a finding of no adverse effect. On April 27, 2007,  
4 the South Carolina SHPO responded with a request to review the cultural resources survey  
5 reports referenced in SCE&G's April 9, 2007 letter (SCDAH 2007a). Having received these  
6 reports, the South Carolina SHPO sent another letter to SCE&G concurring with these  
7 recommendations and findings (SCDAH 2007b). The South Carolina SHPO also recommended  
8 that a preservation covenant be recorded to protect site 38FA330 and the DAR monument  
9 (SCDAH 2007b). In addition, the SHPO recommended that a Programmatic Agreement be  
10 developed to last the lifetime of the COLs issued for VCSNS Units 2 and 3 (SCDAH 2007b).  
11 Further discussion is provided in Section 4.6 on the development of this agreement. Sites  
12 38FA38, 38FA39, and 38FA40 are located within NSA's 2007 survey area, but apparently were  
13 not located again. Having been collected in 1979 and with minimal integrity or presence of  
14 archaeological deposits, the tangible evidence of these sites is no longer present (Teague 1979;  
15 NSA 2007a).

16 In 2008, NSA conducted a third archaeological survey of 232 ac on the VCSNS site planned for  
17 improvements and 5800 ft of planned road improvements (NSA 2008) submitted by SCE&G  
18 (2009p). Eight new archaeological sites (38FA359–38FA366) and three isolated finds  
19 consisting of prehistoric lithic material were recorded. Two were recommended as potentially  
20 eligible: site 38FA360, a Middle Woodland period prehistoric ceramic scatter, and site  
21 38FA366, a prehistoric lithic scatter (see Table 2-47). Avoidance was recommended at both of  
22 these sites and if avoidance was not possible it was recommended that Phase II testing occur to  
23 officially evaluate their eligibility for listing in the National Register (NSA 2008). The remaining  
24 six archaeological sites and isolated finds were recommended as not being eligible because of  
25 their lack of integrity due to heavy disturbance of these sites (NSA 2008). SCE&G concurred  
26 with NSA's findings and forwarded these to the South Carolina SHPO (SCE&G 2008a). The  
27 South Carolina SHPO concurred with the recommendations made by NSA (SCDAH 2009a).

28 While conducting surveys at the VCSNS site, NSA was unable to re-locate sites 38FA38,  
29 38FA39, and 38FA40, despite Teague having reported them to be within the project APE but  
30 outside of the areas to be disturbed. Site files at SCIAA listed the location of the sites as  
31 questionable due to a gap in time between the date of survey (1972) and the date of reporting  
32 (1979) (NSA 2009d). NSA was unable to re-locate archaeological sites 38FA38, 38FA39, and  
33 38FA40 to correlate them with those reported by Teague (1979) due to "significant  
34 discrepancies in location, size, and cultural components." With concurrence from the SCIAA  
35 site files manager, it was decided to assign new site numbers to all archaeological sites located  
36 by NSA on the VCSNS site (NSA 2009d).

37 Because site 38FA360 was located in an area that may be affected by road widening, Phase II  
38 archaeological testing was completed by NSA in 2008 (NSA 2009a). Based on the results of



1 the Phase II testing, NSA concluded and recommended that 38FA360 be determined eligible for  
2 listing in the National Register for its potential to yield information regarding Middle to Late  
3 Woodland settlement systems (NSA 2009a). Specifically, the site contained archaeological  
4 material associated with four to five households including ceramics and lithic material. NSA  
5 recommended that the site be preserved in place and if it could not be protected that the site be  
6 mitigated (NSA 2009a). SCE&G concurred with NSA's findings and forwarded them to the  
7 South Carolina SHPO (SCE&G 2009u). The South Carolina SHPO concurred with the  
8 recommendations made by NSA and recommended that the site be avoided or that a  
9 Memorandum of Agreement be developed with a data-recovery plan if the site could not be  
10 avoided (SCDAH 2009a).

11 In 2009, NSA inventoried a 5-ac area proposed for road improvements along SC-213 for  
12 archaeological resources (NSA 2009b). One isolated historic ceramic was recorded. NSA  
13 concluded that the proposed improvements would not affect historic properties (NSA 2009b).  
14 SCE&G concurred with NSA's findings and forwarded them to the South Carolina SHPO  
15 (SCE&G 2009v). SHPO concurred with the identification of APE and historic properties  
16 identified within the APE and the finding that no historic properties would be affected (SCDAH  
17 2009c).

18 Also in 2009, a 7.7-ac area in the vicinity of the proposed water-treatment plant was inventoried  
19 for cultural resources via surface inspection and shovel testing (SCE&G 2009w; NSA 2009c).  
20 Old car parts were noted, but not formally recorded. No archaeological sites were recorded by  
21 this survey. The South Carolina SHPO concurred with NSA's assessment that no historic  
22 properties would be affected by this activity (SCDAH 2009d).

23 In summary, a total of 43 archaeological sites have been recorded by these investigations and  
24 are listed in Table 2-47. Of these, 39 archaeological sites are located within the VCSNS site  
25 APE, most of which have been recommended as ineligible for listing in the National Register.  
26 Four archaeological sites have either been recommended as National Register eligible –  
27 38FA330 (General Pearson Cemetery) and 38FA360; potentially eligible – 38FA366; or  
28 recommended for preservation – 38FA349. Of the remaining 35 archeological sites recorded  
29 and recommended as ineligible for listing in the National Register, 14 would actually be affected  
30 by building activities associated with VCSNS Units 2 and 3.

31 No aboveground structures have been identified within the project APE. Consultations  
32 conducted by SCE&G and NSA with the Fairfield County Museum, Fairfield County Archives,  
33 and the South Carolina SHPO indicate that no knowledge of significant standing structures  
34 within the project APE or within the vicinity of the project APE (SCE&G 2009h, j). The Mayo  
35 family cemetery is located 1.5 mi south of proposed VCSNS Units 2 and 3 and is marked on  
36 plant layout maps and protected by SCE&G (SCE&G 2009a). There are 20 National Register-  
37 listed standing structures within 10 mi of the APE, 13 of which are located within Fairfield  
38 County (SCE&G 2009a).

1    **2.7.3    Historic and Cultural Resources Within Transmission-Line Corridors**

2    Both SCE&G and Santee Cooper completed siting studies for the proposed transmission lines  
3    associated with VCSNS Units 2 and 3 (FP&S 2008; MACTEC 2008). The proposed  
4    transmission lines are described in Section 2.2.2. Although final routes have not been  
5    determined, transmission-line corridors have been identified by both SCE&G and Santee  
6    Cooper in their siting studies (FP&S 2008; MACTEC 2008). It is expected that some of the  
7    transmission-line routes would be co-located next to existing corridors while others would  
8    require new corridors (SEC&G 2009a). Both SCE&G and Santee Cooper completed desktop  
9    assessments using available GIS cultural resources data and literature reviews for areas within  
10   1.2 mi of the proposed transmission-line corridors, using known cultural resources data from the  
11   SCIAA and the SCDAAH (FP&S 2008; MACTEC 2008).

12   Before completing siting studies, SCE&G contracted with NSA to complete a literature search  
13   for all National Register-listed properties within the counties through which SCE&G expected  
14   the transmission-line corridors to pass (NSA 2007c) submitted by SCE&G (2009p). NSA  
15   identified 353 National Register-listed sites (NSA 2007c). As part of the siting-study process,  
16   SCE&G contracted with Brockington and Associates, which summarized known archaeological  
17   sites and aboveground resources recorded after 1989 and their National Register eligibility, all  
18   National Register-listed cultural resources (archaeological, structures, and districts), and all  
19   cultural resource investigations completed since 1989 located within 1.2 mi of Santee Cooper's  
20   proposed corridors (VC Summer-Killian, VC Summer-St. George, and VC Summer-Lake  
21   Murray) in three separate letter reports (FP&S 2008). Santee Cooper contracted with TRC  
22   Companies Inc. (TRC), which summarized similar data for its proposed corridors (VC Summer  
23   Varnville and VC Summer Flat Creek) (TRC 2008). Both studies indicate that there are National  
24   Register-eligible and -listed aboveground resources and archaeological resources within 1.2 mi  
25   of all five proposed transmission-line corridors. SCE&G and Santee Cooper indicated that they  
26   would work with the South Carolina SHPO to complete cultural resources surveys these corridor  
27   locations (SCE&G 2009h, j).

28   **2.7.4    Consultation**

29   In January 2009, the NRC initiated consultation with the South Carolina SHPO, the Advisory  
30   Council on Historic Preservation (ACHP), and four American Indian Tribes (see Appendix F for  
31   a complete list of contacts). The letters informed consulting parties that the NRC is coordinating  
32   compliance with Section 106 of the NHPA through NEPA. The ACHP responded, indicating that  
33   NRC must also consult with the South Carolina SHPO and notify the ACHP in consultation with  
34   SHPO if NRC concludes that there is a finding of adverse effect on historic properties resulting  
35   from the issuance of the COLs for proposed VCSNS Units 2 and 3 (ACHP 2009). To date, no  
36   response has been received from American Indian Tribes. Consultation with the SHPO is  
37   ongoing.

1 The NRC conducted a public scoping meeting in Winnsboro, South Carolina, on January 27,  
2 2009, and one in Blair, South Carolina, on January 28, 2009. No comments or concerns  
3 regarding historic and cultural resources were made at these public scoping meetings. During  
4 the scoping period, the NRC received one written comment from an individual indicating that a  
5 relative is buried at the VCSNS site. The staff responded that locations of known cemeteries  
6 have been identified on the SCE&G property, are marked on SCE&G plant layout maps. No  
7 building or operational activities are planned to occur near these cemeteries.

## 8 **2.8 Geology**

9 A detailed description of geological, seismological, and geotechnical conditions at the VCSNS  
10 site is provided in Section 2.5 of the VCSNS FSAR (SCE&G 2009i) submitted as part of the  
11 COL application. A description of the hydrogeological setting of the proposed site is addressed  
12 in the ER as well (SCE&G 2009a). In addition to the site characterization conducted originally  
13 for VCSNS Unit 1, results of the SCE&G subsurface investigations performed as part of the  
14 applicant's safety analysis for this COL application (Section 2.5 of the FSAR) provide further  
15 definition of the site geology. These descriptions are based on published geologic reports of the  
16 region along with site-specific characterization activities conducted during construction of Unit 1  
17 and characterization activities conducted during preapplication activities for proposed VCSNS  
18 Units 2 and 3 (SCE&G 2009a, i). The NRC staff's independent assessment of the site safety  
19 issues related to the proposed VCSNS site will consider the applicant's detailed analysis and  
20 evaluations of geological, seismic, and geotechnical data. The NRC staff's detailed description  
21 of the geological features in the VCSNS site vicinity will be addressed in the NRC staff's SER (in  
22 progress).

23 The VCSNS site is located on the eastern edge of the Piedmont physiographic province (see  
24 Figure 2-9), approximately 20 mi northwest of the fall line that delineates the boundary with the  
25 Coastal Plain physiographic province (SCE&G 2009i). Regionally, the Piedmont physiographic  
26 province is generally characterized by rolling hills with greater relief than the adjacent Coastal  
27 Plain physiographic province to the southeast and less relief than the Blue Ridge physiographic  
28 province to the northwest (Figure 2-9). According to the FSAR (SCE&G 2009i), "[t]he site  
29 topography is characteristic of the region, consisting of gently to moderately rolling hills and  
30 generally well-drained mature valleys" with topography ranging from 220 to 520 ft above msl  
31 within a 5-mi radius. In addition, the FSAR states that "[t]he local drainage pattern is generally  
32 dendritic, with subtle trellis patterns that are likely the result of regional bedrock structure and  
33 joint systems" (SCE&G 2009i).

34 "Most of the local terrain is mantled by residual soils and saprolite that overlie igneous and  
35 metamorphic bedrock at depth" (SCE&G 2009i). As described by SCE&G, "[t]he residual soil  
36 and saprolite predominantly consist of red to reddish-brown stiff clayey and silty soils with  
37 varying sand content" with a combined thickness ranging "from about 25 to 70 feet at Units 2

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1 and 3 (SCE&G 2009i). Depths to sound bedrock range “from about 40 to 75 feet in the vicinity  
2 of Units 2 and 3” (SCE&G 2009i).

3 Based on the borehole characterization at the VCSNS Units 2 and 3 site, in addition to earlier  
4 subsurface characterization around VCSNS Unit 1 that included extensive excavations, SCE&G  
5 describes the most common rock types at the site as being granitic (granodiorite and quartz  
6 diorite) as part of the Winnsboro plutonic complex (SCE&G 2009i). Less common rock types  
7 found in the area are older amphibolite-grade metamorphic rocks (biotite, hornblende gneiss,  
8 and amphibolite schist), into which the Winnsboro pluton intruded, and migmatites, which form  
9 from the partial melting of rocks from high-temperature metamorphism (SCE&G 2009i, b).

10 FSAR Section 2.5.1.2.5 (SCE&G 2009i) describes economic geologic resources in the area.  
11 SCE&G stated that “[w]ithin 25 miles of the site, there are numerous active and abandoned  
12 mines and quarries.” SCE&G also stated that “[n]o mining operations (other than borrow of  
13 surficial soils) or excessive extraction and/or injection of groundwater occur or have occurred  
14 within the site area that could affect site area geologic conditions” (SCE&G 2009i).

## 15 **2.9 Meteorology and Air Quality**

16 The following three sections describe the climate and air quality of the VCSNS site.  
17 Section 2.9.1 describes the local and large-scale climate of the region and area in the  
18 immediate vicinity of the site, Section 2.9.2 describes the air quality of the region, and Section  
19 2.9.3 describes atmospheric dispersion at the site. Section 2.9.4 describes the meteorological  
20 monitoring program at the site.

### 21 **2.9.1 Climate**

22 The VCSNS site has a humid subtropical climate (Koeppel and De Long 1958) with mild winters  
23 and hot humid summers. Air masses may approach the region from any direction. During the  
24 summer, high pressure off the coast of the eastern continental United States leads to  
25 southwesterly winds over South Carolina leading to large amounts of low-altitude moisture (LCD  
26 2007). This semi-permanent feature also blocks many summer-time cold fronts. During the  
27 winter, the Appalachian Mountains frequently block the cold air associated with winter-time  
28 storm systems. The closest first-order weather station with long periods of record is in  
29 Columbia, South Carolina, about 26 mi southeast of the site. This station provides a good  
30 indication of the general climate at the site because of its proximity and similarities in  
31 topography and vegetation. The closest National Weather Service Cooperative Network Station  
32 is a short distance away on the Parr Reservoir. Other National Weather Service Cooperative  
33 Network Stations include Little Mountain, South Carolina, approximately 9 mi southwest of the  
34 site, and Winnsboro, South Carolina, approximately 15 mi northeast of the site. The VCSNS

1 site is located near the Monticello and Parr reservoirs in an area of rolling hills (SCE&G 2009a).  
2 The proposed site is on a ridge between these two reservoirs.

3 The following statistics were derived from local climatological data for Parr, Little Mountain,  
4 Winnsboro, and Columbia. The mean daily maximum temperatures at Columbia range from  
5 92°F in August to 55°F in January, while daily minimum temperatures range from 71°F in  
6 August to 34°F in February (LCD 2007). While not identical to the conditions at Columbia, the  
7 average temperatures at Parr, Winnsboro, and Little Mountain range from 0.5°F larger to -3°F  
8 smaller than the observations at Columbia (NCDC 2004). Monthly average wind speeds at  
9 Columbia range from about 6 mph in the summer to about 7 mph in the winter and early spring.  
10 Approximately 33 percent of the annual precipitation occurs during the months of June, July,  
11 and August. Large amounts of precipitation can occur in the late summer and early fall, due to  
12 tropical storms that move through the region. Snow can occur, but accumulations are small,  
13 and the normal amount of snowfall is only 2 in.

14 The relative humidity in Columbia varies with both the time of day and the season. The smallest  
15 values of relative humidity occur during the late winter and through the spring. The highest  
16 normal relative humidity is 76 percent and occurs in August. The lowest normal relative  
17 humidity is 62 percent and occurs in April. The daily range of relative humidity is much larger  
18 than the month-to-month changes. On a daily basis, the highest relative humidity occurs in the  
19 early morning hours, ranging from peak values of 92 percent during the summer and fall to  
20 83 percent in the winter; the lowest relative humidity occurs in the early afternoon and is  
21 generally between 60 percent and 30 percent (Columbia, South Carolina, Local Climatological  
22 Data).

23 On a larger scale, climate change is a subject of national and international interest. The recent  
24 compilation of the state of knowledge in this area by the U.S. Global Change Research Program  
25 [GCRP], a Federal Advisory Committee (Karl et al. 2009), has been considered in preparation of  
26 this EIS. Projected changes in the climate for the region over the period encompassing the  
27 licensing action (i.e., to the period of 2040 to 2059 in the GCRP report) include an increase in  
28 average temperature of 2 to 3°F; a decrease in precipitation in the winter, spring, and summer;  
29 and a small precipitation increase in the fall. Changes in climate during the life of proposed  
30 Units 2 and 3 could result in either an increase or decrease in the amount of runoff; the  
31 divergence in model projections for the southeastern United States precludes a definitive  
32 estimate (Karl et al. 2009).

33 Based on the assessments of the GCRP and the National Academy of Sciences' National  
34 Research Council, the EPA determined that potential changes in climate caused by greenhouse  
35 gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated  
36 that, while ambient concentrations of GHGs do not cause direct adverse health effects (such as  
37 respiratory or toxic effects), public health risks and impacts can result indirectly from changes in  
38 climate. As a result of the determination by the EPA and the recognition that mitigative actions

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1 are necessary to reduce impacts, the review team concludes that the effect of GHG on climate  
2 and the environment is already noticeable, but not yet destabilizing. In CLI-09-21, the  
3 Commission provided guidance to the NRC staff to consider carbon dioxide and other GHG  
4 emissions in its NEPA reviews and directed that it should encompass emissions from  
5 constructing and operating a facility as well as from the fuel cycle (NRC 2009b). The review  
6 team characterized the affected environment and the potential GHG impacts of the proposed  
7 action and alternatives in this EIS. Consideration of GHG emissions was treated as an element  
8 of the existing air quality assessment that is essential in a NEPA analysis. In addition, where it  
9 was important to do so, the review team considered the effects of the changing environment  
10 during the period of the proposed action on other resource assessments.

### 11 **2.9.1.1 Wind**

12 The prevailing wind direction at Columbia is from the west-southwest. At the VCSNS Units 2  
13 and 3 meteorological tower, the prevailing wind direction at 10 m above the ground is also from  
14 the west-southwest, but northwesterly winds occur approximately 20 percent of the time  
15 (SCE&G 2009a). Observations made at the VCSNS Unit 1 meteorological tower are somewhat  
16 different. During the same 1-year period, northwesterly winds are less common and  
17 northeasterly winds are more common than at the VCSNS Units 2 and 3 meteorological tower  
18 (SCE&G 2009a). This can be explained by the proximity of the Unit 1 tower to the Monticello  
19 Reservoir, which can lead to lake breezes associated with differences in the relative heating  
20 rate of the land and water (e.g., Ahrens 1988), and also changes in low-altitude wind speed  
21 because of the smoother surface of the water compared to the land. There is also a small ridge  
22 to the northwest of the tower that leads to some channeling of the low-altitude winds. The  
23 VCSNS Units 2 and 3 meteorological tower is located away from the Monticello Reservoir on a  
24 plateau that slopes gently to the west and south.

### 25 **2.9.1.2 Atmospheric Stability**

26 Atmospheric stability is a calculated meteorological parameter that describes the dispersion  
27 characteristics of the atmosphere. It can be determined by the difference in temperature  
28 between two heights. A seven-category atmospheric stability classification scheme based on  
29 temperature differences is set forth in Regulatory Guide 1.23, Revision 1 (NRC 2007a). When  
30 the temperature decreases rapidly with height, the atmosphere is unstable and atmospheric  
31 dispersion is greater. Conversely, when temperature increases with height, the atmosphere is  
32 stable and dispersion is more limited. The stability varies with season as well as time of day,  
33 with stable conditions occurring more frequently at night and unstable conditions occurring more  
34 frequently during the day.

35 Conditions at the VCSNS site are generally neutral or slightly stable (occurring nearly  
36 63 percent of the year). Unstable or stable conditions occur onsite 16 percent or 21 percent of  
37 the year, respectively. While stable conditions can occur at any time during the year, they are

1 more common in the winter, spring, and fall. For example, during the winter, stable or very  
2 stable conditions occur more frequently, approximately 23 percent of the time, while during the  
3 summer stable conditions are observed 16 percent of the time (SCE&G 2009a).

4 The presence of the Monticello and Parr reservoirs has little impact on the stability observed at  
5 the VCSNS Units 2 and 3 meteorological tower because the tower is approximately 1 mi south  
6 of the Monticello Reservoir and 1 mi east of the Parr Reservoir. In contrast, the static stability at  
7 the VCSNS Unit 1 meteorological tower is influenced by its close proximity to the Monticello  
8 Reservoir and associated differences in the reservoir and land temperatures. When the water in  
9 the reservoir is warmer than the surrounding land, and the winds are blowing from the water  
10 towards the Unit 1 tower, then conditions at the meteorological tower are less stable than they  
11 would otherwise have been. This condition is most common in the fall. At the Unit 1 tower,  
12 moderately to extremely stable conditions were observed 16 percent of the time during the fall,  
13 while at the Units 2 and 3 tower, stable conditions were observed 26 percent of the time. If the  
14 winds are blowing in the opposite direction, then conditions at the tower are more stable than  
15 the conditions over the reservoir. In fact, conditions over the reservoir could even be unstable  
16 while conditions at the tower would be stable. When the water is cooler than the land, the  
17 conditions are reversed; in situations when the wind is blowing from the water to the land then  
18 conditions at the tower could be more stable than they would have otherwise been.

### 19 **2.9.1.3 Temperature**

20 The temperature measured at the 33-ft level of the VCSNS Units 2 and 3 meteorological tower  
21 is considered to be representative of the VCSNS site. Temperature data from the tower for the  
22 January 1, 2007 through December 31, 2007 time period show the daily average temperature  
23 ranges from a low of 30.4°F in January to a high of 90.4°F in August. During this 12-month  
24 period, the absolute minimum temperature was 20.5°F and the absolute maximum temperature  
25 was 99.7°F. These temperatures are consistent with long-term values for Columbia.

### 26 **2.9.1.4 Atmospheric Moisture**

27 The moisture content of the atmosphere can be represented in a variety of ways, the most  
28 common being relative humidity and dewpoint. Both the dew-point temperature and relative  
29 humidity are reported at the VCSNS site. For the period from January 1, 2007 through  
30 December 31, 2007, the daily average relative humidity ranged from a low of 23 percent in June  
31 to a high of 98 percent in January. These values are more extreme than those reported at  
32 Columbia, South Carolina, but this is likely due to the short period of record at the VCSNS Units  
33 2 and 3 tower. South Carolina has suffered a severe drought from 1998 through 2002 (Crouch  
34 2006) and during 2007–2008 (NCDC 2009a).

1 **2.9.1.5 Severe Weather**

2 The site can experience severe weather in the form of thunderstorms, hail, tornadoes,  
3 hurricanes, and snow and ice. While thunderstorms can occur during any month of the year at  
4 the VCSNS site, they are much more common in the late spring and summer. On average  
5 there are 52 days per year during which thunder is heard at the First Order Station in Columbia,  
6 South Carolina; of these 52 days, 37 of them occur during the period from May through August.

7 Tornadoes occur with some frequency. A total of 79 tornadoes were reported in a 1° latitude by  
8 1° longitude box that includes the VCSNS site during the period from January 1, 1950 through  
9 August 2003 (Ramsdell Jr. and Rishel 2007). The total probability of a tornado strike at the site  
10 is 0.00768 yr<sup>-1</sup> (Ramsdell Jr. and Rishel 2007). The strongest tornado reported in Fairfield  
11 County was an F4 (wind speeds of 207–260 mph) tornado on March 28, 1984. This tornado led  
12 to 5 deaths and 49 injuries. All other tornadoes reported in Fairfield County were F2 (wind  
13 speeds of 113–157 mph) or smaller (NCDC 2009b).

14 Snow can occur during the months of December, January, February, and March. The average  
15 snowfall at Columbia, South Carolina, is 2.1 in. The maximum monthly snowfall was 16 in.,  
16 which was observed in February of 1973 (LCD 2007). Ice storms can occur when rain falls  
17 through cold air that is trapped against the Appalachian Mountains. Freezing precipitation is  
18 observed to occur on approximately 4 days per year (NCDC 2000).

19 Because of its location on the Atlantic Coast of the United States, South Carolina is susceptible  
20 to hurricanes, tropical storms, and tropical depressions. The VCSNS site is sufficiently far  
21 inland that the majority of hurricanes weaken before reaching the site. Only hurricanes Hugo in  
22 1989, Able in 1952, and an unnamed storm in 1893 were of hurricane strength when they  
23 passed within 50 nautical mi of the site (NOAA 2009). Focusing on the period from 1952 to  
24 2006, a total of 17 hurricanes, tropical storms, and tropical depressions have passed within 50  
25 nautical mi of the site (NOAA 2009). Before 1952, storms were not named, which may have led  
26 to double counting when a storm moved slowly through the area or changed strength.

27 **2.9.2 Air Quality**

28 The discussion on air quality includes the six common “criteria pollutants” for which the EPA has  
29 set national ambient air quality standards (ozone, particulate matter, carbon monoxide, nitrogen  
30 oxides, sulfur dioxide, and lead). The air quality discussion also includes heat-trapping GHGs  
31 (primarily carbon dioxide), which have been the principal factor causing climate change over the  
32 last 50 years (Karl et al. 2009).

33 The VCSNS site is located in Fairfield County, South Carolina, which is in the Columbia  
34 Intrastate Air Quality Control Region (AQCR) (40 CFR 81.108). In addition to Fairfield County,  
35 this AQCR consists of Lexington, Newberry, and Richland Counties. The Columbia Intrastate



1 AQCR is bordered by the Metropolitan Charlotte Interstate AQCR to the north, the Camden-  
2 Sumter Intrastate AQCR to the east, the Augusta (Georgia)-Aiken (South Carolina) Interstate  
3 AQCR to the south, and the Greenwood Intrastate AQCR to the west. All of the counties in the  
4 Columbia Intrastate AQCR are in compliance with the National Ambient Air Quality Standards  
5 (NAAQSs) for all criteria pollutants (40 CFR 81.341). Part of York County, which is located in  
6 the Metropolitan Charlotte Interstate AQCR, has been designated as nonattainment for ozone  
7 (8-hour standard). This area is located approximately 35 mi north of the VCSNS site.

8 There are no mandatory Class 1 Federal Areas where visibility is an important value within  
9 100 mi of the VCSNS site.

10 The EPA revised the 8-hour ozone standard in 2008, decreasing it from 0.08 ppm to 0.075 ppm  
11 (73 FR 16436). This change will result in changes in the definition of nonattainment areas for  
12 ozone. On September 16, 2009, the EPA indicated that the new standards would be  
13 reconsidered and final designation would be made in August 2011 (EPA 2009b). Because the  
14 VCSNS site is within an attainment area for ozone, a conformity analysis, which is used to  
15 determine if a Federal action conforms to any applicable State implementation plans, is not  
16 required. If the attainment status of Fairfield County changes, the need for a conformity  
17 analysis will be revisited. Carbon dioxide concentration has been building up in the earth's  
18 atmosphere since the beginning of the industrial era in the mid-1700s, primarily due to the  
19 burning of fossil fuels (coal, oil, and natural gas) and the clearing of forests. Human activities  
20 have also increased the emissions of other GHGs such as methane, nitrous oxide, and  
21 halocarbons. These emissions are thickening the blanket of heat-trapping gases in the earth's  
22 atmosphere, causing global surface temperatures to rise (Karl et al. 2009)

### 23 **2.9.3 Atmospheric Dispersion**

24 Atmospheric dispersion factors ( $\chi/Q$  values) are used to evaluate the potential consequences of  
25 routine and accidental releases at the VCSNS site. SCE&G used meteorological data from the  
26 period January 1, 2007 through December 31, 2008 to develop the atmospheric dispersion  
27 factors.

28 The long- and short-term atmospheric dispersion estimates were made using the meteorological  
29 data that were collected onsite at the VCSNS Units 2 and 3 meteorological tower. Short-term  
30 estimates are made using the PAVAN model (Bander 1982). PAVAN implements the guidance  
31 set forth in Revision 1 of Regulatory Guide 1.145 (NRC 1982) and uses joint frequency  
32 distributions of the wind direction, wind speed, and atmospheric stability to provide relative air  
33 concentrations of an atmospheric contaminant. Long-term dispersion estimates are made using  
34 the XOQDOQ model (Sagendorf et al. 1982), which was designed for evaluating routine  
35 releases of radionuclides from commercial nuclear power stations in accordance with Revision 1  
36 of Regulatory Guide 1.111 (NRC 1977). The XOQDOQ model uses meteorological data  
37 collected at the VCSNS Units 2 and 3 meteorological tower and computes the annual average

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1 relative air concentrations at a number of receptors of interest, including the highest  
 2 concentration at Unit 3 (when Unit 2 is operational and Unit 3 is under construction) (SCE&G  
 3 2009a), along the dose evaluation periphery, at the nearest residence, at the nearest meat  
 4 animal, at the nearest milk animal, and at the nearest vegetable garden. The maximum annual  
 5 average atmospheric dispersion and deposition factors are reported in Table 2-48.

6 **Table 2-48.** Maximum Annual Atmospheric Dispersion and Deposition Factors for the Dose  
 7 Evaluation Periphery, Nearest Residence, Nearest Meat Animal, Nearest Milk  
 8 Animal, and Nearest Vegetable Garden

Type of Location	Direction from Site	Distance (mi)	$\chi/Q$ (sec/m <sup>3</sup> ; No Decay)	$\chi/Q$ (sec/m <sup>3</sup> ; 2.26-Day Decay)	$\chi/Q$ (sec/m <sup>3</sup> ; 8-Day Decay)	D/Q (1/m <sup>2</sup> )
Dose Evaluation Periphery	ENE	0.50	—	—	—	$1.6 \times 10^{-8}$
Residence	SE	0.50	$5.8 \times 10^{-6}$	$5.8 \times 10^{-6}$	$5.3 \times 10^{-6}$	—
Meat Animal	ENE	1.30	—	—	—	$3.3 \times 10^{-9}$
	SE	1.68	$8.7 \times 10^{-7}$	$8.6 \times 10^{-7}$	$7.3 \times 10^{-7}$	—
Milk Animal	WNW	1.74	$4.6 \times 10^{-7}$	$4.5 \times 10^{-7}$	$3.8 \times 10^{-7}$	—
	NE	2.14	—	—	—	$1.4 \times 10^{-9}$
Vegetable Garden	W	4.74	$1.7 \times 10^{-7}$	$1.7 \times 10^{-7}$	$1.3 \times 10^{-7}$	$2.7 \times 10^{-10}$
	E	1.23	—	—	—	$3.1 \times 10^{-9}$
	SE	1.68	$8.7 \times 10^{-7}$	$8.6 \times 10^{-7}$	$7.3 \times 10^{-7}$	—

Source: SCE&G 2009a, Table 2.7-16; updated by SCE&G (2009t).

9 SCE&G provided the staff with meteorological data for the 2-year period from January 1, 2007  
 10 through December 31, 2008 (SCE&G 2009t). The staff used these data to independently  
 11 estimate atmospheric dispersion factors for the site. The staff viewed the meteorological site  
 12 and instrumentation, reviewed the available information on the meteorological measurement  
 13 program, and evaluated data collected by the program. Based on this information, the staff  
 14 concludes that the program provides data that represent the affected environment onsite  
 15 meteorological conditions as required by 10 CFR 100.20. The data also provide an acceptable  
 16 basis for making estimates of atmospheric dispersion for the evaluation of the consequences of  
 17 routine and accidental releases required by 10 CFR 50.34 and 10 CFR Part 50, Appendix I.

### 18 2.9.4 Meteorological Monitoring

19 A meteorological monitoring program has existed at the VCSNS Units 2 and 3 site since  
 20 January 2007. The initial instrumentation was installed to provide the onsite meteorological  
 21 information required for licensing Units 2 and 3. The instrumentation is described in SCE&G's  
 22 ER (SCE&G 2009a). The tower location was selected to be representative of the conditions at  
 23 the proposed location for Units 2 and 3, and is located approximately 3500 ft south-southeast of

1 the site of the proposed two units. Measurements made at the tower include wind speed, wind  
2 direction, relative humidity, and temperature at three levels (10, 30, and 60 m). The  
3 measurements are made in accordance with Regulatory Guide 1.23 (NRC 2007a). In addition  
4 to the meteorological tower associated with Units 2 and 3, a separate meteorological tower has  
5 been operated in support of Unit 1 for the entire period of record of the Units 2 and 3 tower.  
6 Differences in the wind speed, wind direction, and stability measured with the two towers are  
7 discussed in Sections 2.9.1.1 and 2.9.1.2.

## 8 **2.10 Nonradiological Environment**

9 This section describes aspects of the environment at the VCSNS site and within the vicinity of  
10 the site associated with nonradiological human health impacts. It provides the basis for  
11 evaluation of impacts on human health from building and operation of the proposed Units 2  
12 and 3. Building activities have the potential to affect public and occupational health, create  
13 impacts from noise, and affect the health of the public and workers by transportation of  
14 construction materials and personnel to the VCSNS site. Operation of the proposed Units 2 and  
15 3 has the potential to affect the public and workers at the VCSNS site from operation of the  
16 cooling system, noise generated by operations, electromagnetic fields (EMFs) generated by  
17 transmission systems, and transportation of operations and outage workers to and from the  
18 VCSNS site.

### 19 **2.10.1 Public and Occupational Health**

20 This section describes public and occupational health at the VCSNS site and vicinity associated  
21 with air quality, occupational injuries, and etiological agents (i.e., disease-causing  
22 microorganisms)

#### 23 **2.10.1.1 Air Quality**

24 Public and occupational health can be affected by changes in air quality from activities that  
25 contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust  
26 from commuter traffic (NRC 1996). Air quality for Fairfield County is discussed in Section 2.9.2.  
27 Fugitive dust and other particulate matter (including particulate matter smaller than 10  $\mu\text{m}$  and  
28 particulate matter smaller than 2.5  $\mu\text{m}$ ) can be released into the atmosphere during any site  
29 excavations and while grading is being conducted. Most of these activities that generate  
30 fugitive dust are short in duration, over a small area, and can be controlled by watering unpaved  
31 roads, stabilizing construction roads and spoil piles, and other BMPs described in Section  
32 4.4.1.3 (SCE&G 2009a). Mitigation measures to minimize and control fugitive dust are required  
33 for compliance with all Federal, State, and local regulations that govern such activities (NRC  
34 1996; SCE&G 2009a).

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1 Exhaust emissions during normal plant operations associated with onsite vehicles and  
2 equipment as well as from commuter traffic can affect air quality and human health.  
3 Nonradiological supporting equipment (e.g., diesel generators, fire-prevention pump engines),  
4 and other nonradiological emission-generating sources (e.g., storage tanks) or activities are not  
5 expected to be a significant source of criteria pollutant emissions. Diesel generators and  
6 supporting equipment would be in place for emergency use only but would be started regularly  
7 to confirm that the systems are operational. Emissions from nonradiological sources of air  
8 pollution are permitted by SCDHEC, as described in the South Carolina Code of Laws 48,  
9 Chapter 1, (SC Code Ann. 48-1 2008) and any applicable Federal regulatory requirements.  
10 Based on estimates provided by SCE&G, the annual releases of criteria pollutants at the  
11 VCSNS site related to the operation of the onsite generators would be minimal based on the  
12 infrequent use (approximately 4 hours per month) of the four standby generators and the four  
13 ancillary diesel generators; the projected emissions are discussed in Section 5.7.2. These  
14 emission sources are not expected to significantly affect ambient air quality levels at the VCSNS  
15 site or in the vicinity of the site.

### 16 **2.10.1.2 Occupational Injuries**

17 In general, occupational health risks to workers and onsite personnel engaged in activities such  
18 as building, maintenance, testing, excavation, and modifications are expected to be dominated  
19 by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses.  
20 Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the  
21 average U.S. industrial rates (BLS 2008). The U.S. Bureau of Labor Statistics provides reports  
22 that account for occupational injuries and illnesses as total recordable cases, which includes  
23 cases that result in death, loss of consciousness, days away from work, restricted work activity  
24 or job transfer, or medical treatment beyond first aid. The State of South Carolina also tracks  
25 the annual incidence rates of injuries and illnesses for utility system construction. These  
26 records of statistics are used to estimate the likely number of occupational injuries and illnesses  
27 for the proposed new units. Occupational injury and fatality risks are reduced by strict  
28 adherence to NRC and Occupational Safety and Health Administration safety standards,  
29 practices, and procedures to minimize worker exposures. Appropriate State and local statutes  
30 also must be considered when assessing the occupational hazards and health risks associated  
31 with the VCSNS site. SCE&G has developed and implemented a worker health and safety  
32 program with a goal of zero accidents. SCE&G will require all contractors and subcontractors to  
33 have and implement a health and safety program that, at a minimum, meets the same  
34 requirements as SCE&G's health and safety program. SCE&G will require construction  
35 contractors and subcontractors to develop and implement safety procedures with the intent of  
36 preventing injuries, occupational illnesses, and deaths (SCE&G 2009a).

### 1 2.10.1.3 Etiological Agents

2 Public and occupational health can be compromised by activities at the VCSNS site that  
3 encourage the growth of disease causing microorganisms (etiological agents). Thermal  
4 discharges from Units 2 and 3 into the circulating-water system and the Parr Reservoir (SCE&G  
5 2009a) have the potential to increase the growth of thermophilic microorganisms. The types of  
6 organisms of concern for public and occupational health include enteric pathogens (such as  
7 *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.).  
8 These microorganisms could result in potentially serious human health concerns, particularly at  
9 high exposure levels.

10 A review of the outbreaks of human waterborne diseases in South Carolina indicates that the  
11 incidence of most of these diseases is not common. Available data assembled by the U.S.  
12 Centers for Disease Control and Prevention (CDC) for the years 1996 to 2007 (CDC 1997,  
13 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007) report only two occurrences of  
14 waterborne outbreaks of disease from recreational water in the State of South Carolina. From  
15 1989 to 2000, the CDC surveillance system for waterborne-disease outbreaks documented 24  
16 fatal cases of primary amebic meningoencephalitis (a disease caused by *Naegleria fowleri*) in  
17 the United States, most occurring in southern states during the months of July and September  
18 (CDC 2008). Outbreaks of Legionellosis, Salmonellosis, or Shigellosis that occurred in South  
19 Carolina were within the range of national trends (CDC 1997, 1998, 1999, 2001, 2002, 2003,  
20 2004, 2005, 2006, 2007) in terms of cases per 100,000 population or total cases per year, and  
21 the outbreaks were associated with pools, spas, or lakes.

22 Epidemiological reports from the State of South Carolina indicate a very low risk of outbreaks  
23 from thermophilic microorganisms associated with recreational water (CDC 2006). Two  
24 SCDHEC water-quality monitoring stations along Parr Reservoir located in or near recreation  
25 areas monitor for species that are indicators for the presence of other pathogens that may be  
26 present in the water. The main recreational activities associated with Parr Reservoir are fishing  
27 and hunting (SCE&G 2009a). There are no public swimming beaches along Parr Reservoir. No  
28 reported cases of Legionellosis, Salmonellosis, or Shigellosis occurred in Fairfield County in  
29 2006 (CDC 2006).

30 *Naegleria fowleri* is common in freshwater ponds, lakes, and reservoirs throughout the southern  
31 states. While it is possible that the thermal discharge from Units 2 and 3 could have an impact  
32 on the abundance of this organism, the affected area of Parr Reservoir would be relatively small  
33 under normal operating conditions at most times of the year. In addition, because there are no  
34 swimming beaches on Parr Reservoir and limited public access to the outfall area, the likelihood  
35 for recreational exposure is expected to be minimal. Based on the historically low risk of  
36 diseases from etiological agents in South Carolina, the limited extent of thermal impacts in Parr  
37 Reservoir, and the limited opportunities for public exposure, the review team concludes that the  
38 impacts on human health would be minimal, and mitigation would not be warranted.

1 **2.10.2 Noise**

2 Sources of noise at the VCSNS site are those associated with operation of Unit 1, including  
3 transformers and other electrical equipment, circulating-water pumps, and the public address  
4 system. Additional sources for background noise at the site include railroad operations (~1 mi  
5 to the west) and from the Parr combustion turbines (~1.4 mi to the south-southeast) (SCE&G  
6 2009a). The nearest residence to the site is 5800 ft away (SCE&G 2009a). SCE&G states in  
7 its ER that it has never received a complaint about the noise produced by Unit 1 (SCE&G  
8 2009a).

9 Activities associated with building the new units at the VCSNS site would have peak noise  
10 levels that may exceed 100 decibels on the A-weighted scale (dBA) on the site. Noise levels  
11 would be attenuated by distance and obstacles such as buildings, vegetation, and topography.  
12 Noise from traffic along the access routes to the sites may intermittently exceed levels  
13 acceptable for residential areas. These impacts would be highly concentrated in the area  
14 immediately proximate to the site or the site access roads. However, sensitive noise receptors  
15 closest to the site are likely to experience intermittent and irritating, but temporary, noise  
16 pollution during the peak of construction and preconstruction activities. A decrease of 10 dBA in  
17 noise level is generally perceived as cutting the loudness in half. At a distance of 50 ft from the  
18 source these peak noise levels would generally decrease to the 8- to 95-dBA range and at  
19 distance of 400 ft; the peak noise levels would generally be in the 60- to 80-dBA range. For  
20 context, the sound intensity of a quiet office is 50 dBA, normal conversation is 60 dBA, busy  
21 traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA (Tipler 1982).  
22 Regulations governing noise associated with the activities at the VCSNS site are generally  
23 limited to worker health. Federal regulations governing construction noise are found in 29 CFR  
24 Part 1910, *Occupational Health and Safety Standards*, and 40 CFR Part 204, *Noise Emission*  
25 *Standards from Construction Equipment*. The regulations in 29 CFR Part 1910 deal with noise  
26 exposure in the construction environment, and the regulations in 40 CFR Part 204 generally  
27 govern the noise levels of compressors.

28 **2.10.3 Transportation**

29 According to the ER (SCE&G 2009a) current primary road access to the VCSNS site is via  
30 CR-311 (Ollie Bradham Boulevard), a two-lane paved road. CR-311 intersects SC-215  
31 approximately 1.5 mi east of Unit 1. Parr Road and South Lake Access Road would be  
32 upgraded to accommodate increased traffic when the project is built, and approximately 3/4 mi  
33 of the South Lake Access Road would be relocated to run parallel to and east of the existing  
34 railroad spur into the site, terminating at the VCSNS Units 2 and 3 discharge structure. SC-215  
35 has a north-south orientation and is used by employees traveling from Richland and Fairfield  
36 Counties.

1 Employees traveling from Richland and Lexington Counties may use U.S. Highway 176  
2 (US-176) north to SC-213, which intersects SC-215 2 to 3 mi south of the VCSNS site. The site  
3 is also accessed by a railroad spur connected to the Norfolk Southern line. The existing railroad  
4 line would be rerouted through a fabrication and laydown area between the new units and the  
5 cooling towers, and would be supplemented with an additional railroad spur. A new spur also  
6 may be routed into the unloading areas at the concrete batch plant. Norfolk Southern Railway's  
7 existing railroad line also may require upgrades to support the heaviest loads. Upgrades may  
8 include installing new ballast or rail sections on the existing railroad bed. There is no direct  
9 access to the site via the Broad River.

#### 10 **2.10.4 Electromagnetic Fields**

11 Transmission lines generate both electric and magnetic fields, referred to collectively as EMFs.  
12 Public and worker health can be compromised by acute and chronic exposure to EMFs from  
13 power transmission systems, including switching stations (or substations) onsite and  
14 transmission lines connecting the plant to the regional electrical distribution grid. Transmission  
15 lines operate at a frequency of 60 MHz (60 cycles per second), which is considered to be  
16 extremely low frequency. In comparison, television transmitters have frequencies of 55 to  
17 890 MHz and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

18 Electric shock resulting from direct access to energized conductors or from induced charges in  
19 metallic structures is an example of an acute effect from EMFs associated with transmission  
20 lines (NRC 1996). Objects near transmission lines can become electrically charged by close  
21 proximity to the electric field of the line. An induced current can be generated in such cases,  
22 where the current can flow from the line through the object into the ground. Capacitive charges  
23 can occur in objects that are in the electric field of a line, storing the electric charge, but isolated  
24 from the ground. A person standing on the ground can receive an electric shock from coming  
25 into contact with such an object because of the sudden discharge of the capacitive charge  
26 through the person's body to the ground. Such acute effects are controlled and minimized by  
27 conformance with National Electrical Safety Code criteria that limit the induced current due to  
28 electrostatic effects of 5 mA (SCE&G 2009a)

29 Long-term or chronic exposure to power transmission lines has been studied for a number of  
30 years. These health effects were evaluated in NUREG-1437, *Generic Environmental Impact*  
31 *Statement for License Renewal for Nuclear Plants* (GEIS) (NRC 1996) for nuclear power in the  
32 United States, and are discussed in the ER (SCE&G 2009a). The GEIS (NRC 1996) reviewed  
33 human health and EMFs and concluded the following:

34 The chronic effects of electromagnetic fields (EMFs) associated with nuclear  
35 plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs  
36 have not uncovered consistent evidence linking harmful effects with field  
37 exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic

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1 chemicals and ionizing radiation) in that dramatic acute effects cannot be forced  
2 and longer-term effects, if real, are subtle. Because the state of the science is  
3 currently inadequate, no generic conclusion on human health impacts is possible.

### 4 **2.11 Radiological Environment**

5 A radiological environmental monitoring program (REMP) has been conducted around the  
6 VCSNS site since 1982, when VCSNS Unit 1 began operation. This program measures  
7 radiation and radioactive materials from all sources, including the existing unit at the VCSNS  
8 site. The REMP includes the following pathways: direct radiation, atmospheric, aquatic and  
9 terrestrial environments; and groundwater and surface water. A pre-operational environmental  
10 monitoring program was conducted beginning in 1979 to establish a baseline to observe  
11 fluctuations of radiation levels and radioactivity in the environment after operations began. After  
12 routine operation of Unit 1 started in 1982, the monitoring program continued to assess the  
13 radiological impacts on workers, the public, and the environment. The results of this monitoring  
14 are documented in annual reports titled "Annual Radiological Environmental Operating Report"  
15 (SCE&G 2006a, 2007a, 2008c, 2009l) and "Annual Radioactive Effluent Release Report"  
16 (SCE&G 2006b, 2007b, 2008b, 2009m) for the VCSNS site. These reports show that  
17 exposures or concentrations in air, water, and vegetation are comparable to, if not statistically  
18 indiscernible from, pre-operational levels, with minor exceptions. The VCSNS REMP has  
19 consistently observed the presence of fission product activity attributed to residual fallout from  
20 atmospheric weapons testing and the Chernobyl accident in environmental media, including  
21 sediment, fish, and grass (SCE&G 2009l). No detectable fission or activation product activity  
22 attributed to VCSNS operations was observed in environmental media except for tritium in two  
23 surface-water sampling sites. The tritium concentrations were far below the EPA drinking water  
24 standard, and at levels that produce a small fraction of VCSNS effluent dose limits (SCE&G  
25 2009l; SCE&G 2007c).

26 The *U.S. Nuclear Regulatory Commission's Lessons Learned Task Force Report* (NRC 2006)  
27 made recommendations regarding potential unmonitored groundwater contamination at U.S.  
28 nuclear plants. In response to that report, SCE&G began additional groundwater sampling in  
29 various locations that may be a source of groundwater contamination around Unit 1. The  
30 results of this additional groundwater sampling are summarized in the Annual Radioactive  
31 Effluent Release Reports (SCE&G 2008c, 2009). Tritium at concentrations well below the EPA  
32 drinking water standards (40 CFR Part 141) was detected in six samples at two locations during  
33 2008.

### 34 **2.12 Related Federal Project Activities and Consultations**

35 The NRC staff reviewed the possibility that activities of other Federal agencies might affect the  
36 granting of a COL permit for VCSNS Units 2 and 3. Any such activities could result in



1 cumulative environmental impacts and the possible need for another Federal agency to become  
2 a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)). After reviewing the  
3 Federal activities in the region surrounding the VCSNS site, the NRC staff determined that it  
4 would be advantageous for the USACE to become a cooperating agency for preparation of the  
5 EIS. As discussed in Chapter 1, the USACE is a cooperating agency for preparation of this EIS.

6 The Federal Power Commission (FPC, which became FERC) issued a license (Project Number  
7 1894) to SCE&G on June 30, 1974, for the Parr Hydroelectric Project, which consisted of a set  
8 of related actions (elevation of Parr Shoals Dam, enlargement of Parr Reservoir, construction of  
9 the FPSF, impoundment of Frees Creek for Monticello Reservoir). The Federal Power  
10 Commission prepared an EIS for this major Federal licensing action that evaluated potential  
11 environmental impacts, including the inundation of 9350 ac of land (eliminating farmland, timber,  
12 wildlife habitat, and 25 homes) and enhanced recreational opportunities provided by the public  
13 recreational facilities at the expanded Parr Reservoir and new Monticello Reservoir. The FPC  
14 concluded that the loss of 9350 ac of farmland and wildlife habitat was significant (FPC 1974),  
15 but that, with prudent evaluation and selection of construction methods and project operation,  
16 no serious cumulative adverse environmental impacts were foreseen. The FPSF began  
17 commercial operation in 1978, four years before VCSNS Unit 1. The FERC license for the Parr  
18 Hydroelectric Project, including FPSF, expires on June 30, 2020. Under current rules, SCE&G  
19 will be required to file a Notice of Intent with FERC by the year 2015 declaring whether or not it  
20 intends to renew the license for the hydroelectric project. At least 2 years before the current  
21 FERC license expires (i.e., before June 30, 2018), SCE&G will be required to file an application  
22 for a license renewal.

23 Federal activities within the 50-mi radius of VCSNS include the Sumter National Forest  
24 managed by the U.S. Department of Agriculture, the Congaree Swamp National Monument  
25 managed by the U.S. Department of Interior, and the United States Army's 52,000-ac Fort  
26 Jackson southeast of Columbia. Fort Jackson employs 4000 civilians and is the largest and  
27 most active Initial Entry Training Center in the Army, training 19,000 each year. Fort Jackson  
28 has added several new schools and training institutions, including the Soldier Support Institute,  
29 the Chaplains Center and School, and the U.S. Department of Defense Polygraph Institute.  
30 Shaw Air Force Base is located in Sumter, South Carolina, outside of the Central Midlands  
31 region but within the 50-mi radius of VCSNS site.

32 The NRC is required under NEPA Section 102(c) (NEPA 1969) to consult with and obtain the  
33 comments of any Federal agency that has jurisdiction by law or special expertise with respect to  
34 any environmental impact involved in the subject matter of the EIS. The NRC is consulting with  
35 the FWS and NMFS. Consultation correspondence is listed in Appendix F.

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- 4 10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of  
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13 Part 325, "Processing of Department of the Army Permits."
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- 16 40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81,  
17 "Designation of Areas for Air Quality Planning Purposes."
- 18 40 CFR Part 131. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 131,  
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- 20 40 CFR Part 141. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 141,  
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## 3.0 Site Layout and Plant Description

The site of proposed Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 (referred to as the proposed Units 2 and 3) is located in Fairfield County in central South Carolina. South Carolina Electric and Gas (SCE&G), acting for itself and as an agent for Santee Cooper (the State-owned electric and water utility, formally called South Carolina Public Service Company), applied to the U.S. Nuclear Regulatory Commission (NRC) for combined construction permits and operating licenses (COLs) for VCSNS Units 2 and 3. In addition to the COL application, SCE&G also applied for a Department of the Army (DA) permit from the U.S. Army Corps of Engineers (USACE) to conduct activities that result in alteration of waters of the United States, including wetlands. The proposed new units would be situated wholly within the existing VCSNS site and located approximately 1 mi to the south-southwest of existing Unit 1. The site is situated approximately 26 mi northwest of the State capital Columbia, South Carolina.

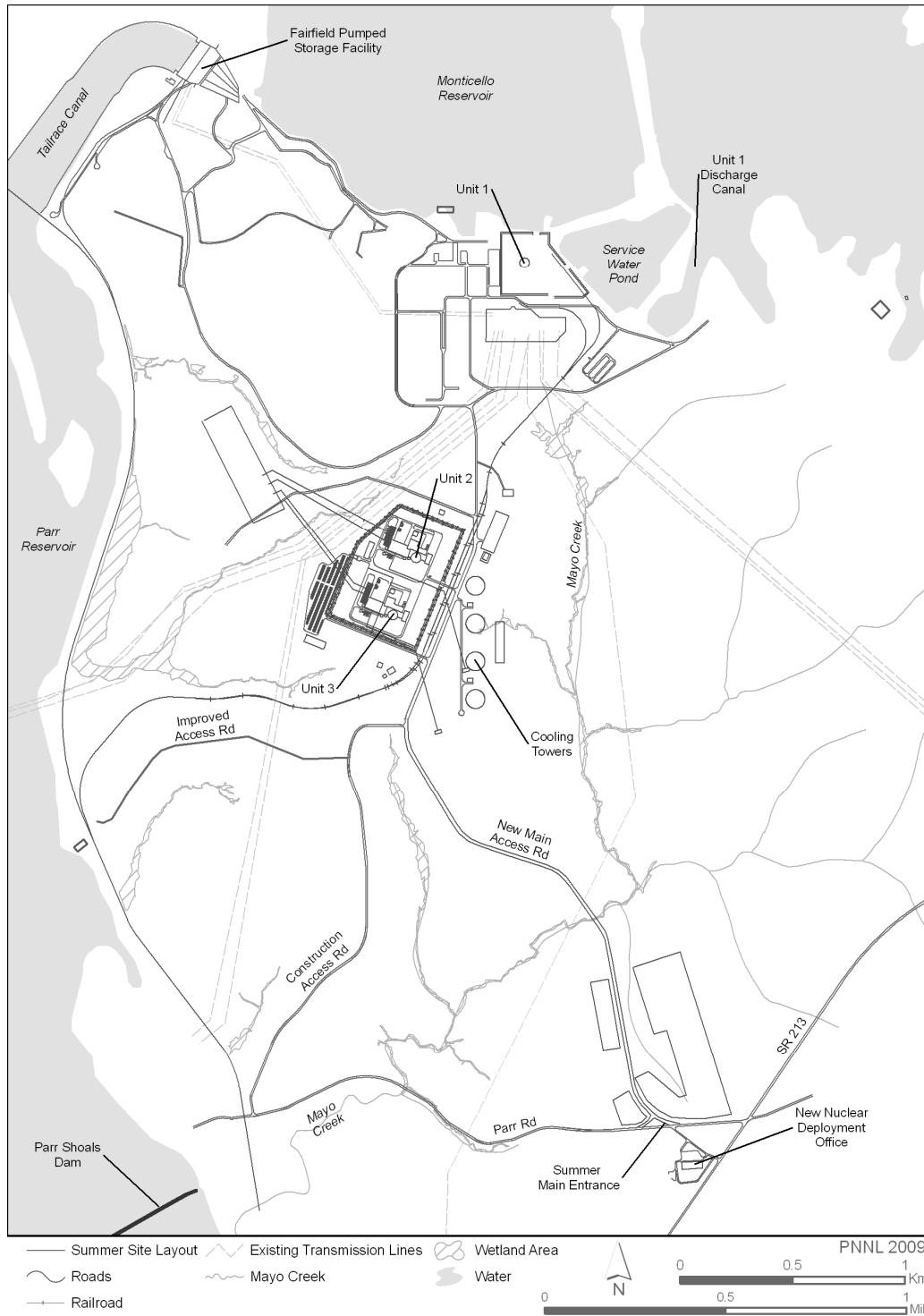
This chapter describes the key plant characteristics that are used to assess the environmental impacts of the proposed action. The information is drawn from SCE&G's Environmental Report (ER) (SCE&G 2009a), its Final Safety Analysis Report (FSAR) (SCE&G 2009b), and supplemental documentation from SCE&G (SCE&G 2009c, d, e).

Whereas Chapter 2 of this environmental impact statement (EIS) describes the existing environment of the proposed site and its vicinity, this chapter describes the physical layout of the proposed plant. This chapter also describes the physical activities involved in building and operating the plant. The environmental impacts of building and operating the plant are discussed in Chapters 4 and 5, respectively. This chapter is divided into four sections. Section 3.1 describes the external appearance and layout of the proposed plant. Section 3.2 describes the major plant structures and distinguishes structures that routinely interface with the environment from those that minimally or temporarily interface with the environment. Section 3.3 describes the activities involved in building or installing each of the plant structures. Section 3.4 describes the operational activities of the plant that interface with the environment. References cited are listed in Section 3.5.

### 3.1 External Appearance and Plant Layout

The VCSNS site currently contains one pressurized light water reactor and associated facilities (VCSNS Unit 1) located on the southern shore of Monticello Reservoir (NRC 2004). Proposed VCSNS Units 2 and 3 would be located approximately 1 mi south of Unit 1 (Figure 3-1). All systems and structures directly supporting power generation by Units 2 and 3 would be built with new independent facilities; none would be shared with Unit 1. However, SCE&G noted that existing infrastructure such as administrative buildings, warehouses, and the training center, would be modified to accommodate Units 2 and 3 and the existing unit (SCE&G 2009a).

# Site Layout and Plant Description



1  
2

**Figure 3-1. VCSNS Site Layout**



1 The proposed location of the VCSNS Units 2 and 3 would have a design site grade of 400 ft  
2 North American Vertical Datum 1988 (NAVD88). SCE&G (2009a) states that the “center point  
3 of Unit 2 containment would be approximately 1600 ft west and 4300 ft south of the center point  
4 of Unit 1 containment” and the “center point of Unit 3 containment would be approximately 900 ft  
5 south-southwest of the center point of Unit 2.” The containment vessel, shield building, and  
6 auxiliary building make up the “nuclear island,” which is one of five principal structures of the  
7 standard Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000  
8 (AP1000) pressurized water nuclear power reactor proposed for VCSNS Units 2 and 3. The  
9 other four principal structures of an AP1000 unit are the turbine, diesel generator, radwaste, and  
10 annex buildings.

11 The footprint area of each new unit is adjacent to, but separate from, the other. The area  
12 required for the proposed two power-generating units is approximately 47 ac. Each new  
13 VCSNS reactor unit would be supported by two mechanical draft cooling towers, each  
14 approximately 70 ft high and 275 ft in diameter. The total area required for four cooling towers  
15 and associated structures for the circulating-water system (CWS) would be approximately 38 ac  
16 (SCE&G 2009a). A conceptualization of proposed Units 2 and 3 superimposed on the site is  
17 shown in Figure 3-2.



18  
19 **Figure 3-2.** Conceptualization of Proposed Units 2 and 3 Superimposed on the VCSNS Site  
20 (SCE&G 2009a)

## 1 **3.2 Proposed Plant Structures**

2 This section describes each of the major plant structures: the reactor power system, structures  
3 that would have a significant interface with the environment during operation, and the balance of  
4 plant structures. All of these structures are relevant in the discussion of the impacts of building  
5 proposed Units 2 and 3 in Chapter 4. Only the structures that interface with the environment  
6 are relevant to the operational impacts discussed in Chapter 5.

### 7 **3.2.1 Reactor Power Conversion System**

8 SCE&G has proposed building and operating two Westinghouse AP1000 reactor steam electric  
9 generating systems at the VCSNS site. On January 27, 2006, the NRC issued the final design  
10 certification rule for the AP1000 in the *Federal Register* (71 FR 4464) based on Revision 15 of  
11 the AP1000 Design Control Document (DCD). Each applicant or licensee intending to construct  
12 and operate a plant based on the AP1000 design may do so by referencing its design  
13 certification rule, as set forth in Appendix D to Title 10 of the Code of Federal Regulations  
14 (CFR) Part 52.

15 Westinghouse is requesting to amend the AP1000 DCD. As mentioned in Section 1.1.4, the  
16 reactor design referenced in the application is Revision 17 of the certified design (Westinghouse  
17 2008). The amended application is currently undergoing review. The status of the amended  
18 DCD review is available at [www.nrc.gov](http://www.nrc.gov). Figure 3-3 is an illustration of the reactor power-  
19 conversion system. Each AP1000 reactor is connected to two steam generators that transfer  
20 heat from the reactor core, converting feed water to steam that drives high-pressure and low-  
21 pressure turbines, thereby creating electricity. Steam that has passed through the turbines is  
22 condensed back to water that is heated and pumped back to the steam generators, repeating  
23 the cycle. The AP1000 design has a thermal power rating of 3400 MW(t), with a design gross-  
24 electrical output of approximately 1200 MW(e). The estimated station and auxiliary service load  
25 is 93 MW(e) for each proposed new unit at the VCSNS site, for a net electrical output of  
26 1107 MW(e) per unit (SCE&G 2009a).

### 27 **3.2.2 Structures with a Major Environmental Interface**

28 The review team divided the plant structures into two primary groups: those that interface with  
29 the environment and those that are internal to the reactor and associated facilities but without  
30 direct interaction with the environment. Examples of interfaces with the environment are  
31 withdrawal of water from the environment at the intake structures, release of water to the  
32 environment at the discharge structure, and release of excess heat to the atmosphere. The  
33 structures or locations with environmental interfaces are considered in the review team's  
34 assessment of the environmental impacts of facility construction and preconstruction, and  
35 facility operation in Chapters 4 and 5, respectively. The power-production processes that would  
36 occur within the plant itself and that do not affect the environment are not relevant to a National  
37 Environmental Policy Act of 1969, as amended (NEPA) review and are not discussed further in

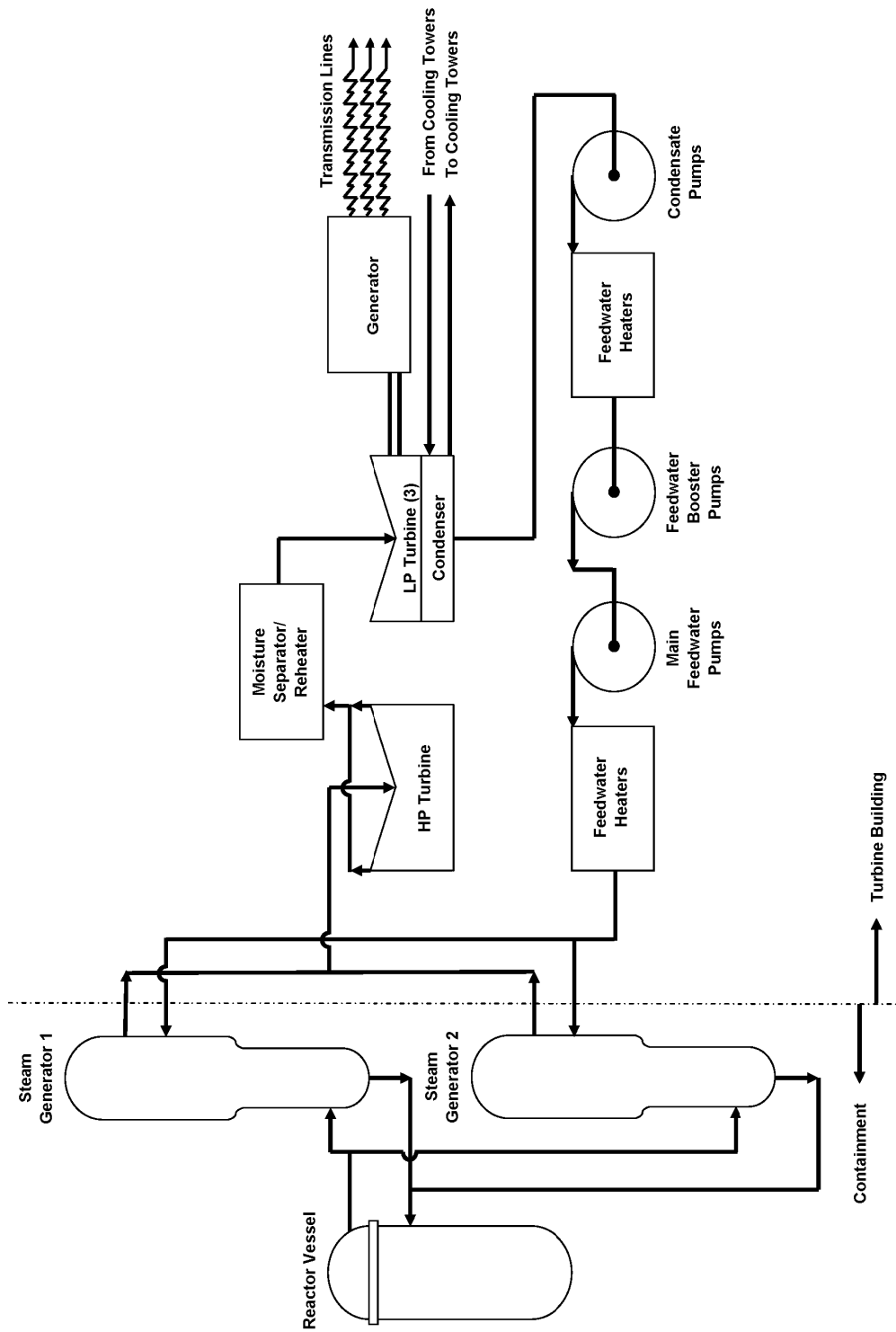


Figure 3-3. AP1000 Power Conversion Diagram (SCE&G 2009a)

## Site Layout and Plant Description

1 this EIS. However, such internal processes are considered by the NRC staff in the  
2 Westinghouse AP1000 design certification documentation and in NRC safety reviews of the  
3 SCE&G COL application. This section (3.2.2) describes the structures with significant plant-  
4 environment interfaces. The remaining structures are discussed in Section 3.2.3, inasmuch as  
5 they may be relevant in the review team's consideration of impacts discussed in Chapter 4 of  
6 this EIS. Figure 3-4 illustrates the VCSNS site layout with a grid overlay to reference the  
7 locations of various plant structures and activity areas as they are described in the following  
8 sections. Existing Unit 1 is located primarily in the C2 quadrant. Proposed Units 2 and 3  
9 structures are located primarily in the C3 and C4 quadrants.

### 10 **3.2.2.1 Landscape and Stormwater Drainage**

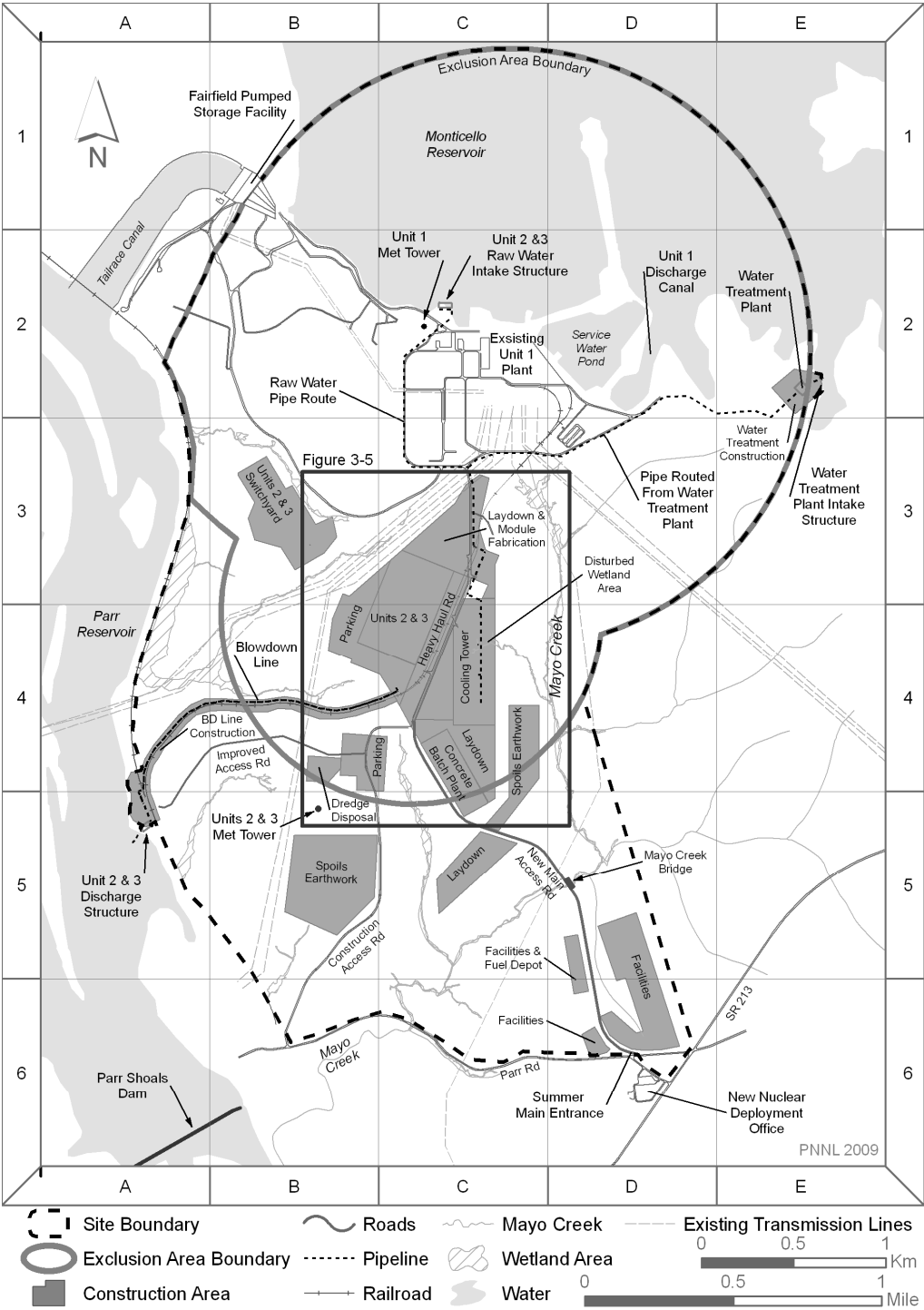
11 Landscaping and the stormwater-drainage system affect both the recharge to the subsurface  
12 and the rate and location at which precipitation drains into adjacent creeks and streams.  
13 Impervious areas eliminate recharge to aquifers beneath the site. Pervious areas managed to  
14 reduce runoff and maintained free of vegetation would experience considerably higher recharge  
15 rates than adjacent areas with local vegetation. The stormwater-management system, including  
16 site grading, drainage ditches, and swales, provides a safety function to keep locally intense  
17 precipitation from flooding safety-related structures.

18 The stormwater-retention basins in the immediate vicinity of the location of proposed Units 2  
19 and 3 are shown in Figure 3-5. The proposed site is on top of a hill and stormwater would drain  
20 away from the site in several directions and into several unnamed creeks to the west and into  
21 Mayo Creek to the east. Once drainage enters Mayo Creek it would flow south, then west  
22 around the southern base of the powerblock area.

### 23 **3.2.2.2 Cooling System**

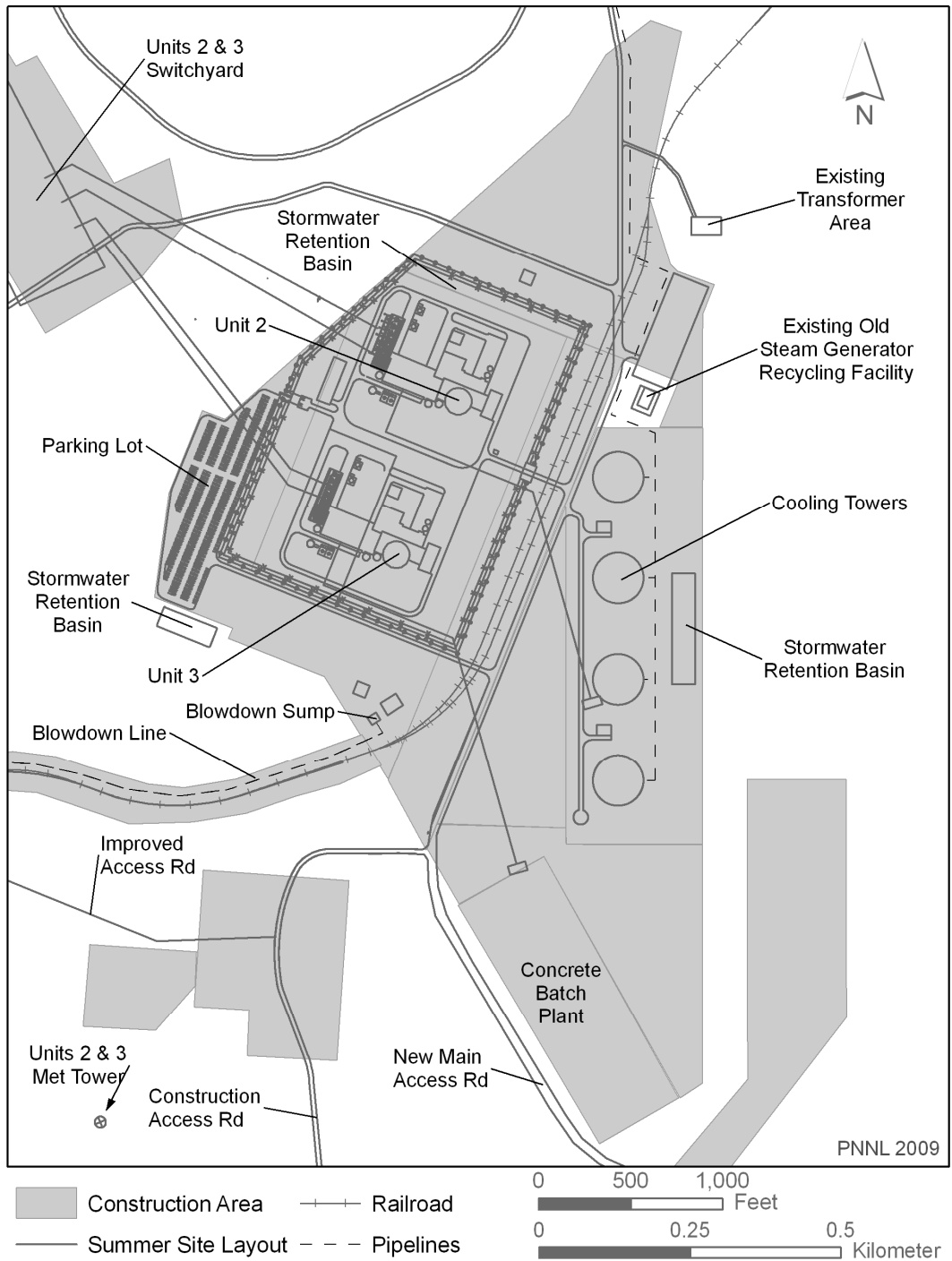
24 The cooling system represents the largest interface between the plant and the environment.  
25 Makeup water would be provided to the plant through an intake structure on Monticello  
26 Reservoir. A portion of the makeup water would be returned to the environment via the  
27 discharge structure on Parr Reservoir. The remaining portion of the water would be released to  
28 the atmosphere via evaporative cooling through mechanical draft cooling towers.

29 These components represent interfaces between the plant and the environment. This section  
30 describes the components of the proposed cooling system based on the information provided by  
31 SCE&G in its ER (SCE&G 2009a) and FSAR (SCE&G 2009b).



1  
2 **Figure 3-4.** VCSNS Site Layout Showing Major Structure and Activity Areas for Proposed  
3 Units 2 and 3

# Site Layout and Plant Description



1  
2

**Figure 3-5. Site Layout Closeup**

## 1 **Cooling-Water Intake Structures**

2 VCSNS Units 2 and 3 would obtain water for the cooling-water systems from Monticello  
3 Reservoir. Two new intake structures are proposed: one for makeup water for the CWS cooling  
4 towers and one for makeup water for the service-water system (SWS) cooling tower and for the  
5 potable, fire-protection, and demineralized water systems. The CWS intake would be the larger  
6 of the two and would be located on the shore of Monticello Reservoir approximately 1250 ft west  
7 of the Unit 1 intake (Figure 3-4, grid reference C2). This intake would be constructed of  
8 concrete; it would be approximately 60 ft long and 75 ft wide. It would house six raw-water  
9 pumps (three per AP1000 unit), each in an individual pump bay with a dedicated trash rack for  
10 coarse-debris removal and a traveling screen for fine-debris removal. A plan view of the CWS  
11 intake system's six pump bays is shown in Figure 3-6. A cross-sectional view of one pump bay  
12 is shown in Figure 3-7.

13 The intake structure for the water-treatment plant proposed for providing SWS makeup water,  
14 and other miscellaneous treated-water systems (potable, fire protection, demineralized water  
15 systems) would be located in Monticello Reservoir approximately 5500 ft east of the Unit 1 intake  
16 (Figure 3-4, grid reference E2). This proposed intake structure consists of a 255-ft-long, 17-ft-  
17 wide access pier extending approximately 200 ft into the reservoir, a 14-in.-diameter intake pipe  
18 suspended from the pier, and a cylindrical concrete wet well approximately 10 ft in diameter  
19 (SCE&G 2009f). The wet well is a chamber set in the reservoir to collect the water to be pumped  
20 to the water-treatment plant; the end of the intake pipe extends into the wet well. Screens in the  
21 side of the wet well allow water to pass through but exclude debris.

## 22 **Discharge Structure**

23 Water released from proposed Units 2 and 3 would flow through a pipeline to a discharge  
24 structure (outfall) on the eastern shore of Parr Reservoir, approximately 5000 ft west-southwest  
25 of Units 2 and 3. The pipeline would be routed along the rail corridor between VCSNS Units 2  
26 and 3 and Parr Reservoir (Figure 3-4, grid references A4, B4, C4). The proposed discharge  
27 structure consists of a valve box and weir chamber housed in a structure 20 ft wide, 60 ft long,  
28 and approximately 23 ft deep, situated mostly below grade on the shoreline (Figure 3-8).  
29 Effluent would exit the weir chamber through a 36-in.-diameter discharge pipe to a diffuser line  
30 containing multiple ports that discharge approximately 3 ft above the bottom of Parr Reservoir.  
31 The proposed diffuser design has 20 ports, each with an inside diameter of 7 in., spaced 3.67 ft  
32 apart (on center), and alternately opening upstream and downstream. The diffuser line would  
33 be approximately 70 ft long; the main pipe and bottom part of each diffuser would be sunk into  
34 the bottom of the reservoir and stabilized with riprap (Figure 3-9) (SCE&G 2009a).

Site Layout and Plant Description

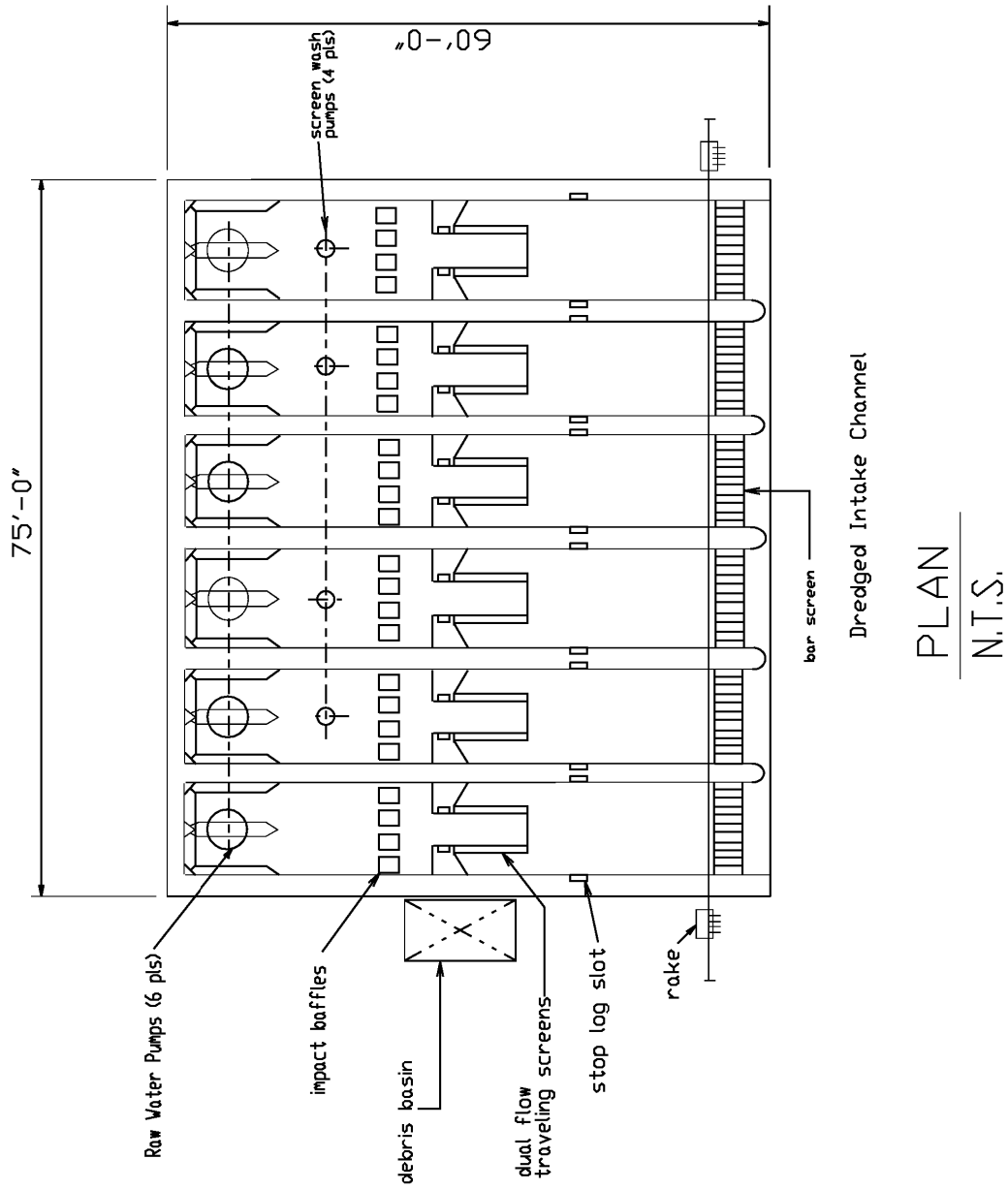
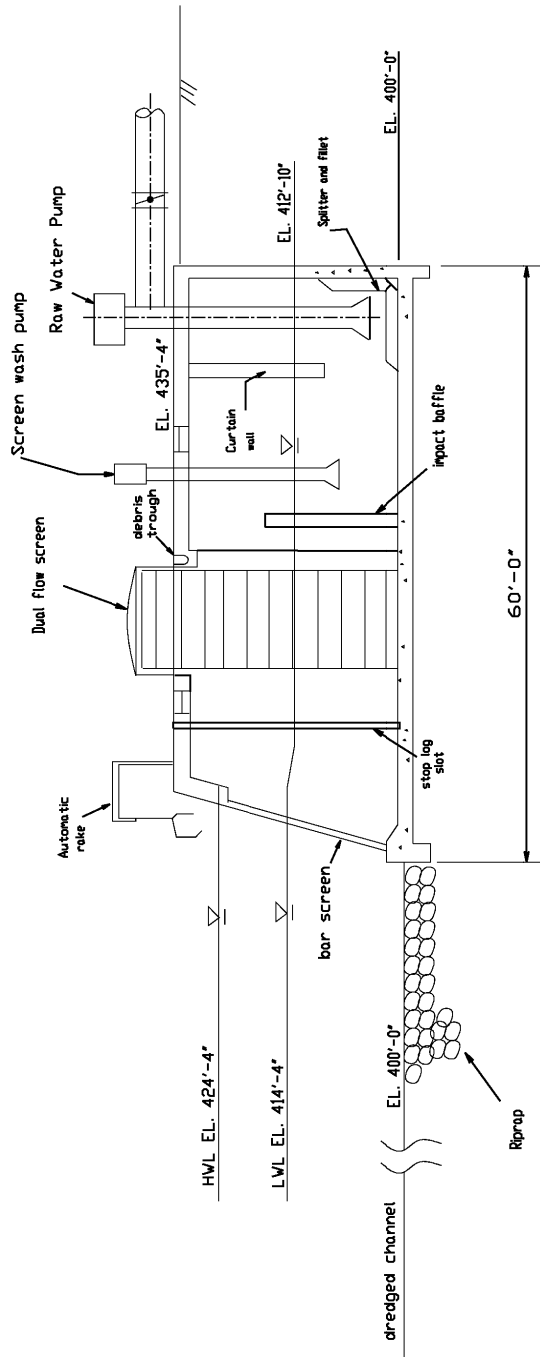


Figure 3-6. Plan View of the Circulating-Water System Intake Structure (SCE&G 2009a)



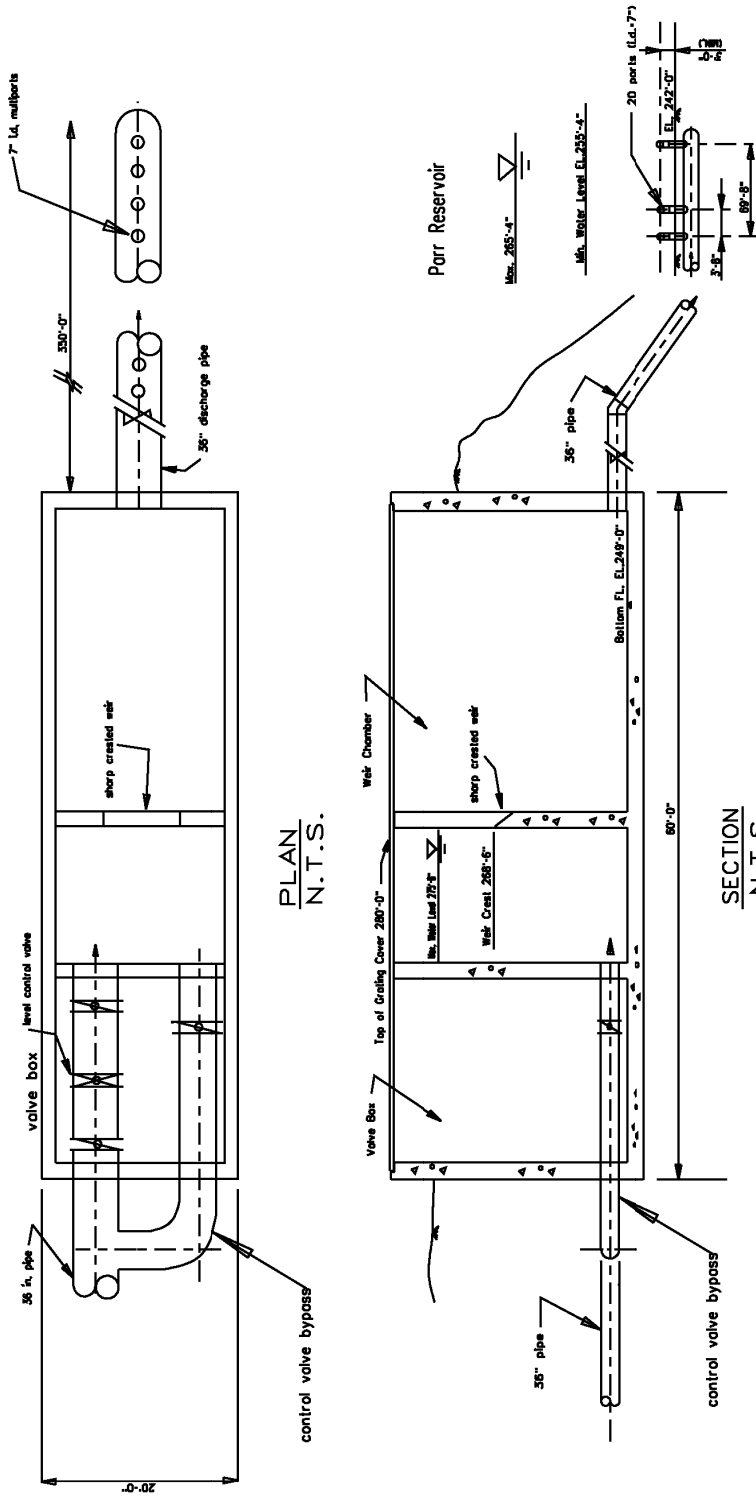


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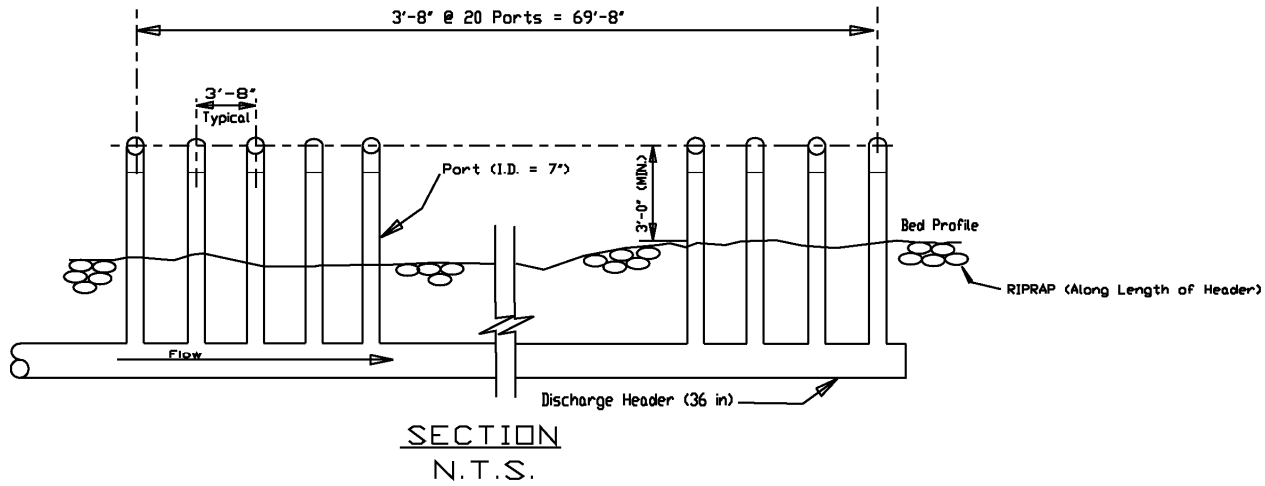
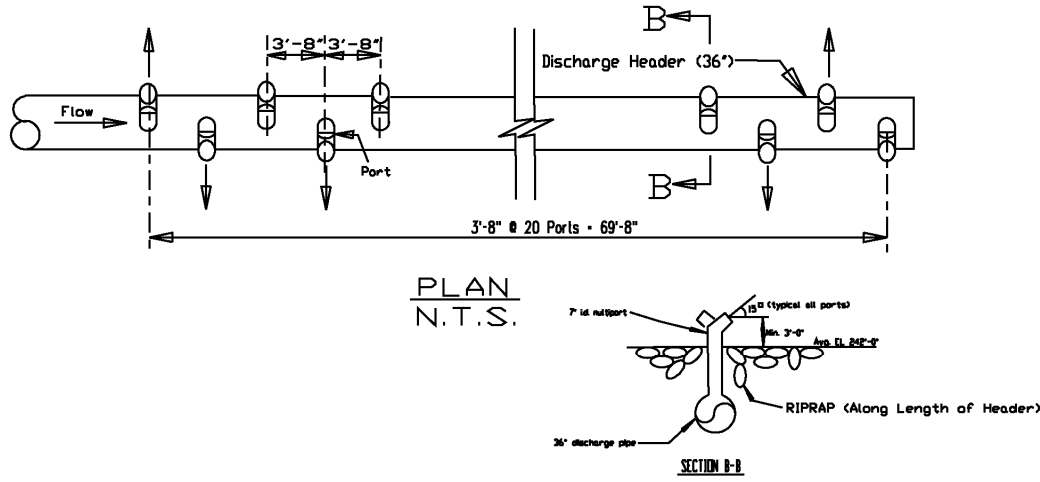
1 2

Figure 3-7. Cross-Section View of the Circulating-Water System Intake Structure (SCE&G 2009a)



ALL ELEVATIONS SHOWN ARE NAVD 88  
**Figure 3-8.** Plan and Cross-Section Views of the Outfall Discharge System (SCE&G 2009a)

1  
 2



ALL ELEVATIONS SHOWN ARE NAVD 88

Figure 3-9. Plan and Cross-Section Views of the Outfall Discharge Ports (SCE&G 2009a)

1    **Cooling Towers**

2    Proposed Units 2 and 3 would use closed-cycle cooling towers to dissipate heat from both the  
3    CWS and the SWS. As described in Section 3.1, each unit requires two cooling towers for the  
4    CWS; these are mechanical draft towers with circular concrete shells, approximately 275 ft in  
5    diameter at the base and 70 ft high, including the fans on top. In each tower, fans blow air  
6    across water sprayed through fine nozzles, removing heat from the water and rejecting that heat  
7    to the atmosphere. The four towers would be aligned north-south, located to the east, and  
8    extending slightly farther south of Units 2 and 3 (Figure 3-5). Each new unit would also have  
9    one cooling tower for the SWS, rectangular in shape, located adjacent to the AP1000 turbine  
10    building. These would also be mechanical draft cooling towers, each divided into two cells.

11   **3.2.2.3    Other Structures with a Permanent Environmental Interface**

12    Roads, railroad lines, and buildings are the additional structures with a permanent  
13    environmental interface that would be built on the proposed site. Proposed new buildings  
14    associated with proposed Units 2 and 3 include the water-treatment plant, sanitary waste-  
15    treatment plant, and power transmission system.

16    **Roads**

17    An existing road network on the VCSNS site would provide access to and between the existing  
18    facilities. To support proposed Units 2 and 3, existing roads would be improved, and  
19    approximately 6 mi of new road would be constructed. New roadways would include an  
20    approximately 1.5-mi main access road from State Highway 213 (SC-213) near SCE&G's New  
21    Nuclear Deployment Office to Units 2 and 3, a 0.33-mi heavy-haul road between the laydown  
22    and fabrication areas, a 1.5-mi access road between the Units 2 and 3 cooling towers and the  
23    raw-water intake structure on Monticello Reservoir, and a perimeter road around the new units.  
24    Parr Road and much of the existing access road between Parr Road and VCSNS Unit 1 would  
25    be upgraded for use as the main access for Units 2 and 3 building materials and worker traffic.  
26    In the vicinity of the new units, this access road would be rerouted to the east side of the rail line  
27    into the site (SCE&G 2009a).

28    **Railroad Lines**

29    SCE&G owns a spur railroad line connecting the VCSNS site to the Norfolk Southern Railroad's  
30    main line along the Broad River. The VCSNS railroad line, which terminates at Unit 1, would be  
31    rerouted and another spur added between the new units and their cooling towers (Figure 3-4,  
32    grid reference C4). SCE&G indicated that another spur might be added to serve the concrete  
33    batch plant, which would be located south of the site of the proposed cooling towers along the  
34    new main access road (Figure 3-5).

**1 Water-Treatment Plant**

2 A new water-treatment plant would be built near the proposed treatment plant intake on  
3 Monticello Reservoir approximately 1.5 mi northeast of VCSNS Units 2 and 3 (Figure 3-4, grid  
4 reference E2) (SCE&G 2009a). Water would be pretreated as necessary at this treatment plant  
5 prior to supplying the plant service, potable, fire protection, and demineralized water systems.

**6 Diesel-Generator Building**

7 Diesel generators would be installed on the site to provide a backup source of power when the  
8 normal power source is disrupted. Combustion emissions would be released to the atmosphere  
9 from the generators only during emergency operations and periodic testing. Two diesel  
10 generators would be located in the AP1000 diesel-generator building; ancillary diesel generators  
11 would be located in the AP1000 annex building (SCE&G 2009a).

**12 Turbine Building**

13 The AP1000 turbine building would be a metal-sided rectangular structure rising 146 ft above  
14 grade, oriented with its long axis radiating from the containment structure (Figure 3-5). The  
15 turbine building would have a drain system that discharges to a wastewater retention basin  
16 connected to the blowdown sump, and a vent system for the condenser and turbine.

**17 Radioactive Waste Facility**

18 The AP1000 radioactive waste facility would be a steel-framed structure with a height of  
19 approximately 36 ft above grade. It would house the holding and processing systems for low-  
20 level liquid radioactive waste and solid radioactive waste. It also would house the collection and  
21 processing system for gaseous radioactive waste. Radioactive waste management is described  
22 in more detail in Section 3.4.3. Packaged solid wastes and liquid mixed wastes would be stored  
23 in the radioactive waste facility until shipment offsite for further processing or disposal. The  
24 environmental interfaces for the radioactive waste-treatment facility would be liquid effluent  
25 discharges to the blowdown discharge line, gaseous effluent venting, and solid waste handling  
26 for offsite shipment.

**27 Sanitary Waste-Treatment Plant**

28 SCE&G plans to build a new sanitary waste-treatment plant to support proposed VCSNS Units  
29 2 and 3. It would be sized to serve the operational workforce of both units (approximately 800  
30 workers) and would likely be built in the vicinity of Units 2 and 3. Effluent from the sanitary  
31 waste-treatment plant would be discharged to the blowdown sump where it would be mixed with  
32 cooling-tower blowdown before being discharged to Parr Reservoir (SCE&G 2009a).

1 **Power Transmission System**

2 In Sections 2.2.2 and 3.7 of its ER (SCE&G 2009a), SCE&G described the power transmission  
 3 system that would connect proposed VCSNS Units 2 and 3 to the power grid. A new 230-kV  
 4 switchyard occupying about 28 ac would be constructed approximately 1000 ft northwest of  
 5 Units 2 and 3 (Figure 3-4, grid reference B3). Once the switchyard is completed, it would be  
 6 fenced off to limit access; the switchyard is considered to minimally interface with the  
 7 environment during normal operation. Table 3-1 lists the proposed new 230-kV transmission  
 8 lines for VCSNS Units 2 and 3.

9 **Table 3-1.** Summary of New 230-kV Transmission Lines for Proposed VCSNS Units 2 and 3

Transmission-Line Route	Owner	Total Length (mi)	Length in Existing Rights-of-Way (mi)	Length to Parallel Existing Corridor (mi)	Length of New Rights-of-Way (mi)
VCSNS-Killian	SCE&G	37	19	0	18
VCSNS-Flat Creek	Santee Cooper	72	70	2	0
VCSNS-Lake Murray No. 2 (second line added to existing single line)	SCE&G	19	19	0	0
VCSNS-St. George (double line)	SCE&G	134	66	0	68
VCSNS-Varnville	Santee Cooper	163	162	1	0

Sources: FP&S 2008; MACTEC 2008; SCE&G 2009a

10 Transmission lines and corridors are considered to interface with the environment during  
 11 operation because there are potential continuing impacts from electric fields, noise, and corridor  
 12 maintenance. Each new unit would be connected to the new switchyard by two overhead lines.  
 13 Three overhead lines would connect the new switchyard with the existing Unit 1 switchyard.  
 14 Ten 230-kV transmission lines (eight owned by SCE&G, two owned by Santee Cooper) and one  
 15 115-kV line presently connect the Unit 1 switchyard with the regional transmission system.  
 16 However, the existing transmission system at VCSNS does not have the capacity to support  
 17 proposed VCSNS Units 2 and 3. As noted in Section 2.2.2, six new 230-kV lines (three for each  
 18 unit) would be required to connect the new units to the regional power grid. All of the new lines  
 19 for Unit 2 would be single-circuit lines. Two of the three new lines for Unit 3 would be double-  
 20 circuit lines and one would be a single-circuit line. The proposed routes of the new transmission  
 21 lines are described in Section 2.2.2. Where possible, the new lines would occupy, expand, or  
 22 parallel existing transmission-line corridors; however, routes for several of the proposed lines  
 23 have yet to be determined. Most of the new lines would connect to existing substations or  
 24 switchyards, but SCE&G proposes to build a new substation on SCE&G-owned property near  
 25 St. George, South Carolina, to connect the new double-circuit VCSNS-St. George line. As with  
 26 the onsite switchyard, the new substation is not considered to interface with the environment  
 27 once it is built.

1 Structures associated with the transmission-line corridors are support towers and access roads.  
2 Where a new line would be sited alongside an existing corridor, that corridor might require  
3 widening and/or moving of existing structures (widths of the existing corridors vary from 50 ft to  
4 240 ft). While the specific structure design depends on the terrain and engineering properties of  
5 the soil along the route, all tower structures would be designed so that span clearances meet or  
6 exceed National Electrical Safety Code standards, and all structures would be properly grounded  
7 (SCE&G 2009a). Towers on the two Santee Cooper lines would be either H-frame or single-pole  
8 design (MACTEC 2008). SCE&G expects to use single steel or concrete poles, which are  
9 standard for its 230-kV lines. These poles are typically 85 ft to 105 ft tall, and spaced 500 ft to  
10 800 ft apart depending on the topography and land cover (FP&S 2008).

#### 11 **3.2.2.4 Other Structures with a Temporary Environmental Interface**

12 Some temporary plant-environment interfacing structures would need to be removed before  
13 proposed Unit 3 operation commences. These include a concrete batch plant, a temporary  
14 sewage treatment plant, and dewatering systems. The impacts from the operation and  
15 installation of these structures are discussed in Chapter 4.

##### 16 ***Concrete Batch Plant***

17 A concrete batch plant would occupy 17 ac located south of the VCSNS Units 2 and 3 cooling  
18 towers, adjacent to the new main access road and a 20.5-ac laydown area (Figure 3-4, grid  
19 references C4, C5). This area would house the equipment and facilities needed for delivery,  
20 materials handling and storage, and preparation of concrete. Water for the concrete batch plant  
21 would come from the Jenkinsville Water District until the planned water-treatment facility for  
22 Units 2 and 3 is completed and operational (SCE&G 2009a).

##### 23 ***Temporary Sanitary Waste-Treatment Plant***

24 A temporary sanitary waste-treatment plant would be placed near the main building-support  
25 area (Figure 3-4, grid reference D6). This treatment plant would serve approximately 350  
26 workers in the support area (onsite workers would be served by portable toilet facilities and by  
27 the proposed permanent sanitary waste-treatment system when that system becomes  
28 operational) (SCE&G 2009a). The discharge location for the temporary sanitary waste-  
29 treatment plant would be finalized as part of the National Pollutant Discharge Elimination  
30 System (NPDES) permitting process; proposed locations are Mayo Creek, Parr Reservoir, or  
31 the Broad River (SCE&G 2009a).

##### 32 ***Dewatering Systems***

33 Dewatering is expected to be a localized activity associated with dredging or excavation  
34 (SCE&G 2009a). Submersible pumps would be used to dewater the shoreline areas at the  
35 intake and discharge structure locations; these pumps would discharge to the adjacent surface

## Site Layout and Plant Description

1 water. Deep excavation in the powerblock region might require temporary installation of  
2 dewatering sumps and pumps, which would discharge to the stormwater-management system.

### 3 **3.2.3 Structures with a Minor Environmental Interface**

4 The structures described in the following sections would have minimal environmental interface  
5 during plant operation.

#### 6 **3.2.3.1 Nuclear Island and Annex Building**

7 Each AP1000 nuclear island would consist of a containment building, a shield building, and an  
8 auxiliary building (Figure 3-5). The foundation for the nuclear island would be an integral base  
9 mat that supports these buildings. The steel containment vessel would be completely  
10 surrounded by the shield building and the auxiliary building. The containment foundations  
11 would be approximately 40 ft below grade. The construction materials would be “architecturally  
12 similar to Unit 1” (SCE&G 2009a), i.e., generally concrete or steel, for a similar external  
13 appearance. The tallest building would be the shield building at approximately 229 ft above  
14 grade; the auxiliary building would be approximately 80 ft above grade. The annex building  
15 would be a concrete-and-steel structure that would rise to a height of approximately 81 ft above  
16 grade and provide personnel access to the plant and house plant-support systems and  
17 equipment.

#### 18 **3.2.3.2 Cranes and Footings**

19 A 250-ft tall crane on a concrete footing would be used to erect Units 2 and 3. Other cranes  
20 may be used for materials handling and erection.

#### 21 **3.2.3.3 Pipelines**

22 New pipelines would be constructed to convey water from the raw-water intake to the proposed  
23 Units 2 and 3 cooling towers, from the water-treatment plant intake to the water-treatment plant,  
24 from the water-treatment plant to the Units 2 and 3 SWS, from the various water systems to the  
25 blowdown sump, and from the blowdown sump to the discharge structure on Parr Reservoir.  
26 The locations of these structures and the pipeline routes are shown in Figure 3-4 and  
27 Figure 3-5. The blowdown discharge pipe would be 36-in. in diameter and would be buried in a  
28 trench parallel to the railroad line.

#### 29 **3.2.3.4 Support, Laydown, and Spoils Areas**

30 Multiple construction support and laydown areas would be established to support fabrication  
31 and erection activities and might be maintained as laydown areas for future maintenance and  
32 refurbishment of the plant (Figure 3-4). A 48-ac construction support area located at the facility  
33 entrance on the new main access road, just north of the existing New Nuclear Deployment  
34 Office, would contain temporary offices, warehouses, and sanitary, craft, and training facilities.  
35 Other laydown, fabrication, parking, and support areas would range in size from 6 ac to 37 ac.



1 Two proposed earthwork spoils areas are identified: a 54-ac area, approximately 4500 ft south  
2 of Units 2 and 3, and a 23-ac area, approximately 1500 ft southeast of the cooling towers  
3 (Figure 3-4). Dredge spoils from the intake and discharge structure areas would be placed in a  
4 5.5-ac spoils area approximately 3000 ft south of Units 2 and 3 near the discharge-structure  
5 access road (Figure 3-4).

#### 6 **3.2.3.5 Parking**

7 Parking areas would be created to support the construction workforce and some parking would  
8 be retained for the operating workforce once plant installation is completed. Temporary parking  
9 areas would be in the vicinity of the plant, support, and laydown areas identified in Figure 3-4.  
10 The permanent parking area for the operating workforce would be approximately 800 spaces,  
11 located west of VCSNS Units 2 and 3 (Figure 3-4).

#### 12 **3.2.3.6 Miscellaneous Buildings**

13 A variety of small miscellaneous buildings would exist throughout the site to support worker,  
14 fabrication, building, and operational needs (e.g., shop buildings, support offices, warehouses,  
15 and guard houses). Some buildings may be temporary and would be removed after the plant  
16 begins operation.

### 17 **3.3 Construction and Preconstruction Activities**

18 The NRC's authority is limited to construction activities that have "a reasonable nexus to  
19 radiological health and safety or common defense and security" (72 FR 57416), and the NRC  
20 has defined "construction" within the context of its regulatory authority. Examples of  
21 construction (defined at 10 CFR 50.10(a)) activities for safety-related structures, systems, or  
22 components include driving of piles; subsurface preparation; placement of backfill, concrete, or  
23 permanent retaining walls within an excavation; installation of foundations; or in-place assembly,  
24 erection, fabrication or testing.

25 Other activities related to building the plant that do not require NRC approval (but may require a  
26 DA permit) may occur before, during, or after NRC-authorized construction activities. These  
27 activities are termed "preconstruction" in 10 CFR 51.45(c) and may be regulated by other local,  
28 State, Tribal, or Federal agencies. Preconstruction includes activities such as site preparation  
29 (e.g., clearing, grading, erosion control and other environmental mitigation measures); erection  
30 of fences; excavation; erection of support buildings or facilities; building service facilities (e.g.,  
31 roads, parking lots, railroad lines, sanitary treatment systems, potable water system,  
32 transmission lines); and procurement or fabrication of components occurring somewhere other  
33 than the final, in-place location at the proposed site. Further information about the delineation of  
34 construction and preconstruction activities is presented in Chapter 4 of this EIS.

35 This section describes the structures and activities associated with building proposed Units 2  
36 and 3. Table 3-2 provides general definitions and examples of activities that would be

## Site Layout and Plant Description

1 performed when building the new units. This section characterizes the activities for the principal  
 2 structures to provide the requisite background for the assessment of environmental impacts; it is  
 3 not intended to be a complete discussion of every activity or a detailed engineering plan.

4 **Table 3-2.** Descriptions and Examples of Activities Associated with Building Proposed Units 2  
 5 and 3

Activity	Description	Examples
Clearing	Removing vegetation or existing structures from the land surface.	Cutting planted pines from an area to be used for construction laydown.
Grubbing	Removing roots and stumps by digging.	Removing stumps and roots of pines logged from the construction laydown area.
Grading	Reforming the elevation of the land surface to facilitate operation of the plant and drainage of precipitation.	Leveling the site of the reactors and cooling towers.
Hauling	Transport of material and workforce along established roadways.	Driving on new access road by construction workforce.
Paving	Laying impervious surfaces, such as asphalt and concrete, to provide roadways, walkways, parking areas, and site drainage.	Paving the parking area.
Shallow excavation	Digging a hole or trench to a depth reachable with a backhoe. Shallow excavation may not require dewatering.	Placing pipelines; setting foundations for small buildings.
Deep excavation	Digging an open hole in the ground. Deep excavation requires equipment with greater vertical reach than a backhoe. Deep excavation generally requires dewatering systems to keep the hole from flooding.	Excavating the base mat for the reactor.
Excavation dewatering	Pumping water from wells or pumping water directly to keep excavations from flooding with groundwater or surface runoff.	Pumping water from reactor building deep excavation.
Dredging	Removal of substrates and sediment in navigable waters, including wetlands.	Preparing the location of the outfall diffuser in Parr Reservoir.
Spoils placement	Placement of construction (earthwork) or dredged material in an upland location.	Relocating dredge spoils from Parr Reservoir discharge area to an upland dredge disposal area.
Erection	Assembly of all modules into their final positions, including all connections between modules.	Using a crane to assemble reactor modules.
Fabrication	Creating an engineered material from the assembly of a variety of standardized parts. Fabrication can include conforming native soils to some engineered specification (e.g., compacting soil to meet some engineered fill specification).	Preparing concrete for pours; laying rebar for base mat.
Vegetation management	Thinning, planting, trimming, and clearing vegetation.	Maintaining the switchyard free of vegetation.
Filling a wetland or waterbody	Discharge of dredge and/or fill material into waters of the United States, including wetlands.	Placing fill material into wetlands to bring it to grade with the adjacent land surface.

### 1 **3.3.1 Major Affected Areas**

2 SCE&G has stated (SCE&G 2009a) that building activities for proposed Units 2 and 3 would  
3 occur within the boundaries of SCE&G's property (Figure 3-4), except for the new transmission  
4 lines described in Sections 2.2.2 and 3.2.2.3. Access roads for Units 2 and 3 would enter the  
5 property from the south; the railroad spur enters from the west. The blowdown discharge  
6 pipeline would share the railroad corridor between Units 2 and 3 and the discharge structure on  
7 Parr Reservoir. The intake structures would be on Monticello Reservoir at the north end of the  
8 property. The following sections briefly describe the construction and preconstruction activities  
9 associated with the structures described in Sections 3.2.2 and 3.2.3.

#### 10 ***Landscape and Stormwater Drainage***

11 Preparing to build and operate proposed VCSNS Units 2 and 3 would require land to be cleared  
12 and graded for the main reactor buildings and support facilities and additional space for material  
13 and equipment laydown areas. The details of the alterations are discussed in the following  
14 sections. After the site is graded, a stormwater-drainage system would be created around the  
15 facilities to direct stormwater away from the operational areas. Drainage ditches and pipes  
16 would route surface water to three water-retention and/or infiltration ponds. The locations of  
17 these ponds are shown in Figure 3-5.

#### 18 ***Powerblock and Cooling Towers***

19 Preparing the locations for the powerblock and cooling towers would be the largest and most  
20 complex activity on the site (Figure 3-5). Deep excavation and extensive fill placement and  
21 large-scale fabrication and erection activities would be involved in building the AP1000 units.  
22 The cooling towers would require extensive grading, filling (including a portion of a wetland),  
23 shallow excavation, and fabrication and erection activities. Building the diesel-generator facility  
24 would involve limited fabrication and erection. Various components would be hauled to the site  
25 by railroad and road. Railroads and roads would be built or upgraded on the VCSNS site,  
26 particularly in the immediate vicinity of Units 2 and 3 and their cooling towers.

#### 27 ***Excavation Dewatering***

28 Setting the reactor-shield building foundation would require excavation to about 40 ft to 50 ft  
29 below grade level. The water table in this area is about 27 ft to 34 ft below grade level (SEC&G  
30 2009a). Dewatering systems would be installed if required. At a minimum, SCE&G expects to  
31 install drainage sumps at the bottom of the excavation to facilitate the removal of surface  
32 drainage. Water from the excavations would be pumped to the stormwater-management  
33 system (SCE&G 2009a).

## Site Layout and Plant Description

1 Shallow excavation for foundations for other buildings and trenching for pipelines are not  
2 expected to require dewatering.

### 3 ***Intake Structures***

4 Installing the intake structure for the CWS would require excavation or dredging below the water  
5 level of Monticello Reservoir. Approximately 10,000 yd<sup>3</sup> of material would be removed from an  
6 approximately 25,000-ft<sup>2</sup> area (SCE&G 2009c, d). The dredged material would be relocated to  
7 the onsite dredge spoils disposal area (Figure 3-4, grid reference B4). SCE&G has proposed  
8 the placement of a temporary cofferdam that would enclose an area to be excavated and  
9 dewatered to facilitate building the proposed intake structure, which would extend out into the  
10 Monticello Reservoir. The cofferdam would be surrounded by a turbidity curtain, which is a  
11 floating geotextile material designed to deflect and contain sediment within a limited area and  
12 provide sufficient residence time to settle soil particles, thereby minimizing sediment transport  
13 from a disturbed area adjacent to or within a body of water. Water removed from within the  
14 cofferdam would be discharged outside the cofferdam and inside the turbidity curtain (SCE&G  
15 2009a).

16 Fabrication of the CWS intake structure would occur after excavation and dredging to reach the  
17 necessary elevation for the bottom of the structure. After excavation and dredging, the pump  
18 house would be erected and the necessary electrical systems and piping would be installed to  
19 create an operational intake structure.

20 Similar activities would be required to prepare for and fabricate the intake structure for the  
21 water-treatment plant intake on Monticello Reservoir. A cofferdam would be installed to allow  
22 dewatering of the work area; a turbidity curtain would be used to control suspended sediment  
23 during dewatering. Options considered by SCE&G include a rock-filled cofferdam enclosing the  
24 entire access pier and wet well structure, or a localized sheet-pile cofferdam enclosing only the  
25 wet well (SCE&G 2009f). This intake structure would also require installation of pilings to  
26 support the access pier. Piling installation would be done from within or from the top of the  
27 rock-filled cofferdam if that option was implemented, or from a barge platform if the localized  
28 cofferdam option was implemented. All wet well installation activities would occur within the  
29 cofferdam: a concrete foundation would be poured on compacted base material and the  
30 precast concrete wet well sections would be attached to the base.

### 31 ***Discharge Structure***

32 Installation of the blowdown-discharge diffuser in Parr Reservoir would require the creation of  
33 an enclosure that can be dewatered and excavated or dredged. Sheet pile would be driven into  
34 the bottom of Parr Reservoir approximately 1.25 mi above Parr Shoals Dam to create the  
35 enclosure; it would extend 100 ft offshore to allow excavation of the reservoir bottom and  
36 emplacement of the diffuser pipe. Approximately 11,000 yd<sup>3</sup> of material would be removed from

1 an approximately 24,000-ft<sup>2</sup> area (SCE&G 2009c, d). The dredged material would be relocated  
2 to the onsite dredge spoils disposal area (Figure 3-4, grid reference B4).

### 3 **Roadways**

4 Building the heavy-haul road and the site-access roads would require clearing and grading of land  
5 along the proposed routes shown in Figure 3-4 (SCE&G 2009a). The new main access road  
6 would cross Mayo Creek just north of the construction-support area near the SCE&G New  
7 Nuclear Deployment office and approximately 1 mi southeast of proposed Units 2 and 3.

### 8 **Railroad Lines**

9 Relocating the existing rail line and adding any new rail spurs would require clearing, grading,  
10 and fill placement in the locations of the new rail lines.

### 11 **Water-Treatment Plant**

12 Building the water-treatment plant would involve shallow excavation, fabrication, and erection on  
13 a cleared, graded area.

### 14 **Sanitary Waste-Treatment Plant**

15 Building the sanitary waste-treatment plant would involve shallow excavation and limited  
16 fabrication and erection. The facility would be designed in accordance with industry standards  
17 and in compliance with the Clean Water Act and NPDES-permit requirements.

### 18 **Pipelines**

19 Laying pipelines would occur in several areas on the site. The pipelines connecting the water-  
20 intake structure to the cooling-tower basins would run south from the intake structure along  
21 currently existing roads. The pipelines connecting the water-treatment plant to Units 2 and 3  
22 would run west from the water-treatment plant along existing roads. The blowdown lines would  
23 run west from the cooling-tower basins along the rail corridor to Parr Reservoir and along the  
24 shoreline to the diffuser location approximately 1.25 mi above Parr Shoals Dam. The intake,  
25 treated-water, and discharge pipelines would generally be buried in trenches. Pipeline  
26 installation would require the clearing of land along the pipeline corridor and shallow excavation  
27 (trenching).

### 28 **Concrete Batch Plant**

29 Erecting the temporary concrete batch plant would occur on a cleared, graded area.

## Site Layout and Plant Description

### 1 **Construction Support and Laydown Areas**

2 Establishing and preparing laydown areas would be necessary to stage activities. Prior to and  
3 during construction and preconstruction, materials would be brought to the site and stored in  
4 laydown areas. SCE&G expects to clear and grade laydown areas in various locations on the  
5 proposed VCSNS Units 2 and 3 sites. Support and laydown areas would be graded relatively  
6 level and covered with crushed stone or gravel. Normally only limited vegetation is allowed in  
7 laydown areas.

### 8 **Parking**

9 Parking areas would be graded and paved.

### 10 **Miscellaneous Buildings**

11 Excavating for shallow foundations would be required prior to fabrication and erection of  
12 miscellaneous buildings.

### 13 **Switchyard**

14 Clearing and grading 28 ac of land would be required for the proposed 230-kV switchyard.  
15 Electrical switching structures would be erected and the switchyard would be fenced  
16 (SCE&G 2009a).

### 17 **Transmission Lines**

18 Installation of transmission lines would require the removal of trees and shrubs along portions of  
19 the transmission-line corridor, movement of construction equipment, and shallow excavation for  
20 the foundations of the transmission-line towers.

### 21 **Cranes and Crane Footings**

22 Fabrication of footings and erection of cranes would be necessary to build the larger plant  
23 structures.

### 24 **3.3.2 Summary of Resource Commitments During Construction and** 25 **Preconstruction**

26 Table 3-3 provides a list of the significant resource commitments of construction and  
27 preconstruction. The values in the table combined with the affected environment described in  
28 Chapter 2 provide the basis for the impacts assessed in Chapter 4. These values were stated  
29 in the ER and the review team has confirmed that the values are not unreasonable.

1 **Table 3-3.** Summary of Resource Commitments Associated with Proposed Units 2 and 3  
 2 Construction and Preconstruction

<b>Resource Areas</b>	<b>Value</b>	<b>Parameter Description</b>
All Resource Areas	123 mo (10.25 yr)	Duration of construction and preconstruction activities for two AP1000 units
Land Use, Terrestrial Ecology, Cultural and Historic Resources (Site and Vicinity)	505 ac	Disturbed area footprint: 255 ac permanently disturbed; 180 ac temporarily disturbed
Land Use, Terrestrial Ecology, Cultural and Historic Resources (Offsite, Transmission Lines)	86 mi  50 ft to 250 ft	Length of new transmission-line corridors: 18 mi on Killian line; 68 mi on St. George line  Final width of new and expanded corridors (assuming these would be similar to existing corridors)
Hydrology – Groundwater	40 ft to 50 ft below grade	Excavation depth to which dewatering would be required
Hydrology – Surface Water, Aquatic Ecology	420 gpm (1 cfs)  12.1 gpm (17,500 gpd)	Water supply (maximum) obtained from Monticello Reservoir and Jenkinsville Water District  Effluent discharge to surface water, temporary sanitary water-treatment plant
Socioeconomics, Transportation, Air Quality	2170 workers  3600 workers	Average workforce over 10-year period: first quarter of year 2 through fourth quarter of year 11; number of workers is above average for 5.5 years from the first quarter of year 5 through the second quarter of year 10  Maximum workforce: peak occurs in year 6; more than 3000 workers would be onsite from the third quarter of year 5 to the second quarter of year 9
Terrestrial Ecology, Nonradiological Health, Socioeconomics	108 dBA  60-80 dBA	Peak noise level  Noise level 400 ft from activity

## 1 **3.4 Operational Activities**

2 The operational activities considered in the review team's environmental review are those  
3 associated with structures that interface with the environment, as described in Section 3.2.2.  
4 Examples of operational activities are withdrawing water for the cooling system, discharging  
5 blowdown water and sanitary effluent, and discharging waste heat to the atmosphere. Safety  
6 activities within the plant are discussed by the applicant in the FSAR portion of its application  
7 (SCE&G 2008). The results of NRC's safety review will be documented in its Safety Evaluation  
8 Report.

9 The following sections describe the operational activities, including operational modes  
10 (Section 3.4.1), plant-environment interfaces during operations (Section 3.4.2), and the  
11 radioactive and nonradioactive waste-management systems (Sections 3.4.3 and 3.4.4), and  
12 summarize the values of resource parameters likely to be experienced during operations in  
13 Section 3.4.5.

### 14 **3.4.1 Description of Operational Modes**

15 The operational modes for proposed Units 2 and 3 considered in the assessment of operational  
16 impacts on the environment (Chapter 5 of this EIS) are normal operating conditions and  
17 emergency shutdown conditions. These are considered the conditions under which maximum  
18 water withdrawal, heat dissipation, and effluent discharges occur. Cooldown, refueling, and  
19 accidents are alternate modes to normal plant operation during which water intake, cooling-  
20 tower evaporation, water discharge, and radioactive releases may change from nominal  
21 conditions.

### 22 **3.4.2 Plant-Environment Interfaces During Operation**

23 This section describes the operational activities related to structures with an interface to the  
24 environment.

#### 25 **3.4.2.1 Intake Structures**

26 Monticello Reservoir would be the source of water involved in the operation of proposed Units 2  
27 and 3. Water would be pumped from Monticello Reservoir to supply cooling water to Units 2  
28 and 3 at the CWS intake and to supply other plant water systems at the water-treatment plant  
29 intake structures described in Section 3.2.2.2. Under normal operating conditions for both units,  
30 the CWS withdrawal rate would be approximately 36,000 gpm; the maximum combined  
31 pumping rate to supply both units with raw makeup water would be approximately 59,000 gpm.  
32 The water withdrawal rate for the water-treatment plant would be approximately 1000 gpm  
33 under normal conditions and 3000 gpm maximum. The normal case assumes the cooling  
34 towers are operating at four cycles of concentration; the maximum assumes the cooling towers



1 are operating at two cycles of concentration. The systems would be operated at four cycles of  
2 concentration unless high suspended solids concentrations in Monticello Reservoir occurred.  
3 Under elevated suspended solids conditions, two cycles of concentration would be used to  
4 prevent scale formation or deposition from degrading tower performance (SCE&G 2009a).

5 Each CWS intake pump would be protected by a debris-exclusion system consisting of a bar  
6 screen to trap large debris and a dual-flow traveling screen to filter out fine debris. The intake-  
7 approach channel and pump-bay structures are designed so that the maximum through-screen  
8 velocity would be 0.5 fps at the minimum water elevation in Monticello Reservoir. At the water-  
9 treatment plant intake, the end of the intake pipe would be inside a concrete wet well (a  
10 chamber used to collect liquid) in Monticello Reservoir. Screens in the side of the wet well allow  
11 water to pass into the wet well while excluding debris. The maximum through-screen velocity at  
12 the water-treatment plant intake would also be 0.5 fps at the minimum water elevation in  
13 Monticello Reservoir (SCE&G 2009a; SCE&G 2009f).

#### 14 **3.4.2.2 Cooling Towers**

15 Waste heat is a byproduct of normal power generation at a nuclear power plant. VCSNS Units  
16 2 and 3 would each have two closed-cycle wet-cooling towers to dissipate heat from the CWS  
17 to the atmosphere. Two CWS cooling towers are designed to dissipate a heat load of  
18  $7.63 \times 10^9$  Btu/hr ( $1.53 \times 10^{10}$  Btu/hr for both units) (SCE&G 2009a). Each unit would also have  
19 one SWS cooling tower, which, during normal operation, is expected to dissipate a heat load of  
20  $103 \times 10^6$  Btu/hr through one of its two cells. If increased cooling capacity were needed, such  
21 as during plant cooldown, both cells would be used to dissipate a maximum heat load of  
22  $346 \times 10^6$  Btu/hr ( $692 \times 10^6$  Btu/hr maximum for both units) (SCE&G 2009a).

23 Excess heat in the cooling water would be transferred to the atmosphere by evaporative and  
24 conductive cooling in the cooling tower. In addition to evaporative losses, a small percentage of  
25 water would be lost in the form of droplets (drift) from the cooling towers, potentially causing  
26 visible plumes. Water lost to evaporation and drift is considered consumptive use because the  
27 water is not available for reuse. As with water withdrawal, the normal case assumes the cooling  
28 towers are operating at four cycles of operation and the maximum case assumes two cycles of  
29 concentration. SCE&G provided the following consumptive use rates in the ER (SCE&G  
30 2009a). The CWS normal and maximum evaporation rates would be 27,160 and 29,400 gpm,  
31 respectively. The SWS normal and maximum evaporation rates would be 480 and 1380 gpm,  
32 respectively. The drift rates of 13 gpm for the CWS and 1 gpm for the SWS would not change  
33 with the number of cycles of concentration (SCE&G 2009a).

1 **3.4.2.3 Discharge Structure**

2 ***CWS and SWS Cooling-Tower Blowdown***

3 The cooling water that does not evaporate or drift from the towers would be routed back to the  
4 cooling-tower basin at the base of each tower; this water is known as blowdown. Some waste  
5 heat would be removed from the cooling system with the blowdown water. The maximum  
6 blowdown water temperature was estimated to be 91.8°F (SCE&G 2009a). SCE&G estimated  
7 the normal CWS blowdown flow rate to be 9041 gpm (maximum 29,387 gpm) and the normal  
8 SWS blowdown flow rate to be 159 gpm (maximum 459 gpm).

9 Evaporation of cooling-water system water from the cooling tower increases the concentration  
10 of dissolved solids in the cooling-water system. To limit the concentration of dissolved solids, a  
11 portion of the blowdown water would be removed and replaced with makeup water from  
12 Monticello Reservoir. The blowdown water from each cooling tower would collect in a basin at  
13 the base of the tower. Time spent in the basin allows for settling of suspended solids, and  
14 chemical treatment if required, prior to discharging to the blowdown sump and eventually to Parr  
15 Reservoir. SCE&G plans to maintain the chemical concentration factor for the CWS cooling  
16 tower between two and four cycles of concentration. As noted previously, the CWS would be  
17 operated at four cycles of concentration unless high suspended solids concentrations in  
18 Monticello Reservoir occurred. If suspended solids were elevated, two cycles of concentration  
19 would be used to prevent scale formation or deposition from degrading tower performance  
20 (SCE&G 2009a). The estimated mean and maximum concentrations of chemicals in blowdown  
21 from proposed VCSNS Units 2 and 3 are tabulated below the applicable state water-quality  
22 criteria in Table 3-4.

23 ***Other Plant Wastewater***

24 Miscellaneous low-volume wastewater would flow from various equipment and floor drains to  
25 building sumps. Sumps in the turbine building and diesel fuel oil area would discharge  
26 wastewater to an oil separator to isolate waste oil from wastewater. The turbine building sumps  
27 would be monitored for radioactive material; if detected then wastewater would be routed to the  
28 liquid radioactive waste-processing system. The common discharge piping of the sump pumps  
29 would also be monitored for radioactive material. If radioactive material was detected in this  
30 piping, the monitor alarm would trip the sump pumps and retention-basin pumps to isolate  
31 radioactive wastewater. Under normal conditions, nonradioactive wastewater would be pumped  
32 to a wastewater retention basin and mixed with cooling-tower blowdown in the blowdown sump  
33 (Figure 3-10). SCE&G estimated the normal wastewater discharge rate from the wastewater  
34 retention basin to be 144 gpm (maximum 431 gpm) (SCE&G 2009a).

35

**Table 3-4. Water Quality of Proposed Units 2 and 3 Blowdown Effluent**

Category	Constituent Concentration (µg/L)													
	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Silver	Zinc
South Carolina PQLs <sup>(a)</sup>	5	50	0.1	5	10	20	2	50	10	0.0005	10	5	5	10
South Carolina CMCs for freshwater aquatic life <sup>(b)</sup>	340	—	0.53	—	3.8	—	14.0	—	—	1.6	150	—	0.37	0.37
South Carolina MCLs <sup>(b)</sup>	10	2000	5	100	—	—	—	—	—	2	—	50	—	—
Mean and maximum values calculated from SCDHEC and SCE&G monitoring <sup>(c,d)</sup>	0	18	0.1	5.0	0	241	2.0	1856	8.9	0.0005	9.2	0	5.0	4.2
Four-cycle concentration in blowdown at point of discharge <sup>(e)</sup>	0	18	0.1	5.0	0	600	2.0	1856	21	0.0005	10	0	0	24
Diluted blowdown effluent concentration at broad river's 7Q10 flow <sup>(e)</sup>	0	71	0.4	20	0	962	8.0	7424	36	0.002	37	0	20	17
Diluted blowdown effluent concentration at broad river's annual mean flow <sup>(e)</sup>	0	71	0.4	20	0	2400	8.0	7424	84	0.002	40	0	20	96
Diluted blowdown effluent concentration at broad river's annual mean flow <sup>(e)</sup>	0	19	0.1	5.5	0	264	2.2	2034	9.8	0.00055	10	0	5	4.6
Diluted blowdown effluent concentration at broad river's annual mean flow <sup>(e)</sup>	0	19	0.1	5.5	0	657	2.2	2034	23	0.00055	11	0	5.5	26
Diluted blowdown effluent concentration at broad river's annual mean flow <sup>(e)</sup>	0	18	0.1	5.0	0	244	2.0	1881	9.0	0.00051	9.3	0	5.1	4.3
Diluted blowdown effluent concentration at broad river's annual mean flow <sup>(e)</sup>	0	18	0.1	5.1	0	608	2.0	1881	21	0.00051	10	0	5.1	24

Source: Adapted from SCE&G 2009a  
 PQL = practical quantitation limit; MCL = maximum contaminant level; CMC = criterion maximum concentration; 7Q10 = lowest flow for 7 consecutive days; expected to occur once per decade; MDL = method detection limit  
 (a) SCDHEC (2008)  
 (b) SCDHEC Water Classifications and Standards Regulation (R. 61-68), effective April 25, 2008  
 (c) Mean and maximum concentrations from SCDHEC monitoring at station B-327 (EPA 2006) and SCE&G monitoring of Monticello Reservoir (Table 2.3-32)  
 (d) A single analytical result with an MDL exceeding the applicable PQL was available for silver. SCE&G used a value for the incoming water concentration for silver equal to the PQL of 5 µg/L. Although this value exceeds the relevant SCDHEC CMC, SCE&G does not believe the limited data for silver supports a conclusion that the water quality in Monticello Reservoir is degraded or that the blowdown effluent would degrade the water quality in Parr Reservoir. Future NPDES permit evaluations for the blowdown discharge would confirm protection of water quality.

Blowdown flow rate (normal) 9383 gpm  
 Broad River at VCSNS 7Q10 382,800 gpm  
 Broad River annual mean flow at VCSNS 2,828,000 gpm

# Site Layout and Plant Description

- NOTES:**
1. VALUES SHOWN AS XXX (XXX) ARE NORMAL FLOW VALUES AND VALUES SHOWN AS XXX (XXX) ARE FLOW VALUES FOR PUMPED FLOW. FLOW VALUES ARE FOR THE FLOW BETWEEN THE MONTECELLO RESERVOIR AND THE PARR RESERVOIR. FOR A FLOW STREAM SUMMARY AND ADDITIONAL NOTES, REFER TO THE PLANT WATER USE TABLE (TABLE 3.9.4).
  2. THE WATER USE FOR THE POWER PLANT THROUGH (F) FOR STREAM INTERFACE POINTS THROUGH (F) FOR STREAM INTERFACE POINTS 3.3.2. SEE CORRESPONDING NODES (A THROUGH F) FOR STREAM INTERFACE POINTS. THE SHORT TERM LIQUID WASTE DISCHARGE FLOWRATE MAY BE HIGHER, REGARDLESS OF THE FLOWRATE OF THE AVAILABLE DILUTION FLOW TO MAINTAIN THE EFFLUENT ACTIVITY LEVEL WITHIN REQUIRED LIMITS.
  3. THE PARR RESERVOIR IS LOCATED ON THE WEST SIDE OF THE MONTICELLO RESERVOIR AND BETWEEN THE MONTECELLO RESERVOIR AND THE PARR RESERVOIR VIA THE FAIRFIELD PUMPED STORAGE FACILITY.
  4. ONLY PUMPED WASTE STREAMS TO THE PARR RESERVOIR ARE PUMPED. INTERNALLY RECYCLED STREAMS ARE NOT DEPICTED.
  5. FLOWS ARE INTERMITTENT OR RECIRCULATED AND THEREFORE CONSIDERED ZERO.
  6. FLOW VARIES AS REQUIRED TO ENSURE ADEQUATE DILUTION FOR LIQUID WASTE DISCHARGE TO THE PARR RESERVOIR. NOT SUFFICIENT FLOW RATE ON ALTERNATE DILUTION STREAM WHEN COMBINED WITH EXISTING MAXIMUM ALLOWED DISCHARGE. EXCEEDS MAXIMUM ALLOWED DISCHARGE FOR FINAL EFFLUENT DISCHARGE TO PARR RESERVOIR.
  7. FLOWPATH PROVIDED FOR UNFILTERED RAW WATER FOR MAKEUP TO SERVICE WATER SYSTEM IS NOT NORMALLY USED.

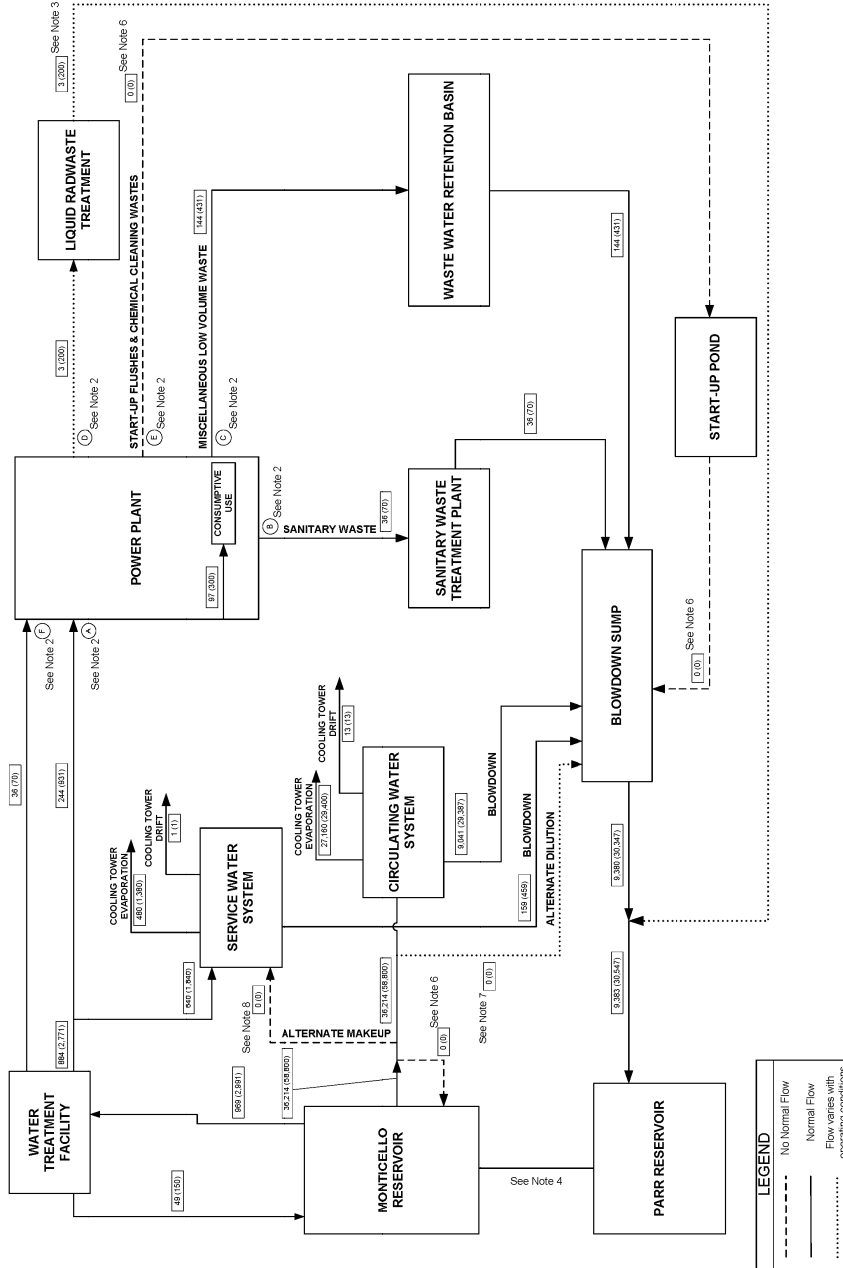


Figure 3-10. Water-Use Summary Diagram (SCE&G 2009a)

1 2 3

1 The liquid radioactive waste-treatment system discharges to the blowdown pipeline downstream  
 2 of the blowdown sump. SCE&G estimated the liquid radioactive waste-treatment system  
 3 discharge flow rate to be approximately 3 gpm (maximum 200 gpm). However, the discharge  
 4 flow rate would be adjusted to make sure radionuclide levels would be maintained below  
 5 permitted discharge limits (SCE&G 2009a).

6 ***Sanitary Wastewater-Treatment Plant***

7 The expected sanitary-system effluent flow rate is 36 gpm under normal operating conditions  
 8 and 70 gpm maximum (SCE&G 2009a). Liquid effluent from the sanitary wastewater system  
 9 would be discharged to the blowdown sump where it would be combined with cooling-tower  
 10 blowdown water before being discharged to Parr Reservoir (Figure 3-10).

11 Sludge generated from the sanitary wastewater-treatment system would be disposed of in an  
 12 approved manner, including shipment offsite or disposal at an approved onsite location.  
 13 Nonradioactive waste management is described further in Section 3.4.4.

14 ***Water-Treatment Plant***

15 The water-treatment plant that would provide treated water to other plant water systems  
 16 (service, demineralized, potable, and fire protection water systems) would return 49 gpm of  
 17 water to Monticello Reservoir under normal operating conditions and 150 gpm maximum  
 18 (SCE&G 2009a). This effluent would discharge into the existing Unit 1 cooling-water discharge  
 19 canal that discharges into Monticello Reservoir (Figure 3-1).

20 ***Stormwater-Management System***

21 The stormwater-management system for proposed VCSNS Units 2 and 3 would be designed to  
 22 direct runoff away from buildings via drainage ditches and swales to stormwater-retention  
 23 basins. Water from the stormwater-retention basins (shown in Figure 3-5) would ultimately  
 24 discharge to Mayo Creek to the east, an unnamed creek to the south, or an unnamed creek to  
 25 the west. The two unnamed creeks flow into Parr Reservoir; Mayo Creek flows into the Broad  
 26 River below Parr Shoals Dam. The design and operation of the stormwater systems for the  
 27 proposed VCSNS Units 2 and 3 would comply with NPDES stormwater regulations  
 28 administered by the SCDHEC.

29 **3.4.2.4 Power Transmission System**

30 As noted in Section 3.2.2.3, transmission lines and corridors are considered to interface with the  
 31 environment during plant operation, because there are potential continuing impacts from electric  
 32 fields, noise, and corridor maintenance. Corridor maintenance requires controlling woody  
 33 vegetation and maintaining access roads. Both SCE&G and Santee Cooper have established  
 34 procedures for transmission system inspection and for maintenance of transmission-line

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1 corridors using both chemical (U.S. Environmental Protection Agency [EPA]-registered  
2 herbicides) and mechanical (tree trimming, mowing, hand clearing) means of vegetation control  
3 (SCE&G 2009a, e; Sott 2006; MACTEC 2008, Appendix B).

### 4 **3.4.2.5 Emergency Diesel Generators**

5 Proposed Units 2 and 3 would each have two 4000-kW standby generators and two 35-kW  
6 ancillary diesel generators. Emissions from these generators include particulates, sulfur oxides,  
7 carbon monoxide, hydrocarbons, nitrogen oxides, and carbon dioxide (SCE&G 2009a). When  
8 operated, the generators would produce gaseous emissions that would comply with all  
9 emissions standards, including EPA Tier 4 requirements governing diesel emissions being  
10 phased in over the 2009–2015 period. Gaseous releases would comply with levels permitted by  
11 the SCDHEC (SCE&G 2009a).

### 12 **3.4.3 Radioactive Waste-Management System**

13 Liquid, gaseous, and solid radioactive waste-management systems would be used to collect  
14 and treat the radioactive materials produced as byproducts of operating proposed Units 2 and 3.  
15 These systems would process radioactive liquid, gaseous, and solid effluents to maintain  
16 releases within regulatory limits and to levels as low as is reasonably achievable before  
17 releasing them to the environment. Waste processing systems would be designed to meet the  
18 design objectives of 10 CFR Part 50, Appendix I (“Numerical Guides for Design Objectives and  
19 Limiting Conditions for Operation to Meet the Criterion ‘As Low as is Reasonably Achievable’ for  
20 Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents”). The radioactive  
21 waste-management systems are not shared between the existing Unit 1 and proposed Units 2  
22 and 3. Radioactive materials in the reactor coolant would be the primary source of gaseous,  
23 liquid, and solid radioactive wastes in AP1000s. Radioactive fission products build up within the  
24 fuel as a consequence of the fission process. These fission products would be contained in the  
25 sealed fuel rods, but small quantities could escape the fuel rods into the reactor coolant.  
26 Neutron activation of the primary coolant system would also add radionuclides to the coolant.

27 The Offsite Dose Calculation Manual (ODCM) for the VCSNS (SCE&G 2007) describes the  
28 methods and parameters used for calculating offsite radiological doses from liquid and gaseous  
29 effluents. The ODCM also describes the methodology for calculation of gaseous and liquid  
30 monitoring alarm/trip set points for release of effluents from VCSNS. Operational limits for  
31 releasing liquid and gaseous effluents are also specified in the ODCM to ensure compliance  
32 with NRC regulations.

33 The systems used to process liquid, gaseous, and solid wastes are described in the following  
34 sections. A more detailed description of these systems for proposed Units 2 and 3 can be found  
35 in Chapter 11 of the *AP1000 Design Control Document* (Westinghouse 2008). Solid radioactive  
36 wastes produced from operating proposed VCSNS Units 2 and 3 would be both dry and wet  
37 solids.

### 1 **3.4.3.1 Liquid Radioactive Waste-Management System**

2 The liquid radioactive waste-management system functions to control, collect, segregate,  
3 process, handle, store, and dispose of liquids containing radioactive material such that any  
4 discharged liquid effluents are below concentration levels specified in 10 CFR Part 20,  
5 Appendix B, Table 2 (Westinghouse 2008). The system uses several process trains consisting  
6 of tanks, pumps, ion exchangers, and filters and is designed to handle both normal and  
7 anticipated operational occurrences. Normal operations include processing of: (1) borated,  
8 reactor-grade waste water, (2) floor drains and other wastes with potentially high suspended  
9 solid contents, (3) detergent wastes, and (4) chemical wastes. In addition, the radioactive  
10 waste-management system can handle effluent streams that typically do not contain radioactive  
11 material, but that may, on occasion, become radioactive (e.g., steam generator blowdown as a  
12 result of steam generator tube leakage). With two exceptions, liquid effluents processed  
13 through the liquid radioactive waste-management system are discharged to the environment.  
14 The exceptions are steam generator blowdown that is normally returned to the condensate  
15 system after processing and reactor coolant that can be degassed prior to reactor shutdown and  
16 returned to the reactor coolant system.

17 Liquid waste is discharged in batches, with flow rates controlled during discharge to maintain  
18 acceptable concentrations when diluted by other nonradioactive liquid effluents, primarily  
19 cooling tower blowdown (SCE&G 2009a). The diluted liquid radioactive waste would be  
20 discharged into the blowdown discharge pipeline below the blowdown sump, and ultimately  
21 discharged to Parr Reservoir. The rate of discharge into the blowdown discharge pipeline is  
22 controlled and monitored to make sure the average annual effluent concentration limits from  
23 10 CFR Part 20 are not exceeded. The calculated dose to the maximally exposed individual  
24 (MEI) from liquid effluents is evaluated in Section 5.9.2 of this EIS.

### 25 **3.4.3.2 Gaseous Radioactive Waste-Management System**

26 The gaseous radioactive waste-management system functions to collect, process, and  
27 discharge radioactive or hydrogen-bearing gaseous wastes. It is a once-through, ambient  
28 temperature, activated carbon delay system (Westinghouse 2008). Radioactive isotopes of  
29 iodine and the noble gases xenon and krypton are created as fission products within the fuel  
30 rods during operation. Some of these gases escape to the reactor coolant system through  
31 cladding defects and subsequently decay to stable isotopes and are released to the  
32 environment via plant ventilation, or are captured and then released by the gaseous radioactive  
33 waste-management system. In addition, various gaseous activation products, such as  
34 argon-41, are formed directly in the reactor containment during operation. The gaseous  
35 radioactive waste-management system is typically active only when monitored gaseous  
36 concentrations reach a given threshold. Waste gas flows through a guard bed that removes  
37 iodine, oxidizing chemicals, and moisture. From the guard bed it flows through two delay beds  
38 containing activated carbon that dynamically adsorbs and desorbs the gases, delaying them

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1 long enough for significant radioactive decay to occur. The gaseous system can only delay  
2 noble gases, not collect them. If noble gases monitored in the coolant reach a threshold value,  
3 then the reactor coolant is diverted to the liquid radioactive waste-management system where  
4 the noble gases can be collected using the degasifier.

5 Radioactive gaseous effluents from the system described above are discharged through the  
6 plant vent, which is on the side of the containment building about 183 ft above grade level  
7 (Westinghouse 2008). The rate of discharge into the atmosphere is controlled and monitored to  
8 verify that the average annual effluent concentration limits from 10 CFR Part 20 are not  
9 exceeded (SCE&G 2009a). The calculated dose to the MEI from gaseous effluents is evaluated  
10 in Section 5.9.2 of this EIS.

### 11 **3.4.3.3 Solid Radioactive Waste Management System**

12 The solid radioactive waste-management system functions to treat, temporarily store, package,  
13 and dispose of dry or wet solids. Solid radioactive wastes include spent ion-exchange resins,  
14 deep-bed filtration media, spent filter cartridges, dry active wastes, and mixed wastes. The  
15 system has a 60-year design objective and is designed to handle both normal and anticipated  
16 operational occurrences. The packaged wastes would be temporarily stored in the auxiliary and  
17 radwaste buildings prior to being shipped to a licensed disposal facility. The AP1000 solid  
18 waste-management system releases no gaseous or liquid effluent directly to the environment.  
19 This system discharges effluent through the liquid and gaseous waste-management systems.

20 The expected total annual volume of solid radioactive waste treated and shipped would be  
21 1964 ft<sup>3</sup>/yr from each unit with an expected total activity of radioactive material shipped from  
22 each unit of 1764 Ci/yr (SCE&G 2009a). The maximum total annual volume of solid radioactive  
23 waste shipped from each unit is estimated at 5717 ft<sup>3</sup>/yr with a maximum total activity of  
24 radioactive material of 33,670 Ci/yr.

25 The storage and transportation of used reactor fuel is discussed in Chapter 6, Fuel Cycle,  
26 Transportation, and Decommissioning.

### 27 **3.4.4 Nonradioactive Waste-Management Systems**

28 The following sections provide descriptions of the nonradioactive waste systems proposed for  
29 VCSNS Units 2 and 3, including systems for chemical (including biocide), sanitary, and other  
30 effluents. All discharges to surface waters would be regulated by an NPDES permit that would  
31 limit the volume and constituent concentrations.



1 **3.4.4.1 Effluents Containing Chemicals or Biocides**

2 Water withdrawn from Monticello Reservoir for use in the CWS and the SWS would be treated  
 3 with both biocides and other chemicals. The biocides would be used to control biofouling of the  
 4 systems, and other chemicals would be added to control scaling, corrosion, and solids  
 5 deposition (SCE&G 2009a). SCE&G estimated the amount, frequency of use, and  
 6 concentrations of chemicals and biocides for proposed VCSNS Units 2 and 3 (Table 3-5). While  
 7 some variation occurs in chemical treatment to meet particular water-use needs, plant effluents  
 8 are required to be within regulated discharge limits (i.e., 40 CFR Part 423). Natural constituents  
 9 in Monticello Reservoir in the vicinity of the VCSNS site are provided in Table 2-11. As  
 10 described in Section 3.4.2, naturally occurring chemicals and trace minerals in the makeup  
 11 water would be concentrated up to four times in the blowdown prior to discharge to Parr  
 12 Reservoir (Table 3-4).

13 **Table 3-5. Waste Stream Concentration of Water-Treatment Chemicals from Two Units**

Chemical-Type / Specific	Frequency of Use	Concentration in Waste Stream
Biocide/sodium hypochlorite	1.5 h/d	0.05 ppm residual chlorine
Algaecide/quaternary amine	Intermittent	<10 ppm
pH adjustment/sulfuric acid	Continuous	10 ppm
Corrosion Inhibitor/ortho-polyphosphate	Continuous	14.5 ppm
Silt dispersant/polyacrylate	Continuous	25 ppm
Scale inhibitor/phosphonate	Continuous	1.5 ppm
Coagulant/polyaluminum chloride	Intermittent	0.000042-0.00013 lb/gal
Anti-scalant/polyacrylate	Intermittent	150-450 ppm polyacrylate
Oxygen scavenging/hydrazine	2.5 h/y or 1.25 h per shutdown	100 ppm hydrazine <sup>(a)</sup>
pH adjustment/ammonium hydroxide	20.7 h/y or 10.4 h per shutdown	100 ppm ammonia <sup>(a)</sup>

Source: SCE&G 2009a

(a) If steam generator is drained to the wastewater system.

14 **3.4.4.2 Sanitary System Effluents**

15 As described in Sections 3.2 and 3.4.2, a new sanitary wastewater-treatment plant would be  
 16 installed to serve the operational needs of VCSNS Units 2 and 3. This plant would process  
 17 sanitary water and waste to meet local and State regulations for effluent quality as specified in  
 18 the NPDES permit (SCE&G 2009a). The sanitary wastewater-treatment plant would discharge  
 19 36 gpm of treated wastewater (70 gpm maximum) to the blowdown sump and thence to Parr  
 20 Reservoir. Sludge from treatment plant holding tanks would be managed according to  
 21 SCDHEC regulation, either by disposal in a landfill or onsite at a location approved by SCDHEC  
 22 (SCE&G 2009a; SCDHEC 2009).

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### 1 **3.4.4.3 Other Effluents**

2 The plant wastewater system is designed to manage liquid effluent streams that would contain  
3 pollutants from system flushing wastes during startup; oil, grease, and suspended solids from  
4 floor drains; corrosion and wear of plant piping and equipment; and liquid waste generated  
5 during maintenance or inspection activities. These waste streams would be collected in sumps,  
6 processed (e.g., through an oil separator), and discharged to a retention basin (normal plant  
7 wastewater) or pond (startup flushing) for settling of solids. Liquid from the retention basin  
8 (144 gpm normal, 431 gpm maximum) and startup pond (intermittent) would be pumped to the  
9 blowdown sump for discharge to Parr Reservoir (Figure 3-10).

10 The new water-treatment plant that would pretreat water for the SWS and other plant water  
11 systems would return 49 gpm water (150 gpm maximum) to Monticello Reservoir via the  
12 existing Unit 1 discharge canal (Figure 3-4, grid reference D2).

13 Nonradioactive solid wastes include typical solid waste (garbage, wood, paper, metal), and  
14 nonradioactive resins, filters, and sludge. SCE&G would recycle or recover scrap metal,  
15 aluminum, oil, antifreeze, batteries, cardboard, and paper. Nonradioactive resins would be  
16 disposed of in an industrial landfill. Oil and solids periodically collected from the wastewater  
17 processing system would also be shipped offsite for disposal. As noted above, sanitary  
18 treatment plant sludge would be applied at an SCDHEC-approved location onsite, or shipped  
19 offsite for disposal at a permitted facility (SCE&G 2009a).

20 Being classified as a large-quantity generator of hazardous waste, any such waste generated at  
21 the VCSNS site would be temporarily stored onsite and then disposed of offsite at a permitted  
22 facility (SCE&G 2009a). Hazardous wastes would be managed in compliance with Resource  
23 Conservation and Recovery Act and South Carolina Hazardous Waste Management Act  
24 requirements.

### 25 **3.4.5 Summary of Resource Commitments During Operation**

26 Table 3-6 provides a list of the significant resource commitments involved in operating Units 2  
27 and 3. The values in the table, combined with the affected environment described in Chapter 2  
28 of this EIS, provide a part of the basis for the operational impacts assessed in Chapter 5. These  
29 values were stated in the ER, and the review team has determined that the values are not  
30 unreasonable.

1 **Table 3-6. Resource Commitments Associated with Units 2 and 3 Operation**

Resource(s)	Value	Description
Hydrology-Surface Water, Aquatic Ecology	37,183 gpm (83 cfs)	Normal operational raw-water withdrawal from Monticello Reservoir, all cooling towers for both units operating at four cycles of concentration
	61,791 gpm (138 cfs)	Maximum operational water withdrawal from Monticello Reservoir, all cooling towers for both units operating at two cycles of concentration
Hydrology-Surface Water, Meteorology-Air Quality	27,160 gpm	Normal CWS evaporation rate
	29,400 gpm	Maximum CWS evaporation rate
Meteorology-Air Quality, Terrestrial Ecology	13 gpm	Normal CWS drift rate
	13 gpm	Maximum CWS drift rate
Hydrology-Surface Water	27,751 gpm (62 cfs)	Normal consumptive water use (all systems combined)
	31,094 gpm (69 cfs)	Maximum consumptive water use (all systems combined)
Hydrology-Surface Water	9383 gpm (21 cfs)	Normal discharge flow rate to Parr Reservoir (all systems combined, 98 percent is blowdown)
	30,547 gpm (68 cfs)	Maximum discharge flow rate to Parr Reservoir (all systems combined, 98 percent is blowdown)
Hydrology-Surface Water, Aquatic Ecology	78.7°F 70.8°F to 86.6°F	Average blowdown temperature Range of modeled monthly blowdown temperatures
	91.8°F	Maximum blowdown temperature
Terrestrial Ecology, Meteorology-Air Quality	70 ft	CWS cooling-tower height
Terrestrial Ecology	229 ft above plant grade	Tallest building height (shield building)
Socioeconomics	800 workers	Normal operating workforce for two units
	1800 workers	Maximum workforce during refueling outages lasting 3 to 5 weeks
Terrestrial Ecology, Nonradiological Health, Socioeconomics	71 dBA 55 dBA 55 dBA	CWS cooling-tower sound level at 200 ft CWS cooling-tower sound level at 1000 ft Diesel generators sound level at 1000 ft
Uranium Fuel Cycle, Transportation Need for	3400 MW(t)	Thermal power rating per unit
Power	1200 MW(e)	Gross electrical output per unit 87°F circulating water cold water temperature
	93 MW(e)	Station load per unit
Uranium Fuel cycle, Transportation	93 percent	Expected annual capacity factor

## 1 **3.5 References**

- 2 10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, “Standards for  
3 Protection against Radiation.”
- 4 10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, “Domestic Licensing of  
5 Production and Utilization Facilities.”
- 6 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, “Environmental  
7 Protection Regulations for Domestic Licensing and Related Regulatory Functions.”
- 8 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, “Licenses,  
9 Certifications, and Approvals for Nuclear Power Plants.”
- 10 40 CFR Part 423. Code of Federal Regulations, Title 40, *Protection of the Environment*,  
11 Part 423, “Steam Electric Power Generating Point Source Category.”
- 12 71 FR 4464. January 27, 2006. “AP1000 Design Certification.” *Federal Register*. U.S. Nuclear  
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- 23 Sott, K.R. 2006. *Santee Cooper – Transmission Vegetation Management Program*. Accession  
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5 *Carolina Electric and Gas Company Virgil C. Summer Nuclear Station*. Revision 26.  
6 Jenkinsville, South Carolina. Accession No. ML081280582 and ML072910571.
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8 *COL Application, Part 2, Final Safety Analysis Report*. Revision 0, Jenkinsville, South Carolina.  
9 Accession No. ML081300555.
- 10 South Carolina Electric and Gas (SCE&G). 2009a. *V.C. Summer Nuclear Station, Units 2 and*  
11 *3 COL Application, Part 3, Applicant's Environmental Report – Combined License Stage*.  
12 Revision 1, Jenkinsville, South Carolina. Accession No. ML090510261.
- 13 South Carolina Electric and Gas (SCE&G). 2009b. *V.C. Summer Nuclear Station, Units 2 and*  
14 *3 COL Application, Part 2, Final Safety Analysis Report*. Revision 1, Jenkinsville, South  
15 Carolina. Accession No. ML092170463.
- 16 South Carolina Electric and Gas (SCE&G). 2009c. Letter from R.B. Clary (SCE&G) to U.S.  
17 Nuclear Regulatory Commission in response to letters from S.A. Byrne dated March 27, 2008  
18 and R.B. Clary dated February 13, 2009, "Subject: V.C. Summer Nuclear Station Units 2 and 3,  
19 Docket Numbers 52-027 and 52-028, Combined License Application – Environmental Report  
20 Audit Information Needs: G-3, GW-4, HP-6, HP-10, HP-11, LU-4, and SE-1." NND-09-0148.  
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25 Docket Numbers 52-027 and 52-028, Combined License Application – Response to NRC  
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17

## 4.0 Construction Impacts at the VC Summer Site

This chapter examines the environmental issues associated with building the proposed nuclear reactor Units 2 and 3 at the Virgil C. Summer Nuclear Station (VCSNS) site as described in the application for combined construction permits and operating licenses (COLs) submitted to the U.S. Nuclear Regulatory Commission (NRC) by South Carolina Electric and Gas (SCE&G) (SCE&G 2008). As part of its application, SCE&G submitted an Environmental Report (ER) (SCE&G 2009a), which discusses the environmental impacts of building, operating, and decommissioning proposed Units 2 and 3 and a Final Safety Analysis Report (SCE&G 2009o), which addresses safety aspects of construction and operation.

In addition, SCE&G submitted the *Combined Application of South Carolina Electric and Gas Company for a Certificate of Environmental Compatibility and Public Convenience and Necessity and for a Base Load Review Order for the Construction and Operation of a Nuclear Facility in Jenkinsville, South Carolina*, to the Public Service Commission of South Carolina (PSCSC) on May 30, 2008. The final order provided by the PSCSC approving the combined application and Certificate of Environmental Compatibility and Public Convenience and Necessity (CPCN) was issued to SCE&G on March 2, 2009 (PSCSC 2009).

As discussed in Section 3.3 of this environmental impact statement (EIS), the NRC's authority related to building new nuclear generating units is limited to "activities that have a reasonable nexus to radiological health and safety and/or common defense and security" (72 FR 57416). Many of the activities required to build a nuclear power plant do not fall within the NRC's regulatory authority and, therefore, are not "construction" as defined by the NRC. Such activities are referred to as "preconstruction" activities in Title 10 of the Code of Federal Regulations (CFR) 51.45(c). The NRC staff evaluates the direct, indirect, and cumulative impacts of the construction activities that would be authorized with the issuance of a COL. The environmental effects of preconstruction activities (e.g., clearing and grading, excavation, and erection of support buildings) are included as part of this EIS in the evaluation of cumulative impacts.

As described in Section 1.1.3, the U.S. Army Corps of Engineers (USACE) is working as a cooperating agency on this EIS consistent with the Memorandum of Understanding (MOU) (USACE and NRC 2008). The NRC and USACE concluded that entering into a cooperative agreement on preparation of this EIS is the most effective and efficient use of Federal resources in the environmental review of impacts associated with building proposed Units 2 and 3 at the VCSNS site. The goal of this cooperative agreement is to develop one EIS that provides all of the environmental information and analyses needed by the NRC to make a license/permit decision and all of the information needed by the USACE to perform analyses, draw conclusions, and make a permit decision in the USACE's Record of Decision (ROD)

## Construction Impacts at the VC Summer Site

1 documentation. To accomplish this goal, the environmental review described in this EIS was  
2 conducted by a joint NRC/USACE review team. The review team was composed of NRC staff,  
3 its contractor's staff, and USACE staff.

4 The information needed by the USACE includes information to perform (1) analyses to  
5 determine that the proposed action is the least environmentally damaging practicable alternative  
6 (LEDPA), and (2) its public interest assessment. To perform the public interest assessment, the  
7 USACE considers the following public interest factors: conservation, economics, aesthetics,  
8 general environmental concerns, wetlands, historic and cultural resources, fish and wildlife  
9 values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion,  
10 recreation, water supply, water quality, energy needs, safety, food and fiber production, and  
11 mineral needs.

12 Many of the impacts the USACE must address in its LEDPA analysis are the result of  
13 preconstruction activities. Also, most of the activities conducted by a COL applicant that would  
14 require a Department of the Army (DA) permit would be related to preconstruction. On March 2,  
15 2010, SCE&G submitted an application to the USACE for a permit to conduct the following  
16 activities: filling, dredging, excavating, grading, removing or destroying vegetation, and building  
17 structures.

18 While both NRC and the USACE must meet the requirements of the National Environmental  
19 Policy Act of 1969, as amended (NEPA), both agencies also have additional requirements  
20 related to their permitting or licensing authorities. The NRC's regulatory authority is based on  
21 the Atomic Energy Act of 1954, as amended (42 USC 2011 et seq.). The USACE's regulatory  
22 authority related to the proposed action is based on Section 10 of the Rivers and Harbors  
23 Appropriations Act of 1899 (33 USC 403), which prohibits the obstruction or alteration of  
24 navigable waters of the United States without a permit from the USACE, and Section 404 of the  
25 Clean Water Act (33 USC 1344), which prohibits the discharge of dredged or fill material into  
26 waters of the United States without a permit from the USACE. Therefore, an applicant may not  
27 commence preconstruction or construction activities in jurisdictional waters, including wetlands,  
28 without a DA permit. The permit would typically be issued after the USACE's evaluation and  
29 public feedback in the form of public comments on its draft environmental review. Because the  
30 USACE is a cooperating agency under the MOU for this EIS, the USACE's ROD of whether to  
31 issue a permit will not be made until after public comment has been received on this  
32 NRC/USACE draft EIS and the final EIS is issued.

33 The collaborative effort of the NRC and the USACE in presenting their discussion of the  
34 environmental effects of building the proposed project, in this chapter and elsewhere, must  
35 serve the needs of both agencies. Consistent with the MOU, the staff of the NRC and the  
36 USACE collaborated in: (1) the review of the COL application and information provided in  
37 response to requests for additional information (developed by the NRC and the USACE) and  
38 (2) the development of the EIS. NRC regulations (10 CFR 51.45(c)) require that the impacts of



1 preconstruction activities be addressed by the applicant as cumulative impacts in its ER.  
2 Similarly, the NRC's analysis of the environmental effects of preconstruction activities on each  
3 resource area would be addressed as cumulative impacts, normally presented in Chapter 7.  
4 However, because of the collaborative effort between the NRC and the USACE in this  
5 environmental review, the combined impacts of construction activities that would be authorized  
6 by the NRC with its issuance of a COL and the preconstruction activities are presented in this  
7 chapter. For each resource area, the NRC also provides an impact characterization solely for  
8 construction activities that meet the NRC's definition of construction at 10 CFR 50.10(a).  
9 Thereafter, both the assessment of the impacts of 10 CFR 50.10(a) construction activities and  
10 the assessment of the combined impacts of construction and preconstruction activities are used  
11 in the description and assessment of cumulative impacts in Chapter 7 of this EIS.

12 For most environmental resource areas (e.g., aquatic ecology), the impacts are not the result of  
13 either solely preconstruction or solely construction activities. Rather, the impacts are  
14 attributable to a combination of preconstruction and construction activities. For most resource  
15 areas, the majority of the impacts would occur as a result of preconstruction activities.

16 This chapter is divided into 13 sections. In Sections 4.1 through 4.10, the review team  
17 evaluates the potential impacts on land use, meteorology and air quality, water use and quality,  
18 terrestrial and aquatic ecosystems, socioeconomics, environmental justice, historic and cultural  
19 resources, nonradiological health effects, and nonradioactive waste. In Section 4.9, the NRC  
20 staff assesses the potential radiological health impacts to construction workers. An impact  
21 category level – SMALL, MODERATE or LARGE – of potential adverse impacts has been  
22 assigned by the review team for each resource area using the definitions for these terms  
23 established in Chapter 1. In some resource areas, for example, in the socioeconomic area  
24 where the impacts of taxes are analyzed, the impacts may be considered beneficial and would  
25 be stated as such. The review team's determination of the impact category levels is based on  
26 the assumption that the mitigation measures identified in the ER or activities planned by various  
27 State and county governments, such as infrastructure upgrades (discussed throughout this  
28 chapter), are implemented. Failure to implement these upgrades might result in a change in the  
29 impact category level. Possible mitigation of adverse impacts, where appropriate, is presented  
30 in Section 4.11. A summary of the construction impacts is presented in Section 4.11. Citations  
31 for the references cited in this chapter are listed in Section 4.13. The technical analyses  
32 provided in this chapter support the results, conclusions, and recommendations presented in  
33 Chapters 7, 9, and 10 of this EIS.

34 The review team's evaluation of the impacts of construction of proposed VCSNS Units 2 and 3  
35 draws on information presented in SCE&G's ER, supplemental documents, the USACE's  
36 permitting documentation, as well as other government and independent sources.

## 1 **4.1 Land-Use Impacts**

2 This section provides information about the land-use impacts associated with site-preparation  
3 activities and building of Units 2 and 3 at the VCSNS site. Topics discussed include land-use  
4 impacts at the site and in the vicinity of the site and land-use impacts within transmission-line  
5 corridors and on offsite areas.

### 6 **4.1.1 The Site and Vicinity**

7 VCSNS Units 2 and 3 would be located southwest of the existing Unit 1 on the VCSNS site.  
8 The VCSNS site encompasses about 3600 ac of land and water entirely owned by SCE&G.  
9 The review team estimates that roughly 500 ac at the site would be required for the new units,  
10 including all laydown areas and support functions, which would include onsite transmission-line  
11 improvements. Additional land disturbance would occur to install a new cooling-water makeup  
12 pipeline between VCSNS Units 2 and 3 and Monticello Reservoir. The location of Units 2 and 3  
13 and supporting facilities is not classified as prime farmland. The site is not used as agricultural  
14 land or for mineral extraction, but is actively managed for forestry.

15 SCE&G indicated that developing the site would result in the removal of approximately 225 ac of  
16 planted pine forest, 103 ac of naturally vegetated pine forest, 65 ac of mixed pine-hardwood  
17 forest, and 41 ac of hardwood forest. The remaining 56 ac that would be affected consist of  
18 nonforested, open, and recently cleared areas and the estimated areas for the access road  
19 (18 ac) and water-treatment plant (10 ac) (SCE&G 2009a).

20 Based on SCE&G's ER (SCE&G 2009a) and the review team's characterization of site  
21 development activities in Section 3.3 of this EIS, the review team believes the following major  
22 activities would cause land-use impacts on the VCSNS site and in the vicinity:

- 23 • Approximately 240 ac would be permanently altered on the site to build VCSNS Units 2 and  
24 3 and associated infrastructure. This would include all excavation, trenching, and dredging  
25 for new intake and blowdown pipelines and the new water-treatment facility. It also would  
26 include clearing land for the new switchyard (38 ac).
- 27 • Approximately 180 ac within the plant site would be altered for temporary laydown and  
28 spoils storage. This area would include the concrete batch plant, spoils deposition areas,  
29 and temporary site support areas.
- 30 • A new 1.5-mi, four-lane, paved, main access road would link Parr Road with the VCSNS  
31 Units 2 and 3 site, requiring approximately 10 ac on the site in addition to the affected areas  
32 above.
- 33 • A new 1.5-mi improved access road would link the Units 2 and 3 cooling-tower area to an  
34 intake structure at Monticello Reservoir, affecting about 3 ac of land on the site.

- 1 • Parr Road and South Lake Access Road would be upgraded to accommodate increased  
2 traffic, and approximately 3/4 mi of the South Lake Access Road would be relocated to run  
3 parallel to and east of the existing railroad spur into the site, terminating at the VCSNS Units  
4 2 and 3 discharge structure. About 2 ac of land on the site would be affected to  
5 accommodate the upgrading.
- 6 • The existing railroad line would be rerouted through a fabrication and laydown area between  
7 the new units and the cooling towers, and would be supplemented with an additional railroad  
8 spur. A new spur also may be routed into the unloading areas at the concrete batch plant.  
9 Norfolk Southern Railway's existing railroad line also may require upgrades to support the  
10 heaviest loads. Upgrades may include installing new ballast or rail sections on the existing  
11 railroad bed, both on and off of the site. The review team expects these impacts to occur  
12 within the footprints described above.
- 13 • Dredging in Parr Reservoir (off of the site) would be required to establish the blowdown  
14 discharge for VCSNS Units 2 and 3. Dredge spoils would be disposed of in a 5.5-ac onsite  
15 spoils disposal area about a 1/2 mi east of the river (see Figure 4-1).
- 16 • Miscellaneous disturbance of as much as 60 additional acres on the site.

17 Approximately 0.26 ac of wetlands on the VCSNS site would be affected by developing the  
18 proposed new units and associated infrastructure. Wetland impacts are discussed in greater  
19 detail in Section 4.3.1.

20 Land-clearing activities would be mitigated to the extent possible. SCE&G would use best  
21 management practices (BMPs) during site development and would conform to all applicable laws  
22 and regulations. Examples of expected mitigation activities include wetland avoidance, use of  
23 stormwater-management systems, and implementation of spill containment controls before earth-  
24 disturbing activities begin. Site-development activities that would affect land use include clearing,  
25 grubbing, grading and excavating, and stockpiling soils. Re-vegetation would comply with site  
26 maintenance and safety requirements. Permanently disturbed locations would be stabilized and  
27 contoured in accordance with design specifications. Methods to stabilize areas and prevent  
28 erosion or sedimentation would comply with accepted engineering, construction practices, and  
29 recognized environmental BMPs (SCE&G 2009a).

30 Based on information provided by SCE&G and the review team's independent evaluation, the  
31 review team recognizes that land-use changes on the VCSNS site would be substantial and  
32 notes several planned mitigation activities SCE&G would be implemented to lessen impacts.  
33 New land-use impacts on the site were viewed by the review team in the context of the previous  
34 significant impacts from building Unit 1. The site has already been significantly altered by that  
35 development and the associated operations (timber harvesting, etc.), and the development of  
36 the site is consistent with current zoning ordinances, as described in Section 2.2.1. Therefore,  
37 the review team concludes that land-use impacts of the proposed action on the site and vicinity  
38 would be SMALL, and additional mitigation would not be warranted.

Construction Impacts at the VC Summer Site



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**Figure 4-1.** Habitats and Areas that Would Be Disturbed by the Development of the VCSNS Site

#### 1 **4.1.2 Transmission-Line Corridors and Other Offsite Areas**

2 In its application for the two COLs, SCE&G proposed to build and operate two units at the  
3 VCSNS site, each with a rated net electrical output capacity of 1107 MW(e). As discussed in  
4 Section 2.2.2 of this EIS, the VCSNS site is connected to the regional power grid via existing  
5 230-kV transmission lines (see Figure 2-4). As illustrated in Figure 2-5, six new 230-kV  
6 transmission lines (four single-circuit lines and one SCE&G double circuit line) are planned to  
7 connect VCSNS Units 2 and 3 to the grid. Two of these lines would be owned by Santee-  
8 Cooper (the State-owned electric and water utility, formally called the South Carolina Public  
9 Service Authority) and routed almost entirely within existing transmission-line corridors  
10 (MACTEC 2008). The existing corridors and transmission lines were originally built to support  
11 the operation of VCSNS Unit 1. The other four lines would be owned by SCE&G. The precise  
12 routing of the SCE&G lines has not been determined, but the review team believes the corridors  
13 identified in Figure 2-5 are representative of the eventual routing.

14 The PSCSC requires any jurisdictional utility (this applies to SCE&G but not Santee Cooper)  
15 proposing to build “major facilities,” including transmission lines of 125 kV or more, to apply for a  
16 CPCN. PSCSC’s rules are found in Title 58, Chapter 33, of the South Carolina Code of Laws  
17 (SC Code Ann. 58-33). An applicant for a CPCN must provide PSCSC with “a summary of any  
18 studies that have been made by or for applicant of the environmental impact of the facility ....”  
19 The PSCSC may not grant a CPCN for the installation, operation, and maintenance of a major  
20 utility facility unless the applicant has adequately defined “the nature of the probable  
21 environmental impact” (SC Code Ann. 58-33-160(1)) and has determined that the impact on the  
22 environment is “...justified, considering the state of available technology and the nature and  
23 economics of the various alternatives” under consideration.

24 According to SCE&G, once the need for additional generating capacity has been demonstrated,  
25 and the size and location of generating units have been determined, SCE&G analyzes  
26 transmission system requirements (SCE&G 2009a). Once the utility determines desired grid  
27 termination and connection points, it initiates the siting process to develop transmission-line  
28 corridors. SCE&G has completed a siting study (FP&S 2008), which the review team has relied  
29 upon in its review.

30 The review team expects that SCE&G transmission-line corridors planned to connect VCSNS  
31 Units 2 and 3 to the grid would require State certification, but the Santee Cooper lines would not  
32 require certification. Although the review team recognizes that State certification would not  
33 apply to Santee Cooper’s proposed transmission system improvements, in siting the new  
34 transmission-line corridors, Santee Cooper would consult with the South Carolina State Historic  
35 Preservation Office (SHPO), the U.S. Fish and Wildlife Service (FWS), and the South Carolina  
36 Department of Natural Resources (SCDNR), and apply for a permit from the USACE.

37 In siting new transmission lines, SCE&G has indicated a number of areas to be avoided in the  
38 transmission-line siting process, if possible, including buildings, mines, airports, military

## Construction Impacts at the VC Summer Site

1 facilities, parks, and wetlands. For any wetlands that are encountered, installation of  
2 transmission lines would be conducted in accordance with necessary State and Federal  
3 regulations to protect wetland areas.

4 SCE&G characterized the proposed routes of the six new transmission lines as follows (SCE&G  
5 2009a):

- 6 1. VCSNS-Killian – This SCE&G line would be routed to the vicinity of Winnsboro, South  
7 Carolina, and then generally follow the Interstate 77 (I-77) corridor to connect to the  
8 existing Killian substation near Killian, South Carolina, southeast of the VCSNS and  
9 northeast of Columbia, South Carolina.
- 10 2. VCSNS-Flat Creek – This Santee Cooper line would connect to the existing Winnsboro  
11 substation near Winnsboro, South Carolina, then to the existing Richburg switching station  
12 near Great Falls, South Carolina, and finally to the existing Flat Creek substation west of  
13 Lancaster, South Carolina.
- 14 3. VCSNS-Lake Murray No. 2 – This SCE&G line would connect to the existing Lake Murray  
15 switchyard for the McMeekin and Saluda Hydro stations near the eastern boundary of Lake  
16 Murray.
- 17 4/5. VCSNS-St. George – This double-circuit SCE&G line would connect to a new substation  
18 near St. George, South Carolina.
- 19 6. VCSNS-Varnville – This Santee Cooper line would connect to the existing Sandy Run  
20 substation near Sandy Run, then to Orangeburg substation in Orangeburg, South Carolina  
21 then to the St. George substation near St. George, and then to the existing Varnville  
22 substation near Varnville, Hampton County, South Carolina.

23 The expected land-use impacts associated with these corridors are given in Table 4-1. For  
24 land-use impact analysis, the review team performed its own analysis of the affected acreage,  
25 based on GIS data provided by the applicant (SCE&G 2009r). The review team used the  
26 specific GIS-based routes to determine what acreage would be affected, based on land-use and  
27 land-cover data from USGS (2001). The review team's analysis indicates that as much as 2100  
28 ac of land may be needed to develop the transmission system for VCSNS Units 2 and 3.  
29 Several factors mitigate this impact. About half of the proposed corridors requiring some  
30 corridor expansion would likely be located immediately adjacent to an existing transmission-line  
31 corridor or other utility corridor. Of the expected 424.5 mi of new transmission lines, more than  
32 half (248.9 mi) would be placed within existing transmission-line corridors and not further  
33 fragment forest cover or other existing land uses. Corridors crossing agricultural areas would  
34 not remove affected land from agricultural production. The majority of the land-use impacts  
35 would occur in the VCSNS-St. George corridor, with the VCSNS-Killian corridor having much  
36 smaller affected acreage, and the other corridors having only minimal acreage affected.

1 **Table 4-1.** Land-Use Impacts of the Proposed New Transmission-Line Corridors

<b>Corridor Name</b>	<b>Termination Point</b>	<b>Total Length (mi)</b>	<b>Length Requiring Expansion of Existing Corridor (mi)</b>	<b>Length Requiring New Corridor (mi)</b>	<b>Corridor width (ft)</b>	<b>Land-Use Impact (ac)</b>
VCSNS-Killian	Killian Substation	36.6	18.9	17.7	100	443.6
VCSNS-Flat Creek	Flat Creek Substation	71.7	0.7	0.0	100	8.5
VCSNS-Lake Murray No. 2	Lake Murray Switchyard	19.0	0.0	0.0	100	0.0
VCSNS-St. George	St. George Substation (proposed)	134.2	65.8	68.4	100	1626.7
VCSNS-Varnville	Varnville Substation	163.0	1.7	0.0	100	20.6
	<b>Total</b>	<b>424.5</b>	<b>87.1</b>	<b>86.1</b>		<b>2099.4</b>

Sources: SCE&G 2009a; MACTEC 2008; SCE&G 2009r

Totals are affected by rounding. Acreages are estimated, based on GIS data provided by SCE&G. Where no corridor width data were available, the review team estimated uniform 100-ft corridor widths, for consistency.

2 Based on information in Table 4-1, the most significant land-use impacts would occur as a result  
 3 of siting over 86 mi of entirely new transmission-line corridors in portions of the VCSNS-Killian  
 4 and VCSNS-St. George corridors. These new portions would not be adjacent to or within  
 5 currently existing corridors. Clearing these new corridors would noticeably alter existing land  
 6 uses on about 1058.1 ac as current uses are converted to utility corridor use. The review team  
 7 estimates, based on proportions presented in Table 2-2, about 390 ac of forested land, some of  
 8 which is currently devoted to silviculture production, would be cleared and converted to utility  
 9 use. Minimal plots of land would be removed from agricultural production where new  
 10 transmission towers would be sited. Land-clearing and transmission-line installation activities in  
 11 the corridors would follow BMPs and would be mitigated to the extent possible. For example,  
 12 agricultural access would not be precluded during the growing season.

13 Information about roads, housing and indirect infrastructure impacts appears in Section 4.4 of  
 14 this EIS. No impacts on offsite land uses (outside of the transmission line corridors) are  
 15 expected to result from the proposed action.

16 Based on information provided by SCE&G and the review team’s independent review, the  
 17 review team concludes that because over 86 mi of entirely new transmission-line corridor would  
 18 be required to connect VCSNS Units 2 and 3 to the grid, coupled with an additional 87 mi of

## Construction Impacts at the VC Summer Site

1 necessary corridor expansion, that land conversions over such long runs would be noticeable to  
2 the general public. SCE&G identified several mitigation methods that would limit the land-use  
3 impacts significantly. Four of the six new corridors would be sited in either an expansion of  
4 existing corridors or entirely within existing corridors to the extent practicable. The review  
5 team's conclusion also is based on the fact that the proposed corridor routing attempted to use  
6 existing corridors to the maximum extent practicable, thereby avoiding potentially significant  
7 land-use impacts. In addition, SCE&G stated that flexibility in routing would prevent significant  
8 impacts on existing urban and residential uses. Therefore, the review team concludes the land-  
9 use impacts of transmission-line installation would be MODERATE, but additional mitigation  
10 beyond the applicant's commitments would not be warranted. Because no other offsite land-  
11 use changes are expected to result directly or indirectly from the proposed action, the review  
12 team concludes that impacts on other offsite land uses would be SMALL.

### 13 **4.1.3 Summary of Land-Use Impacts During Construction and Preconstruction**

14 The review team evaluated the construction and preconstruction activities related to building  
15 proposed VCSNS Units 2 and 3 and the potential land-use impacts at the site and vicinity, in the  
16 region, and in the potential transmission-line corridors. The review team determined that,  
17 because of the large amount of land owned by SCE&G at the VCSNS site and consistency with  
18 local zoning regulations, the land-use impacts of the proposed action would be SMALL at the  
19 site and in the vicinity, MODERATE for proposed transmission-line corridors, and SMALL for  
20 other offsite areas. The review team considered SCE&G's commitments to planned mitigation  
21 activities, including a high degree of transmission-line routing flexibility, as the basis for reaching  
22 these conclusions. Based on the above analysis, and because NRC-authorized construction  
23 activities represent only a part of the analyzed activities (not including transmission-line  
24 installation activities); the NRC staff concludes that the impacts of NRC-authorized construction  
25 activities would be SMALL. The NRC staff also concludes that no further mitigation measures  
26 beyond SCE&G's commitments would be warranted.

## 27 **4.2 Water-Related Impacts**

28 Water-related impacts involved in building a nuclear power plant are similar to impacts that  
29 would be associated with the development of any large industrial site, and not much different  
30 than those seen while building VCSNS Unit 1. Prior to initiating onsite activities, including any  
31 site-preparation work, SCE&G would be required to obtain the appropriate authorizations  
32 regulating alterations to the hydrologic environment. These authorizations would likely include  
33 the following:

- 34 • Clean Water Action Section 404 Permit issued by USACE
- 35 • River and Harbors Act Section 10 Permit issued by the USACE



- 1 • Clean Water Act Section 401 Certification by the South Carolina Department of Health and  
2 Environmental Control (SCDHEC)
- 3 • Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES)  
4 and Industrial Stormwater Permits by SCDHEC
- 5 • Water and Sewer Connection Permits typically issued by a city, county or municipal district.

6 Hydrologic alterations are discussed in Section 4.2.1; water-use impacts are discussed in  
7 Section 4.2.2; water-quality impacts are discussed in Section 4.2.3; and water monitoring is  
8 discussed in Section 4.2.4. This section draws from material presented in SCE&G's ER  
9 (SCE&G 2009a).

#### 10 **4.2.1 Hydrologic Alterations**

11 Activities associated with building the proposed VCSNS Units 2 and 3 would affect several  
12 bodies of surface water and the aquifers underlying the site. Affected bodies of surface water  
13 include Monticello Reservoir, Parr Reservoir, Mayo Creek, and the Broad River below Parr  
14 Shoals Dam. Building VCSNS Units 2 and 3 would require dredging for the installation of the  
15 blowdown discharge diffuser in Parr Reservoir and excavation and/or dredging for installation of  
16 the new intake structures for the circulating-water system and water-treatment plant on  
17 Monticello Reservoir. Other activities would require alteration of the land surface in the vicinity  
18 of the new units. The surface would be contoured to include surface-water drainage ditches  
19 and three stormwater-retention ponds to handle stormwater flows and allow suspended solids to  
20 settle prior to discharge to a waterbody. Other hydrologic alterations include clearing and  
21 grading for the new and upgraded roadways and for modifications to the railroad line (widening  
22 existing railroad line, rerouting, and adding a railroad spur). The railroad line to be widened is  
23 adjacent to a seasonal stream. The new main access road would cross Mayo Creek about 1 mi  
24 north of the main facility entrance. These land surface modifications would alter surface-water  
25 runoff flow patterns and would alter the infiltration properties of the land surface.

26 Intake structure sites on Monticello Reservoir would be dewatered with submersible pumps  
27 installed inside cofferdams. A well-point dewatering system may also be used to maintain a dry  
28 environment to allow for fabrication of each intake structure once excavation is completed.  
29 SCE&G plans to return this water to the reservoir via discharge behind a turbidity curtain. A  
30 turbidity curtain is a floating barrier of geotextile material designed to deflect and contain  
31 sediment within a limited area minimizing sediment transport within a body of water. SCE&G  
32 also indicated that dewatering activities to support open excavation, sheet-pile installation, or  
33 behind cofferdams may generate water that could be routed to a settlement basin (SCE&G  
34 2009a).

35 Hydrologic alterations to offsite surface waterbodies could occur during installation of the  
36 proposed new transmission lines discussed in Section 4.1.2. No surface or groundwater would

## Construction Impacts at the VC Summer Site

1 be used in the installation of these lines. Although the exact routes are not yet determined,  
2 proposed locations indicate the lines would cross numerous waterbodies and wetlands. BMPs  
3 would be applied for erosion and sedimentation control (SCE&G 2009a).

4 Onsite groundwater would not be used during construction and preconstruction activities for the  
5 proposed units, but it would be affected as a result of those activities. Conditions and activities  
6 that could affect groundwater levels and alter groundwater flow around VCSNS Units 2 and 3  
7 include the following: site grading that includes in-filling to the east of the site for cooling towers,  
8 the hydraulic properties of fill (structural and common fill), changes in recharge due to  
9 impervious surfaces and stormwater basins, and dewatering during excavation (see SCE&G  
10 2009b). As described in Section 2.3.1.2 of this EIS, the site is located on a hilltop with the water  
11 table forming a subdued reflection of the topography, resulting in a groundwater divide near the  
12 proposed Units 2 and 3 locations. Site grading and the redistribution of groundwater recharge  
13 from impervious surfaces and/or stormwater basins would alter the groundwater flow locally  
14 around the hilltop but would not affect the broader groundwater flow in the area, particularly on  
15 the other side of surrounding surface waterbodies. Excavation dewatering would lower the  
16 water-table elevation locally and reduce the hydrostatic pressures in the deeper bedrock  
17 aquifer. The impacts of excavation dewatering are discussed more fully in Section 4.2.2.2, but  
18 the low aquifer yields in the area and large distance to water-supply wells minimize the impact  
19 of this temporary groundwater alteration.

20 Offsite impacts on groundwater from activities on the hilltop around VCSNS Units 2 and 3 would  
21 be limited by the influence of local bodies of surface water along the project boundaries (Mayo  
22 Creek, Broad River, Parr Reservoir, and Monticello Reservoir). Alterations from excavation  
23 dewatering would be temporary with the aquifers recovering after pumping has stopped. Water  
24 from the powerblock excavations would be pumped to the stormwater-management system  
25 (SCE&G 2009a). Within this system, water would be routed to settlement basins before being  
26 discharged through an NDPES-permitted outfall.

27 In summary, the hydrologic alterations associated with construction and preconstruction  
28 activities on and in the vicinity of the VCSNS site would be limited to dredging for the intake and  
29 discharge structures, altering the surface topography, changes to runoff and infiltration  
30 characteristics (e.g., site grading, laydown yards, stormwater-collection trenches and basins),  
31 and dewatering the excavations for the nuclear island, intake structures, and discharge  
32 structures. Offsite hydrologic alterations are associated with the proposed new or expanded  
33 transmission-line corridors where they cross wetlands or surface waters. The impacts of  
34 hydrologic alterations resulting from both onsite and offsite activities would be localized and  
35 temporary, and the required permits, certifications, and stormwater pollution prevention plan  
36 (SWPPP) call for the implementation of BMPs to minimize impacts.

## 1   **4.2.2   Water-Use Impacts**

2   The impacts of building a nuclear power plant on water use are similar to impacts that would be  
3   associated with the development of any large industrial site. This section includes identification  
4   of the proposed activities associated with building VCSNS Units 2 and 3 that could affect water  
5   use, and analysis and evaluation of proposed practices to minimize adverse impacts on water  
6   use by these activities. The impacts on the use of surface water and groundwater are  
7   discussed in Sections 4.2.2.1 and 4.2.2.2, respectively. Information in this section is drawn from  
8   the ER and supplemental information provided by SCE&G (2009a, b, c).

### 9   **4.2.2.1   Impacts on Surface-Water Use**

10   Monticello Reservoir would supply water for construction and preconstruction activities for  
11   VCSNS Units 2 and 3. Water needs for building activities at the site would be similar to typical  
12   uses of water for large industrial projects. These uses include dust abatement, concrete mixing,  
13   and potable water needs. Peak water needs during preconstruction and construction activities  
14   are estimated to be 420 gpm (approximately 1 cfs) SCE&G (2009a). Assuming complete  
15   consumptive use, the peak withdrawal represents less than 1 percent of the 7Q10 (lowest flow  
16   for 7 consecutive days expected to occur once per decade) estimated for Broad River (SCE&G  
17   2009a). The 7Q10 flow is used to assess the impacts of alteration on flow during low-flow  
18   periods. Federal Energy Regulatory Commission (FERC) approval is required for any  
19   withdrawal from Monticello Reservoir other than for the operation of VCSNS Unit 1.

20   Until the proposed water-treatment plant is completed, water needed during construction and  
21   preconstruction activities would be supplied by the Jenkinsville Water Company. The  
22   Jenkinsville Water Company is a public source with enough excess capacity to meet the site's  
23   needs (SCE&G 2009a). In addition to groundwater wells in Fairfield County, the water company  
24   also purchases water from other nearby water systems including the Town of Winnsboro. The  
25   Town of Winnsboro has significant excess capacity from surface-water sources (more than  
26   1 million gpd) (SCE&G 2009a; SCDNR 2005a).

27   The impacts on surface water would be of limited duration. Peak water demands would  
28   represent a small portion of the available water. Based on the information provided by SCE&G  
29   and the above observations from the review team's independent evaluation, the review team  
30   concludes that the impacts on surface water use during construction and preconstruction  
31   activities for the proposed VCSNS Units 2 and 3 would be SMALL, and no mitigation would be  
32   warranted. Based on the above analysis, and because NRC-authorized construction activities  
33   represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of  
34   NRC-authorized construction activities would be SMALL, and no mitigation measures would be  
35   warranted.

1 **4.2.2.2 Impacts on Groundwater Use**

2 SCE&G stated “[t]here are no plans to use local groundwater for construction or operations of  
3 VCSNS Units 2 and 3. Construction of Units 2 and 3 power blocks requires temporary  
4 dewatering of the power block area” (SCE&G 2009b). However, “[c]urrently the dewatering  
5 plans the EPC [engineer, procure, and construct] contractor is developing are conceptual and  
6 details on rates, durations, and discharge locations are still being established” (SCE&G 2009c).  
7 Due to the low hydraulic conductivity of the subsurface materials at the site (as described in  
8 Section 2.3.1.2 of this EIS), the review team determined that the excavation dewatering would  
9 be temporary and localized with minimal offsite impact.

10 As stated in Section 2.3.2.2 of this EIS, currently the closest water-supply well to the site is at a  
11 private residence approximately 1 mi east of the site (SCE&G 2009a). The nearest groups of  
12 wells, used for residences and stores, are located 1.5 mi east of the site and 2.5 mi southeast of  
13 the site (SCE&G 2009a). The closest location at which a water-supply well could be installed  
14 near the facility is on the nearest site boundary approximately 0.75 mi to the southeast (SCE&G  
15 2009b). As discussed in EIS Sections 2.3.1.2 and 2.3.2.2, groundwater well yields, both  
16 regionally and locally, are generally less than 30 gpm.

17 As mentioned in the previous section, until the proposed water-treatment plant is completed,  
18 water needed during construction and preconstruction would also be supplied by the  
19 Jenkinsville Water Company which utilizes groundwater wells in Fairfield County and purchases  
20 water from nearby water systems utilizing mainly surface water. The review team  
21 acknowledges that a portion of water supplied to VCSNS until the treatment plant is constructed  
22 could be provided from groundwater pumped by one or more of the regional water supply  
23 utilities. However, even if the entire water supply came from groundwater, the groundwater use  
24 would only occur until the water treatment plant was completed and would not exceed the  
25 existing water supply capacity of these utilities. Therefore, this groundwater use would not  
26 significantly alter the region’s ability to meet groundwater demands.

27 Factors that limit the impacts of construction and preconstruction activities on groundwater use in  
28 the area are: (1) limited and temporary excavation dewatering, which may be required for Units 2  
29 and 3; (2) the low groundwater pumping rates due to the generally low permeability of the  
30 aquifers in this area; (3) the relatively large distances to local groundwater supply wells; and  
31 (4) the site location that is partially isolated hydrologically from offsite users by surface  
32 waterbodies (Mayo Creek, Broad River, Parr Reservoir, and Monticello Reservoir). As a result,  
33 the review team concludes that the groundwater use impacts of construction and preconstruction  
34 of VCSNS Units 2 and 3 would be SMALL and no mitigation would be warranted. Based on the  
35 above analysis, and because NRC-authorized construction activities represent only a portion of  
36 the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction  
37 would be SMALL, and no further mitigation measures would be warranted.

1 **4.2.3 Water-Quality Impacts**

2 The impacts of building a nuclear power plant on water quality are similar to impacts that would  
3 be associated with the development of any large industrial site. This section includes  
4 identification of the proposed activities associated with building VCSNS Units 2 and 3 that could  
5 affect water quality, and analysis and evaluation of proposed practices to minimize adverse  
6 impacts on water quality by these activities. The impacts on surface water and groundwater are  
7 discussed in Section 4.2.3.1 and Section 4.3.3.2, respectively.

8 **4.2.3.1 Impacts on Surface-Water Quality**

9 The activities associated with building VCSNS Units 2 and 3 would occur close enough to  
10 Monticello Reservoir, Parr Reservoir, Broad River, and Mayo Creek that the impacts from these  
11 activities on the quality of surface water need to be considered. These impacts are discussed in  
12 SCE&G's ER (SCE&G 2009a).

13 Section 4.2.1 of this EIS discusses the impact of surface-water runoff and the discharge of  
14 water from dewatering activities. These activities are regulated by NPDES permitting, FERC  
15 approval, adoption of a SWPPP, use of BMPs, and by obtaining dredging permits and USACE  
16 approval. Discharges to Parr Reservoir would also require FERC approval.

17 Activities related to road and railroad spur improvement could potentially affect water quality in  
18 Mayo Creek or other small creeks on the property as land clearing and grading increase the  
19 potential for runoff and erosion. Other activities associated with building the proposed units  
20 would occur in areas that drain into Mayo Creek, its tributaries, or small unnamed creeks to the  
21 south and east of the proposed new facilities. SCE&G would use BMPs for soil erosion controls  
22 and comply with applicable regulations designed to prevent stormwater runoff from affecting the  
23 water quality in Mayo Creek and other small streams (SCE&G 2009a).

24 The temporary sewage-treatment plant in place during the building of VCSNS Units 2 and 3  
25 would use sodium hypochlorite disinfection and process up to 17,500 gpd (12.15 gpm). The  
26 location of the treatment plant, the waterbody receiving its effluent, and the discharge location  
27 would be established as part of the NPDES permitting process (SCE&G 2009a).

28 New transmission lines would need to be installed. Tower and line installation activities would  
29 comply with State and Federal guidelines and BMPs would be used to minimize impacts on  
30 water quality from erosion and sedimentation.

31 Because the impacts of hydrologic alterations resulting from activities associated with building  
32 the proposed units would be localized and temporary, and because the required permits,  
33 certifications, and the SWPPP call for the implementation of BMPs to minimize impacts, the  
34 review team concludes that the impacts on surface-water quality from activities related to  
35 construction and preconstruction of VCSNS Units 2 and 3 would be SMALL, and no further

## Construction Impacts at the VC Summer Site

1 mitigation beyond the actions stated would be warranted. Based on the above analysis, and  
2 because NRC-authorized construction activities represent only a portion of the analyzed  
3 activities, the review team concludes that the impacts of NRC-authorized construction would be  
4 SMALL, and no further mitigation measures beyond the BMPs would be warranted.

### 5 **4.2.3.2 Impacts on Groundwater Quality**

6 SCE&G committed to quickly cleaning up “minor spills of diesel fuel, hydraulic fluid, or  
7 lubricants” which would “mitigate impacts to local groundwater because spills would be quickly  
8 attended to and not allowed to penetrate into the groundwater” (SCE&G 2009a). SCE&G also  
9 developed a spill prevention plan as a part of the SWPPP, which is a condition of the  
10 stormwater discharge permit issued by SCDHEC. The spill prevention plan lists BMPs that are  
11 implemented to minimize the potential for releases of pollutants during preconstruction and  
12 construction that would be followed as required by SCDHEC.

13 Factors that limit the impacts of preconstruction and construction activities on groundwater  
14 quality in the area are 1) SCE&G’s BMPs for spill prevention and control as mentioned above;  
15 2) the relatively large distances to local groundwater supply wells; and 3) the partial isolation of  
16 the site from offsite users by surface waterbodies (Mayo Creek, Broad River, Parr Reservoir,  
17 and Monticello Reservoir). As a result, the NRC staff concludes that the impacts of construction  
18 and preconstruction on groundwater quality would be SMALL and no further mitigation would be  
19 warranted. Therefore, the impacts of NRC-authorized construction would be SMALL, and no  
20 further mitigation would be warranted.

### 21 **4.2.4 Water Monitoring**

22 SCE&G outlines monitoring programs for hydrologic and chemical monitoring in Sections 6.3  
23 and 6.6 of its ER for proposed VCSNS Units 2 and 3 (SCE&G 2009a). The SCDHEC requires  
24 NPDES permitting for projects that disturb more than 1 ac of land. The NPDES permit covers  
25 the monitoring of stormwater discharges from the areas associated with building the proposed  
26 units. To obtain an NPDES permit a SWPPP must be filed. The SWPPP developed by SCE&G  
27 would include a description of visual inspection actions to detect erosion and provide effective  
28 sediment control. The SWPPP also would include a description of sediment control BMPs. The  
29 approval of the SWPPP precedes the issuance of the NPDES permit, which would typically  
30 describe the monitoring locations and frequency. In addition, SCE&G indicated it would use the  
31 NPDES monitoring program for Unit 1 to detect any water-quality changes that might be caused  
32 by activities associated with building the proposed units (SCE&G 2009a). The current NPDES  
33 monitoring program for VCSNS Unit 1 includes 11 existing outfalls.

34 SCE&G outlines groundwater monitoring programs for hydrologic and chemical monitoring in  
35 Sections 6.3 and 6.6 of its ER for proposed VCSNS Units 2 and 3 (SCE&G 2009a). SCE&G  
36 installed 31 monitoring wells to characterize the groundwater flow in the vicinity of proposed  
37 VCSNS Units 2 and 3 as part of preapplication site characterization activities. Four of the

1 wells have been retained for future groundwater monitoring (SCE&G 2009d). These four  
2 wells are located outside the footprint of the nuclear island (see Figure GW-11-1 in SCE&G  
3 2009d). SCE&G indicated that it would add other groundwater monitoring wells based on  
4 any needs identified during discussions with the SCDHEC during final design and  
5 permitting (SCE&G 2009d).

## 6 **4.3 Ecological Impacts**

7 This section describes the potential impacts on ecological resources from building the proposed  
8 VCSNS Units 2 and 3, including the installation of new transmission lines to connect the units to  
9 the grid. The section is divided into two subsections: terrestrial impacts and aquatic impacts.

### 10 **4.3.1 Terrestrial and Wetland Impacts**

11 This section provides information about the construction and preconstruction activities for  
12 proposed VCSNS Units 2 and 3 and their associated impacts on the terrestrial ecosystem.  
13 Topics discussed include terrestrial resource impacts on the VCSNS site and in areas  
14 associated with the expansion of the transmission system to include six new 230-kV  
15 transmission lines. SCE&G stated it would develop and follow a Construction Environmental  
16 Controls Plan, which would include compliance with applicable local, State, and Federal  
17 ordinances, laws, etc. to prevent or minimize potential impacts (SCE&G 2009a). Other  
18 environmental-management controls, such as meeting the requirements of existing permits and  
19 use of BMPs, would be implemented through existing SCE&G VCSNS procedures and modified  
20 as necessary. The plan would cover topics such as protection of sensitive resources,  
21 stormwater management, erosion and sediment control, noise and vibration, air quality (fugitive  
22 dust), spill prevention and response, and cleanup and restoration. In addition, all construction  
23 personnel would be required to take environmental awareness training covering the  
24 aforementioned topics prior to being allowed to work onsite (SCE&G 2009a).

#### 25 **4.3.1.1 Terrestrial Resources – Site and Vicinity**

26 A majority of the site-preparation and project-development activities for proposed VCSNS Units  
27 2 and 3 would occur in areas previously disturbed during construction of Unit 1. Impacts from  
28 development of VCSNS Units 2 and 3 and associated areas would result from the clearing and  
29 grading of approximately 490 ac (SCE&G 2009a). Approximately 137 ac outside the exclusion  
30 area boundary would be used for temporary facilities, laydown areas, and spoils-disposal areas  
31 (SCE&G 2009a). Approximately 120 ft of shoreline on the Parr Reservoir would be temporarily  
32 disturbed to install the blowdown discharge structure, and installation of the raw- (makeup-)  
33 water intake from Monticello Reservoir would temporarily disturb approximately 175 ft of  
34

## Construction Impacts at the VC Summer Site

1 shoreline (SCE&G 2009a). In addition, approximately 2.44 mi of new transmission-line corridor  
2 would be cleared of forest and planted in grass to accommodate two of the proposed new  
3 230-kV transmission lines.

### 4 ***Impacts on Habitats***

5 Affected habitats would include forested land and wetlands.

### 6 Forests

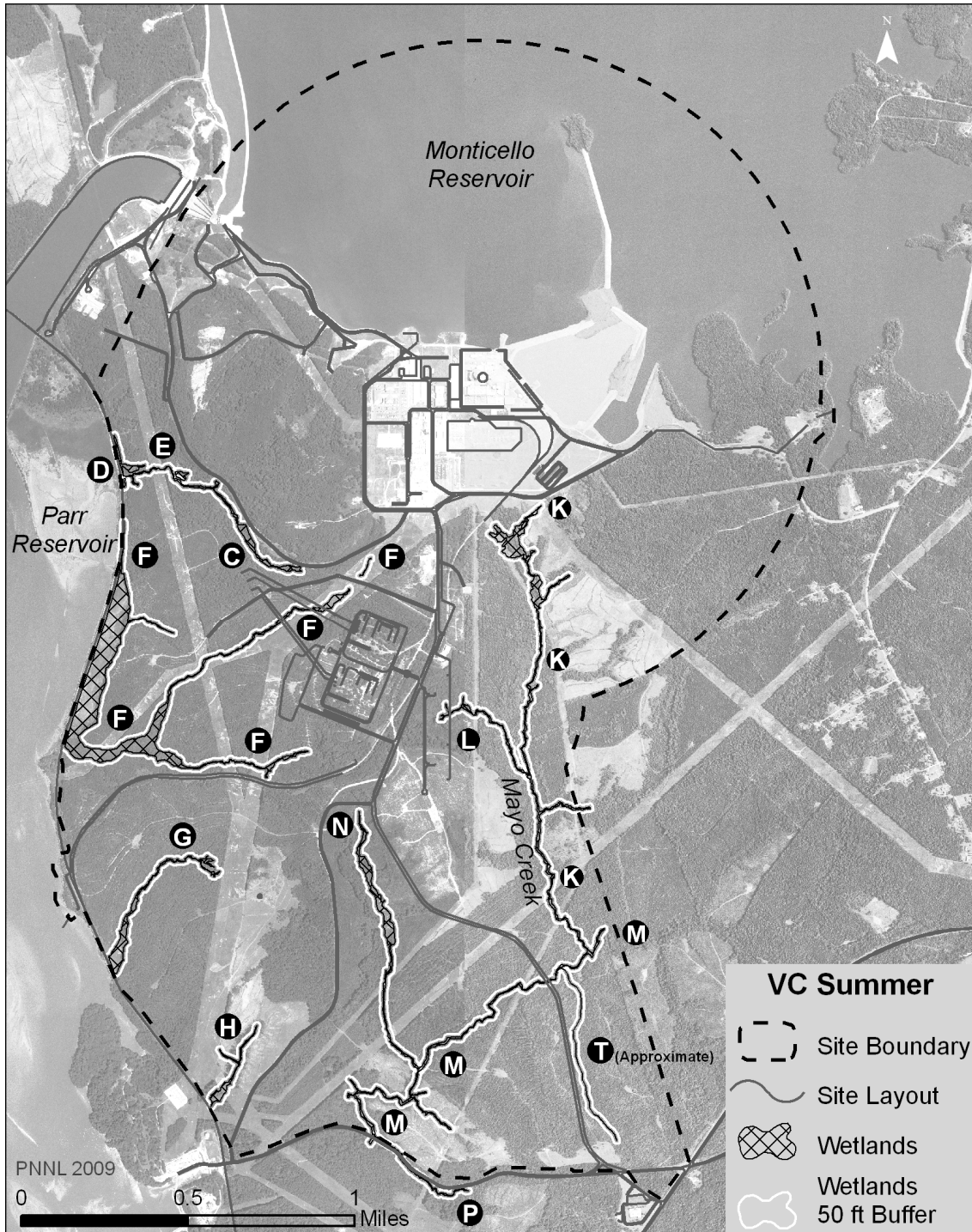
7 The grading, clearing, and excavation related to the development of VCSNS Units 2 and 3, site  
8 structures, and roadways would disturb approximately 435 ac of forested habitat, which would  
9 result in the permanent removal of approximately 225 ac of planted pines, 103 ac of naturally  
10 vegetated pines, 65 ac of mixed pine-hardwoods, and 41 ac of hardwood. Approximately 56 ac  
11 of open, nonforested, and recently cleared areas would be disturbed during development,  
12 including approximately 18 ac for the access road and 10 ac for the water-treatment plant  
13 (SCE&G 2009a) (see Figure 4-1). Approximately 40 percent of the 1090 ac of mixed forest on  
14 the VCSNS site would be permanently removed during site-preparation activities, and a large  
15 portion of forests removed would be planted pine. The permanent loss of approximately 435 ac  
16 of forest is less than 1 percent of the available approximately 51,000 ac of mixed forest in the  
17 vicinity of the VCSNS site (SCE&G 2009a).

18 Proposed VCSNS Units 2 and 3 would occupy an area dominated by planted loblolly pine  
19 (*Pinus taeda*) with a few small stands of hardwood forest present. The proposed site for the  
20 cooling-tower development area contains a small stand of naturally vegetated loblolly pine,  
21 planted pine, and a few small hardwood stands in the more mesic sites along streams and  
22 ravines (Tetra Tech NUS, Inc. 2009b; SCE&G 2002; SCE&G 2009a).

### 23 Wetlands

24 Site-preparation and site-development impacts on wetlands on the VCSNS site may include  
25 filling, clearing of vegetation, sedimentation, erosion, and alterations to hydrology. SCE&G  
26 stated that it has sited the proposed facilities and infrastructure in a way that would minimize  
27 impacts on wetlands and wildlife habitat, and that impacts on wetlands that occur near areas of  
28 site preparation and development would be minimized by using established BMPs (SCE&G  
29 2009a). SCE&G has established 50-ft buffered streamside management zones onsite that  
30 would be protected in accordance with BMPs such as the use of turbidity curtains and spill  
31 control established by the South Carolina Forestry Commission (Figure 4-2) (SCFC 1994;  
32 SCE&G 2009a). Site preparation for the cooling towers would permanently remove  
33 approximately 0.26 ac of wetland "L" associated with a small stream (Figure 4-2) (SCE&G  
34 2009a). This activity would result in the loss of less than 1 percent of the approximately 44.3 ac  
35 of the total wetlands on the VCSNS site (see Table 2-14).





1  
2 **Figure 4-2.** Streams and Wetlands, Including a 50-ft Buffer, on the VCSNS Site (letters in  
3 circles identify streams)

## Construction Impacts at the VC Summer Site

1 SCE&G has conducted wetland delineations on the site and received a Jurisdictional  
2 Determination from the USACE on June 29, 2009. The USACE issued the Jurisdictional  
3 Determination based on an onsite inspection, review of soil survey information, aerial maps, and  
4 other relevant information sources (USACE 2009). SCE&G (2009n) states the following:

5 To provide compensatory mitigation for unavoidable jurisdictional waters impacts  
6 associated with the proposed project, SCE&G would likely propose to purchase  
7 adequate credits from an approved mitigation bank in the service territory in  
8 which impacts are proposed. If such a bank does not exist, mitigation credits  
9 could be purchased from another bank as deemed appropriate by the regulatory  
10 agencies. SCE&G may also propose to provide mitigation credits by conducting  
11 certain activities on company-owned property in close proximity to proposed  
12 jurisdictional waters impacts as deemed appropriate by the regulatory agencies.

13 The proposed cooling-tower blowdown line and raw-water intake structures were sited in a way  
14 that would minimize impacts on wildlife habitat and wetlands. The blowdown line would be  
15 routed along an existing railroad corridor and the intake structure would be sited adjacent to the  
16 existing intake in an area with no wetlands (SCE&G 2009a). A sheet-pile cofferdam and  
17 dewatering system would be used to facilitate construction of the intake and discharge  
18 structures. Erosion and sediment control measures such as a turbidity curtain would be used  
19 and other BMPs would be used when needed (SCE&G 2009a). All excavated and dredged  
20 material would be transported to an onsite spoils area. Thus, impacts on terrestrial habitats  
21 associated with the intake and discharge installation activities would be minimal.

22 Cleared and disturbed lands resulting from site-preparation and site-development activities are  
23 vulnerable to significant soil erosion due to wind and water forces. Appropriate measures and  
24 controls to limit soil erosion during these activities would be taken to stabilize these areas,  
25 prevent erosion and sedimentation, and reduce runoff as required by applicable laws,  
26 regulations, and permit requirements, and recognized BMPs would be used for all proposed  
27 activities (SCE&G 2009a).

28 Due to the existence of similar habitats onsite and the large amount of those habitats  
29 surrounding the VCSNS site, impacts due to from habitat in loss from the site-preparation and  
30 site-development footprint for Units 2 and 3 and associated areas are expected to be minimal.

### 31 ***Impacts on Wildlife***

32 Impacts from proposed VCSNS Units 2 and 3 and supporting facilities on wildlife habitat would  
33 be unavoidable. Site-preparation and site-development activities that would affect wildlife at the  
34 VCSNS site include loss of habitat (temporary and permanent), presence of humans, heavy  
35 equipment operation, traffic, noise, avian collisions, outdoor lighting, and fugitive dust. These  
36 activities would likely displace or destroy wildlife that inhabits the development areas. Larger

1 and more mobile animals would likely flee the area, while less mobile animals such as reptiles,  
2 amphibians, and small mammals such as the beaver (*Castor canadensis*), would be at greater  
3 risk of incurring mortality. Although the surrounding forest and wetland habitat would be  
4 available for displaced animals, the movement of wildlife into surrounding areas would increase  
5 competition for available space and could result in increased predation and decreased fecundity  
6 for certain species. These conditions could lead to a temporary localized reduction in  
7 population size for particular species. When site-preparation and site-development activities are  
8 completed, species that can adapt to disturbed or developed areas may readily recolonize  
9 portions of the site where suitable habitat remains, is replanted, or restored.

10 Increased traffic in the area from site-preparation and site-development activities would increase  
11 roadway mortality due to forced movement of wildlife into traffic areas as individuals flee  
12 construction areas. Mammals such as white-tailed deer (*Odocoileus virginianus*), raccoon  
13 (*Procyon lotor*), eastern cottontail rabbit (*Sylvilagus floridanus*), and eastern gray squirrel  
14 (*Sciurus carolinensis*) would likely suffer increased roadside mortality (Forman and Alexander  
15 1998). The review team concludes that these impacts would not be detectable beyond the local  
16 vicinity and would not destabilize regional wildlife populations.

17 Noise from site-preparation and site-development activities can affect wildlife by inducing  
18 physiological changes, nest or habitat abandonment, or behavioral modifications, or it may  
19 disrupt communications required for breeding or defense (Larkin 1996). However, it is not  
20 unusual for wildlife to adapt to such noise (Larkin 1996). Development activities that would  
21 generate noise include operation of equipment such as jackhammers, pile drivers, and heavy  
22 construction vehicles. Short-term noise levels from development activities onsite could be as  
23 high as 108 dBA (SCE&G 2009a). However, that level would not extend far beyond the  
24 boundaries of the project site. The predicted noise level range from development activity is  
25 approximately 55 to 84 dBA at a distance of 400 ft from each activity (SCE&G 2009a). The  
26 threshold at which birds and small mammals are startled or frightened is 80 to 85 dBA  
27 (Golden et al. 1980). The review team expects that noise levels associated with creation of the  
28 transmission-line corridor would be similar to noise levels associated with development activities  
29 at the VCSNS site (which is below threshold levels for wildlife at 400 ft) but would be incurred  
30 for a more limited duration at any given location. Thus, impacts on wildlife from noise are  
31 expected to be negligible.

32 Avian collisions with fabricated structures such as large cranes and other construction  
33 equipment are a result of numerous factors related to species characteristics, such as flight  
34 behavior, age, habitat use, seasonal habits, and diurnal habits, as well as to environmental  
35 characteristics such as weather, topography, land use, and the orientation of the structures  
36 (Manville 2005). Most authors on the subject of avian collisions with utility structures agree that  
37 collisions are not a biologically significant source of mortality for thriving populations of birds  
38 with good reproductive potential (Brown 1993). The NRC (1996) reviewed monitoring data

## Construction Impacts at the VC Summer Site

1 concerning avian collisions at nuclear power plants with large cooling towers and determined  
2 that the overall avian mortality rate is low, therefore avian collisions are not expected to be  
3 significant.

4 Refueling stations, fuel storage, and the storage of other liquids during site-preparation and  
5 development activities also pose a threat to local surface waters used by wildlife on the site.  
6 However, SCE&G has established environmental controls to keep such liquids from escaping  
7 containment, thereby minimizing mortality and morbidity of wildlife (SCE&G 2009a). BMPs  
8 related to the management of effluent and stormwater runoff as required by the Stormwater  
9 Management Plan and the SCDHEC NPDES permit would also limit these impacts.

10 Impacts on habitats and wildlife related to site-preparation and site-development include direct  
11 mortality from land clearing, increased traffic, noise, and chemical spills. Displacement of  
12 individuals, increased competition, and lost productivity could also result from construction and  
13 preconstruction activities. However, the review team does not expect these activities to be  
14 measurable at a population level beyond the project site. The review team has determined that  
15 the site-preparation and site-development-related impacts of habitat loss, noise, avian collisions,  
16 and increased traffic may adversely affect onsite wildlife. However, these impacts would be  
17 temporary, minor, and mitigated. Development of proposed VCSNS Units 2 and 3 would be  
18 done according to Federal and State regulations, permit conditions, existing procedures, and  
19 established BMPs. Waterways and wetlands would be avoided to the extent possible (SCE&G  
20 2009a). Therefore, the review team concludes that site-preparation and site-development  
21 impacts on wildlife habitat on the proposed VCSNS site would be localized.

### 22 **4.3.1.2 Terrestrial Resources – Transmission Lines**

23 This section assesses impacts on terrestrial resources expected to occur from site-preparation  
24 and site-development activities within the proposed transmission system. Impacts on habitats  
25 and wildlife from development of the new transmission lines required for VCSNS Units 2 and 3  
26 would vary depending on the site-preparation and site-development activities required for the  
27 specific line.

#### 28 ***Impacts on Habitats***

29 The review team examined potentially affected habitats within the proposed SCE&G and Santee  
30 Cooper transmission-line corridors. As described in Sections 2.2 and 3.2, a total of six new  
31 offsite 230-kV transmission lines would be needed to distribute the power generated by the  
32 proposed Units 2 and 3 at the VCSNS site. Santee Cooper would develop and maintain two of  
33 the lines, and the other four would be developed and maintained by SCE&G in three corridors.

1 SCE&G Transmission Lines

2 The VCSNS-Lake Murray line would be upgraded and routed entirely within existing  
3 transmission-line corridors. Because the entire line resides within Fairfield, Richland, and  
4 Lexington Counties (the same counties used in the site and vicinity analysis for VCSNS Units 2  
5 and 3 in Section 4.3.1), the habitat types and wildlife are generally similar. There would be no  
6 clearing for the Lake Murray line, only structure replacement and restringing of lines (FP&S  
7 2008). All work performed by SCE&G would be done in compliance with applicable Federal,  
8 State, and local laws, regulations, and permit requirements. Therefore, the potential impacts on  
9 terrestrial habitats from upgrading transmission lines in existing transmission-line corridors  
10 would be minimal, and mitigation beyond the use of standard BMPs would not be warranted.

11 For the remaining two SCE&G lines (the VCSNS-Killian line [single-circuit], and the VCSNS-St.  
12 George line [double-circuit]), the exact routing is not yet determined, so the extent and type of  
13 wildlife within the proposed new transmission-line corridors are not known at the time of this  
14 writing. A siting study was conducted to identify optimal viable routes that would minimize  
15 impacts on important habitats and species. Both lines would require widening of existing  
16 corridors and creation of new corridors. Where the new lines are parallel to existing SCE&G  
17 transmission lines, the existing transmission-line corridor width would be increased by 70 ft.  
18 Where new lines require new right-of-way, the width of the corridor would be 100 ft. (FP&S  
19 2008). The VCSNS-Killian line siting study area encompasses 144,640 ac (226 mi<sup>2</sup>) which  
20 encompasses an approximate linear distance of 37 mi, and approximately 19 mi of the line  
21 would run parallel to existing electrical transmission lines. The remaining approximately 18 mi  
22 of line would require the creation of new corridor. The VCSNS-St. George line siting study area  
23 encompasses 874,888 ac (1367 mi<sup>2</sup>), which encompasses an approximate linear distance of  
24 134 mi; approximately 66 mi of the line would be routed parallel to existing transmission-line  
25 corridors and approximately 68 mi would require the creation of a new corridor (see Table 3-1).  
26 Within the larger study areas for both lines, hypothetical transmission-line rights-of-way routes  
27 were presented for the VCSNS-Killian line and the VCSNS-St. George line to use for analysis.

28 The proposed VCSNS-Killian line would be 37 mi long with a total of 380 ac of new  
29 transmission-line right-of-way in Fairfield and Richland Counties. The proposed VCSNS-St.  
30 George line would be 134 mi long with a total of 1491 ac of new right-of-way and would cross  
31 Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington,  
32 Newberry, Orangeburg, Richland, and Saluda Counties (Figure 2-5) (FP&S 2008). For the  
33 VCSNS-Killian line, the total acreage of wetland (all palustrine) to be affected by land clearing  
34 would be approximately 18 ac, which represents approximately 4.7 percent of the 380-ac  
35 corridor (SCE&G 2009n). The total acreage of wetland (all palustrine) to be disturbed in the  
36 VCSNS-St. George line would be approximately 201 ac within the 1491-ac corridor, which  
37 represents approximately 13.5 percent of the corridor (SCE&G 2009n) Data for affected  
38 wetlands and stream buffers in SCE&G's proposed transmission-line corridors are listed in

## Construction Impacts at the VC Summer Site

1 Table 4-2. Land-cover data for the siting-study areas for each of the proposed VCSNS-Killian  
 2 and VCSNS-St. George lines and the total areas of each classification type that would be  
 3 affected are listed in Table 4-3.

4 **Table 4-2.** Affected Wetlands and Stream Buffers in SCE&G's Proposed New Transmission-  
 5 Line Corridors

Construction Activity	VCSNS- Killian 230-kV Line	VCSNS-St. George 230-kV Line
Acres of river, stream, lake, or pond in the transmission-line corridor	0.6	19.4
Acres of transmission-line corridor requiring hand clearing within 100 ft of any stream, river, lake, or pond	24.2	131.4
Acres of transmission-line corridor requiring hand clearing within 100 ft of any wetland	13.5	92.3
Acres of PSS wetland affected by clearing within a wetland	0.1	21.1
Acres of PEM wetland affected by clearing within a wetland	1.6	5.2
Acres of PFO wetland affected by clearing within a wetland	4.4	95.4
Acres of upland in the transmission-line corridor	336	1126
Total	380	1491

PEM = palustrine emergent; PFO = palustrine forested; PSS = palustrine scrub-shrub

6 Assuming that the actual routes would be similar to those proposed as "viable" routes, the  
 7 number of acres of each type of habitat that would be affected represent a small fraction of the  
 8 available habitat in the traversed landscapes, and thus, impacts on habitats would be negligible.  
 9 However, if the actual routes differ from the hypothetical routes, impacts on habitats could be  
 10 greater.

### 11 Santee Cooper Transmission Lines

12 The Santee Cooper lines are almost entirely routed within existing transmission-line corridors  
 13 with the exception of 2.44 mi that would require a new 100-ft-wide corridor adjacent to the  
 14 existing transmission-line corridor. The VCSNS-Flat Creek and VCSNS-Varnville lines would be  
 15 routed 99 percent within existing transmission-line corridors (MACTEC 2008). The remaining 1  
 16 percent (2.44 mi) would require new 100-ft-wide corridors, which would be adjacent to existing  
 17 maintained transmission-line corridors (MACTEC 2008). Clearing of the 2.44 mi of new  
 18 transmission-line corridor would occur very close to the VCSNS site. Impacts on habitats and  
 19 wildlife in these areas would be the same as impacts onsite and would be mitigated (see  
 20 Section 4.3.1). A total of 45 ac of new transmission-line corridor, which is equal to  
 21 approximately 1.3 percent of the entire 3534 ac of transmission-line corridor, would be cleared  
 22 (SCE&G 2009n; MACTEC 2008).

1 **Table 4-3.** Impacts on Land Cover in the Proposed VCSNS-Killian and VCSNS-St. George  
 2 Transmission-Line Corridors

Land Cover Classification	VCSNS-Killian 230-kV Line (Affected Area)	VCSNS-Killian 230-kV Line Total Study Area	VCSNS-St. George 230-kV Line (Affected Area)	VCSNS-St. George 230-kV Line Total Study Area
	Acres			
Bottomland/Floodplain Forest	8.1	4978.3	79.1	69,759.5
Closed Canopy Evergreen Forest/Woodland	50.2	30,610.0	93.1	85,890.0
Cultivated Land	0.0	102.3	87.8	36,568.5
Dry Deciduous Forest/Woodland	13.2	7324.5	31.5	19,572.1
Dry Scrub/Shrub Thicket	41.8	40,833.4	200.4	226,099.3
Dry Mixed Forest/Woodland	100.2	8345.1	379.1	145,595.7
Fresh Water	1.0	3242.5	8.5	6105.6
Grassland/Pasture	86.9	18,229.7	511.0	202,472.3
Marsh/Emergent Wetland	0.2	30.4	2.2	699.0
Mesic Deciduous Forest/Woodland	7.1	5112.2	10.6	5025.8
Mesic Mixed Forest/Woodland	0.7	517.6	16.7	4932.7
Needle-Leaved Evergreen Mixed Forest/Woodland	6.2	6486.9	5.1	7449.2
Open Canopy/Recently Cleared Forest	24.2	6102.4	12.6	2159.1
Pocosin	0.0	NA	0.9	1010.7
Urban Development	33.7	10,086.2	49.5	51,833.1
Urban Residential	5.4	1648.1	0.0	3931.7
Wet Scrub/Shrub Thicket	1.3	682.0	3.0	1444.5
Swamp	0.2	45.8	0.0	NA
<b>Total</b>	<b>380.4</b>	<b>144,393.4</b>	<b>1491.1</b>	<b>874,853.7</b>

Sources: MACTEC 2008; FP&S 2008  
 NA = Not applicable

3 A wetland delineation was completed along the 2.44 mi of proposed new transmission-line  
 4 corridor in July 2008 and it was determined that site preparation to widen the VCSNS-Flat Creek  
 5 line would result in the conversion of approximately 276 linear ft (0.11 ac) of forested stream to  
 6 nonforested stream, and site preparation to widen the VCSNS-Varnville line would result in the  
 7 conversion of 0.60 ac of forested wetlands to nonforested wetlands and 276 linear ft (0.11 ac) of  
 8 forested stream to nonforested stream (SCE&G 2009e). Santee Cooper stated that all clearing  
 9 would be done using BMPs and that no mechanized clearing or grubbing would be necessary  
 10 (SCE&G 2009e).

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1 Site-preparation and structure installation activities that would occur in the existing transmission-  
2 line corridors that may cause temporary impacts would be limited to replacement of existing  
3 structures and installation of new lines. Santee Cooper stated that it would install new  
4 structures on or adjacent to existing footprints whenever possible and that disturbance from  
5 these activities would not create impacts greater than those that already occur during ongoing  
6 transmission-line corridor maintenance activities (MACTEC 2008). Santee Cooper has also  
7 stated that it would take measures to minimize impacts on wetlands by following  
8 recommendations from the USACE to mitigate temporary impacts from site preparation and  
9 structure installation such as the use of mulches, hay bales, turbidity curtains, and other  
10 erosion-control methods. Engineering controls and existing procedures are also in place to  
11 address unavoidable disturbances. All work performed by Santee Cooper would be done in  
12 compliance with applicable Federal, State, and local laws, regulations, and permit requirements.  
13 Based on the small amount of new corridor clearing and subsequent small loss of wetlands and  
14 streams, the review team concludes that the impacts on habitats from clearing the new  
15 transmission-line corridors and upgrading existing corridors for the proposed Santee Cooper  
16 lines would be minimal.

### 17 Summary of Overall Transmission Line Impacts on Habitats

18 The combined length mileage of new or expanded (widened) transmission-line right-of-way for  
19 both SCE&G and Santee Cooper would be approximately 174 mi. An estimated 1916 ac of new  
20 right-of-way would be established. A total of approximately 220 ac of wetlands (all palustrine)  
21 would be subject to land-clearing impacts. Additional nonforested (emergent) wetlands are also  
22 present within the proposed new transmission-line right-of-way areas, but these wetlands would  
23 not have to be physically disturbed to build or maintain the transmission lines.

### 24 ***Impacts on Wildlife***

25 Wildlife present in the transmission-line corridors during the proposed work would be subjected  
26 to many of the same types of impacts described for the proposed VCSNS site. Some wildlife  
27 would perish or be displaced during clearing of new transmission-line corridors, and, as a  
28 consequence of habitat loss and fragmentation, competition for remaining resources could  
29 increase. Less mobile animals, such as reptiles, amphibians, and small mammals, would be at  
30 greater risk of incurring mortality than more mobile animals, such as birds, which would be  
31 displaced to adjacent habitats. Undisturbed land adjacent to the corridors could provide habitat  
32 to support displaced wildlife, but increased competition for available space and resources could  
33 reduce population levels. Wildlife would also be subjected to impacts from construction noise  
34 and traffic, and birds could be injured if they collide with new transmission towers and  
35 conductors or the equipment used to install these components. Noise levels associated with the  
36 building of the transmission lines would be similar to or less than and of shorter duration than  
37 noise levels associated with construction at the proposed VCSNS site, and would be below  
38 disturbance threshold levels for wildlife at about 400 ft (SCE&G 2009a; MACTEC 2008). Thus,



1 the impact on wildlife from noise is expected to be temporary and minor. The potential for  
 2 traffic-related wildlife mortality is expected to be low because construction crews would be small  
 3 and dispersed over very large geographic areas (MACTEC 2008; FP&S 2008). Avian mortality  
 4 resulting from collisions with structures and equipment during transmission-line development  
 5 would represent a small hazard for bird populations, particularly when compared to impacts  
 6 resulting from habitat loss (Manville 2005; MACTEC 2008; FP&S 2008). The review team  
 7 expects that noise levels associated with creation of the transmission-line corridor would be  
 8 similar to noise levels associated with development activities at the VCSNS site and would be  
 9 below threshold levels for wildlife at 400 ft.

10 The creation of new transmission-line corridors could be beneficial for some species, including  
 11 those that inhabit early successional habitat or use edge environments, such as white-tailed  
 12 deer, northern bobwhite (*Colinus virginianus*), eastern meadowlark (*Sturnella magna*), and the  
 13 gopher tortoise (*Gopherus polyphemus*). Birds of prey, such as red-tailed hawks  
 14 (*Buteo jamaicensis*) and great-horned owls (*Bubo virginianus*), would likely exploit newly created  
 15 hunting grounds. Forested wetlands within the corridors would be converted to and maintained  
 16 in a herbaceous or scrub-shrub condition that could provide foraging habitat for wading birds.  
 17 However, fragmentation of forests could affect species that are dependent on large tracts of  
 18 continuous forested habitat. All work in the proposed transmission-line corridors would be done  
 19 according to Federal and State regulations, permit conditions, existing procedures, and  
 20 established BMPs. Because SCE&G and Santee Cooper have procedures in place to minimize  
 21 impacts on wildlife and habitats, and both plan to use existing footprints for new structures, the  
 22 potential impacts of construction in existing corridors would be minimal. Because of the  
 23 uncertainty concerning the possible routing of new transmission-line rights-of-way, the review  
 24 team concludes that the terrestrial resources within and adjoining the new transmission-line  
 25 rights-of-way could be altered noticeably.

#### 26 **4.3.1.3 Important Terrestrial Species and Habitats**

27 This section describes the potential impacts on the important species identified using NRC  
 28 criteria (NRC 2000) in Section 2.4.1 resulting from development of VCSNS Units 2 and 3 and  
 29 associated transmission lines.

#### 30 ***Important Species – Site and Vicinity***

31 No Federally or State-listed species are known to occur on the VCSNS site. There are no areas  
 32 designated as critical habitat on and in the vicinity of the VCSNS site. The delisted bald eagle  
 33 (*Haliaeetus leucocephalus*) is known to occur on the VCSNS site and is still protected under the  
 34 Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Two active bald eagle  
 35 nests are known to occur on or in the immediate of the VCSNS site; one is located on SCE&G  
 36 property north of existing Unit 1 on a jetty that extends into Monticello Reservoir, and the other  
 37 is located west of Parr Reservoir less than 1 mi from the western boundary of the SCE&G

## Construction Impacts at the VC Summer Site

1 property (see Figure 4-1). Proposed site-preparation and site-development activities would not  
2 encroach upon either nest because they would take place well beyond the 660-ft buffer  
3 recommended for commercial construction activities near active bald eagle nests (FWS 2007).  
4 Therefore, the potential to disturb eagles using these two nest sites would be minimal.

### 5 ***Important Species – Transmission Lines***

6 The transmission lines associated with the proposed project would not travel through any areas  
7 designated or proposed by the FWS as “critical habitat” for endangered or threatened species  
8 (FP&S 2008; MACTEC 2008). However, the SCE&G siting study stated occurrences of  
9 protected species have been mapped within 500 ft of the proposed VCSNS-St. George line  
10 (FP&S 2008), although it did not indicate the identities of the species. Additional Federally and  
11 State-listed species inhabit counties crossed by the proposed transmission-line corridors. A  
12 complete list of Federally and State-listed species that are known to occur in counties crossed  
13 by transmission lines associated with the project is given in Table 2-17. This list was compiled  
14 from the SCDNR Natural Heritage Database (SCDNR 2006a) and the FWS list (FWS 2008).  
15 Because the exact routes have not yet been determined by SCE&G, ground surveys were not  
16 conducted. SCE&G stated it would perform detailed ecological surveys to protect Federally and  
17 State-listed threatened and endangered species that may occur along the transmission lines as  
18 part of the permitting process prior to commencing construction activities (FP&S 2008). Once  
19 final routes are determined, the FWS and SCDNR would be consulted.

20 The proposed transmission lines would travel through a variety of habitats that support large  
21 and small game as well as waterfowl species. Because most of the new transmission lines  
22 would be constructed within or adjacent to existing corridors for operation of VCSNS Units 2 and  
23 3, no significant additional impacts would be expected to occur on any commercially or  
24 recreationally important species as a result of transmission-line upgrade activities in those  
25 corridors.

26 No areas designated or proposed by the FWS as “critical habitat” for threatened or endangered  
27 species occur on or immediately adjacent to the proposed transmission-line corridors (MACTEC  
28 2008). None of the transmission lines crosses State or Federal parks, wildlife refuges, wildlife  
29 management areas, or preserves. Because SCE&G and Santee Cooper have procedures in  
30 place to minimize impacts on important species and habitats, the potential impacts of site  
31 preparation and development in existing corridors would be minimal. Uncertainty remains about  
32 the exact routing of the proposed new transmission lines. The review team therefore concludes  
33 that, depending upon the exact routing ultimately selected, the terrestrial resource impacts  
34 resulting from associated with the site-preparation and development work within the new  
35 transmission-line rights-of-way might be regionally noticeable.

1 **4.3.1.4 Terrestrial Monitoring**

2 SCE&G has stated that it would not conduct any monitoring of terrestrial resources during site  
3 preparation and development at the VCSNS site and associated transmission-line corridors  
4 (SCE&G 2009a). The review team likewise does not consider any monitoring necessary to  
5 protect terrestrial ecological resources.

6 **4.3.1.5 Potential Mitigation Measures for Terrestrial Impacts**

7 Mitigation measures for terrestrial impacts related to site preparation and development include  
8 the implementation of BMPs and performance of wetland mitigation, which are described in the  
9 previous sections.

10 **4.3.1.6 Summary of Impacts on Terrestrial Resources**

11 Based on information provided by SCE&G and the review team's independent evaluation, the  
12 review team has determined that the impacts from site preparation and development on  
13 terrestrial resources on the VCSNS site, including permanent and temporary losses of forests  
14 and wetlands, would be localized and would not noticeably alter the ecology of the surrounding  
15 landscape. The affected terrestrial habitat types are common in the surrounding landscape, and  
16 much of the affected habitat consists of planted pine forest and successional vegetation on soils  
17 previously disturbed during development of VCSNS Unit 1. SCE&G stated that it would work  
18 with the USACE to determine appropriate mitigation through the permitting process of Section  
19 404 of the Clean Water Act (33 USC 1344), which prohibits the discharge of dredged or fill  
20 material into waters of the United States. The impact on wildlife at the population level  
21 (including Federally and State-listed species), would be negligible. SCE&G and Santee Cooper  
22 have both identified BMPs they use on the site (SCE&G 2009a) and in the transmission-line  
23 corridors and which they would use throughout the development and maintenance of the  
24 proposed facilities. Each utility also has stated that it would adhere to all applicable permit  
25 requirements. Because SCE&G and Santee Cooper have established procedures for  
26 minimizing impacts on important species and habitats, the potential impacts of transmission-line  
27 development in existing corridors would be minimal. There is uncertainty concerning the routing  
28 of new transmission-line corridors and the creation of approximately 86 mi of new right-of-way.  
29 Therefore, the review team concludes that the terrestrial resource impacts associated with the  
30 development of the new transmission-line corridors could noticeably alter the terrestrial  
31 ecological character of the surrounding landscape, especially due to forest fragmentation.

32 Based on information provided by SCE&G and the review team's independent evaluation, the  
33 review team concludes that the impacts of construction and preconstruction activities on  
34 terrestrial ecology resources on the VCSNS site would be SMALL. No further mitigation beyond  
35 that discussed above would be warranted. Based on the above analyses, and because  
36 NRC-authorized construction activities represent only a portion of the analyzed activities, the

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1 NRC staff concludes that the impacts of NRC-authorized construction activities on terrestrial  
2 ecological resources would be SMALL on the VCSNS site. The NRC staff also concludes that  
3 further mitigation beyond that stated above would not be warranted.

4 Based on information provided by SCE&G and the review team's independent evaluation, the  
5 review team concludes that the offsite terrestrial ecological impacts from preconstruction  
6 activities related to the development of the proposed associated transmission lines would be  
7 MODERATE. The greatest potential for regionally noticeable terrestrial ecological impacts  
8 would be from clearing and fragmentation of forest cover caused by clearing approximately 86  
9 mi of new transmission-line corridor not parallel to existing rights-of-way. The review team also  
10 concludes that further mitigation beyond that stated above would not be warranted. The Limited  
11 Work Authorization (LWA) rule specifically indicates that transmission lines are not included in  
12 the definition of construction. Therefore, no noticeable offsite terrestrial ecological impacts  
13 would result from NRC-authorized construction activities.

### 14 **4.3.2 Aquatic Impacts**

15 Impacts on aquatic resources stemming from site-preparation activities for VCSNS Units 2 and  
16 3 would include activities associated with the three main waterbodies at the site. As described  
17 in Sections 3.2 and 3.3, a discharge structure would be built at Parr Reservoir. A raw-water  
18 intake structure and a water-treatment plant intake structure would be installed at Monticello  
19 Reservoir. Site preparation activities for building the cooling towers would result in the filling of  
20 a seasonal headwater tributary to Mayo Creek. The locations of these structures and  
21 associated activity areas are shown in Figure 3-4. Additional aquatic impacts may include  
22 nonpoint source pollution in the form of stormwater runoff from site-preparation areas,  
23 preparation of new transmission-line corridors, and widening of existing transmission-line  
24 corridors. All work would be conducted in accordance with Clean Water Act, Section 401 and  
25 404 regulations (40 CFR 230).

#### 26 **4.3.2.1 Aquatic Resources – Site and Vicinity**

##### 27 ***Parr Reservoir***

28 Construction and preconstruction activities associated with installation of the discharge structure  
29 in Parr Reservoir include dredging and pile driving, which can cause noise impacts as well as  
30 increased sedimentation and runoff. The specifications pertaining to the discharge structure  
31 have not been finalized, but the proposed shoreline disturbance area is estimated to include 120  
32 linear ft, the structure is 20-ft wide with 50 ft of disturbance on either side (SCE&G 2009a). The  
33 estimated dredge volume required for installation of the discharge structure is 11,000 yd<sup>3</sup> and  
34 the estimated dredge area is 34,000 ft<sup>2</sup> (SCE&G 2009f, g). All dredge and excavated materials  
35 would be disposed of at the upland location on the VCSNS site shown in Figure 3-4. The 36-in.-  
36 diameter blowdown discharge pipe and associated diffuser line would extend approximately 100

1 ft from the shoreline into the reservoir and would be stabilized with rip-rap. The diffuser line  
2 would contain multiple ports with the discharge points approximately 3 ft above the bottom of  
3 the reservoir (SCE&G 2009a).

4 Activities associated with the installation of the blowdown line and discharge structure include  
5 pile driving and excavation of the land extending from the uplands to the water's edge to  
6 facilitate an adequate slope of the blowdown line (SCE&G 2009a). Preparation and installation  
7 of the discharge structure at Parr Reservoir include installation of sedimentation and turbidity  
8 control structures such as turbidity curtains and cofferdams, excavation and dredging in the  
9 vicinity of the diffuser structure, and disposal of dredged materials (SCE&G 2009a).

#### 10 **Monticello Reservoir**

11 The installation of two water-intake structures on the Monticello Reservoir may affect aquatic  
12 biota. Dredging activities in these locations may temporarily increase turbidity, siltation, and  
13 noise. As described in Sections 3.2.2 and 3.3.1, SCE&G has proposed to install a new raw-  
14 water intake structure approximately 1250 ft west of the existing VCSNS Unit 1 intake structure  
15 to supply makeup cooling water for Units 2 and 3. The raw-water intake structure for VCSNS  
16 Units 2 and 3 would be constructed of concrete and would be approximately 60 ft long and 75 ft  
17 wide (SCE&G 2009a). The estimated dredge volume for the raw-water intake structure is  
18 10,000 yd<sup>3</sup> and the estimated dredge area is 25,000 ft<sup>2</sup> (SCE&G 2009f, g). All dredged  
19 materials would be disposed of at the upland location on the VCSNS site shown in Figure 3-4.  
20 Proposed activities associated with the installation of a new raw-water intake structure include  
21 the installation of a sheet-pile cofferdam and the subsequent dewatering of the construction  
22 area (SCE&G 2009a). Plans include the installation of a turbidity curtain around the perimeter  
23 of the installation area prior to the installation of the cofferdam (SCE&G 2009a). Turbidity  
24 curtains are often used in conjunction with activities that cause increased sedimentation and  
25 turbidity and are a tool for implementing BMPs (Francingues and Palermo 2005).

26 The water for plant operations (service water system and potable, fire protection, and  
27 demineralized water systems) would also be derived from Monticello Reservoir, but would be  
28 obtained from the water-treatment plant intake structure to be installed approximately 5500 ft  
29 east of the existing VCSNS Unit 1 intake structure (see Section 3.3.1 and Figure 3-4) (SCE&G  
30 2009a). SCE&G has proposed two options for building the water-treatment plant intake  
31 structure, both of which necessitate using barges as work platforms and installation of a  
32 cofferdam and turbidity curtain. The deployment of barges into Monticello Reservoir may  
33 require modifications of up to 100 ft of shoreline, which may result in the removal of rip-rap or  
34 other bank-stabilizing structures. Both options would also require the installation of a  
35 maintenance access pier approximately 17-ft wide extending approximately 200 ft from the  
36 shoreline into Monticello Reservoir. Compliance in both installation and design would be in  
37 accordance with USACE requirements and FERC permitting (SCE&G 2009p).

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### 1 **Onsite Streams**

2 Site-preparation activities associated with onsite streams include permanent and temporary  
3 impacts on aquatic environments. The designated location of cooling towers associated with  
4 VCSNS Units 2 and 3 would require filling Stream L, a seasonal headwater stream that drains  
5 into Mayo Creek (Figure 4-2) (SCE&G 2009a). Filling of this headwater stream would result in  
6 the permanent loss of 774 linear ft of stream habitat (SCE&G 2009a).

7 Localized, temporary site-preparation impacts on onsite streams include the widening of an  
8 existing railroad spur right-of-way adjacent to a seasonal stream and the construction of a new  
9 bridge at Mayo Creek. SCE&G has proposed to widen an existing railroad spur right-of-way to  
10 make room for railroad upgrades and the new blowdown line associated with VCSNS Units 2  
11 and 3. Site-preparation activities associated with the expansion of the railroad line right-of-way  
12 are proposed to occur adjacent to a seasonal stream for approximately 0.5 mi (SCE&G 2009a).  
13 Impacts associated with widening the right-of-way, upgrading the railroad spur, and installing a  
14 new 36-in.-diameter blowdown line adjacent to the seasonal stream may result in increased  
15 runoff to, and sedimentation in, the stream, resulting in degradation of habitat and lower  
16 dissolved oxygen levels. The development of a new four-lane road connecting the site-  
17 preparation area associated with VCSNS Units 2 and 3 to State Highway 213 (SC-213) includes  
18 plans for a new bridge crossing that would span Mayo Creek (SCE&G 2009a). Although  
19 temporary, aquatic impacts associated with bridge installation include an increased potential for  
20 runoff and sedimentation. The SCDHEC regulates activities related to stormwater management  
21 and sediment control (SCDHEC 2008). SCE&G (2009a) has recognized the aquatic ecosystem  
22 implications of runoff generated from site-preparation activities at the VCSNS site and has  
23 acknowledged the necessity of compliance with practices and permits such as a SWPPP and a  
24 general NPDES permit for industrial stormwater. Impacts from runoff and in-water installation  
25 activities would be mitigated through use of temporary culverts and BMPs such as the use of  
26 cofferdams and turbidity (silt) curtains (SCE&G 2009a).

27 As described in Section 3.2.2, the proposed location of VCSNS Units 2 and 3 is on the top of a  
28 hill, and stormwater would drain away from the site in several directions. A stormwater-  
29 management system would be installed (SCE&G 2009a). Installation would include site  
30 grading, ditches, swales, and basins. The current and proposed stormwater-retention basins in  
31 the immediate vicinity of the site are shown in Figure 3-5. Outflow from these basins would  
32 eventually drain into several unnamed creeks to the west and into Mayo Creek to the east.  
33 Once drainage enters Mayo Creek it would flow south, then west around the southern base of  
34 the powerblock area (SCE&G 2009a).

35 To minimize sedimentation and impacts on water quality, SCE&G intends to conduct land  
36 clearing activities during dry periods (SCE&G 2009a).

#### 1 **4.3.2.2 Aquatic Resources – Transmission Lines**

2 The delivery of power associated with proposed VCSNS Units 2 and 3 would require upgrading  
3 existing transmission-line corridors and installing new transmission lines and substations. With  
4 regard to the delivery of power, two entities, SCE&G and Santee Cooper, are responsible for  
5 identifying the proposed locations associated with new and upgraded transmission lines. In  
6 total, six new 230-kV lines are proposed for the transmission of electricity associated with  
7 VCSNS Units 2 and 3 (FP&S 2008; MACTEC 2008).

#### 8 ***SCE&G Transmission Lines***

9 The final locations for the majority of the SCE&G proposed transmission systems have yet to be  
10 determined. Three corridors would be required to carry the four SCE&G-owned transmission  
11 lines as described in Section 4.1.2. The VCSNS-Lake Murray corridor would not include any  
12 new corridor development, while the VCSNS-Killian line would require approximately 18 mi of  
13 new corridor and 19 mi of corridor adjacent to existing corridor. The VCSNS-St. George  
14 corridor would require 66 mi of corridor adjacent to existing corridor and 68 mi of new corridor  
15 (FP&S 2008). Activities associated with the SCE&G transmission system would include  
16 clearing land, installing new poles, hanging new lines, and upgrading existing lines. The  
17 SCE&G transmission system would cross numerous streams and rivers throughout the State of  
18 South Carolina, which includes the Piedmont and Coastal Plain ecoregions. SCE&G has  
19 proposed to follow State and Federal guidelines involving the use of BMPs for limiting impacts  
20 on waterbodies as described previously, during transmission system installation activities, which  
21 includes leaving low-growing vegetation intact to provide stream buffer zones (FP&S 2008). An  
22 estimated 24.2 ac and 131.4 ac of corridor would be cleared within 100 ft of a stream, river,  
23 lake, or pond for the VCSNS-Killian and VCSNS-St. George lines, respectively. Only 0.6 ac of  
24 river, lake, stream, or pond habitat is within the proposed VCSNS-Killian corridor, and 19.4 ac  
25 are within the proposed VCSNS-St. George corridor (FP&S 2008, Chart 6.3-1).

26 Impacts on the waterways associated with transmission-line activities include erosion of soils,  
27 potential for pollutant discharge from equipment, and temporary disturbance and/or  
28 displacement of aquatic biota. Both SCE&G and Santee Cooper would implement BMPs to  
29 minimize adverse conditions for aquatic biota and habitats during transmission-line installation.  
30 Examples of BMPs to minimize impacts on streams and open water include establishment of  
31 sediment basins, sediment traps, and silt fences to control and divert runoff away from streams,  
32 and maintenance of stream buffers (MACTEC 2008; FP&S 2008). In addition, both Santee  
33 Cooper and SCE&G have acknowledged the need for acquiring State and Federal permits and  
34 the incorporation of BMPs and SWPPPs into said permits (MACTEC 2008; FP&S 2008).  
35 SCE&G stated that it “will comply with the S.C. Stormwater Management and Sediment  
36 Reduction Act related to water quality protection and will comply with the recommendations of  
37

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1 various regulatory agencies, including the S.C. Department of Natural Resources, S.C.  
2 Department of Health and Environmental Control, the U.S. Army Corps of Engineers, etc.”  
3 (FP&S 2008).

### 4 **Santee Cooper Transmission Lines**

5 Two transmission-line corridors would be installed by Santee Cooper: the VCSNS-Flat Creek  
6 and the VCSNS-Varnville lines. Santee Cooper intends to install 2.44 mi of new transmission-  
7 line corridor adjacent to an existing corridor, and upgrade 232 mi of existing transmission-line  
8 corridors. Activities associated with Santee Cooper transmission lines would include replacing  
9 transmission poles, moving existing poles, and adding new poles within the footprint of the  
10 existing corridors; hanging new lines on existing supports; and clearing land (MACTEC 2008).  
11 The Santee Cooper transmission lines would include 140 stream and river crossings throughout  
12 various watersheds within the State of South Carolina (Figure 4-3) (MACTEC 2008). Within the  
13 existing transmission-line corridors, the new transmission structures are expected to span  
14 streams. However, the 2.44 mi of proposed new 100-ft-wide transmission-line corridor  
15 associated with the VCSNS-Varnville line may require the installation of one or two structures  
16 within the Parr Reservoir (MACTEC 2008). Placement of pile foundations in the Parr Reservoir  
17 would be required for installation of new transmission towers, but no dredging activities would  
18 be required. The new corridor would run adjacent to the existing corridor that currently spans  
19 Parr Reservoir. Santee Cooper would prepare a SWPPP, in accordance with SCDHEC  
20 guidance (SCDHEC 2002), for minimization of impacts on sediment quality during installation  
21 activities (MACTEC 2008).

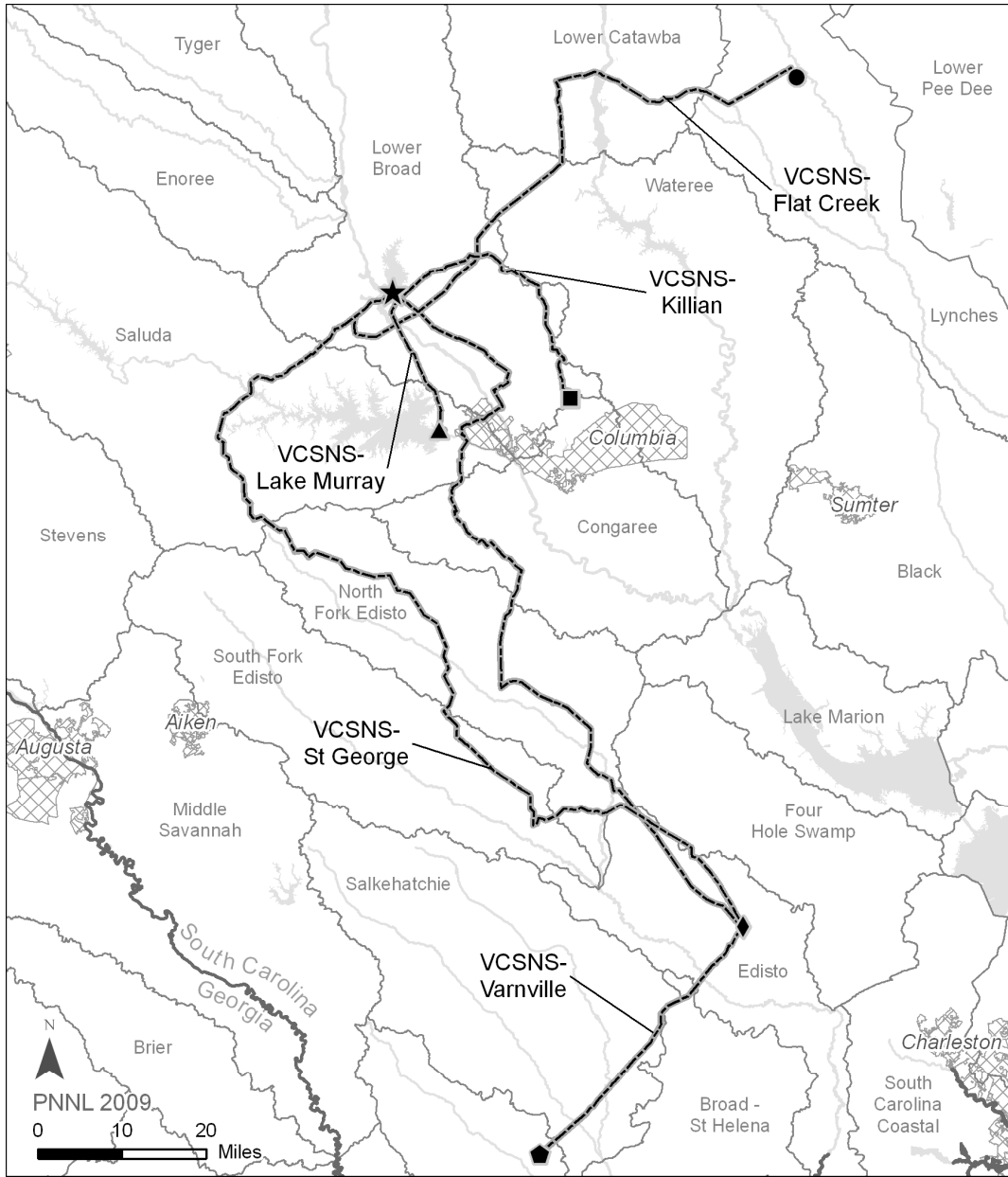
22 A combined 551 linear ft of forested stream habitat would be converted to nonforested stream  
23 habitat through preparation of both Santee Cooper transmission-line corridors (SCE&G 2009e).  
24 To minimize impacts on streams and open water, MACTEC (2008) states “installation and  
25 replacement of transmission structures at river and stream crossings can be accomplished by  
26 setting the transmission structures on the banks in such a way that runoff will be diverted,  
27 resulting in minimal impacts to adjacent streams and rivers.” Santee Cooper transmission lines  
28 would cross navigable waters of the State of South Carolina at 18 locations. Permitting  
29 approval would be required by the USACE through Section 10 of the Rivers and Harbors  
30 Appropriations Act of 1899 (33 USC 403) and SCDHEC.

### 31 **4.3.2.3 Important Aquatic Species and Habitats**

32 One Federally listed endangered aquatic species, the Carolina heelsplitter (*Lasmigona*  
33 *decorata*), is listed as possibly occurring in Fairfield County, but is not known to occur at the  
34 VCSNS site. In total, six Federally listed threatened or endangered aquatic species occur within  
35 counties proposed for siting of new transmission lines, including designated critical habitat for  
36 the Carolina heelsplitter. Several aquatic taxa within Fairfield and Newberry Counties are State



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1  
2 **Figure 4-3.** Proposed SCE&G and Santee Cooper Transmission-Line Corridors in Relation to  
3 Crossings of Major Waterbodies

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1 species of concern. The list of taxa includes one freshwater fish, three freshwater mussels, and  
2 one crayfish. In addition, two species of invasive aquatic plant are known to occur at the  
3 VCSNS site. Impacts stemming from the various installation activities are dependent on the  
4 sensitivity of a species to localized disturbance, habitat associations typically made by a  
5 particular species, critical time periods associated with a species' life cycle, and the intensity  
6 and duration of the disturbance. Numerous aquatic biota are found within the vicinity of the  
7 VCSNS site. The following discussion includes aquatic species that are of conservation  
8 concern and are known or thought to exist in the vicinity of the VCSNS site.

### 9 **Recreational Species**

10 Both Parr and Monticello reservoirs support recreational fisheries for largemouth bass  
11 (*Micropterus salmoides*), sunfish (*Lepomis* spp.), and catfish (*Ictalurus* spp.). Except for catfish,  
12 these species have life histories that indicate known use of shallow-water habitats for  
13 reproduction and nesting activities. The use of turbidity curtains and cofferdams can minimize  
14 impacts on these shallow-water habitats. However, the timing of installation activities may have  
15 more detrimental effects on aquatic resources if performed during critical spawning seasons in  
16 mid to late spring. Because no exact schedule is given for installation activities associated with  
17 the raw-water and water-treatment plant intakes or the blowdown line for VCSNS Units 2 and 3,  
18 activities in these potential shallow-water habitat areas may affect recreational species.

### 19 **Invasive Species**

20 Alligatorweed (*Alternanthera philoxeroides*) has been identified as an aquatic invasive species  
21 by the South Carolina Aquatic Invasive Species (AIS) Task Force. Alligatorweed is a rapidly  
22 colonizing aquatic plant that forms dense vegetative mats that can alter flow and inhibit the  
23 uptake of water by other plants (SCDNR 2008). Proliferation of this aquatic nuisance species  
24 can occur via disturbance if plants become fragmented and subsequently re-root (SCDNR  
25 2006c). Alligatorweed has been documented above and below the proposed discharge location  
26 in Parr Reservoir (SCE&G 2009a). In addition, water primrose (*Ludwigia uruguayensis*) occurs  
27 in Monticello Reservoir, and can be an invasive, colonizing plant capable of choking shorelines  
28 and clogging intake structures. Shoreline installation activities that result in the disturbance of  
29 alligatorweed or water primrose may result in these plant species spreading to other aquatic  
30 habitats if vegetative fragments become uprooted and established elsewhere.

### 31 **Important Species**

32 The three freshwater mussel species listed as State species of concern within the vicinity  
33 (Fairfield or Newberry Counties) of the VCSNS site include the eastern creekshell (*Villosa*  
34 *delumbis*), the eastern floater (*Pyganodon cataracta*), and the yellow lance (*Elliptio lanceolata*).  
35 It is unknown whether the eastern creekshell or the yellow lance occurs within the vicinity of the  
36 VCSNS site. However, a single eastern floater was collected near the proposed raw-water

1 intake in Monticello Reservoir (CBS 2009a). A more detailed mussel sampling survey may be  
 2 necessary to determine the extent of eastern floater presence near the intake-installation area  
 3 prior to installation activities. Potential impacts on populations of mussels in the area of the  
 4 proposed intake include habitat loss, reproductive losses, and mortality associated with  
 5 dredging.

6 **Federally Listed Species**

7 The Carolina heelsplitter is the only Federally protected aquatic species that may reside in  
 8 onsite creeks and streams in the vicinity of VCSNS. Six Federally protected aquatic species  
 9 reside within the counties affected by transmission-line installation activities: the shortnose  
 10 sturgeon (*Acipenser brevirostrum*), Carolina heelsplitter, and four species of sea turtle:  
 11 loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea  
 12 turtle (*Dermochelys coriacea*), and Kemp's ridley sea turtle (*Lepidochelys kempii*). As part of  
 13 the NRC's responsibilities under Section 7 of the Endangered Species Act (ESA), the review  
 14 team has prepared biological assessments documenting potential impacts on the Federally  
 15 listed threatened or endangered aquatic and terrestrial species as a result of the construction  
 16 and preconstruction activities at the VCSNS site. The biological assessments are included in  
 17 Appendix F of this EIS, and the findings and determinations are summarized in this section.

18 The shortnose sturgeon is an amphidromous freshwater fish that spends a portion of its life  
 19 cycle in freshwater environments and a portion in estuarine ecosystems (NOAA 1998). The  
 20 shortnose sturgeon is reported to occur in six counties proposed for transmission-line crossings:  
 21 Aiken, Calhoun, Colleton, Hampton, Orangeburg, and Richland (FP&S 2008; MACTEC 2008;  
 22 FWS 2008; SCDNR 2006a). FWS (2008) reports the possible occurrence of shortnose  
 23 sturgeon in Dorchester and Lexington Counties, also proposed counties for transmission-line  
 24 crossings.

25 The Carolina heelsplitter is a freshwater mussel that has endured significant habitat degradation  
 26 by various development activities. This species is thought to be sensitive to sedimentation and  
 27 pollutants in waterways (SCDNR 2009). The Carolina heelsplitter is known to occur in three  
 28 counties proposed for transmission-line crossings: Chester, Lancaster and Saluda with critical  
 29 habitat designated in Chester and Lancaster Counties (FP&S 2008; MACTEC 2008; FWS 2008;  
 30 SCDNR 2006a), and is listed as possible to occur in Fairfield, Lexington, Newberry, and  
 31 Richland Counties (FWS 2008).

32 The use of BMPs for activities associated with preparation and installation of new transmission-  
 33 line corridors and infrastructure is expected to limit potential impacts on these species. Carolina  
 34 heelsplitter was included in the habitat survey of the 2.44 mi of proposed new corridor in Parr  
 35 Reservoir. Historically, the species was reported in small to large streams and rivers, and  
 36 usually found in mud, muddy sand, or muddy gravel substrates along stable, well-shaded  
 37 stream banks.

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1 The Carolina darter (*Etheostoma collis*) is a Federal species of concern in Fairfield and Richland  
2 Counties (FWS 2008), a State threatened species in Richland County (SCDNR 2009), and a  
3 State species of concern in Fairfield County (SCDNR 2006a). Due to the limited distribution of  
4 this freshwater fish, any development activities that result in an alteration of habitats used by the  
5 Carolina darter pose a threat to this species (Hayes and Bettinger 2006). The Carolina darter  
6 was not documented during the SCDNR 2000-2004 Broad River drainage aquatic surveys  
7 (Bettinger et al. 2003, 2006), within the vicinity of the VCSNS site (Tetra Tech NUS, Inc. 2007,  
8 2009a; Quattlebaum 2008a, 2008b; Normandeau 2007, 2008, 2009) and was not captured  
9 during the 1978-1984 survey efforts within Parr and Monticello reservoirs (Dames and Moore  
10 1985).

11 Two mollusks listed as Federal species of concern are known to occur within counties proposed  
12 for transmission-line crossings. The brook floater (*Alasmidonta varicosa*) is known to occur in  
13 Lancaster County and the Savannah lilliput (*Toxolasma pullus*) is known to occur in Saluda  
14 County (FWS 2008). Both the brook floater and the Savannah lilliput are listed as State species  
15 of concern in Lancaster and Saluda Counties, respectively (SCDNR 2006a).

16 The robust redhorse (*Moxostoma robustum*) is known to occur in Aiken County, which is  
17 proposed for transmission-line crossings, and it is listed as a Federal species of concern within  
18 this county (FWS 2008). The Robust Redhorse Conservation Committee has implemented  
19 efforts to reintroduce this native species to river basins such as the Broad River by stocking  
20 rivers with robust redhorse fingerlings (Self and Bettinger 2006; Rohde et al. 2009). In 2008,  
21 SCDNR caught two robust redhorse while electrofishing for smallmouth bass (*Micropterus*  
22 *dolomieu*) in Monticello Reservoir (NRC 2009a). Aquatic surveys in the vicinity of the VCSNS  
23 site resulted in the capture of two robust redhorse in the Parr Reservoir, representing 0.1  
24 percent of the total catch (Quattlebaum 2008a; Normandeau 2008).

25 *Distocambarus youngineri*, also commonly known as the Saluda crayfish (FWS 2008) or the  
26 Newberry burrowing crayfish (Taylor et al. 2007) is a State and Federal species of concern  
27 (FWS 2008). This species has been encountered in few locations within South Carolina; all  
28 have been limited to Newberry County and only one occurrence has been documented in the  
29 Broad River (SCDNR 2006b). It is unknown whether *D. youngineri* occurs within the vicinity of  
30 the VCSNS site; however, only *Procambarus* species were collected during field sampling in  
31 Mayo Creek in 2009 (CBS 2009b).

32 Although exact placement of final corridors has not yet been determined, SCE&G has indicated  
33 that activities for installation would be avoided in any critical habitat for Federal or State listed  
34 species (SCE&G 2009a).

35 The loggerhead sea turtle, green sea turtle, leatherback sea turtle, and Kemp's ridley sea turtle  
36 do not occur in counties associated with VCSNS or transmission-line corridors with the  
37 exception of Colleton County. Current siting plans for the VCSNS-Varnville transmission-line

1 corridor, as discussed in Section 2.4.2.2, do not occur near nesting beaches or near marine  
2 habitats used by sea turtles in Colleton County. Therefore, there is no potential for  
3 transmission-line preparation activities to affect these species.

#### 4 **4.3.2.4 Aquatic Monitoring During Site Preparation**

5 SCE&G plans to perform preconstruction-related monitoring for water quality in accordance with  
6 Federal and State permitting requirements as specified by USACE and SCDHEC. Prior to  
7 building activities within transmission-line corridors, monitoring may include on- the-ground  
8 surveys to implement appropriate site-specific BMPs. Accidental spills during the building  
9 phase would be mitigated through a Spill Prevention, Control, and Countermeasures Plan  
10 (SCE&G 2009a). Monitoring associated with the SWPPP may also be implemented during the  
11 preconstruction and construction phases of the project (SCE&G 2009a), and SCDHEC may  
12 require specific monitoring activities as a part of its permitting process to assess potentially  
13 affected areas such as waterbodies associated with the VCSNS Units 2 and 3 site and within  
14 transmission-line corridors. The USACE would conduct compliance monitoring during the  
15 building phase of the project relative to activities within permitted areas (e.g., streams, wetlands,  
16 transmission-line corridors) (SCE&G 2009a).

#### 17 **4.3.2.5 Summary of Impacts on Aquatic Resources**

18 The review team has reviewed the proposed site construction and preconstruction activities  
19 associated with VCSNS Units 2 and 3 and the potential impacts on aquatic biota in the Broad  
20 River and Parr Reservoir, Monticello Reservoir, onsite streams, and waterbodies associated  
21 with transmission-line corridors. Site construction and preconstruction activities would ultimately  
22 be episodic, yet impacts would be greatest for nonmotile aquatic organisms.

23 Filling in of the headwaters for Stream L, which flows into Mayo Creek (Figure 4-2), would result  
24 in a noticeable change for that immediate area; however, water-quality impacts are likely to be  
25 negligible through the use of BMPs to control sedimentation. Aquatic biota residing in this  
26 portion of Stream L would either move downstream as filling activities commence, or be  
27 eliminated if prevented from moving downstream (SCE&G 2009a). The loss of habitat and  
28 potential loss of species are expected to be minimal when considering similar unaffected  
29 freshwater stream habitats in the region.

30 Installation of water-intake and discharge structures would result in temporary impacts at distinct  
31 locations within the Parr and Monticello reservoirs, but would be largely controlled by the use of  
32 BMPs associated with the management of water quality. By following State and Federal BMPs  
33 associated with water quality, the impacts of the installation of new transmission-line corridors  
34 on aquatic biota would be short-term and minimal. Based on this review, the review team  
35 concludes that the impacts resulting from the proposed preconstruction and construction  
36 activities would be minimal.

## Construction Impacts at the VC Summer Site

1 Based on the information provided by SCE&G and the above observations from the review  
2 team's independent evaluation, the review team concludes that the impacts on onsite aquatic  
3 biota during construction and preconstruction activities for the proposed VCSNS Units 2 and 3  
4 would be SMALL, and no further mitigation measures would be warranted. Based on the above  
5 analysis, and because NRC-authorized construction activities represent only a portion of the  
6 analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction  
7 activities would be SMALL, and no further mitigation measures would be warranted.

8 Based on information provided by SCE&G and the above observations from the review team's  
9 independent evaluation, the review team concludes that impacts on offsite aquatic biota from  
10 preconstruction activities related to the development of the proposed associated transmission  
11 lines would be SMALL, and no further mitigation measures would be warranted. The LWA rule  
12 specifically indicates that transmission lines are not included in the definition of construction.  
13 Therefore, the NRC staff concludes that there would be no impacts on offsite aquatic biota  
14 associated with NRC-authorized construction activities.

### 15 **4.4 Socioeconomic Impacts**

16 Socioeconomic impacts may occur in the region surrounding the proposed site. This discussion  
17 emphasizes socioeconomic impacts from construction and preconstruction activities on  
18 Fairfield, Lexington, Newberry, and Richland Counties, although it considers the entire 50-mi  
19 region surrounding the proposed VCSNS site.<sup>(a)</sup> The scope of the review is guided by the  
20 magnitude and nature of the expected impacts of the construction and preconstruction activities  
21 of the proposed project and by the site-specific community characteristics that can be expected  
22 to be affected by these activities.

23 Along with the region and the subset of the region mentioned above, the review team  
24 considered an additional subset of the region called the economic impact area. This area  
25 includes the same four counties identified above, which the review team concludes make up the  
26 functional economic region for current and future impacts tied to the VCSNS site. This  
27 economic impact area is discussed in terms of employment, income, and output impacts.

28 Very large projects, such as proposed VCSNS Units 2 and 3 can affect individual communities,  
29 the surrounding region, and minority and low-income populations. The evaluation here  
30 assesses the impacts of project-related activities and of the onsite workforce during the VCSNS

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(a) For the purposes of this EIS, the relevant region is limited to the area necessary to include social and economic base data for (1) the county in which the proposed plant would be located and (2) the specific portions of surrounding counties and urbanized areas (generally, up to 50 mi from the VCSNS site) from which the construction and/or operations workforce would be principally drawn, or that would receive stresses to community services by a change in the residence of construction and/or operations workers.

1 construction and preconstruction activities on the communities and governmental jurisdictions  
2 within the vicinity of the VCSNS site; i.e., the region within 50 mi of the VCSNS site. Unless  
3 otherwise specified, the primary source of information for this section is the SCE&G ER  
4 (SCE&G 2009a). The review team's conclusions are based upon independent verification of  
5 SCE&G's information in the ER, visits to the site, vicinity, and region, and consultation with local  
6 officials.

7 If the two COLs are approved, construction and preconstruction activities are planned to span a  
8 total of 123 months, with 30 months dedicated to site clearing and preparation, and 93 months  
9 for building Units 2 and 3 (SCE&G 2009a). The building of Units 2 and 3 would be staggered by  
10 2 years, for a total construction and preconstruction period of 10.25 years (SCE&G 2009a).  
11 SCE&G estimates that the peak onsite workforce for proposed VCSNS Units 2 and 3 during  
12 construction and preconstruction activities would occur during 2013 and during 2015 reaching a  
13 total of up to 3600 workers. The staggered construction and preconstruction periods would  
14 allow the peak workforce from Unit 2 to transfer to Unit 3 and then steadily decline until both  
15 units are ready for operation. SCE&G indicates the operations staff of 400 at each unit would  
16 be employed approximately 2 to 3 years before fuel loading of each unit, to allow time for  
17 simulator training and startup testing (SCE&G 2009a).

18 The VCSNS site and parts of the surrounding region have experienced significant growth over  
19 recent decades, and, as a result, the area has adjusted to providing services needed by in-  
20 migrating populations. The region has not been insulated from recent negative economic  
21 impacts from the current economic downturn.

22 The following sections describe the economic component of the physical impacts on the site  
23 (Section 4.4.1), demographic impacts on the community (Section 4.4.2), economic impacts  
24 (Section 4.4.3), and the impacts on infrastructure and community services (Section 4.4.4). The  
25 impacts on minorities and low-income populations are covered in Section 4.5 of this chapter.

#### 26 **4.4.1 Physical Impacts**

27 Construction and preconstruction activities can cause temporary and localized physical impacts  
28 such as noise, odors, vehicle exhaust, light, and dust. Vibration and shock impacts are not  
29 expected because of the strict control of blasting and other shock-producing activities. This  
30 section addresses potential impacts that may affect people, buildings, and roads.

##### 31 **4.4.1.1 Impacts on Workers and the Local Public**

32 The VCSNS site is in a rural setting, bounded on the north by Monticello Reservoir and on the  
33 west by the Broad River. To the west and south are forested and agricultural lands in which a  
34 few residences and small communities are located. The site is located entirely within Fairfield  
35 County. No significant industrial or commercial facilities are planned in the immediate vicinity of

## Construction Impacts at the VC Summer Site

1 the site. SCE&G plans to use the existing transmission lines and facilities where possible,  
2 although six new 230-kV transmission lines would be needed to connect the new units to the  
3 SCE&G grid, requiring 100-ft widening of some existing transmission-line corridors or entirely  
4 new corridors in some cases (see Section 4.1.2).

5 SCE&G has indicated that all construction and preconstruction activities would occur within the  
6 VCSNS site boundary and would be performed in accordance with applicable Occupational  
7 Safety and Health Administration (OSHA) standards, BMPs, and other applicable regulatory and  
8 permit requirements.

9 The people most vulnerable to noise, fugitive dust, and gaseous emissions resulting from  
10 construction and preconstruction activities include personnel working onsite, and people  
11 working or living immediately adjacent to the site. Based on the 2000 U.S. Census, an  
12 estimated 104 individuals lived within 1 mi of the VCSNS site (SCE&G 2009o). Given their  
13 proximity, the residents living directly adjacent to the VCSNS site in the town of Jenkinsville and  
14 unincorporated Fairfield County have the greatest potential for offsite exposure to aesthetic,  
15 noise, air quality, and light impacts from construction and preconstruction activities. Impacts  
16 from the increased and altered traffic patterns and resulting noise, emissions, and congestion,  
17 and from impacts caused by the presence of VCSNS project-related workers would extend  
18 farther from the VCSNS site, but are likely to be most concentrated in the nearby communities  
19 and on the roadways within the vicinity of the site.

### 20 **4.4.1.2 Noise Impacts**

21 Noise is an environmental concern because it can cause adverse health effects, annoyance,  
22 and disruption of social interactions. Noise would result from clearing, earthmoving, foundation  
23 preparation, pile driving (if needed), concrete mixing and pouring, steel erection, and various  
24 stages of facility equipment fabrication, assembly, and installation, during which a substantial  
25 number of diesel- and gasoline-powered vehicles and other equipment would be used. Noise  
26 from the VCSNS site also would be generated by internal combustion engines, impact  
27 equipment (e.g., jackhammers, pile drivers), and other equipment such as grinders and saws,  
28 explosives, loudspeakers, alarms, and sirens. Decibels increase logarithmically, with pressure  
29 levels of separate sounds being logarithmically, not arithmetically, additive. This means that if  
30 one sound of 60 dB is added to another sound of 60 dB, the total is 63 dB, a 3-dB increase, and  
31 not 120 dB. The Federal Interagency Committee on Noise determined that project-related  
32 increases of 1.5 dBA (if the ambient level is above 65 Ldn [day night average sound level]) or  
33 3 dBA (if the ambient level is below 65 Ldn) are considered “substantial.” In addition to routine  
34 noises, sudden, infrequent, short-term blasts of noise may be disruptive of sleep or have a  
35 “startle effect” on humans and wildlife that can result in significant annoyance to affected  
36 populations.



1 During construction and preconstruction activities, noise is expected to peak above 100 dBA at  
2 a 50-ft distance from the equipment, with multiple pieces operating simultaneously. The  
3 activities that produce noises in this range would be intermittent, although at points in the  
4 project, activities could be scheduled for 24-hour days, 7 days a week. It is expected that noise  
5 levels experienced by sensitive noise receptors outside of the exclusion area boundary would  
6 rapidly attenuate to below 50 dBA (SCE&G 2009a). Continuous noise would be lower.  
7 Because the site is surrounded by forests and moderate topography, the review team concludes  
8 that noise emanating from the project site could be somewhat muffled to surrounding  
9 communities and the associated impact would not be significant.

10 The majority of transmission lines that would be needed for VCSNS Units 2 and 3 already have  
11 been constructed, although some expansions and upgrades would need to be built. Limited  
12 maintenance activities in transmission-line corridors and improvements to towers, lines, and  
13 corridors would be undertaken as part of the project and would create short-term sources of  
14 noise in the corridors. Consequently, the review team concludes that noise impacts on  
15 surrounding communities from these activities during construction and preconstruction would be  
16 negligible.

#### 17 **4.4.1.3 Impacts on Air Quality**

18 The VCSNS site is in Fairfield County, South Carolina, which is an attainment area for all criteria  
19 pollutants (40 CFR 81.108 and 81.341). The baseline air quality characteristics are described in  
20 Section 2.9.2 of this EIS. The Clean Air Act establishes National Ambient Air Quality Standards  
21 (NAAQSs), which include the following criteria pollutants:

- 22 • sulfur dioxide (SO<sub>2</sub>)
- 23 • particulate matter with an aerodynamic diameter of 10 microns or less (PM<sub>10</sub>)
- 24 • particulate matter with an aerodynamic diameter of 2.5 microns or less (PM<sub>2.5</sub>)
- 25 • carbon monoxide (CO)
- 26 • nitrogen dioxide (NO<sub>2</sub>)
- 27 • ozone (O<sub>3</sub>)
- 28 • lead (Pb).

29 Temporary and minor impacts on local ambient air quality could occur as a result of activities at  
30 the VCSNS site during construction and preconstruction. Fugitive dust and fine particulate  
31 emissions, including those PM<sub>10</sub> in size, would be generated during earthmoving and material-  
32 handling activities. Equipment and offsite vehicles used for hauling debris, equipment, and  
33 supplies also produce emissions. Given Fairfield County's attainment status for criteria  
34 pollutants, only oxides of nitrogen (a precursor to ozone) and carbon monoxide (combustion

## Construction Impacts at the VC Summer Site

1 exhaust) are pollutants of primary concern for construction and preconstruction impacts at the  
2 VCSNS site. Several variables affect emissions; these variables include the type of vehicles,  
3 the timing and phasing of construction and preconstruction activities, and haul routes. The  
4 emissions and their impacts on air quality would be minimized through mitigative actions and  
5 compliance with all Federal, State, and local regulations that govern construction and  
6 preconstruction activities and emissions from construction vehicles.

7 SCE&G stated that it would identify specific mitigation measures to control fugitive dust (SCE&G  
8 2009a). Mitigation measures would include any or all of the following:

- 9 • Stabilize access roads and spoil piles.
- 10 • Limit speeds on unpaved access roads.
- 11 • Periodically water unpaved access roads to control dust.
- 12 • Perform housekeeping (i.e., remove dirt spilled onto paved roads).
- 13 • Cover haul trucks.
- 14 • Minimize material handling (e.g., limit drop heights and double handling).
- 15 • Cease grading and excavation activities during high winds and extreme air pollution  
16 episodes.
- 17 • Phase grading to minimize the area of disturbed soils.
- 18 • Revegetate road medians and slopes.
- 19 • Phase construction and preconstruction activities to minimize daily emissions.
- 20 • Perform proper maintenance of construction vehicles to maximize efficiency and minimize  
21 emissions.

22 Local air quality could be affected by construction and preconstruction activities. Exhaust  
23 emissions from construction vehicles and equipment would generate small amounts of  
24 particulate matter, carbon monoxide, oxides of nitrogen, and volatile organic compounds. If  
25 construction and preconstruction activities include the burning of debris, refuse, or residual  
26 building materials, SCE&G has indicated that it would secure any required permits from the  
27 State or county and follow any pertinent local ordinances.

28 Therefore, although emissions from construction and preconstruction activities and equipment  
29 operation are unavoidable, the review team concludes that SCE&G's mitigation efforts would  
30 limit impacts on air quality during construction and preconstruction activities and would not  
31 warrant mitigation beyond the measures discussed for inclusion in the mitigation plans.

1 BMPs and control measures would be used to limit the impacts of emissions. The concrete  
2 batch plant would be operated in compliance with SCDNR regulations; use of the onsite plant  
3 would reduce emissions from trucks that otherwise would deliver concrete to the site. Control  
4 measures would include development and implementation of a plan to control fugitive dust;  
5 grading to promote drainage and minimize mud on vehicles; stabilization of ground surfaces as  
6 soon as practical after clearing (e.g., reseeded); wetting of bare ground and unpaved roadways  
7 during dry conditions; conduct of any burning in accordance with applicable regulations and  
8 forest fire-safety measures; and inspecting and servicing construction equipment regularly  
9 (SCE&G 2009a).

#### 10 **4.4.1.4 Impacts on Buildings**

11 Only SCE&G buildings would be affected by construction and preconstruction activities at the  
12 immediate VCSNS site. Existing buildings at the site have been constructed to safely withstand  
13 any possible impact, including shock and vibration, from activities associated with additional  
14 development at the VCSNS site (10 CFR Part 50, Appendix A). Except for the existing  
15 structures on the VCSNS site, no other industrial, commercial, or recreational structures would  
16 be directly affected by the construction of the new facility.

17 The nearest residence is approximately 1.3 mi from the site and is not expected to be directly  
18 affected by construction and preconstruction activities (SCE&G 2009a). If blasting is necessary,  
19 the building(s) most vulnerable to shock and vibration would be the VCSNS-related facilities,  
20 which have been built to withstand forces in excess of those they would experience as a result  
21 of activities at the VCSNS site (SCE&G 2009a). Consequently, the review team concludes that  
22 the impacts on buildings would be limited and would not warrant mitigation.

#### 23 **4.4.1.5 Transportation Impacts**

24 This EIS assesses the impact of transporting workers and construction materials to and from the  
25 VCSNS site from three perspectives: the socioeconomic impacts, the air quality impacts of dust  
26 and particulate matter put into the air by vehicle traffic, and the potential health impacts caused  
27 by additional traffic-related accidents. The socioeconomic impacts are addressed here and in  
28 Section 4.4.4.1. The air quality impacts are addressed in Section 4.4.1.1, and the human health  
29 impacts are addressed in Section 4.8.

30 No new construction or major modification of public roads is planned and only minor repairs and  
31 maintenance of existing roadways are likely in preparation for site-development activities. The  
32 affected roads are primarily rural or county roads and do not support large volumes of daily  
33 traffic. Therefore, the review team concludes that the expected physical impacts on public  
34 roads and highways would be limited to wear and tear on the local roads from the increased  
35 traffic to the site.

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1 The main railroad lines in central South Carolina are owned and operated by the Norfolk  
2 Southern Railroad. Material deliveries to support construction and preconstruction activities are  
3 expected to be made by railroad using the existing VCSNS railroad spur that enters the site at  
4 its southern boundary and extends to the central portion of the site. The Norfolk Southern line  
5 and the VCSNS railroad spur would experience increased use if materials are brought in by  
6 train. The review team expects that some upgrading of the railroad line would be required  
7 between the site and Peak, South Carolina. Because these modifications are expected to be  
8 made within the existing railroad bed and any new railroad line would be built within the VCSNS  
9 site only, the review team concludes that the impacts of railway upgrading would be minimal.

### 10 **4.4.1.6 Impacts on Aesthetics**

11 The VCSNS site is on a plateau above the Broad River and surrounded by lowlands, forested  
12 hills, and agricultural lands. The site is largely concealed from view by the surrounding forests.  
13 The 6800-ac Monticello Reservoir hosts numerous water sports and outdoor activities  
14 throughout the year and is surrounded by natural woodlands and low-density residential  
15 communities. Jenkinsville Park, approximately 2 mi east of the site, is the closest park. Any  
16 plumes and some construction equipment are likely to be visible from the reservoir. However,  
17 because Monticello Reservoir is north of the proposed facility, direct view of the VCSNS Units 2  
18 and 3 site is blocked by forest from most points on the reservoir or screened by views of Unit 1.

19 Visual impacts are determined by assessing the consequences of actions on scenic quality,  
20 scenic value, and the sensitivity of the affected viewsapes (DOI 2008). Negative visual  
21 impacts from additional development on the VCSNS site would be lessened by topography and  
22 by the fact that low-profile cooling towers would be used. Visual impacts on neighboring  
23 residents and individuals using the reservoir caused by cranes and increased traffic would be  
24 temporary. Therefore, the review team concludes that the impact of construction and  
25 preconstruction activities at the proposed VCSNS site on aesthetics and recreational  
26 opportunities would not be significant and would not require mitigation.

### 27 **4.4.1.7 Summary of Physical Impacts**

28 The review team has evaluated information provided by SCE&G, visited the site and its  
29 environs, and performed an independent review of the potential physical impacts of construction  
30 and preconstruction activities on the local area and region of the VCSNS site. The review team  
31 concludes that the expected physical impacts enumerated in the preceding sections would be  
32 SMALL and that mitigation beyond the strategies outlined by SCE&G in its ER would not be  
33 warranted.

#### 1 **4.4.2 Demographic Impacts on the Community**

2 Socioeconomic impacts are the result of project expenditures and employment that change the  
3 employment and population levels of a community from baseline levels. Project expenditures  
4 and employment drive changes in population baselines by drawing new residents into an area  
5 and/or by preventing the departure of existing residents from an area. Growth in population and  
6 employment increase spending in the area, leading to increased demand for housing,  
7 education, and other facilities and services. The assessment of demographic impacts of the  
8 proposed VCSNS Units 2 and 3 construction and preconstruction activities is based on the  
9 consequences to the region and local communities of employment of an estimated peak of  
10 almost 3600 workers. An expected 800 operations workers also would be onsite for training  
11 purposes toward the end of construction and preconstruction activities.

12 All workers onsite during the project are included in the assessment of impacts of the NRC-  
13 authorized activities, whether “construction” workers or “operations” workers. The building of  
14 Units 2 and 3 would be staggered by 2 years for a total site construction and preconstruction  
15 period of 10.25 years. This schedule would allow for sustained peak employment as employees  
16 finishing Unit 2 are then transferred to Unit 3 as it is reaching its employment peak, followed by  
17 a gradual reduction in employment as both units are completed.

18 As discussed in Section 2.5 of this EIS, the region extends 50 mi from the site boundary.  
19 Although the review team considered the entire region within a 50-mi radius of the VCSNS site  
20 when assessing socioeconomic impacts of construction and preconstruction activities, the  
21 primary focus is on Fairfield, Lexington, Newberry, and Richland Counties, all of which are in  
22 South Carolina. Based on the size of the resident workforce within commuting distance of the  
23 VCSNS site, commuter patterns, and the distribution of residential communities in the area, the  
24 review team expects minimal demographic impacts on other counties within the region.

25 Based on this information, the review team anticipates that the majority of the construction and  
26 preconstruction workforce would not migrate into the economic impact area but already would  
27 live within a reasonable commuting distance. The review team examined the Final  
28 Environmental Statement (FES) issued for the Operating License for Unit 1 by NRC (NRC  
29 1981). The timing of the FES was such that construction of Unit 1 was nearly complete and  
30 provided some ready observations to the NRC staff about the extent of the socioeconomic  
31 impacts. Based on a survey of Unit 1 construction workers, the NRC staff concluded that  
32 80 percent of them lived within the 50-mi region, and that 50 percent of them lived in Lexington  
33 and Richland Counties (NRC 1981). While construction methods and skill sets have changed  
34 over the intervening years, the greater Columbia metropolitan area has also grown significantly.  
35 The review team would not expect significantly different settlement patterns during the Units 2  
36 and 3 construction and preconstruction activities.

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1 Over the past decade, the four-county region surrounding the VCSNS site has experienced  
 2 strong population growth, creating many employment opportunities for construction workers in  
 3 the area. Given the presence of a significant construction industry and related workforce in the  
 4 region, significant in-migration appears unlikely during construction and preconstruction  
 5 activities (see Tables 2-30 and 2-31).

6 As discussed in Section 2.5, the baseline (without VCSNS Units 2 and 3) population of the  
 7 region is expected to continue to grow at a steady rate (see Table 2-24). Based on regional  
 8 growth since the Unit 1 construction, coupled with observed migration behavior during the Unit 1  
 9 construction, and typical outage workforce migration patterns, the review team concludes that  
 10 50 percent of the peak workforce or 1800 workers can be assumed to migrate into the four-  
 11 county economic impact area. Potentially, it could be less than that amount, but 50 percent  
 12 provides a reasonable assumption, given that the skills required for modern, large-scale  
 13 construction projects have increased in complexity and finding sufficient numbers of  
 14 appropriately skilled workers would require searching beyond the Columbia metropolitan area  
 15 (SCE&G 2009c). Using the U.S. Census Bureau's estimated household size of 2.6 persons,  
 16 1800 in-migrating workers amount to 4680 in-migrating persons when families are considered.  
 17 The specific community impacts resulting from potential demographic changes are discussed in  
 18 Section 4.4.4. Table 4-4 highlights expected county-level demographic impacts.

19 **Table 4-4.** Expected Distribution of In-Migrating Construction Workers in the Region at Peak  
 20 of Construction

County	Number of Current Unit 1 Operations Workforce	Percent of Current Unit 1 Operations Workforce	Number of Units 2 and 3 In-Migrating Construction Workforce	Number of In-Migrating People
Fairfield County	58	9.1	164	426
Lexington County	219	34.5	621	1615
Newberry County	115	18.1	326	847
Richland County	209	32.9	592	1540
Economic Impact Area	601	94.6	1703	4427
Other Counties	34	5.4	97	253
Total	635	100.0	1800	4680

21 The review team anticipates that the majority of the in-migrating workers would move into  
 22 Richland and Lexington Counties because of their relative proximity to the site, housing  
 23 availability, and amenities. The review team estimated the baseline population of the four most  
 24 local counties would increase steadily over the 2010–2060 period (see Table 2-23). Therefore,  
 25 based upon current and projected population levels, the expected increase in in-migrating  
 26 workers and their families would represent a less than 1 percent increase over the region's  
 27 projected 2010 population.

1 Because of the area's size, the review team expects that any demographic impacts from  
2 construction and preconstruction activities would be SMALL and temporary. Likewise, the  
3 review team expects that Fairfield and Newberry Counties would receive relatively few of the in-  
4 migrating workers and their families. Therefore, the review team anticipates any population  
5 impacts of construction and preconstruction activities in Fairfield and Newberry Counties would  
6 not be noticeable and the communities nearest the VCSNS site would likely experience SMALL  
7 and temporary demographic impacts.

#### 8 **4.4.3 Economic Impacts on the Community**

9 This section evaluates the changes in employment, income, and output attributable to the  
10 VCSNS Units 2 and 3 construction and preconstruction activities in the four-county economic  
11 impact area.

##### 12 **4.4.3.1 Economy**

13 The impacts of construction and preconstruction activities on the local and regional economy  
14 depend on the region's current and projected economy and population. Characteristics of the  
15 economy and workforce in the region are described in Section 2.5.2 of this EIS. At its peak, the  
16 construction- and preconstruction-phase workforce is estimated to require about 3600 workers.  
17 Construction and preconstruction activities would be staggered by 2 years between Units 2 and  
18 3 to avoid dramatic swings in employment. In its ER, SCE&G estimates that the Units 2 and 3  
19 construction and preconstruction activities would last 30 months for preparation and grading and  
20 93 months for building the new units, for a total project duration of 10.25 years (SCE&G 2009a).

21 The in-migration of approximately 1800 workers, most bringing their families, would create new  
22 indirect jobs in the area through a process called the "multiplier effect." The number of in-  
23 migrating workers would be affected to some degree by local training programs and other  
24 measures to prepare the local labor force. Each dollar spent on goods and services by one  
25 person becomes income to another, who saves some money but re-spends the rest. In turn,  
26 this re-spending becomes income to someone else, who in turn saves a portion and re-spends  
27 the rest, and so on. The percentage by which the sum of all spending exceeds the initial dollar  
28 spent is called the "multiplier." The U.S. Department of Commerce Bureau of Economic  
29 Analysis (BEA), Economics and Statistics Division, provides regional multipliers for industry jobs  
30 and earnings and a custom set of multipliers was provided by BEA to SCE&G for the four-  
31 county economic impact area (SCE&G 2009a).

32 The Regional Input-Output Modeling System (RIMS II) employment multiplier for the economic  
33 impact area is 2.045, meaning that for each direct job created a total of 2.045 jobs (including the  
34 direct job) would be supported in the economic impact area. In the case of the VCSNS  
35 construction and preconstruction activities this means the 1800 direct jobs at the project peak  
36 would generate 1881 indirect and induced jobs in the four-county economic impact area. Only

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1 the in-migrating direct jobs are counted so that a net impact can be estimated. Other indirect  
2 and induced jobs are assumed to be allocated to area residents who would be leaving other  
3 jobs to take VCSNS-related employment. As a result, the direct employment of 3600 workers at  
4 the project peak would support a total of 3672 indirect employment in the economic impact area.  
5 Because half of the workforce is expected to migrate to the area, only half of the direct and  
6 indirect employment supported by the project would count as an impact on the economic  
7 impact area.

8 Skilled workers required for construction and preconstruction activities at the proposed VCSNS  
9 Units 2 and 3 include electrical workers, welders, and pipe fitters. To obtain the necessary  
10 skilled and unskilled workers, construction companies are expected to recruit some employees  
11 from local technical school programs and to work with local and regional technical school  
12 programs and school administrators to expand offerings in the necessary technical and craft  
13 areas.

14 During visits to the area, the review team observed that significant job training programs are  
15 being implemented in the local area specifically to train workers for the VCSNS construction  
16 jobs and other similar jobs beyond the VCSNS project. Given the nature of the regional  
17 economy and the materials needed to construct proposed Units 2 and 3, only a relatively limited  
18 quantity of materials and services are expected to be purchased from within the economic  
19 impact area during construction and preconstruction activities.

20 The review team estimates that the average wage in the Columbia metropolitan area for these  
21 workers currently is about \$37,000 per year or about \$18.50 per hour, based on a 2000-hour  
22 work year, based on data from the Bureau of Labor Statistics (BLS 2008a). Assuming a  
23 benefits package that would double that annual amount to \$74,000, the review team estimates  
24 that annual earnings at peak project employment would be about \$266.4 million. That  
25 \$266.4 million represents the direct income effect of the project to the economic impact area.  
26 Applying the income multiplier of 1.926 supplied to SCE&G from RIMS II, the earnings, including  
27 benefits, paid to the project workforce would result in generation of an additional \$246.7 million  
28 annually in the economic impact area during peak employment years, for a total income effect of  
29 \$513.1 million. As discussed with employment, the real impact would net out to about half  
30 (\$256.5 million) because only half of the direct and indirect employment supported by the  
31 project would count as an impact to the economic impact area.

32 Combined with the indirect jobs created by the proposed action, this would likely have a positive  
33 effect on unemployment in the area during the early stages of the project when onsite  
34 employment would be increasing and would create business opportunities for housing and  
35 service-related industries, especially in Lexington and Richland Counties.

36 The review team concludes, based on its independent review of the likely economic effects of  
37 the proposed action that beneficial economic impacts of the proposed action would be



1 experienced throughout the four-county economic impact area. Depending on actual worker  
2 relocation patterns, portions of Fairfield, Lexington, Newberry, and Richland Counties would  
3 expect temporary positive economic and employment impacts on the local economy during  
4 construction and preconstruction activities. Economic impacts elsewhere in the wider region  
5 would be smaller but beneficial.

#### 6 **4.4.3.2 Taxes**

7 The tax structure of the region is discussed in EIS Section 2.5. Several types of taxes would be  
8 generated during the construction and preconstruction activities, including income taxes on  
9 wages and salaries, sales and use taxes on corporate and employee purchases, and personal  
10 property taxes associated with employees.

11 Given that 50 percent of the peak project workforce already would live in the local area, and that  
12 the in-migrating workers would reside primarily in the four counties roughly in the same  
13 distribution as the current operations workforce for Unit 1, the review team expects no county in  
14 the economic impact area or the State to experience a significant change in its tax revenue  
15 streams during construction and preconstruction activities. To the degree that skilled workers  
16 from out of state are likely to relocate to the economic impact area during construction and  
17 preconstruction activities, the review team expects that a minimal increase in State income tax  
18 revenue would be generated from their salaries. However, the skilled craft jobs would account  
19 for a very small proportion of the overall workforce in the economic impact area, making a major  
20 State income tax revenue impact unlikely.

21 Because the number of new income tax payers in South Carolina resulting from the VCSNS  
22 project would not change noticeably in the context of the State's income tax base, income tax  
23 revenue attributable to the VCSNS project also would be minimal. The review team estimates  
24 that \$12–\$15 million in annual income tax revenue would be attributable to construction and  
25 preconstruction during peak years of activity; however the overwhelming majority of that  
26 revenue would have been generated by the same workers in South Carolina, from their  
27 employment prior to gaining employment at VCSNS. Similarly, State sales tax impacts should  
28 be viewed in the same context. Such revenue impacts only apply to the portion of the workforce  
29 that would be new to South Carolina.

30 The in-migrating employees and contractors working at the VCSNS site during the project also  
31 would pay property taxes, State income taxes, real-estate transfer fees, and motor-vehicle  
32 taxes, which are collected by or on behalf of the State government and distributed to State  
33 agencies and minor jurisdictions, including schools. The area around the proposed site would  
34 experience an increase in sales and use taxes generated by retail expenditures  
35 (e.g., restaurants, hotels, merchant sales, food) by the construction and preconstruction  
36 workforce. The SCE&G estimates, based on a State assumption of 4.17 percent of gross  
37 income being collected in sales taxes, annual sales tax collections directly and indirectly

## Construction Impacts at the VC Summer Site

1 attributable workforce would generate approximately \$4.8 million annually within the economic  
2 impact area (SCE&G 2009h). The economic impact area also would experience an increase in  
3 the sales and use taxes collected from building materials and supplies purchased for the  
4 project. These revenues would likely be generally proportional to the wages paid to workers at  
5 proposed Units 2 and 3, increasing through the peak of construction and preconstruction  
6 activities and then declining until stabilizing after completion of these activities.

7 Although SCE&G currently pays property taxes on the existing land and improvements at the  
8 VCSNS site, the review team does not expect that there would be any increase in property  
9 taxes revenue until after construction and preconstruction activities are completed. Currently,  
10 taxes paid by SCE&G on the VCSNS site account for about 40 percent of Fairfield County's  
11 total annual property tax revenues. For the years 1999 to 2008, based on Table 2-33 of this  
12 EIS, SCE&G's share of Fairfield County's property tax revenue has been slightly declining.  
13 After completion, SCE&G would pay property taxes on the new VCSNS Units 2 and 3 facilities  
14 under a "fee in-lieu of tax" agreement with Fairfield County (SCE&G 2009h). These impacts are  
15 discussed in Section 5.4.3.2.

16 Based on this assessment, the review team concludes that the potential impact of taxes within  
17 the region because of the construction and preconstruction activities would be minimal and  
18 beneficial. The impact within Fairfield County, where the units would be located, also would be  
19 minimal and beneficial because the review team expects most tax impacts to occur during the  
20 operations phase.

### 21 **4.4.3.3 Summary of Economic Impacts on the Community**

22 The review team has reviewed information provided by SCE&G, visited the site and its environs,  
23 and performed an independent review of potential economic impacts of construction and  
24 preconstruction activities on the local area and region of the VCSNS site. The review team  
25 concludes that the expected economic impacts on the affected communities, enumerated in the  
26 preceding sections, would be SMALL and beneficial, and no further mitigation would be  
27 required.

### 28 **4.4.4 Infrastructure and Community Service Impacts**

29 Infrastructure and community services include transportation, recreation, housing, public  
30 services, and education, as described in the following sections.

#### 31 **4.4.4.1 Transportation Impacts**

32 Railways, waterways, roads, and highways are the modes of transportation relevant to the  
33 VCSNS site.

1 **Railways and Waterways**

2 While the spur line from the Norfolk Southern railroad line may be used to bring in heavy  
3 construction materials, the review team does not anticipate its use to increase greatly. Some  
4 railroad upgrading may be required and new spur lines would be laid on the VCSNS site. No  
5 waterways would be used to transport construction materials to the site.

6 **Roads and Highways**

7 This section deals with the infrastructure impacts of the traffic generated by construction and  
8 preconstruction activities. The air quality impacts of transportation are addressed in Section  
9 4.4.1.5 and the human health impacts are addressed in Section 4.8.3.

10 Construction- and preconstruction-related impacts on traffic are determined by five elements:

- 11 • the number and timing of worker vehicles on the roads per shift
- 12 • the number of shift changes for the workforce per day
- 13 • the number and timing of truck deliveries to the site per day
- 14 • the projected population growth rate in Fairfield County
- 15 • the current capacity and usage of the roads, including use by the existing operations  
16 workforce.

17 Based on South Carolina Department of Transportation (SCDOT) traffic data (see Table 2-34),  
18 SC-213 between the Newberry County line and SC-215 at Jenkinsville currently averages  
19 2400 vehicles daily under normal circumstances. That number is well under the 8600-vehicle  
20 capacity suggested by level of service (LOS) "C", which is the SCDOT standard for two-lane  
21 rural roadways (SCDOT 2009). SCDOT also indicates that SC-215 from the Richland County  
22 line to the junction with SC-213 averages 1600 vehicles daily under normal circumstances, also  
23 well under LOS "C" standards. The review team recognizes that many options exist to allow  
24 flexibility in organizing site shift schedules, and believes that a two-shift work schedule would be  
25 a realistic assumption for the VCSNS site for traffic impact analysis during construction and  
26 preconstruction activities. SCE&G suggested that under a two-shift option (two 12-hour shifts),  
27 total peak-hour traffic on SC-213 and SC-215 would be 2118 vehicles, of which 1800 would be  
28 associated with VCSNS Units 2 and 3 activities (SCE&G 2009h). Under that assumption, the  
29 annual average daily traffic (AADT) for each route would rise to 6000 for SC-213 and to 5200 for  
30 SC-215, still well within SCDOT capacity standards.

31 Under these assumptions, SCDOT road-capacity standards would not be exceeded, but the  
32 increase in traffic would be noticeable to local residents in the Jenkinsville area for the worker  
33 commuting hours during the limited period of peak building activity. The review team estimates

## Construction Impacts at the VC Summer Site

1 volumes during construction and preconstruction activities would represent a 50-percent  
2 increase in AADT on SC-213 and a 125-percent increase in AADT on SC-215. The review  
3 team concludes that these impacts would be noticeable, especially during periods of shift  
4 change. These impacts would be further exacerbated by truck traffic and site delivery traffic that  
5 have no other route options available. Without mitigation, acute traffic impacts would increase  
6 during outage periods at Unit 1, when on average 655 additional workers, spread across a  
7 similar shift schedule, would travel to the site.

8 SCE&G states that it would develop a traffic-management plan prior to starting major  
9 construction and preconstruction activities. Planned mitigation measures could include  
10 establishing centralized parking away from the site and using worker bus shuttle services,  
11 encouraging car pools, staggering shift schedules so that acute traffic impacts could be avoided,  
12 scheduling delivery services to occur at off-shift-change times, and establishing shuttle services  
13 from Columbia (SCE&G 2009a).

14 Based on information provided by SCE&G and the review team's own independent review,  
15 including visits to the site and affected communities, the review team concludes that during  
16 peak site employment, the traffic impacts from site-development activities for Units 2 and 3  
17 would have locally noticeable impacts in the immediate vicinity of the VCSNS site and the  
18 community of Jenkinsville and minimal impacts on other roadways in the region. These impacts  
19 would be largely temporary and of short duration, based on the size of the workforce during any  
20 one period, and would abate as construction and preconstruction activities wind down. SCE&G  
21 has identified several planned mitigation measures to minimize the impact. Therefore, the  
22 review team concludes that traffic impacts in the Jenkinsville area would be noticeable, but not  
23 destabilizing, in close proximity to the site, including the Jenkinsville community. The rest of the  
24 region would experience little to no traffic-related impacts.

### 25 **4.4.4.2 Impacts on Recreation**

26 As discussed in Section 2.5.2.4, a variety of recreation areas exist in the region, including State  
27 parks and public and private facilities that support outdoor activities such as recreational boating  
28 and fishing on the Monticello Reservoir, hiking, camping, and hunting.

29 The review team concludes that at least half of construction workers and their families would be  
30 from within the region and therefore would have no net effect on the usage rates for local  
31 recreational facilities. Given the large population of the 50-mi region and the relatively small  
32 number of expected in-migrating workers relative to each county's population, the review team  
33 expects some minimal increase in recreation site usage rates due to the in-migrating worker  
34 families and mitigation would not be warranted.

#### 1   **4.4.4.3   Housing Impacts**

2   Regional housing characteristics and availability are described in Section 2.5.2.5 and  
3   Table 2-35. The proximity of a number of population centers to the VCSNS site, including the  
4   City of Columbia, adds flexibility to the provision of housing in the vicinity of the site. The urban  
5   areas of Columbia, Lexington, and West Columbia – all within reasonable commuting distance  
6   to the site – add to this flexibility. Given the number of new jobs that would be created by the  
7   construction and operation of proposed VCSNS Units 2 and 3, and the availability of heavy  
8   construction workers within the region (see Table 2-31), the demand for housing by in-migrating  
9   workers would not put significant pressure on the local housing supply.

10   The greater Columbia metropolitan area has sufficient housing available for rent or purchase, as  
11   is typical of most developing urban areas. If a significant number of workers migrate into the  
12   area, the region would be able to provide housing for the workers and their families. The four-  
13   county area surrounding the VCSNS site has demonstrated that it can meet the housing  
14   demands of a growing population over the past decade during which it experienced steady  
15   growth. Housing data for this area in 2000 indicate that there were 21,848 vacant housing units,  
16   or 8.8 percent of the county's total housing stock. Renter-occupied housing accounted for  
17   70,549 or 31.2 percent of the area's total occupied housing stock (see Table 2-35). Based on  
18   county population projections, the review team believes that population growth will remain  
19   steady in this area for the 2010–2060 period, necessitating continued expansion of the area's  
20   housing stock (see Table 2-23).

21   The boom-and-bust nature of large-scale construction projects aggravates the housing impacts  
22   in local communities. The typical pattern begins when in-migrating workers and their families  
23   (along with local residents with enhanced economic resources because of project- and worker-  
24   related jobs and expenditures) increase the demand for housing. Increased demand creates  
25   upward pressure on both the housing supply and prices in the local area. When construction  
26   ends, most in-migrating workers leave and local indirect jobs also are lost. Because a  
27   considerable construction workforce already lives locally, many of these impacts could be  
28   avoided. Additionally, the high population growth rate in the region would mitigate much of the  
29   economic decline after the completion of construction. Planning and zoning activities since the  
30   completion of Unit 1 are likely to prevent adverse impacts from haphazard housing practices like  
31   informal recreational vehicle camping, living out of vehicles, etc. Finally, the review team  
32   believes that while recent economic events have depressed the national economy, this  
33   economic downturn is temporary, and current long-term growth projections are still reasonable.

34   Based on the information provided by SCE&G and NRC's own independent review, the review  
35   team concludes that the housing-related impacts of the proposed VCSNS Units 2 and 3  
36   construction and preconstruction activities would be minimal and temporary for the region and  
37   the four-county economic impact area, with no particular concentration of impacts.

1 **4.4.4.4 Impacts on Public Services**

2 This section describes the available public services and discusses the impacts of construction  
3 and preconstruction activities at the VCSNS site on water supply and waste treatment; police,  
4 fire, and medical services; education; and social services in the region.

5 ***Water Supply Facilities***

6 Like VCSNS Unit 1, water for construction and preconstruction activities, including potable water  
7 and industrial use, for VCSNS Units 2 and 3 would likely be obtained from Monticello Reservoir,  
8 which has a maximum capacity of 1.296 million gpd that is maintained by pumping from the  
9 Broad River via the Fairfield Pumped Storage Facility. As described in Section 3.2.2, a new  
10 water-treatment system supplied by Monticello Reservoir would be developed to serve Units 2  
11 and 3. The review team estimates that Units 2 and 3 peak project employment, Unit 1  
12 operations employment, and potential outage contractor employment would represent a  
13 maximum demand on this system of 440,100 gpd using the conservative assumption of 90 gpd  
14 per capita ([635 operations workers + 655 outage workers + 3600 workers] x 90). SCE&G  
15 estimated the peak water demand for construction and preconstruction use at 420 gpm or  
16 604,800 gpd (SCE&G 2009a). Monticello Reservoir capacity is maintained by pumping from the  
17 Broad River; this use rate represents less than 1 percent of the Broad River flow under very low  
18 flow conditions (see Section 4.2.2.1). Until the proposed water-treatment system for Units 2 and  
19 3 is operational, water for construction and preconstruction would be obtained from the  
20 Jenkinsville Water District, a public source with enough excess capacity to meet this additional  
21 demand (SCE&G 2009a). Therefore, the review team concludes that impacts on the site  
22 potable water system would be minimal.

23 Monticello Reservoir is not a source for any other public water systems. As discussed in  
24 Section 4.2.2, the review team does not expect construction and preconstruction activities to  
25 affect groundwater or wells in the region. The review team concludes that there would be  
26 minimal impacts on public water systems and private wells in the vicinity due to water demands  
27 onsite.

28 The location and capacity of water and wastewater systems serving the communities in the four-  
29 county area are described in Section 2.5.2.6. These communities are expected to provide a  
30 majority of the construction and preconstruction workers, minimizing the need for additional  
31 water supplies. The review team expects impacts on public water systems from in-migrating  
32 workers and their families to be minimal, because large concentrations of workers relocating to  
33 any single locality within the four-county area are not likely.

### 1 **Wastewater-Treatment Facilities**

2 The municipal wastewater-treatment facilities affected by the in-migration of population because  
3 of the VCSNS Units 2 and 3 construction and preconstruction activities are described in Section  
4 2.5.2.6. As indicated previously, the majority of the workforce is expected to come from within  
5 the region, while the majority of in-migrating workers would relocate to communities in the four-  
6 county area. The region surrounding the VCSNS site has experienced steady and significant  
7 population growth in the past decade, and as a result, water districts in the region have  
8 developed wastewater-treatment plants capable of absorbing the increased demands (see  
9 Table 2-38). SCE&G expects to construct a new sanitary waste-treatment system to service  
10 site-development activities for Units 2 and 3 (see Section 3.2.2). The review team expects  
11 minimal impacts on wastewater-treatment facilities from the Units 2 and 3 construction and  
12 preconstruction activities.

### 13 **Police, Fire, and Medical Facilities**

14 The Fairfield County Sheriff's Department and local police departments provide law-  
15 enforcement services in Fairfield County. The Fairfield County Sheriff's Department has  
16 jurisdiction in the unincorporated areas of the county and is the designated emergency  
17 response police enforcement provider. Current growth trends in property tax revenue,  
18 illustrated in Table 2-33, suggest that demands for any new services associated with  
19 construction and preconstruction activities would be readily absorbed by the increase in revenue  
20 associated with general growth in the local area. The review team concludes that the impact on  
21 law enforcement and firefighting services would be minimal and no mitigation would be  
22 warranted.

23 Residents in the four-county area are served by several hospitals, a number of clinics, and  
24 private practice doctors and dentists. Within the region surrounding the VCSNS site, Richland  
25 County acts as a central hub for healthcare services with several large medical centers in the  
26 Columbia area. The capacities for each of these medical centers can be found in Section  
27 2.5.2.6. For this reason, the review team concludes that there would be no significant impacts  
28 on medical facilities and on resident healthcare services in the region.

### 29 **Social Services**

30 The review team anticipates that demands placed on social services related to construction and  
31 preconstruction activities would occur in proportion to workforce residence patterns. Therefore,  
32 no single county would experience significant increases in demand for social services compared  
33 to any other. The review team believes the fact that Fairfield County is the host county of the  
34 VCSNS site does not imply that Fairfield County would receive any more impact on its social  
35 services infrastructure than any other county in the economic impact area.

## Construction Impacts at the VC Summer Site

1 Workforce training programs currently getting underway are expected to mitigate some  
2 demands on social services caused by poverty. The enhanced employment opportunities  
3 created by the multiplier effect during construction and preconstruction activities may provide  
4 some benefits to the disadvantaged population served by the South Carolina Department of  
5 Social Services. Increasing populations will most likely result in increased demand for non-  
6 income-related health services, such as aid for children with special needs. However, such  
7 increases would constitute only a minor part of the overall availability of these services. As the  
8 project winds down and direct and indirect jobs are lost, demands on social services may  
9 increase. The review team concludes that the impact on social services within any given county  
10 in the local area would be minimal.

### 11 **4.4.4.5 Impacts on Education**

12 Within the four-county area there are 168 public schools serving almost 111,000 students, with  
13 an average student-to-teacher ratio of 13.3 to 1, well below the State-mandated ratio maximum  
14 of 28:1. The total number of students in the public school systems surrounding the VCSNS site  
15 has grown over the past decade as the population of the region as a whole has grown. The  
16 largest public school districts in the area plan to construct new schools prior to the start of  
17 VCSNS Units 2 and 3 activities. Based on information in Table 4-4, the number of in-migrating  
18 workers and their families will most likely be minimal and would be dispersed across the four-  
19 county area in roughly the proportion of the current operations workforce for Unit 1. The review  
20 team believes that project-related students that would enter the local school systems already  
21 have been factored into current growth projections.

### 22 **4.4.4.6 Summary of Infrastructure and Community Service Impacts**

23 The review team has evaluated information provided by SCE&G, visited the site and its  
24 environs, and performed an independent review of potential infrastructure and community  
25 service impacts of construction and preconstruction activities on the local area and region of the  
26 VCSNS site. The review team concludes that the expected infrastructure and community  
27 service impacts on the affected communities, enumerated in the preceding sections, would be  
28 SMALL, with one exception. The review team concluded that transportation impacts for a  
29 limited number of people living and working along the roadway network in the Jenkinsville  
30 community would be MODERATE. The review team also concluded that no further mitigation  
31 would be warranted for socioeconomic impacts, beyond SCE&G's commitments.

### 32 **4.4.5 Summary of Socioeconomic Impacts During Construction and** 33 **Preconstruction**

34 Based on the discussion in the preceding sections, the review team concluded that the  
35 socioeconomic impacts of construction and preconstruction activities would be SMALL, with one  
36 exception. The review team concludes that transportation impacts for a limited number of



1 people living and working along the roadway network in the Jenkinsville community would be  
2 MODERATE. The review team also concludes that no further mitigation would be warranted for  
3 socioeconomic impacts, beyond SCE&G's commitments.

4 Based on the conclusions above, and because NRC-authorized construction activities represent  
5 only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-  
6 authorized construction activities would be SMALL, with one exception. The NRC concluded  
7 that no further mitigation would be warranted for those impacts.

8 The review team concludes that the transportation impacts along the roadway network in the  
9 Jenkinsville community would be MODERATE. To determine the portion of this impact  
10 attributable to NRC-authorized construction activities, the NRC staff assumes, based on  
11 SCE&G's characterization of construction-related labor hours (SCE&G 2009a), 80 percent of  
12 traffic-related impacts over the life of the project would be associated with NRC-authorized  
13 construction activities. Using this allocation, the NRC staff estimates that VCSNS construction  
14 activities would lead to an increase of traffic on SC-213 of 40 percent above baseline conditions  
15 during peak project employment. The impact on SC-215 would be a 100-percent increase in  
16 traffic above baseline conditions. SCE&G has committed to extensive traffic-mitigation activities  
17 noted in Section 4.4.4.1, which would reduce the potential traffic impacts in the Jenkinsville  
18 area. Traffic levels associated with NRC-authorized construction activities would not exceed  
19 State capacity standards for two-lane highways. However, the NRC staff concludes that the  
20 traffic impacts in the Jenkinsville area from NRC-authorized construction activities still would be  
21 MODERATE, and additional mitigation measures beyond SCE&G's commitments would not be  
22 warranted.

## 23 **4.5 Environmental Justice Impacts**

24 The review team evaluated whether the health or welfare of minority and low-income  
25 populations in the communities identified in Section 2.6 of this EIS could be affected by  
26 disproportionately high and adverse impacts from building VCSNS Units 2 and 3 at the  
27 proposed site. The review team (1) identified all potentially significant pathways for human  
28 health and welfare effects, (2) determined the impact of each pathway for populations, and  
29 (3) determined whether the characteristics of the pathway or special circumstances of the  
30 minority and low-income populations would result in a disproportionately high and adverse  
31 impact. To perform this assessment, the review team followed the methodology described in  
32 Section 2.6.1. In the context of construction and preconstruction activities at the VCSNS site,  
33 the review team considered the questions outlined in Section 2.6.1.

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1 Research of population data indicated several census blocks within the vicinity of the VCSNS  
2 site and region having a minority population representing over 50 percent of the total population.  
3 Therefore, the review team concluded that more research into these populations and potential  
4 pathways was warranted. Upon further investigation, the review team determined that the  
5 population within the vicinity of the site, while not identified through the review criteria discussed  
6 in Section 2.6.1, included a high proportion of low-income people, as well. The review team  
7 determined that, the high proportion of minority and low-income people living in the vicinity of  
8 the VCSNS site and Jenkinsville creates a potential for a disproportionate impact. Furthermore,  
9 these minority and low-income communities exhibit additional unique characteristics and  
10 practices (subsistence fishing and hunting and personal vegetable gardening) that further  
11 identify them as vulnerable to disproportionately high and adverse impacts.

12 Environmental justice impacts are described in the following sections, including the impacts on  
13 health (Section 4.5.1), physical and environmental (Section 4.5.2), subsistence and special  
14 conditions (Section 4.5.3) and socioeconomic impacts (Section 4.5.4). Environmental justice  
15 impacts are summarized in Section 4.5.5.

### 16 **4.5.1 Health Impacts**

17 Section 4.9 of this EIS assesses the radiological doses to construction workers and concludes  
18 that the doses would be within NRC and EPA dose standards. Section 4.9 further concludes  
19 that radiological health impacts on the construction workers for proposed VCSNS Units 2 and 3  
20 would be SMALL. In addition, there would be no radioactive material on the construction site  
21 except for very small sources such as those commonly used by radiographers; therefore, there  
22 would be no radiation exposure to members of the public living near the construction site.  
23 Based on this information, the review team concludes there would be no disproportionately high  
24 and adverse impact on low-income or minority members of the construction workforce or the  
25 local population.

26 Section 4.8 of this EIS assesses the nonradiological health effects for construction workers and  
27 the local population from fugitive dust, noise, occupational injuries, and transport of materials  
28 and personnel. In Section 4.8, the review team concludes nonradiological health impacts on  
29 construction workers and the local population would be SMALL. While the review team found  
30 evidence of unique characteristics and practices in the minority or low-income populations near  
31 the site, no practices or characteristics were found that would result in differential  
32 nonradiological health impacts compared to the general population. Based on this information,  
33 the review team concludes there would be no disproportionately high and adverse impact on  
34 low-income or minority members of the construction workforce or the local population.

## 1 **4.5.2 Physical and Environmental Impacts**

2 Except for the final phases of construction and preconstruction activities, just before the fuel is  
3 loaded into the reactor, construction of a nuclear power plant is very similar in environmental  
4 effects to the construction of any other large-scale industrial project. The three primary  
5 pathways in the environment for impacts to occur are via soil, water, and air. The potential  
6 impacts on each of these pathways, along with noise and socioeconomic impacts are discussed  
7 below.

### 8 **4.5.2.1 Soil-Related Impacts**

9 Construction and preconstruction activities at the VCSNS site represent the largest source of  
10 soil-related environmental impacts. However, while construction and preconstruction activities  
11 would disrupt large volumes of soil, the effects would be primarily localized and would have little  
12 migratory ability and would diminish to imperceptible levels beyond the site boundary. The  
13 planned use of BMPs at the site would mitigate these effects. Soil disruption within local  
14 communities attributable to any induced development activities would be limited, similar to  
15 normal ongoing activities, and dispersed geographically. As discussed in Section 2.6.2 of this  
16 EIS, while the review team found evidence of unique practices (private vegetable gardening) for  
17 the high proportion of low-income communities in the vicinity of the site and near Jenkinsville,  
18 the review team did not find any pathway that could result in different soil-related impacts  
19 compared to the general population. Given these factors, the review team concludes that soil-  
20 related environmental impacts during construction and preconstruction activities would impose  
21 no disproportionate and adverse impacts on minority and low-income populations.

### 22 **4.5.2.2 Water-Related Impacts**

23 Water-related environmental impacts include erosion-related degradation of surface water and  
24 the introduction of anthropogenic substances into surface water and groundwater. Such  
25 impacts attenuate rapidly with distance and would reach near background levels beyond the site  
26 boundary. No local minority or low-income communities were found to use the Broad River as a  
27 source of water for public supply. As analyzed in Section 4.2, the review team expects SMALL  
28 impacts on the Broad River or Monticello Reservoir from sediments and contaminants.

29 Onsite groundwater would not be used as a water-supply source during construction and  
30 preconstruction activities, and there would be no discharges to the groundwater environment.  
31 Any necessary dewatering of the excavation would be localized, temporary, and limited in  
32 impact to areas within the site boundary. Consequently, the impacts of the proposed action on  
33 groundwater quality would be negligible, localized, and temporary. As discussed in Section  
34 2.6.2 of this EIS, the review team found evidence of some subsistence fishing in the vicinity of  
35 the site and near Jenkinsville, but did not identify any construction or preconstruction pathway  
36 that could result in different water-related impacts compared to the general population.

## Construction Impacts at the VC Summer Site

1 Therefore, the review team concludes that the potential for minor negative impacts from  
2 surface-water or groundwater sources would not cause water-related disproportionate and  
3 adverse impacts on minority and low-income populations.

### 4 **4.5.2.3 Air Quality Impacts**

5 Air quality impacts attenuate rapidly with distance from the source. Based on the findings in  
6 Section 4.4.1.3, motor-vehicle exhaust and dust from onsite construction and preconstruction  
7 activities would cause minor and localized air quality impacts that would not extend beyond the  
8 site boundaries. However, traffic-related air quality impacts would be more apparent within the  
9 vicinity of the site or the site access roads. While minority and low-income populations have  
10 been identified in the vicinity of the site and the site access roads, air quality impacts would be  
11 limited in duration to the peak employment period while building the proposed project and only  
12 to short periods of time during worker commutes.

13 Air quality impacts from construction and preconstruction activities at the site are at a distance  
14 from sensitive receptors and as a result are projected to cause minor localized adverse impacts  
15 on air quality at peak employment. These impacts would be highly localized and limited to the  
16 VCSNS site and local transportation routes leading to the site. Other than their location along  
17 access roads that may become congested, the review team did not identify evidence of any  
18 other unique characteristics or practices in the environmental justice community that may result  
19 in different impacts compared to the general population. Given the attenuation due to distance,  
20 the limited duration of construction and preconstruction activities, and the highly localized nature  
21 of the impacts, the review team concludes that construction and preconstruction activities would  
22 cause minor, but not disproportionate, adverse impacts on air quality for minority and low-  
23 income populations.

### 24 **4.5.2.4 Noise Impacts**

25 Section 4.4.1.2 of this EIS describes the review team's evaluation of noise impacts on  
26 surrounding communities from construction and preconstruction activities. These impacts were  
27 determined to be negligible. As stated in that analysis, noise levels from construction and  
28 preconstruction activities may exceed 100 dB within the site, but would be attenuated by  
29 distance and obstacles such as buildings, vegetation, and topography. Noise from traffic along  
30 the access routes to the sites may intermittently exceed levels acceptable for residential areas.  
31 However, these impacts would be more noticeable within the vicinity of the site or the site  
32 access roads. Sensitive noise receptors closest to the site are likely to experience intermittent,  
33 but temporary, noise pollution during the peak of construction and preconstruction activities.

34 Other than their location within the site vicinity, the review team did not identify evidence of  
35 unique characteristics or practices in the environmental justice community that may result in  
36 different noise-related impacts compared to the general population. Adverse noise impacts

1 attenuate rapidly with distance and would not extend beyond this limited geographic area.  
2 Given the noise attenuation due to distance and physical obstructions, the limited duration of  
3 peak construction and preconstruction activities, and the highly localized nature of the activities  
4 (immediate proximity to the site), the review team concludes that construction and  
5 preconstruction activities would cause minor, but not disproportionate, adverse noise impacts on  
6 minority and low-income populations.

#### 7 **4.5.3 Subsistence and Special Conditions**

8 The NRC's environmental justice methodology includes an assessment of affected populations  
9 of particular interest or with unusual circumstances, such as minority communities that are  
10 exceptionally dependent on subsistence resources or identifiable in compact locations such as  
11 American Indian settlements. As discussed in Section 2.6.1, the review team received  
12 anecdotal evidence of private vegetable gardens and subsistence fishing among the low-income  
13 populations in the vicinity of the VCSNS site. However, under closer investigation, no pathways  
14 were identified from construction and preconstruction activities that would modify or disrupt  
15 these subsistence uses. The review team also searched locally for evidence of subsistence  
16 fishing and hunting and could not identify any concentration of these activities that would be  
17 affected by construction and preconstruction activities at the site. Nor did the review team  
18 identify any unusual resource dependencies such as plants with religious or economic  
19 significance or any key transportation routes that might be disrupted by construction and  
20 preconstruction activities. Therefore, the review team concludes that there would be no  
21 disproportionate adverse impacts on the subsistence activities of minority or low-income  
22 populations from construction and preconstruction activities for VCSNS Units 2 and 3.

#### 23 **4.5.4 Socioeconomics**

24 The four-county economic impact area has sufficient housing available and has experienced  
25 levels of growth such that in-migrating workers would not have a noticeable impact on housing  
26 prices or availability in any affected county.

27 Other than their location along access roads that may become congested, the review team did  
28 not identify evidence of any other unique characteristics or practices in the environmental justice  
29 community that may result in different impacts compared to the general population. With  
30 respect to the natural or physical environment, the review team determined that traffic during  
31 construction and preconstruction has the potential for adverse impacts on residents in the  
32 vicinity of the VCSNS site and in Jenkinsville. As discussed in Section 4.4.4.1, while road  
33 capacity standards would not be exceeded by the maximum building related traffic (daily  
34 commute times during peak building activity), construction worker traffic would constitute a 50-  
35 percent increase in average daily traffic along SC-213 and a 125-percent increase along SC-  
36 215. The review team anticipates that because the traffic-related impacts are temporary and of

## Construction Impacts at the VC Summer Site

1 short duration in nature, they would be noticeable but not destabilizing to the Jenkinsville  
2 community. Without mitigation, acute traffic impacts would increase further during outage  
3 periods at Unit 1, when on average 655 additional workers, spread across a similar shift  
4 schedule, would travel to the site.

5 SCE&G states that it would develop a traffic-management plan prior to starting major  
6 construction and preconstruction activities, including a possible centralized parking lot that  
7 would transport workers to and from the VCSNS site, encouraging car pools, staggering shift  
8 schedules and delivery services and establishing shuttle services from Columbia (SCE&G  
9 2009a). However, even with the proposed mitigation, given the communities in the vicinity of  
10 the VCSNS and Jenkinsville exhibit such high proportions of minority and low-income people,  
11 the review team determined that there could still be a disproportionately high and adverse  
12 impact on minority and low-income communities in the vicinity of the VCSNS site.

13 The actions to be taken by SCE&G, together with the intermittent and limited duration  
14 characteristics of commuter traffic, led the review team to determine that there would be a  
15 noticeable but not destabilizing impact on those minority and low-income populations.

### 16 **4.5.5 Summary of Environmental Justice Impacts During Construction and** 17 **Preconstruction**

18 Given the magnitude of the impacts that would generally be attenuated due to distance, the  
19 limited duration of construction and preconstruction activities, and the highly localized nature of  
20 the impacts, the review team concludes that construction and preconstruction activities would  
21 cause SMALL, but not disproportionate, impacts on health, physical and environmental  
22 resources, subsistence and special conditions, and socioeconomics; for traffic-related impacts,  
23 greater detail was considered and is discussed in the following. The review team concluded  
24 there could be traffic-related disproportionately high and adverse impacts on minority and low-  
25 income populations found in the Jenkinsville area. However, the review team believes that  
26 because the traffic-related impacts would be temporary and of short duration in nature, they  
27 would be noticeable but not destabilizing to the Jenkinsville community. Therefore, the review  
28 team concludes that the environmental justice impacts from construction and preconstruction  
29 activities related to traffic would be MODERATE.

30 The review team concluded that there were disproportionately high and adverse impacts from  
31 construction and preconstruction activities on minority and low-income populations, and that the  
32 impacts would be noticeable but not destabilizing. The environmental justice impacts could not  
33 be entirely avoided by the applicant's mitigative measures; therefore, the review team  
34 determined that the remaining impacts would be MODERATE. As discussed in Section 4.4.5,  
35 the NRC staff assumes that 80 percent of the traffic impact is associated with NRC authorized  
36 construction activities. Furthermore, the 80 percent of the total construction and preconstruction

1 traffic-related impacts attributable to NRC-authorized construction activities still would be  
2 noticeable but not destabilizing to the Jenkinsville community. Therefore, the NRC staff  
3 concludes that the environmental justice impacts from NRC-authorized construction activities  
4 related to traffic would be MODERATE.

5 The review team determined there are no other pathways by which the identified minority or  
6 low-income populations in the 50-mi region would be likely to suffer disproportionate and  
7 adverse environmental or health impacts as a result of the project. Therefore, the NRC staff  
8 concludes there are no other health, physical or environmental pathways by which the identified  
9 minority or low-income populations in the 50-mi region would be likely to suffer disproportionate  
10 and adverse environmental or health impacts as a result of the NRC-authorized construction  
11 activities.

## 12 **4.6 Historic and Cultural Resources**

13 The National Environmental Policy Act of 1969, as amended (NEPA) requires that Federal  
14 agencies take into account the potential effects of their undertakings on the cultural  
15 environment, which includes archaeological sites, historic buildings, and traditional places  
16 important to local populations. The National Historic Preservation Act of 1966, as amended  
17 (NHPA), also requires Federal agencies to consider impacts on those resources if they are  
18 eligible for listing in the National Register of Historic Places (such resources are referred to as  
19 "Historic Properties" in NHPA). As outlined in 36 CFR 800.8, "Coordination with the National  
20 Environmental Policy Act of 1969," the NRC is coordinating compliance with Section 106 of the  
21 NHPA in fulfilling its responsibilities under NEPA.

22 Construction and preconstruction of new nuclear power plants can affect either known or  
23 undiscovered cultural resources. In accordance with the provisions of NHPA and NEPA, the  
24 NRC and USACE are required to make a reasonable and good faith effort to identify historic  
25 properties in the Area of Potential Effect (APE) and, if such properties are present, determine  
26 whether any significant impacts are likely to occur. Identification of historic properties is to occur  
27 in consultation with the State Historic Preservation Office (SHPO), American Indian Tribes,  
28 interested parties, and the public. If significant impacts are possible, efforts should be made to  
29 describe potential mitigation. As part of the NEPA/NHPA integration, if no historic properties  
30 (i.e., places eligible for listing in the National Register or meeting the NEPA definition of  
31 important) are present or affected, the NRC and the USACE are still required to notify the SHPO  
32 before proceeding. If it is determined that historic properties are present, the NRC is required to  
33 assess and resolve adverse effects of the undertaking.

1 **4.6.1 Onsite Cultural and Historic Resources Impacts**

2 For a description of the historic and cultural resource information about the VCSNS site, see  
3 Section 2.7 of this EIS. As explained in Section 2.7, previous cultural resource identification  
4 efforts resulting in the identification of a total of 39 archaeological sites within the VCSNS site  
5 APE, most of which have been recommended as ineligible for listing in the National Register.  
6 Four archaeological sites have either been recommended as National Register eligible,  
7 38FA330 (General Pearson Cemetery) and 38FA360; potentially eligible, 38FA366; or  
8 recommended for preservation, despite not being considered potentially eligible for inclusion in  
9 the National Register, 38FA349.

10 These four archaeological sites are located within the project APE but outside of the proposed  
11 footprint of disturbance identified by SCE&G (SCE&G 2009f). SCE&G currently has protective  
12 measures in place for these resources, including fencing at the Pearson Cemetery, temporary  
13 fencing at 38FA360, and delineation of all four sites as sensitive areas on management maps  
14 and plant layout and design drawings (SCE&G 2009i, j). Proposed signage would read  
15 “Environmentally Sensitive Area, Do Not Disturb” (SCE&G 2009j). These protective measures  
16 would be identified and added to SCE&G’s Environmental Management Plan for VCSNS Units 2  
17 and 3 (SCE&G 2009j). In addition, SCE&G would provide cultural awareness training for all  
18 workers including awareness of signage and inadvertent discovery procedures for Unit 1, which  
19 would also be applied to Units 2 and 3 and described in SCE&G’s Environmental Management  
20 Plan (SCE&G 2009i, j, k). These procedures indicate that work would stop and SHPO would be  
21 contacted if inadvertent discovery of cultural resources occurs (SCE&G 2009j, k). The South  
22 Carolina SHPO, in a letter to SCE&G, concurred with a finding of no adverse effect to  
23 archaeological sites 38FA330 and 38FA360 based on protective and avoidance measures  
24 being implemented by SCE&G, but would like to see the protective and avoidance measures  
25 formalized in a Programmatic Agreement (SCE&G 2009q). The SHPO also indicated that if  
26 archaeological site 38FA366 cannot be avoided, additional archaeological testing would need to  
27 occur to evaluate the site for National Register eligibility. The SHPO also concurred in a letter  
28 to SCE&G with a finding of no historic properties affected for the 35 archaeological sites that are  
29 not eligible (SCE&G 2009q).

30 To address the SHPO’s request for a Programmatic Agreement, SCE&G has agreed to enter  
31 into a management agreement with the SHPO to formalize avoidance and protective measures  
32 listed above as well as any updates made to the Environmental Management Plan regarding  
33 cultural resources awareness training and inadvertent discovery procedures (SCE&G 2009j).  
34 Consultation between SCE&G and the SHPO regarding the management agreement is ongoing  
35 (SCE&G 2009m; NRC 2010).

36 The review team analyzed the construction and preconstruction activities related to building the  
37 proposed VCSNS Units 2 and 3 and the potential cultural and historic resources impacts. The



1 review team has also considered the communication between the SHPO and SCE&G regarding  
2 a management agreement that will formalize the protection and avoidance measures being  
3 undertaken by SCE&G to ensure protection of the onsite cultural resources (NRC 2009b, 2010).

4 For the purposes of NHPA 106 consultation, based on the (1) protective measures that SCE&G  
5 will undertake to avoid adversely affecting sites 38FA330 and 38FA360, (2) project design and  
6 avoidance measures that SCE&G will undertake to avoid affects on sites 38FA366 and  
7 38FA349, (3) SCE&G's reliance on inadvertent discovery procedures if ground-disturbing  
8 activities discover cultural or historic resources, and (4) the NRC's and USACE's cultural  
9 resources analysis and consultation, the NRC and USACE conclude a finding of no adverse  
10 effect to 38FA330 and 38FA360. In addition, the NRC and USACE conclude a finding of no  
11 effect to historic properties for 38FA366 (lithic scatter) and FA349 (tree carving), because these  
12 sites have not been determined eligible for the National Register of Historic Places, and the  
13 sites would be outside the areas to be disturbed.

14 The General Pearson Cemetery and the Daughters of the American Revolution monument are  
15 examples of cultural resources located within the APE that would not be physically affected by  
16 the proposed action, but the potential visual impacts of the proposed action are sufficient to alter  
17 noticeably important attributes of the resources. The proposed action would alter noticeably the  
18 landscape and environment surrounding these cultural resources. The grading and excavation  
19 that would occur from preconstruction activities as well as the erection of various buildings to  
20 support the new reactor would modify the visual landscape that is considered to be an important  
21 attribute of these resources. Important attributes of these cultural resources include the  
22 following:

- 23 • context and landscape of the surrounding area
- 24 • relationship of the cemetery and landmark with regional history, settlement patterns, and  
25 use of the land
- 26 • the integrity of the site and the viewshed.

27 Protective measures and avoidance plans are being developed in consultation with the SHPO  
28 so that these impacts can be minimized. The management agreement will mandate that these  
29 protective measures are formalized and enforceable.

30 For the purposes of the review team's NEPA analysis, based on the (1) protective measures  
31 that SCE&G would undertake to avoid adversely affecting 38FA330 and 38FA360, (2) project  
32 design and avoidance measures that SCE&G would undertake to avoid affects to 38FA366 and  
33 FA349, (3) SCE&G's reliance on inadvertent discovery procedures should ground-disturbing  
34 activities discover cultural or historic resources, and (4) the review team's cultural resources  
35 analysis and consultation, the review team concludes that the cultural and historic resources

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1 impacts from construction and preconstruction activities would be MODERATE and no further  
2 mitigation beyond that described above would be warranted.

3 Based on the above analysis, and because the visual impacts on the resources are primarily  
4 from preconstruction, and thus not part of the NRC action, the NRC staff concludes that the  
5 minor visual impacts from NRC-authorized construction activities on historic and cultural  
6 resources would be SMALL and no further mitigation would be warranted.

### 7 **4.6.2 Offsite Cultural and Historic Resource Impacts**

8 Visual impacts from transmission lines may result in significant alterations to the visual  
9 landscape within the geographic area of interest. Visual impacts on cultural resources could be  
10 unavoidable if significant cultural resources where the historic setting and character of the  
11 resource are important attributes associated with that resource are located within the  
12 geographic area of interest. Given the length of new transmission lines and the possibility of  
13 finding significant cultural resources along the transmission lines, some impacts on cultural  
14 resources may be unavoidable. The potential for visual impacts exists and in the absence of  
15 more detailed information, these impacts cannot be evaluated with certainty.

16 SCE&G and Santee Cooper have indicated that they would work with the SHPO to complete  
17 cultural resources surveys once the transmission-line corridors are finalized (SCE&G 2009i, j, l).  
18 A management agreement between the SHPO, Santee Cooper, and SCE&G is being pursued  
19 to formalize how these cultural resource investigations and possible mitigations would be  
20 carried out in consultation with the SHPO (SCE&G 2009m; NRC 2010). The review team has  
21 reviewed impacts related to installation of the proposed transmission lines. The review team  
22 has considered the communications between the SHPO, SCE&G, and Santee Cooper and the  
23 agreement, discussed above, among the parties to pursue a management agreement to  
24 formalize the cultural resources review process prior to installation of the transmission lines.

25 For the purposes of the review team's NEPA analysis, based on the (1) commitment made by  
26 SCE&G and Santee Cooper to pursue a management agreement with the SHPO, as described  
27 above and (2) the review team's cultural resources analysis, preconstruction impacts associated  
28 with transmission lines have the potential to impact cultural resources. Impacts could be  
29 SMALL if there are no significant alterations to the cultural environment. If these activities result  
30 in significant alterations to the cultural environment, the impact could be greater.

31 For the purposes of NHPA 106 consultation, the USACE has considered the impacts related to  
32 the installation of the proposed transmission lines. Because the cultural resource studies for the  
33 transmission lines are not completed, the USACE cannot provide an official finding of effect  
34 conclusion for this portion of the project.

1 According to 10 CFR 50.10 (a) (2) (vii), transmission lines are not included in the definition of  
2 construction and are not an NRC authorized activity. Therefore, the NRC considers the  
3 transmission lines outside the NRC's APE and therefore not part of the NRC's consultation.

## 4 **4.7 Meteorological and Air Quality Impacts**

5 Sections 2.9.1 and 2.9.2 describe the meteorological characteristics and air quality at the  
6 VCSNS site. The primary impacts of the building two new units on local meteorology and air  
7 quality would be from dust from land clearing and building activities, open burning, emissions  
8 from equipment and machinery, concrete batch-plant operations, and emissions from vehicles  
9 used to transport workers and materials to and from the site.

### 10 **4.7.1 Construction and Preconstruction Activities**

11 Development activities planned for the VCSNS site would result in temporary impacts on local  
12 air quality as a result of emissions associated with construction and preconstruction activities.  
13 Similar to any large-scale construction project, dust particle emissions would be generated  
14 during ground-clearing, grading, and excavation activities. Fugitive dust particles would be  
15 generated from the movement of machinery and materials by wind blowing over recently  
16 disturbed or cleared areas. In addition to the fugitive dust emissions associated with grading  
17 and the movement of construction vehicles, there would be fugitive dust emissions associated  
18 with the operation of a concrete batch plant.

19 The SCDHEC regulates air quality control for the State of South Carolina as set forth in Section  
20 48-1-110, 1976 Codes of South Carolina and in the South Carolina Air Quality Control  
21 Regulation 61-62.1, Section II. A permit for dust generated by building activities may be  
22 required and the need for it would be determined on a case-by-case basis (SC Code Regs. 61-  
23 62.1). SCE&G stated in its ER (SCE&G 2009a) that it would develop a dust-control plan that  
24 would include specific dust-mitigation measures. The plan would include techniques such as  
25 imposing speed limits on unpaved construction roads, minimizing material handling, covering  
26 haul trucks, wetting potential source areas during dry periods, limiting grading and excavation  
27 activities during high winds or periods of poor air quality, and revegetation of road medians and  
28 slopes (SCE&G 2009a). A permit from the SDCHEC may also be required for operation of the  
29 batch plant.

30 Exhaust emissions from construction vehicles and equipment would also generate smaller  
31 amounts of particulate matter. These emissions would contain carbon monoxide, oxides of  
32 nitrogen, and volatile organic compounds. As discussed in Section 2.9.2, Fairfield County is  
33 considered to be in attainment for all criteria pollutants for which NAAQSs have been  
34 established (40 CFR 81.341). On April 8, 2008, the EPA changed the NAAQS for ozone from  
35 0.08 to 0.075 ppm (73 FR 16436). The State of South Carolina has recommended that parts of

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1 Lexington and Richland Counties (which are in the Columbia Intrastate Air Quality Control  
2 Region [AQCR]) be designated as nonattainment (SCDHEC 2009). On September 16, 2009,  
3 the EPA indicated that the new ozone standard of 0.075 ppm would be reconsidered and final  
4 designation would be made in August 2011 (EPA 2009a). These changes could result in  
5 additional restrictions of nitrogen oxide emissions within Fairfield County and the need for  
6 additional permits.

7 Preoperational activities would also result in greenhouse gas emissions, principally carbon  
8 dioxide (CO<sub>2</sub>). Assuming a 7-year construction period and typical construction practices, the  
9 review team estimates that the total construction equipment CO<sub>2</sub> emission footprint for building  
10 two nuclear power plants at the VCSNS site would be of the order of 70,000 metric tons, as  
11 compared to a total United States annual CO<sub>2</sub> emission rate of 6,000,000,000 metric tons (EPA  
12 2009b). Appendix J provides the details of the review team estimate for a reference 1000-  
13 MW(e) nuclear power plant. Based on its assessment of the relatively small construction  
14 equipment carbon footprint as compared to the United States annual CO<sub>2</sub> emissions, the review  
15 team concludes that the atmospheric impacts of greenhouse gases from construction and  
16 preconstruction activities would not be noticeable and additional mitigation would not be  
17 warranted.

18 In general, emissions from construction and preconstruction activities (including greenhouse  
19 gases) would vary based on the level and duration of a specific activity, but the overall impact is  
20 expected to be temporary and limited in magnitude. In its ER, SCE&G lists several strategies  
21 that could be used to limit the impact further, including staggering the use of equipment and  
22 keeping equipment in good working order. The review team concludes that the impacts from  
23 VCSNS Unit 2 and 3 construction and preconstruction activities on air quality would not be  
24 noticeable because appropriate mitigation measures would be adopted.

### 25 **4.7.2 Transportation**

26 This EIS assesses the three impacts of transporting workers and materials to and from the  
27 VCSNS site: the socioeconomic impacts, potential health impacts from additional traffic-related  
28 accidents, and the air quality impacts of dust and gaseous emissions released into the air by  
29 vehicle traffic. Only the air quality impacts are discussed in this section. The socioeconomic  
30 impacts are described in Section 4.4.1.3, and health effects from accidents are described in  
31 Section 4.8.3.

32 In the ER, SCE&G estimated that during the period of peak development there would be 3600  
33 workers split equally among four shifts, or 900 workers per shift (SCE&G 2009a). Using a  
34 conservative assumption of one worker per vehicle in its transportation analysis, SCE&G  
35 estimated that an additional 1800 vehicles (900 leaving and 900 arriving) would be added to the  
36 roadway system during a shift change. In addition to the construction workers, SCE&G  
37 estimated increased traffic from approximately 100 daily truck deliveries that would occur at the

1 site (SCE&G 2009a). As described in Section 2.9, Fairfield County is currently an attainment  
2 area for all criteria pollutants. The impact of emissions from an additional 1800 vehicles  
3 (900 per shift) would be localized and temporary and have little impact on the regional air  
4 quality. Some communities near the construction site, such as Jenkinsville, would experience  
5 significant increases in traffic and associated increases in the amount of particulate and  
6 gaseous emissions. SCE&G has committed to developing a project-management traffic plan  
7 that includes a number of potential mitigation measures, including a centralized parking area  
8 away from the site and shuttling construction workers to the site in buses or vans, encouraging  
9 carpools, staggering construction shifts, and/or establishing a shuttle service from the Columbia  
10 area (SCE&G 2009a).

11 Construction workforce transportation would also result in greenhouse gas emissions,  
12 principally CO<sub>2</sub>. Assuming a 7-year construction period and a typical workforce, the review  
13 team estimates that the total construction workforce CO<sub>2</sub> emission footprint for building two  
14 nuclear power plants at the VCSNS site would be of the order of 300,000 metric tons; again, this  
15 is compared to a total United States annual CO<sub>2</sub> emission rate of 6,000,000,000 metric tons  
16 (EPA 2009b). Appendix J provides the details of the review team estimate for a reference 1000-  
17 MW(e) nuclear power plant. Based on its assessment of the relatively small construction  
18 workforce carbon footprint as compared to the United States annual CO<sub>2</sub> emissions, the review  
19 team concludes that the atmospheric impacts of greenhouse gases from construction workforce  
20 transportation would not be noticeable and additional mitigation would not be warranted.

21 Based on SCE&G's commitment to developing a construction traffic-management plan and the  
22 potential mitigation measures listed in the ER, the review team concludes that the impact on the  
23 local air quality (including the effects of greenhouse gas emissions) from the increase in  
24 vehicular traffic related to construction and preconstruction activities would be temporary and  
25 minimal because appropriate mitigation measures would be adopted.

### 26 **4.7.3 Summary**

27 The review team evaluated potential impacts on air quality associated with criteria pollutants  
28 and greenhouse gas emissions during VCSNS site-development activities and determined that  
29 the impacts would be minimal. On this basis, the review team concludes that the impacts of  
30 VCSNS site development on air quality from emissions of criteria pollutants and CO<sub>2</sub> emissions  
31 are SMALL and that no further mitigation is warranted. Because NRC-authorized construction  
32 activities represent only a portion of the analyzed activities, the NRC staff concludes that the air  
33 quality impacts of NRC-authorized construction activities would also be SMALL; the NRC staff  
34 also concludes that no further mitigation, beyond the applicant's commitments, would be  
35 warranted.

## 1 **4.8 Nonradiological Health Impacts**

2 SCE&G indicated that the physical impacts of construction and preconstruction, including public  
3 health, occupational health, and noise, would be minimal and discussed them qualitatively in  
4 Sections 4.4.1 and 4.7 of its ER (SCE&G 2009a). This section focuses primarily on the area  
5 near the VCSNS site; however, preconstruction activities would also occur in the transmission-  
6 line corridors (the exact locations of which are not determined at this time).

7 The nonradiological impacts on health are described in the following sections, including impacts  
8 on public and occupational health (Section 4.8.1), the impacts of noise (Section 4.8.2), and the  
9 impacts of transporting construction materials and personnel to and from the proposed site  
10 (Section 4.8.3). Nonradiological health impacts are summarized in Section 4.8.4.

### 11 **4.8.1 Public and Occupational Health**

12 This section includes a discussion of the impacts of construction and preconstruction activities  
13 on public health and on VCSNS site worker health. Section 2.10 provides background  
14 information on the affected environment and nonradiological health at and within the vicinity of  
15 the VCSNS site.

#### 16 **4.8.1.1 Public Health**

17 The physical impacts on the public from construction and preconstruction activities at the  
18 VCSNS site (including associated transmission-line corridors) would include dust and vehicle  
19 exhaust (including exhaust from haul vehicles) as sources of air pollution during site preparation  
20 (SCE&G 2009a). SCE&G stated that operational controls would be imposed to mitigate dust  
21 emissions, using methods such as watering unpaved roads and exposed soils (when surface is  
22 dry), stabilizing construction roads and spoil piles, and phasing grading activities and ceasing  
23 them during high winds and/or during extreme air pollution episodes (SCE&G 2009a).

24 Engine exhaust would be minimized by maintaining fuel-burning equipment in good mechanical  
25 order and by phasing activities to minimize daily emissions. SCE&G (SCE&G 2009a) stated  
26 that applicable Federal, State, and local emission requirements would be followed as they relate  
27 to open burning or the operation of fuel-burning equipment. The appropriate Federal, State, and  
28 local permits and operating certificates would be obtained as required. VCSNS Units 2 and 3  
29 would be located in Fairfield County, South Carolina, which is part of the Columbia Intrastate  
30 AQCR (40 CFR 81.108 and 81.341). The Clean Air Act establishes NAAQSs, and Fairfield  
31 County is classified as an attainment area under these criteria (SCE&G 2009a).

32 The public would not be allowed close to the proposed plant site. The nearest publicly  
33 accessible area is approximately 0.5 mi from the work site (other than transmission lines), and  
34 the nearest residence is approximately 1 mi from the Units 2 and 3 site (SCE&G 2009a). Given

1 the fugitive dust suppression and vehicle exhaust emission mitigation measures discussed  
2 above and the general public's distance away from the VCSNS site, the review team concludes  
3 that the impacts on nonradiological public health from construction and preconstruction activities  
4 would be negligible. No further mitigation beyond that discussed above would be warranted.

#### 5 **4.8.1.2 Construction Worker Health**

6 In general, human health risks to construction workers and other personnel working onsite are  
7 dominated by occupational injuries (e.g., falls, electrocution, asphyxiation, and burns). SCE&G  
8 has an industrial safety program and a Safety Services Department that uses procedures and  
9 provides training to all employees and contractors to make sure that all workers onsite are  
10 trained in all appropriate safety requirements (SCE&G 2009a).

11 In addition to onsite construction and preconstruction activities, SCE&G has planned for six new  
12 transmission lines. Most of the transmission lines would be built within or adjacent to existing  
13 transmission-line corridors, but three would require the creation of new corridors and two new  
14 associated switchyards, one onsite and one offsite. The transmission lines and associated  
15 switchyards would be built in accordance with the National Electrical Safety Code and  
16 applicable construction standards and codes (SCE&G 2009a).

17 According to the U.S. Bureau of Labor Statistics (BLS), the construction industry continues to  
18 have the greatest number of fatalities of industries in the private sector. In 2008, most fatalities  
19 in South Carolina were due to falls, exposure to harmful substances or environments, and  
20 transportation incidents (BLS 2008c). Nonfatal injury and illness rates from 2007 for  
21 construction workers, including specialty trade contractors, averaged 5.4 percent (BLS 2008b).  
22 The maximum construction workforce for proposed VCSNS Units 2 and 3 and related facilities  
23 would be 3600 during an expected period from 2008 through completion of the project in 2019  
24 (SCE&G 2009a).

25 Based on mitigation measures identified by SCE&G in its ER, permits and authorizations  
26 required by State and local agencies, safety training that would be conducted by SCE&G and its  
27 contractors, and the review team's independent evaluation, the review team concludes that the  
28 nonradiological impacts of construction and preconstruction activities on construction worker  
29 health would be minimal. No further mitigation beyond that discussed above would be  
30 warranted.

#### 31 **4.8.2 Noise Impacts**

32 Development of a nuclear power plant project is similar to other large industrial projects, and it  
33 involves many noise-generating activities. Regulations governing noise from construction and  
34 preconstruction activities are generally limited to worker health. Federal regulations governing  
35 noise are found in 29 CFR Part 1910 and 40 CFR Part 204. The regulations in 29 CFR Part

## Construction Impacts at the VC Summer Site

1 1910 deal with noise exposure in the construction environment, and the regulations in 40 CFR  
2 Part 204 generally govern the noise levels of construction equipment including compressors.  
3 Neither Fairfield County nor the State of South Carolina has regulations or guidelines for noise  
4 (SCE&G 2009a).

5 The ER indicates that activities associated with building of two new units at the VCSNS site  
6 would have peak noise levels as high as 108 dBA up close and 82 dBA at 100 ft away (SCE&G  
7 2009a). A 10-dBA decrease in noise level is generally perceived as cutting the loudness in half.  
8 At a distance of 50 ft from the source, these noise levels would generally decrease to the 73- to  
9 102-dBA range, and at a distance of 400 ft, the noise levels would generally be in the 55- to 73-  
10 dBA range (SCE&G 2009a). For context, Tipler (1982) lists the sound intensity of a quiet office  
11 as 50 dBA, normal conversation as 60 dBA, busy traffic as 70 dBA, and a noisy office with  
12 machines or an average factory as 80 dBA. Construction noise (at 10 ft) is listed as 110 dBA,  
13 and the pain threshold is 120 dBA.

14 The ER states that the exclusion area boundary of the VCSNS site would be greater than 0.5 mi  
15 in all directions from the center of construction and preconstruction activities for Units 2 and 3  
16 (SCE&G 2009a). A 100-dBA noise level at 50 ft from an activity would be expected to decrease  
17 to less than 55 dBA at the exclusion area boundary (SCE&G 2009a). There are no major roads,  
18 public buildings, or residences within the exclusion area. Similarly, a 100-dBA noise level would  
19 be expected to decrease to less than 55 dBA at the nearest residence, which is approximately 1  
20 mi from the development area (SCE&G 2009a). These estimates do not include the noise  
21 attenuation associated with vegetation and topography.

22 Construction and preconstruction activities would be expected to take place 24 hours per day,  
23 7 days per week during peak activity periods. However, the ER (SCE&G 2009a) lists a number  
24 of measures that could be taken to mitigate the potential adverse effects of noise. Among the  
25 mitigation measures are compliance with Federal and State regulations, use of hearing  
26 protection, inspection and maintenance of equipment, restriction of noise-related activities to  
27 daylight hours, and restriction of delivery times to daylight hours.

28 According to NUREG-1437 (NRC 1996),<sup>(a)</sup> noise levels below 60 to 65 dBA are considered to be  
29 of small significance. More recently, the impacts of noise were considered in NUREG-0586,  
30 Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not  
31 expressed in terms of sound levels but was based on the effect of noise on human activities and  
32 on threatened and endangered species. The criterion in NUREG-0586, Supplement 1, is stated  
33 as follows:

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(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999a). All references to NUREG-1437 include NUREG-1437 and its Addendum 1.



1 The noise impacts of decommissioning...are considered detectable if sound  
2 levels are sufficiently high to disrupt normal human activities on a regular basis.  
3 The noise impacts...are considered destabilizing if sound levels are sufficiently  
4 high that the affected area is essentially unsuitable for normal human activities,  
5 or if the behavior or breeding of a threatened and endangered species is  
6 affected.

7 Considering the anticipated low noise levels, the temporary nature of construction and  
8 preconstruction activities, and the location and characteristics of the VCSNS site, the review  
9 team concludes that the noise impacts from construction would be minimal, and additional  
10 mitigation beyond the actions identified above would not be warranted.

### 11 **4.8.3 Impacts of Transporting Construction Materials and Construction** 12 **Personnel to the Proposed Site**

13 This EIS assesses the impact of transporting workers and construction materials to and from the  
14 proposed VCSNS site and alternative sites from the perspective of three areas of impact: the  
15 socioeconomic impacts, the air quality impacts of dust and particulate matter emitted by vehicle  
16 traffic, and the potential health impacts due to additional traffic-related accidents. The human  
17 health impacts are addressed in this section, while the socioeconomic impacts are addressed in  
18 Section 4.4.1.3, and the air quality impacts are addressed in Section 4.7.2.

19 The general approach used to calculate the nonradiological impacts of fuel and waste  
20 shipments (see Section 6.2 of this EIS) is the same as that used for the transportation of  
21 construction materials and construction personnel to and from the VCSNS site and alternative  
22 sites. However, preliminary estimates are the only data sources available to estimate the  
23 demand for these transportation services. The assumptions made to fill in reasonable estimates  
24 of the parameters needed to calculate nonradiological impacts are discussed below.

25 Construction material requirements are based on information taken from the ER (SCE&G  
26 2009a). SCE&G (2009a) estimated that constructing one new Westinghouse Electric Company,  
27 LLC (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water reactor unit requires  
28 up to 75,000 yd<sup>3</sup> of concrete, 23,000 T of structural steel and rebar, 6,500,000 linear ft of cable,  
29 and 137,500 linear ft of piping. These quantities would be doubled to account for a two-unit  
30 plant. Additional information needed to develop the nonradiological impact estimates are as  
31 follows:

- 32 • It was assumed that maximum shipment capacities are ~13 yd<sup>3</sup> of concrete, 11 T of  
33 structural steel, and 3300 linear ft of piping and cable per shipment. It was assumed that  
34 these materials would be transported to the site in levelized annual quantities over a 5-year  
35 period, based on the estimated construction schedule given in the ER (SCE&G 2009a).  
36 (Operation costs are frequently expressed as levelized cost of electricity, which is the price

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- 1 per kWh of producing electricity, including the amounts needed to cover operating costs and  
2 annualized capital costs.)
- 3 • The number of construction workers was estimated to peak at 3600 (SCE&G 2009a). This  
4 value represents the peak workforce for construction of two units simultaneously. For a  
5 single plant, the peak construction workforce was estimated to be 1800 workers per year.  
6 Conservatively assuming that each vehicle carries one worker to the site, there would be  
7 about 1800 vehicles per day per unit. Each person was assumed to travel to and from the  
8 VCSNS site 250 days per year.
  - 9 • Average shipping distances for construction materials were assumed to be 50 mi one way.  
10 The average commute distance for construction workers was assumed to be 20 mi one way.
  - 11 • Accident, injury, and fatality rates for construction materials were taken from Table 4 in  
12 ANL/ESD/TM-150 *State-level Accident Rates for Surface Freight Transportation: A*  
13 *Reexamination* (Saricks and Tompkins 1999). Rates for the State of South Carolina were  
14 used for construction material shipments, typically conducted in heavy-combination trucks.  
15 The data provided by Saricks and Tompkins (1999) are representative of heavy-truck  
16 accident rates and do not specifically address the impacts associated with commuter traffic  
17 (i.e., workers traveling to and from the site). However, a single source that provided all three  
18 rates to estimate the impacts from worker transportation to and from the site was not  
19 available. A South Carolina-specific fatality rate for all traffic for the years 2003 to 2007 was  
20 used to develop representative commuter traffic impacts (DOT 2009a). The average fatality  
21 rate for the 2003 to 2007 period in South Carolina was used as the basis for estimating  
22 South Carolina-specific commuter injury and accident rates. Adjustment factors were  
23 developed using the national traffic accident statistics in *National Transportation Statistics*  
24 *2007* (DOT 2007). The adjustment factors are the ratio of the national injury rate to the  
25 national fatality rate and the ratio of the national accident rate to the national fatality rate.  
26 These adjustment factors were multiplied by the South Carolina-specific fatality rate to  
27 approximate the injury and accident rates for commuters in the State of South Carolina.
  - 28 • The Saricks and Tompkins (1999) accident rates were taken from the Motor Carrier Safety  
29 Administration. The U.S. Department of Transportation (DOT) Federal Motor Carrier Safety  
30 Administration evaluated the data underlying these rates and determined that they were  
31 under-reported. To account for the under-reported accident, injury, and fatality rates from  
32 Saricks and Tompkins (1999), the review team adjusted them using factors derived from  
33 data provided by the University of Michigan Transportation Research Institute (UMTRI  
34 2003). The UMTRI data indicate that accident rates for 1994 to 1996, the same data used  
35 by Saricks and Tompkins (1999), were under-reported by about 39 percent. Injury and  
36 fatality rates were under-reported by 16 percent and 36 percent, respectively. As a result,  
37 the accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57,  
38 respectively, to account for the under-reporting. These adjustments were applied to the

1 construction materials that are transported by heavy-truck shipments similar to those  
 2 evaluated by Saricks and Tompkins (1999) but not to commuter traffic accidents.

3 The estimated nonradiological impacts of transporting construction materials to the proposed  
 4 VCSNS site and of transporting construction workers to and/or from the site are shown in  
 5 Table 4-5. Round-trip distances were used in the assessment. The estimates would be  
 6 approximately doubled for construction of two units at the VCSNS site but because two units are  
 7 being constructed simultaneously, the peak construction worker demands for the two units  
 8 occur in different years. As discussed above, the peak construction workforce would be 3600  
 9 workers, so the peak nonradiological impact estimates would be double the estimates listed in  
 10 Table 4-5. Note that the nonradiological impacts are dominated by the transportation of  
 11 construction workers to and/or from the VCSNS site. The estimated total annual construction  
 12 fatalities represent less than a 3-percent increase above the average 14 traffic fatalities per year  
 13 that occurred in Fairfield County, South Carolina, between 2003 and 2007 (DOT 2009b). This  
 14 represents a small increase relative to the current traffic fatality risks in the area surrounding the  
 15 proposed VCSNS site. Nonradiological impacts for the alternative sites range from less than a  
 16 1-percent increase for the Cope alternative site to about a 7-percent increase in nonradiological  
 17 fatalities for the Saluda alternative site relative to the average traffic fatalities in their respective  
 18 counties from 2003 to 2007 (DOT 2009c, 2009d, 2009e, 2009f). Because these increases are  
 19 small relative to the baseline traffic fatalities (that is, before the plants are constructed) in the  
 20 counties where SCE&G has proposed to build the new plants, the review team concludes that  
 21 the impacts of transporting construction materials and personnel to the proposed VCSNS site  
 22 and alternative sites would be minimal, and mitigation would not be warranted.

23 **Table 4-5.** Annual Nonradiological Impacts of Transporting Workers and Construction  
 24 Materials to and/or from the VCSNS Site for a Single AP1000 Reactor

	Accidents per Year Per Unit	Injuries per Year Per Unit	Fatalities per Year Per Unit
Workers	$5.5 \times 10^{+1}$	$2.5 \times 10^{+1}$	$3.8 \times 10^{-1}$
Materials			
Concrete	$8.6 \times 10^{-2}$	$6.1 \times 10^{-2}$	$4.8 \times 10^{-3}$
Rebar, Structural Steel	$3.1 \times 10^{-2}$	$2.2 \times 10^{-2}$	$1.7 \times 10^{-3}$
Cable	$3.0 \times 10^{-2}$	$2.1 \times 10^{-2}$	$1.6 \times 10^{-3}$
Piping	$6.3 \times 10^{-4}$	$4.4 \times 10^{-4}$	$3.5 \times 10^{-5}$
Total – Construction	$5.5 \times 10^{+1}$	$2.5 \times 10^{+1}$	$3.8 \times 10^{-1}$

25 **4.8.4 Summary of Nonradiological Health Impacts**

26 The review team assessed the information in the SCE&G ER (SCE&G 2009a) and concludes  
 27 that nonradiological health impacts on construction workers at the VCSNS site, operations  
 28 workers at the VCSNS site, and the local population from fugitive dust, occupational injuries,  
 29 noise, and transport of materials and personnel would be SMALL, and additional mitigation

1 beyond the actions identified above would not be warranted. Based on the above analyses, and  
2 because NRC-authorized construction activities represent only a portion of the analyzed  
3 activities, the NRC staff concludes that the nonradiological health impacts of NRC-authorized  
4 construction activities would be SMALL. The NRC staff also concludes that further mitigation  
5 beyond that stated above would not be warranted.

## 6 **4.9 Radiological Health Impacts**

7 The sources of radiation exposure for construction workers include direct radiation exposure,  
8 exposure from discharges of liquid radioactive waste, and exposure from gaseous radioactive  
9 effluents from existing VCSNS Unit 1 during the construction phase, the impacts of which are  
10 described in the following sections and summarized in Section 4.9.5. For the purposes of this  
11 discussion, construction workers are assumed to be members of the public; therefore, the dose  
12 estimates are compared to the dose limits for the public, pursuant to 10 CFR Part 20,  
13 Subpart D. SCE&G noted that all major construction and preconstruction activities are expected  
14 to occur outside of the VCSNS Unit 1 site protected area boundary, but inside the restricted  
15 area boundary (SCE&G 2009a).

### 16 **4.9.1 Direct Radiation Exposures**

17 In its ER (SCE&G 2009a), SCE&G identified three sources of direct radiation exposure from  
18 nuclear facilities within the VCSNS site: (1) the reactor building for existing Unit 1, (2) a planned  
19 independent spent-fuel storage installation (ISFSI), and (3) the old steam generator recycle  
20 facility. In addition, there may be direct radiation to workers finishing construction of Unit 3 from  
21 Unit 2 when it begins operation. The staff did not identify any additional sources of direct  
22 radiation during the site visit or during document reviews.

23 Direct radiation from either Unit 1 or the old steam generator recycle facility was determined to  
24 not be a significant source of dose to the construction workers (SCE&G 2009a). The planned  
25 ISFSI would be more than 600 ft from the construction sites, and, according to SCE&G, would  
26 provide negligible direct radiation (SCE&G 2009a).

27 SCE&G indicated the planned ISFSI would be more than 600 ft from the construction site for  
28 Units 2 and 3 (SCE&G 2009a). SCE&G concluded the direct radiation dose to construction  
29 workers from the ISFSI would be negligible based on experience at operating ISFSIs at nuclear  
30 power plants (SCE&G 2009a). SCE&G did not provide the estimated source term or dose  
31 calculations to support this conclusion. The NRC staff agrees that the direct radiation dose rate  
32 to construction workers from the ISFSI would be low, but may not be negligible. NRC and EPA  
33 regulations would limit the dose rates to 25 mrem/yr.

1 SCE&G used fenceline thermoluminescent dosimeters (TLDs) and environmental TLDs to  
2 measure direct radiation levels at locations in and around the VCSNS site protected area  
3 (SCE&G 2009a). Environmental TLDs are located at the exclusion area boundary around the  
4 VCSNS Unit 1 site, at an inner ring near the site boundary, and at locations at various distances  
5 from the plant (SCE&G 2007). The TLDs are read quarterly and measure the contribution to  
6 dose from any source, including natural background, the current reactor building, and the old  
7 steam generator recycle facility. The TLD monitoring system includes locations that are  
8 representative of the proposed construction site. The environmental TLD results at the old  
9 steam generator recycle facility (the location closest to proposed Units 2 and 3) were  
10 comparable to TLD results at control locations.

11 SCE&G estimated the maximum direct radiation dose for continuous occupancy would be  
12 1 mrem/yr from Unit 1, and an additional maximum of 1 mrem/yr from Unit 2 after it begins  
13 operation. Adjusting for a 2000-hour work year gives a maximum estimate of 0.46 mrem/yr to a  
14 construction worker.

15 The staff reviewed the potential locations for exposures and recent records of dose rates, the  
16 locations of the TLDs, and the method to estimate doses to construction workers from direct  
17 radiation. Based on that review, the NRC staff concludes the direct radiation dose rate to  
18 construction workers would be low.

#### 19 **4.9.2 Radiation Exposures from Gaseous Effluents**

20 Gaseous radioactive effluents from VCSNS Unit 1 are released from the plant stack (SCE&G  
21 2009a). They consist of effluents from the main plant vent, the reactor building purge line, the  
22 waste-gas storage tank, and the oil incinerator (SCE&G 2006). SCE&G estimated a dose to a  
23 maximally exposed individual (MEI) using 2005 gaseous effluent data, which are representative  
24 of recent years. The MEI is assumed to be located 1.2 mi east of Unit 1, and 0.2 mi east of the  
25 Unit 1 exclusion area boundary. Assuming that the total effective dose equivalent to a  
26 construction worker from gaseous effluent from Unit 1 is the same, it would be 0.036 mrem.  
27 This is an overestimate of potential dose to construction workers because the workers would be  
28 south of Unit 1 where gaseous effluents produce lower doses. SCE&G (2009a) used the  
29 0.036 mrem to estimate a maximum dose of 1.2 mrem annually to someone who was  
30 continuously present; correcting for a 2000-hour work year, the annual dose to a construction  
31 worker becomes 0.27 mrem. The NRC staff concludes this estimate of the dose to construction  
32 workers from the gaseous effluents from Unit 1 would be bounding.

33 Using 1 year's meteorological data and the XOQDOQ (Sagendorf et al. 1982) and GASPAR II  
34 (Streng et al. 1987) codes, SCE&G estimated that the dose to a Unit 3 construction worker  
35 from gaseous effluent from Unit 2, once it begins operation, would be 0.43 mrem to the total  
36 body. The staff reviewed SCE&G's calculation and determined that the method used to  
37 estimate dose from gaseous effluents was acceptable. Using 2 years' meteorological data, the

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1 staff estimated that these dose estimates are unchanged. Combining 0.27 mrem from Unit 1  
2 and 0.43 mrem from Unit 2, SCE&G gave a bounding estimate of the dose to construction  
3 workers on Units 2 and 3 of 0.70 mrem for a year from gaseous effluents.

### 4 **4.9.3 Radiation Exposures from Liquid Effluents**

5 Liquid radioactive effluents are discharged from Unit 1 to Monticello Reservoir, and SCE&G  
6 estimated the maximum dose to a construction worker due to liquid radioactive effluents from  
7 Unit 1 to be 0.001 mrem to the total body (SCE&G 2009a). SCE&G used the LADTAP II code  
8 (Streng et al. 1986) to calculate the total body radiation dose to a maximally exposed  
9 construction worker due to liquid radioactive effluents from Unit 2 after it begins operation to be  
10 0.012 mrem/yr to the total body (SCE&G 2009a). Adding the doses from Units 1 and 2 results  
11 in a dose of 0.013 mrem/yr to the total body.

12 Therefore, the dose to construction workers from liquid effluents would be negligible compared  
13 to the dose from direct radiation exposure.

### 14 **4.9.4 Total Dose to Construction Workers**

15 The maximum annual dose to a construction worker was estimated by SCE&G to be 1.2  
16 mrem/yr, which is the sum of three pathways: (1) direct radiation (0.46 mrem), (2) gaseous  
17 effluents (0.70 mrem), and (3) liquid effluents (0.013 mrem) (SCE&G 2009a). This maximum  
18 dose assumes an occupancy of 2000-hr/yr. The NRC has established an annual dose limit to  
19 an individual member of the public of 100 mrem total effective dose equivalent. The NRC staff  
20 concludes the dose to construction workers would be well below the 100-mrem annual limit,  
21 even if the dose from the planned ISFSI may be higher than expected by SCE&G.

22 SCE&G estimates a peak loading of 3600 construction workers before Unit 2 startup and a peak  
23 loading of 3500 construction workers after Unit 2 begins operations. The total estimated  
24 collective dose for the maximum dose year would be 4.3 person-rem (SCE&G 2009a). The  
25 maximum annual dose to a construction worker is much smaller than the approximately  
26 311 mrem/yr that U.S. residents receive on average from background radiation (NCRP 2009).

### 27 **4.9.5 Summary of Radiological Health Impacts**

28 The NRC staff concludes that the estimate of doses to construction workers during building of  
29 the proposed Units 2 and 3 are well within NRC annual exposure limits (i.e., 100 mrem)  
30 designed to protect the public health. Based on information provided by SCE&G and the NRC  
31 staff's independent evaluation, the NRC staff concludes that the radiological health impacts on  
32 workers for proposed Units 2 and 3 would be SMALL, and no further mitigation would be  
33 warranted. Radiation exposure from all NRC-licensed activities, including operation of VCSNS  
34 Unit 1, is regulated by the NRC. Therefore, the NRC staff concludes the radiological health

1 impacts for NRC-authorized construction activities would be SMALL, and no further mitigation  
2 would be warranted.

### 3 **4.10 Nonradioactive Waste Impacts**

4 The following sections provide descriptions of the potential environmental impacts from the  
5 generation, handling, and disposal of nonradiological waste during the building activities for  
6 VCSNS Units 2 and 3. Potential types of nonradioactive wastes expected to be generated,  
7 handled, and disposed of include construction debris, spoils, stormwater runoff, municipal and  
8 sanitary waste, dust, and air emissions. The assessment of potential impacts resulting from  
9 these types of wastes is presented in the following sections.

#### 10 **4.10.1 Impacts on Land**

11 Building activities related to the proposed VCSNS Units 2 and 3 could result in solid waste  
12 materials like construction debris from excavation, land clearing, and dredge spoils. SCE&G  
13 plans to use excess excavation as backfill as needed during construction onsite. Remaining  
14 construction debris from excavation and land clearing would be disposed in one of the several  
15 construction and demolition debris (C&D) landfills in the surrounding counties. SCE&G stated  
16 that there is adequate capacity at these C&D landfills to handle the additional generated waste  
17 (SCE&G 2009a).

18 Spoils generated as a result of dredging the Monticello and Parr reservoirs for building activities  
19 associated with the intake and discharge structure for the new units, would be placed in a 5.5-ac  
20 upland spoils area near the discharge structure access road. The review team anticipates that  
21 disposal of all spoils resulting from dredging would comply with the DA Clean Water Act Section  
22 404 permit.

23 SCE&G plans to minimize construction debris during building activities. One way is by ordering  
24 appropriate quantities of materials and returning any excess to the vendor (SCE&G 2009a).  
25 Other types of solid waste generated such as office waste, cardboard, and aluminum cans  
26 would be recycled (SCE&G 2009a).

27 Based on SCE&G plans to manage solid wastes in accordance with all applicable State, and  
28 local requirements and standards, and implement recycling and minimizing waste practices, the  
29 review team expects the impacts on land from nonradioactive wastes generated during the  
30 building activities of VCSNS Units 2 and 3 would be minimal, and no further mitigation would be  
31 warranted.

1 **4.10.2 Impacts on Water**

2 Surface water and groundwater have the potential to be affected due to the building activities of  
3 VCSNS Units 2 and 3. SCE&G will have to obtain a NPDES General Permit for Stormwater  
4 Discharges from Large and Small Construction Activities to minimize potential impacts on  
5 surface water and groundwater. As part of the permit, a SWPPP will be required. In addition,  
6 an erosion and sediment control plan would be a component of the NPDES permit. Water-use  
7 impacts and water-quality impacts during the development of VCSNS Units 2 and 3 are further  
8 discussed in Sections 4.2.1 and 4.2.3.

9 Onsite sanitary wastes generated during the building activities would be accommodated with a  
10 temporary sanitary waste-treatment plant. This treatment plant would serve workers in the  
11 support area while onsite workers would be served by portable toilet facilities (SCE&G 2009a).  
12 The discharge location for the temporary sanitary waste-treatment plant would be finalized as  
13 part of the NPDES permitting process; proposed locations are Mayo Creek, Parr Reservoir, or  
14 the Broad River (SCE&G 2009a). If additional sanitary waste provisions are necessary during  
15 building activities, SCE&G plans to provide restroom trailers units. Wastes associated with  
16 these units would be disposed of and transported according to local and State regulations and  
17 standards (SCE&G 2009a).

18 The public wastewater-treatment systems serving the four-county area (Fairfield, Lexington,  
19 Newberry, and Richland) have the excess capacity to meet the increased generation of  
20 wastewater by the in-migrating project workforce. The influx of workforce for construction of the  
21 proposed Units 2 and 3 is expected to reside in these four counties.

22 Currently, SCE&G has no plans to use groundwater during the construction phase. However, if  
23 the need for water in remote construction areas onsite becomes necessary, SCE&G plans to  
24 comply with local and State regulations and standards (SCE&G 2009a).

25 Based on the regulated practices for managing liquid discharges, including wastewater, and the  
26 NPDES permit with an approved SWPPP, SCE&G plans to implement for managing surface  
27 and groundwater, the review team expects that impacts on water from nonradioactive effluents  
28 when building VCSNS Units 2 and 3 would be minimal, and no further mitigation would be  
29 warranted

30 **4.10.3 Impacts on Air**

31 As discussed in Section 4.4.1, 4.5.2, and 4.7.1, fugitive dust and other generated emissions  
32 during site-development activities are to be managed. SCE&G plans to control these emissions  
33 through a dust control plan or similar document. Possible mitigation measures in this dust  
34 control plan would include: stabilizing construction roads and spoils piles, covering haul trucks,  
35 and watering unpaved construction roads to control dust. Equipment and vehicles used for site



1 preparation and the increase in vehicle traffic of construction workers involved in building  
2 VCSNS Units 2 and 3 would result in increased emissions. Possible mitigation measures that  
3 would be used to limit these emissions are phase construction and performance maintenance  
4 on construction vehicles and equipment (SCE&G 2009a).

5 Based on the regulated practices for managing air emissions from construction equipment and  
6 temporary stationary sources, the review team expects that impacts on air from nonradioactive  
7 emissions during the building of VCSNS Units 2 and 3 would be minimal, and no further  
8 mitigation would be warranted.

#### 9 **4.10.4 Summary of Impacts**

10 Solid, liquid, and gaseous wastes generated when building VCSNS Units 2 and 3 would be  
11 handled according to county, State, and Federal regulations. County and State standards and  
12 regulations for handling and disposal of solid waste would be obtained and implemented. An  
13 NPDES permit that would include a SWPPP for surface-water runoff and groundwater quality,  
14 and the use of temporary facilities for sanitary waste systems during the construction period  
15 would ensure compliance with the Clean Water Act and the State of South Carolina standards.  
16 Based on this information provided by SCE&G and the review team's independent evaluation,  
17 the review team concludes that nonradiological waste impacts on land, water, and air would be  
18 SMALL and that additional mitigation would not be warranted. Because NRC-authorized  
19 construction activities represent only a portion of the analyzed activities, the NRC staff  
20 concludes that the nonradioactive waste impacts of NRC-authorized construction activities  
21 would be SMALL. The NRC staff also concludes that no further mitigation would be warranted.

22 Cumulative impacts on water and air from nonradioactive effluents and emissions are discussed  
23 in Sections 7.2 and 7.6, respectively. For the purposes of Chapter 9, the review team expects  
24 that there would be no substantive differences between the impacts of nonradioactive waste for  
25 the proposed VCSNS Units 2 and 3 and the alternative sites and no substantive cumulative  
26 impacts that warrant further discussion beyond those discussed for the alternative sites in  
27 Section 9.3.

### 28 **4.11 Measures and Controls to Limit Adverse Impacts During** 29 **Construction**

30 A number of measures and controls are described by SCE&G (2009a) to limit the adverse  
31 impacts during construction, many of which are planned for incorporation into a Construction  
32 Environmental Controls Plan. The plan would include the following:

- 33 • a summary matrix of environmental requirements for project permits, including the titles of  
34 the individuals responsible for confirming compliance with each permit

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- 1 • a training program for construction personnel that would be based on the specific
- 2 requirements for each project. The training would include, but may not be limited to, general
- 3 site maintenance, erosion and sediment control, the protection of sensitive areas, hazardous
- 4 material and/or waste handling, spills prevention/response, and how to respond to such
- 5 unanticipated discoveries as contaminated soils, archaeological artifacts, or tanks.
- 6 • periodic discussions of current and future construction activities and how to maintain
- 7 environmental compliance during these activities
- 8 • field inspections to confirm adherence to environmental requirements for the project.

9 Table 4-6 summarizes the measures and controls to limit adverse impacts when building  
 10 proposed Units 2 and 3 based on Table 4.6-1 in the ER (SCE&G 2009a) and other information  
 11 provided by the applicant. Some measures apply to more than one impact category.

12 Many of the specific controls in the Construction Environmental Controls Plan would be based  
 13 on measures prescribed by applicable Federal, State, and local ordinances, laws and  
 14 regulations, existing permits and licenses for VCSNS Unit 1, and the incorporation of conditions  
 15 of environmental permits for VCSNS Units 2 and 3 into construction contracts. Table 4.6-1 of  
 16 the ER (SCE&G 2009a) lists specific measures and controls to be applied during construction at  
 17 the site and vicinity relevant to land-use impacts, water-related impacts, ecological impacts,  
 18 socioeconomic impacts, impacts from radiation exposure to construction workers, and  
 19 nonradiological health impacts.

20 **Table 4-6.** Measures and Controls to Limit Adverse Impacts when Building Proposed VCSNS  
 21 Units 2 and 3

Impact Category	Specific Measures and Controls
<b>Land-Use Impacts</b>	
<b>Site and Vicinity</b>	Implement stormwater-management systems, groundwater monitoring wells, and spill-containment controls.  Permanently disturbed locations would be stabilized and contoured in accordance with design specifications.  Comply with applicable laws, regulations, permits, good engineering and construction practices, and recognized environmental BMPs.  Follow South Carolina Storm Water Management Best Management Practices handbook and industry guidance.  Locate all but intake and discharge structures outside of 100- and 500-year floodplains.

22

**Table 4-6.** (contd)

Impact Category	Specific Measures and Controls
<b>Transmission Corridors and Offsite Areas</b>	<p>Incorporate recommendations of Federal and State agencies into route selections, including the recommendations of the South Carolina Department of Health and Environmental Control, South Carolina Department of Natural Resources, South Carolina Department of Archives &amp; History, U.S. EPA, US Fish &amp; Wildlife Service, U.S. Army Corps of Engineers.</p> <p>Site new corridors to minimize or avoid critical or sensitive habitats or species as much as possible.</p> <p>Site new corridors to avoid historical properties</p> <p>Before site disturbance, conduct archaeological and ecological surveys as needed and determine site-specific erosion control measures.</p>
<b>Water-Related Impacts</b>	
<b>Hydrologic Alterations</b>	<p>Comply with applicable laws, regulations, permits, sound engineering and construction practices, and recognized environmental BMPs.</p> <p>Follow BMPs for erosion control. Install drainage system to divert dewatering runoff to settling basin before discharge through a permitted NPDES outfall.</p> <p>Install cofferdams and turbidity curtains to minimize suspended sediment impacts in surface waters.</p> <p>Continue conducting hydrological monitoring to determine baseline hydrological conditions and detect changes.</p> <p>Implement BMPs for erosion and sedimentation control during installation of new transmission lines.</p>
<b>Water-Use Impacts</b>	<p>Obtain FERC authorization for construction water use.</p>
<b>Water-Quality Impacts</b>	<p>Develop an erosion, sedimentation, and pollution control plan. Use BMPs, including structural (e.g., slit fences and sediment retention basins) and operational controls, to prevent movement of pollutants (including sediments) into wetlands and waterbodies.</p> <p>Obtain and comply with NPDES stormwater permit; conduct monitoring as required by the permit. Use NPDES monitoring program for Unit 1 to detect water-quality changes due to construction activities.</p> <p>Obtain and comply with Department of the Army permit.</p> <p>Develop and comply with approved Storm Water Pollution Prevention Plan and spill response plan. Quickly clean up any spilled fuel or oil. Follow South Carolina Storm Water Management Best Management Practices handbook and industry guidance.</p> <p>Install stormwater-drainage system and stabilize disturbed soils.</p>

**Table 4-6.** (contd)

Impact Category	Specific Measures and Controls
<b>Ecological Impacts</b>	Conduct shoreline construction when pool level of Parr Reservoir is low, to the extent practicable.
<b>Terrestrial and Wetland Ecosystems</b>	Site structures to minimize impacts on wildlife habitat and wetlands. Site new transmission-line corridors to avoid sensitive habitats.
	Clear land according to Federal and State regulations and permits, SCE&G procedures, good construction practices, and established BMPs.
	Develop and comply with spill response plan. Schedule equipment maintenance procedures to minimize emissions and spills.
	Minimize fugitive dust by watering.
	Obtain and comply with Department of the Army permit; determine mitigation measures for impacted wetland areas in consultation with USACE.
	Install silt fencing or other controls to protect wetlands.
<b>Aquatic Ecosystems</b>	Obtain and comply with NPDES stormwater permit; conduct monitoring as required by the permit. Use NPDES monitoring program for Unit 1 to detect water-quality changes due to construction activities. Develop and implement a construction Storm Water Pollution Prevention Plan.
	Prepare and implement Spill Prevention Control and Countermeasure Plan for construction activities. Restrict activities using petroleum products and solvents to designated areas that are equipped with spill containment.
	Avoid wetlands, waterbodies, and sensitive areas when possible; plan transmission route to minimize impacts on wetland and waterbodies that must be crossed and use equipment specifically designed for work around wetlands and streams; install erosion controls; and implement BMPs to minimize impacts on aquatic ecosystems.
	Stabilize upslope and adjacent areas to shoreline construction sites with erosion-control devices and after construction, reseed the areas. Follow South Carolina Forestry Commission BMPs manual and SCDHEC handbook and field manual BMPs to prevent sediment loading and minimize soil disturbance.
	Before transmission-line construction, conduct surveys, as needed, and determine site-specific erosion control measures.
	If there is potential for construction of a new transmission line that could degrade habitat of a listed aquatic species, work closely with the State agency to develop a construction schedule and construction techniques that are protective of the habitat and species in question. Preserve vegetation in stream buffer zones to minimize disturbance of aquatic habitats.

**Table 4-6.** (contd)

Impact Category	Specific Measures and Controls
<b>Socioeconomic Impacts</b>	
<b>Physical Impacts</b>	<p>Train and appropriately protect construction workers to reduce the risk of potential exposure to noise, dust, and exhaust emissions. Regularly inspect and maintain equipment to include exhaust and noise aspects.</p> <p>Make public announcements or prior notification of atypically loud construction activities.</p> <p>Phase construction to minimize daily emissions. Restrict extreme noise-related activities to daylight hours. Restrict delivery times to daylight hours.</p> <p>Develop and implement a dust control plan that includes mitigation measures such as watering unpaved roads, stabilizing construction roads, phasing grading activities and ceasing them during high winds, limit speeds on unpaved roads, minimizing material handling, etc.</p> <p>Develop construction-management traffic plan before the start of construction. Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas.</p> <p>Minimize waste by using excavated material where fill is needed, ordering materials in appropriate quantities and returning overage to the vendor, and recycling scrap metal.</p>
<b>Social and Economic Impacts</b>	<p>Develop a construction-management traffic plan before the start of construction.</p> <p>Regularly communicate with local school authorities regarding construction worker influx.</p> <p>Coordinate with job-training institutions.</p>
<b>Environmental Justice Impacts</b>	<p>Provide mitigating measures as for socioeconomic impacts.</p>
<b>Historic and Cultural Properties Impacts</b>	<p>Consult State Historic Preservation Office (South Carolina Department of Archives and History). Develop management agreement.</p> <p>Before site disturbance, conduct archaeological surveys.</p> <p>Conduct awareness training for procedures associated with inadvertent discoveries.</p> <p>Develop and implement a procedure for construction activities that includes actions to protect cultural, historic, or paleontological resources.</p> <p>Continue to have a fence barrier around Pearson Cemetery.</p> <p>Continue any applicable mitigation measures for any National Register-eligible sites.</p>
<b>Air Quality Impacts</b>	<p>Implement dust-control plan.</p> <p>Stagger use of equipment and keep equipment in good working order.</p>
<b>Transportation</b>	<p>Develop project traffic-management plan.</p>

**Table 4-6.** (contd)

<b>Impact Category</b>	<b>Specific Measures and Controls</b>
<b>Nonradiological Health Impacts</b>	<p>Train contractors on safety requirements to ensure contractors arriving onsite are adequately trained with regard to VCSNS safety requirements.</p> <p>Require construction contractors and subcontractors to develop and implement safety procedures.</p> <p>Implement noise mitigation to include restricting noise-related activities to daylight hours.</p> <p>Provide onsite services for emergency first aid, and conduct regular health and safety monitoring.</p>
<b>Radiological Health Impacts</b>	None proposed (estimated exposure would be well below established limits to workers and members of the public)

1 **4.12 Summary of Construction and Preconstruction Impacts**

2 The impact levels determined by the review team in the previous sections are summarized in  
 3 Table 4-7. The impact levels for NRC-authorized construction as evaluated in this chapter are  
 4 denoted in the table as SMALL, MODERATE, or LARGE as a measure of their expected  
 5 adverse environmental impacts, if any. Combined construction and preconstruction impact  
 6 levels are similarly noted. Some impacts, such as the addition of tax revenue from SCE&G for  
 7 the local economies, are likely to be beneficial impacts to the community.

8 **Table 4-7.** Summary of Impacts from Construction and Preconstruction of Proposed VCSNS  
 9 Units 2 and 3

<b>Category</b>	<b>Comments</b>	<b>NRC-Authorized Construction Impact Level</b>	<b>Construction and Preconstruction Impact Level</b>
<b>Land-Use Impacts</b>	Construction and preconstruction impacts on land use would be limited. Preconstruction impacts on land use would be noticeable in the immediate vicinity of new transmission-line corridors but limited in the region	SMALL	SMALL for onsite; MODERATE for transmission lines SMALL for other offsite areas
<b>Water-Related Impacts</b>			
Water Use – Surface Water	Construction and preconstruction impacts on surface water use would be negligible.	SMALL	SMALL
Water Use – Groundwater	Construction and preconstruction impacts on groundwater use would be negligible.	SMALL	SMALL

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**Table 4-7. (contd)**

<b>Category</b>	<b>Comments</b>	<b>(NRC- Authorized Construction Impact Level</b>	<b>Construction and Preconstruction Impact Level</b>
Water Quality – Surface Water	Construction and preconstruction impacts on surface and groundwater quality would be negligible.	SMALL	SMALL
Water Quality – Groundwater	Construction and preconstruction impacts on groundwater quality would be negligible	SMALL	SMALL
<b>Ecological Impacts</b>			
Terrestrial and Wetland Ecosystems	Construction and preconstruction activities would have minimal impact on terrestrial ecological resources and habitat on the VCSNS site, but terrestrial habitats are expected to be noticeably altered where new transmission-line corridors are established.	SMALL	SMALL for onsite; MODERATE for transmission lines
Aquatic Ecosystems	Construction and preconstruction activities would have minimal impact on onsite and offsite aquatic ecological resources and habitat.	SMALL	SMALL
<b>Socioeconomic Impacts</b>			
Physical Impacts	Construction and preconstruction physical impacts are minimal; unavoidable impacts would be limited by mitigation measures	SMALL	SMALL
Demography	Construction and preconstruction demographic impacts on the communities nearest VCSNS are expected to be small and temporary.	SMALL	SMALL
Economic Impacts on the Community	Construction and preconstruction economic and tax revenue impacts on the communities nearest VCSNS are expected to be small and temporary.	SMALL	SMALL
Infrastructure and Community Services	Construction and preconstruction traffic impacts would be noticeable but not destabilizing; other infrastructure and community services impacts are expected to be limited.	MODERATE for traffic impacts SMALL for other infrastructure and community service impacts	MODERATE for traffic impacts SMALL for other infrastructure and community service impacts
<b>Environmental Justice</b>	Construction and preconstruction traffic-related impacts would be noticeable but not destabilizing to the Jenkinsville community. The review team expects impacts related to all categories except traffic to be minimal.	MODERATE for traffic impacts; SMALL for other environmental justice impacts	MODERATE for traffic impacts; SMALL for other environmental justice impacts
Health and Environmental	Construction and preconstruction impacts could be adverse, but would not be disproportionate.	SMALL	SMALL

**Table 4-7. (contd)**

Category	Comments	(NRC- Authorized Construction Impact Level	Construction and Preconstruction Impact Level
<b>Historic and Cultural Resources</b>	NRC-authorized construction activities represent only a part of the analyzed activities; nearly all impacts would be attributable to preconstruction activities. The NRC staff concludes that the potential impacts on historic and cultural resources from NRC-authorized construction activities would be SMALL. Construction and preconstruction activities would noticeably alter the resources within the Area of Potential Effect.	SMALL	MODERATE
<b>Air-Quality Impacts</b>	Construction and preconstruction impacts on air quality would be limited.	SMALL	SMALL
<b>Nonradiological Health Impacts</b>	Construction and preconstruction impacts on nonradiological human health are expected to be minimal.	SMALL	SMALL
<b>Radiological Health Impacts</b>	Exposures would be below NRC annual occupational and public dose limits.	SMALL	SMALL
<b>Nonradiological Waste Impacts</b>	Impacts to land, water and air are expected to be minimal.	SMALL	SMALL

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## 5.0 Operational Impacts at the VC Summer Site

This chapter examines environmental issues associated with operation of the proposed new nuclear Units 2 and 3 at the Virgil C. Summer Nuclear Station (VCSNS) site for an initial 40-year period as described by South Carolina Electric and Gas (SCE&G). As part of its application for combined construction permits and operating licenses (COLs), SCE&G submitted an Environmental Report (ER) that discussed the environmental impacts of station operation (SCE&G 2009a). In its evaluation of operational impacts, the review team composed of U.S. Nuclear Regulatory Commission (NRC) staff, its contractor staff, and U.S. Army Corps of Engineers (USACE) staff, relied on operational details supplied by SCE&G in its ER, SCE&G responses to NRC Requests for Additional Information (RAIs), and the review team's own independent review. Also consulted were permitting correspondences between SCE&G and the USACE, a cooperating agency in this action.

This chapter is divided into 13 sections. Sections 5.1 through 5.11 discuss the potential operational impacts on land use, water, terrestrial and aquatic ecosystems, socioeconomics, environmental justice, historic and cultural resources, meteorology and air quality, nonradiological and radiological health effects, postulated accidents, and measures and controls that would limit the adverse impacts of station operation during the 40-year operating period. In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each analysis. In the area of socioeconomics related to taxes, the impacts may be considered beneficial and are stated as such, as appropriate. The NRC staff's determination of significance levels is based on the assumption that the mitigation measures identified in the ER or activities planned by various State and county governments, such as infrastructure upgrades, as discussed throughout this chapter, are implemented. Failure to implement these upgrades might result in a change in significance level. Possible mitigation of adverse impacts is also presented, where appropriate. A summary of operational impacts is presented in Section 5.13. The references cited in this chapter are listed in Section 5.14.

### 5.1 Land-Use Impacts

This section contains information about the land-use impacts associated with operation of proposed VCSNS Units 2 and 3. Section 5.1.1 discusses land-use impacts at the VCSNS site and in the vicinity of the site. Section 5.1.2 discusses land-use impacts with respect to offsite transmission-line corridors and offsite areas.

1 **5.1.1 The Site and Vicinity**

2 Onsite land-use impacts from operation of VCSNS Units 2 and 3 are expected to be minimal.  
3 The proposed units would use two mechanical draft cooling towers for each unit. As discussed  
4 in Sections 5.3.1.1 and 5.7.1 of this chapter, operation of the cooling system would have  
5 minimal impacts on vegetation, and fogging, icing, and drift impacts on land use also are  
6 expected to be minimal. Occasional dredging around the discharge diffuser pipe in the Parr  
7 Reservoir and the intake structure in Monticello Reservoir may be required during operations.  
8 SCE&G would follow generally accepted best management practices (BMPs) and all applicable  
9 regulations and permit conditions for disposal of dredging spoils at an onsite upland location.

10 Some offsite land-use changes can be expected as a result of operational activities. Possible  
11 changes include the conversion of some land in surrounding areas to housing developments  
12 (e.g., recreational vehicle parks, apartment buildings, single-family condominiums and homes,  
13 manufactured home parks) and retail development to serve plant workers. Property tax revenue  
14 from the addition of two new units could also lead to additional growth and land conversions in  
15 Fairfield County and surrounding counties as a result of infrastructure improvements (e.g., new  
16 roads, utility services). Additional information about operations-related infrastructure impacts is  
17 provided in Section 5.4. However, the review team assumes that any induced residential  
18 growth would be managed because the four counties in the economic impact area have  
19 comprehensive land-use plans in place. Fairfield County allows low-density residential  
20 development in the vicinity of the site, in accordance with its Comprehensive Land-Use Plan  
21 (see Section 2.2.1). Based on the existence and projected implementation of land-use plans,  
22 the information provided by SCE&G, and the NRC's own independent review, the review team  
23 concludes that the land-use impacts of operation would be SMALL, and additional mitigation  
24 would not be warranted.

25 **5.1.2 Transmission-Line Corridors and Offsite Areas**

26 Most land-use impacts would occur during installation of the planned new 230-kV transmission  
27 lines. SCE&G and Santee-Cooper (the State-owned electric and water utility, formally called  
28 the South Carolina Public Service Authority) provide easements to allow agricultural activities  
29 under their transmission lines. Transmission-line corridor management practices are discussed  
30 in Section 5.3.1.2. Therefore, the review team concludes that the offsite land-use impacts of  
31 operations would be SMALL, and additional mitigation would not be warranted.

32 **5.2 Water-Related Impacts**

33 This section discusses water-related impacts on the surrounding environment from operation of  
34 the VCSNS Units 2 and 3.

1 Managing water resources requires understanding and balancing the tradeoffs between various,  
2 often conflicting, objectives. At the VCSNS site, these objectives include recreation, visual  
3 aesthetics, reservoir ecology, and a variety of beneficial consumptive uses of water.

4 Water-use and water-quality impacts involved with operation of a nuclear plant are similar to the  
5 impacts associated with any large thermoelectric power generation facility. Accordingly,  
6 SCE&G must obtain the same water-related permits and certifications as any other large  
7 thermoelectric power generation facility. These include:

- 8 • Clean Water Act Section 401 Certification. This certification would be issued by the South  
9 Carolina Department of Health and Environmental Control (SCDHEC) and would confirm that  
10 operation of the plant would not conflict with State water-quality management programs.
- 11 • Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES)  
12 Discharge Permit. This permit would be issued by the SCDHEC and would regulate limits of  
13 pollutants in liquid discharges to surface water.
- 14 • Clean Water Act Section 316(a). This section regulates the cooling-water discharges to  
15 protect the health of the aquatic environment. The scope will be covered under the NPDES  
16 permit with the SCDHEC.
- 17 • Clean Water Act Section 316(b). This section regulates cooling-water intake structures to  
18 minimize environmental impacts associated with location, design, construction, and capacity  
19 of those structures. The scope will be covered under the NPDES permit with the SCDHEC

20 Section 5.2.1 discusses the expected hydrologic alterations in surface water and groundwater  
21 related to operation of VCSNS Units 2 and 3. Water-use impacts are discussed in Section 5.2.2  
22 for surface water (5.2.2.1) and groundwater (5.2.2.2). Water-quality impacts are discussed in  
23 Section 5.2.3 for surface water (5.2.3.1) and groundwater (5.2.3.2). Water monitoring is  
24 discussed in Section 5.2.4 for surface water (5.2.4.1) and groundwater (5.2.4.2).

## 25 **5.2.1 Hydrologic Alterations**

26 The proposed VCSNS Units 2 and 3 would be positioned on a hilltop with natural drainage away  
27 from the facilities. Modifications of the land surface made during construction and  
28 preconstruction activities would alter the local hydrology. Specifically, surface water would be  
29 routed away from the nuclear plant through ditches described in the site layout plan. In addition,  
30 groundwater infiltration areas would be significantly different because of the large number of  
31 impervious surfaces and the use of stormwater-retention basins. The aquifer beneath the  
32 VCSNS site is likely to be affected by the new hydrology for a period shortly after construction  
33 and preconstruction, but it should eventually stabilize into a predictable pattern consistent with  
34 the conditions of VCSNS Units 2 and 3 operations. The aquifer may also be locally affected to a  
35 small extent by the altered surface hydrology, although these impacts are not likely to have a  
36 significant impact on other adjacent permitted users.

## Operational Impacts at the VC Summer Site

1 The impact of the consumptive use of surface water by proposed Units 2 and 3 is evaluated in  
2 terms of the estimated reduction in flow in absolute and percentage terms for normal and  
3 maximum modes of operation and for long-term average flows and low flows in the Broad River.  
4 These flows are discussed in Section 5.2.2.1.

5 The quantitative measures used to assess the level of impact on water use are twofold: (1) the  
6 ability to discern the reduced flow from the historical flows using current U.S. Geological Survey  
7 (USGS) methods, and (2) the decreased ability of a hypothetical small downstream reservoir to  
8 serve hypothetical water users. These measures are discussed in Section 5.2.2.1.

9 SCE&G stated that “groundwater would not be withdrawn for operational use by Units 2 and 3”  
10 (SCE&G 2009a). The hydrologic alterations of groundwater due to construction and  
11 preconstruction activities (e.g., site grading, changes in recharge, fill materials, excavation  
12 dewatering) are discussed in Section 4.2.1 of this environmental impact statement (EIS).  
13 Localized dewatering during operations may be required to reduce the water table to minimize  
14 seepage for below-grade portions of buildings. As mentioned by SCE&G (SCE&G 2009a), the  
15 pumping rates would be low due to the low permeability of the aquifers in this area (see  
16 Sections 2.3.1.2 and 2.3.2.2 of this EIS). Based on the low amount of groundwater pumping  
17 that may occur if dewatering is required, the review team concluded that any groundwater  
18 alterations at VCSNS Units 2 and 3 would be localized to the site.

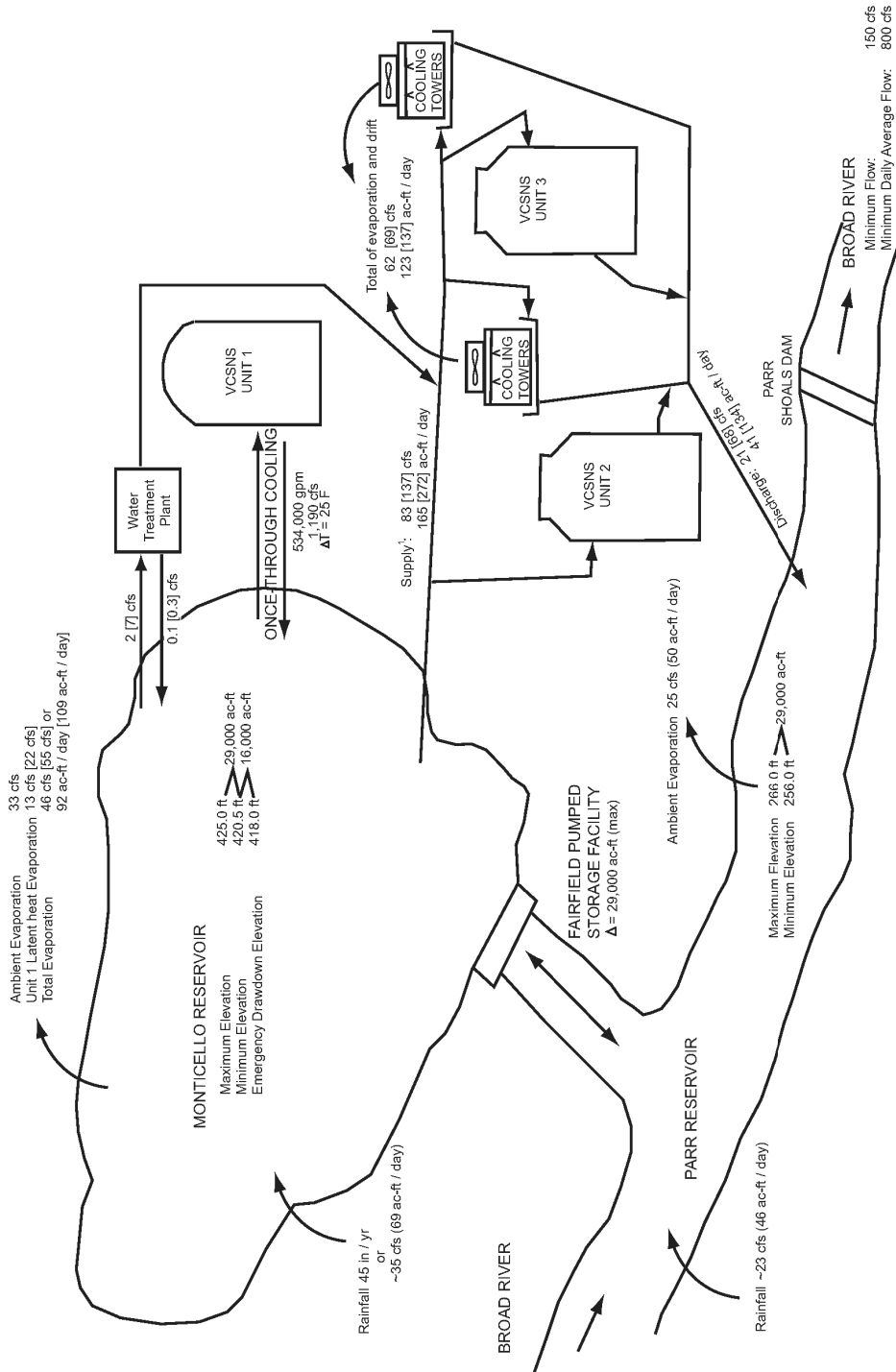
### 19 **5.2.2 Water-Use Impacts**

20 A description of water-use impacts on surface water and groundwater is presented in the next  
21 sections. The water resource usage by VCSNS Units 2 and 3 operations is limited to the  
22 Monticello Reservoir and the Broad River/Parr Reservoir. The impacts of surface-water and  
23 groundwater use are discussed in Sections 5.2.2.1 and 5.2.2.2, respectively. Surface water  
24 would be used by VCSNS Units 2 and 3 for cooling and all other plant water needs. No local  
25 groundwater use is proposed. Information presented in the ER (Revision 1) for VCSNS Units 2  
26 and 3 (SCE&G 2009a), as well as other information obtained by the review team, and  
27 independent analysis performed by the review team were used to assess water-use impacts.

#### 28 **5.2.2.1 Impacts on Surface-Water Use**

29 VCSNS Units 2 and 3 would withdraw water from Monticello Reservoir, which comes from Frees  
30 Creek and indirectly from the Broad River via the Fairfield Pumped Storage Facility (FPSF).  
31 Some of the water supplied to these units would be used consumptively (e.g., through  
32 evaporation). The Broad River, Parr Reservoir, and Monticello Reservoir are hydrologically  
33 connected by the FPSF. Cooling water blowdown would be discharged to Parr Reservoir. The  
34 VCSNS Unit 2 and 3 water treatment facility would discharge to Monticello Reservoir. A  
35 diagram showing the direction and magnitude of flows between the Broad River, Parr Reservoir,  
36 Monticello Reservoir, VCSNS Unit 1, and the proposed VCSNS Units 2 and 3 is shown in  
37 Figure 5-1.





XX [XX] - Normal [Maximum]  
 Elevation Datum NGVD29  
 \* Supply represents total water supply including amount from water treatment plant.

**Figure 5-1. Diagram of the Broad River, Parr Reservoir, and Monticello Reservoir System (SCE&G 2009a)**

## Station Operation Impacts at the VC Summer Site

1 Some water would be consumptively used by VCSNS Units 2 and 3. Operational surface-water  
 2 withdrawals for the proposed VCSNS Units 2 and 3 are estimated to be between 83 cfs (normal  
 3 operation) and 137 cfs (maximum use). Of these totals, between 62 cfs (normal operation) and  
 4 69 cfs (maximum use) of water would be consumptively used due to evaporation and drift  
 5 related to the operation of the proposed cooling towers, while between 21 cfs (normal operation)  
 6 and 68 cfs (maximum use) of water would be discharged to the Parr Reservoir just upstream of  
 7 the Parr Shoals Dam. For comparison purposes, the long-term annual and lowest annual mean  
 8 flows are reported for the Alston gauging station (nearest station downstream of VCSNS) as  
 9 6300 cfs and 2150 cfs, respectively. The estimated surface-water withdrawals for the proposed  
 10 VCSNS Units 2 and 3 would be between 1 and 4 percent of the long-term annual mean of  
 11 Broad River flows, while the actual surface-water consumptive use of VCSNS Units 2 and 3  
 12 would be around 1 percent of the long-term annual mean. For the lowest annual mean flow, the  
 13 withdrawal percentages increase to between 2 and 6 percent, while consumptive use increases  
 14 to around 3 percent. The consumptive surface-water use impacts of VCSNS Units 2 and 3  
 15 operations on Broad River flow are summarized in Table 5-1.

16 **Table 5-1.** Impacts of Proposed VCSNS Units 2 and 3 Water Use on Broad River Flow

	<b>Broad River Flow at Alston (cfs)</b>	<b>Normal (max) Consumptive Use for Units 2 and 3 (cfs)</b>	<b>Difference in Broad River Flow Under Normal (max) Operating Conditions (Percent)</b>
Long-term annual mean flow	6300	62 (69)	1 (1.1)
Lowest annual mean flow	2150	62 (69)	2.9 (3.2)
7Q10 flow	853	62 (69)	7.3 (8.1)

17 The 7Q10 flow (lowest flow for 7 consecutive days expected to occur once per decade) is also  
 18 used to assess the impacts of alteration to flow during low-flow periods. The 7Q10 was  
 19 reported by SCE&G to be 853 cfs in the absence of accounting for VCSNS Units 2 and 3  
 20 consumptive uses. Including the proposed VCSNS Units 2 and 3 consumptive use would  
 21 reduce the 7Q10 to 791 and 784 cfs under normal and maximum use modes of operation or  
 22 between a 7 to 8 percent reduction in 7Q10 flow.

23 When surface-water flow is at or above either the long-term annual or lowest annual mean  
 24 flows, the percent reduction in the Broad River flow due to consumptive use related to the  
 25 operation of the proposed VCSNS Units 2 and 3 (1-6 percent) would be minimal. Due to the  
 26 seasonality of the Broad River flow, it is expected that the impacts would be larger in the  
 27 summer than during the remainder of the year. At lower Broad River flows, SCE&G has  
 28 suggested that, as a mitigative measure, some of the water-supply needs could be met by  
 29 drawing from Monticello Reservoir storage instead of relying fully on the Broad River. The  
 30 useable storage within Monticello Reservoir is 45,000 ac-ft.

## Station Operation Impacts at the VC Summer Site

1 The review team assessed the impact of the estimated maximum consumptive use of water of  
2 the proposed Units 2 and 3 (69 cfs) to assess the ability of the Broad River to satisfy current and  
3 likely future water demands. Based on a combination of existing historical flow records at the  
4 USGS Alston and Richtex gauges, the maximum consumptive use represents about 1 percent  
5 of the average annual flow (6155 cfs) and 1.6 percent of the flow during the lowest month  
6 average flow (4300 cfs) of the entire period of record (1925 to 1983). The consumptive water  
7 use of proposed Units 2 and 3 would fall within the range of uncertainty in typical streamflow  
8 measurements of a stream this size. Given the minor fractional reduction due to consumptive  
9 use, the review team determined that the impact of proposed Units 2 and 3 on the water  
10 resources' ability to meet current water demands would be minimal.

11 The review team also assessed the impact of consumptive water use of the proposed plant with  
12 water demands that might occur toward the end of the plant's operating life in 2060. Because  
13 no precise method exists to project water demands out to 2060, the review team relied on  
14 population projections for 2060 for the primary counties in the Broad River basin (Cherokee,  
15 Chester, Fairfield, Greenwood, Richland, Spartanburg, Union, and York Counties). Based on  
16 the combined population growth for 2060 (discussed in Section 2.5.1.1, Table 2-23) and the per  
17 capita water-use requirements derived from annual South Carolina Water Use Reports  
18 (SCDHEC 2002, 2003a, b, 2004, 2005a, 2006, 2007), the review team postulated a water  
19 requirement of 251,508 ac-ft/yr (350 cfs), assuming a linear relationship between growth in  
20 population and increase in surface-water use.

21 To confirm that a reliable water supply will continue to meet the postulated demand given the  
22 expected seasonal and annual variability of streamflows, the review team postulated a  
23 hypothetical off-stream reservoir sized to ensure that a steady future water demand would be  
24 reliably delivered. For the purposes of this analysis, streamflow withdrawals were limited in the  
25 critical months of July, August, and September so the median Broad River flows would not  
26 change. Withdrawals from the river were limited to 700 cfs (as a water-supply design  
27 parameter) and further limited to 479 cfs (to maintain a required minimum flow in the Broad  
28 River). These limitations represent a postulated set of requirements designed to allow for  
29 transfer of water from the Broad River to the hypothetical reservoir only under excess river flow  
30 conditions. The modeled reservoir size needed to satisfy the postulated steady future water  
31 demand was 55,000 ac-ft. The reliability of this reservoir to meet future water requirements (as  
32 identified above) was reduced from 99.65 percent to 99.61 percent when VCSNS consumptive  
33 use was removed from the available supply. Based on the magnitude of the change the review  
34 team concluded that the impact of VCSNS Units 2 and 3 operation on future water-supply  
35 reliability would not be noticeable and mitigation would not be warranted.

36 VCSNS Units 2 and 3 operation would consumptively use only a small proportion of Broad River  
37 flow, and the review team's independent water-supply reliability analysis found that this  
38 consumptive use would not noticeably alter long-term regional water supply reliability even

## Station Operation Impacts at the VC Summer Site

1 when considering potential future supply reduction because of climate change. Therefore, the  
2 review team concludes that the impacts of surface-water use by VCSNS Units 2 and 3  
3 operations would be SMALL, and mitigation would not be warranted.

### 4 **5.2.2.2 Impacts on Groundwater Use**

5 As described in Section 5.2.1, groundwater would not be used for operation of proposed  
6 VCSNS Units 2 and 3, but some dewatering may be necessary to reduce below-grade seepage  
7 in buildings. Dewatering is currently used to reduce below-grade seepage in buildings around  
8 Unit 1 (using two wells at a combined rate of about 26 gpm as described in Section 2.3.2.2 of  
9 this EIS).

10 As stated in Section 2.3.2.2, the closest water-supply well to the site is currently at a private  
11 residence approximately 1 mi east of the site. The nearest groups of wells, used for residences  
12 and stores, are located 1.5 mi east of the VCSNS site and 2.5 mi southeast of the site (SCE&G  
13 2009a). The closest water-supply well that could potentially be located near the facility is  
14 approximately 0.75 mi to the southeast at the site boundary (SCE&G 2009b). As discussed in  
15 Sections 2.3.1.2 and 2.3.2.2 of this EIS, yields from groundwater wells, both regionally and  
16 locally, are generally less than 30 gpm.

17 Similar to VCSNS Unit 1, a potable-water treatment plant that draws water from Monticello  
18 Reservoir would provide the potable water for Units 2 and 3 during operations (SCE&G 2009a,  
19 b). SCE&G stated that they will not use water from a municipal system for operations (SCE&G  
20 2009a). Therefore, water usage at the VCSNS site during operations would not affect municipal  
21 water suppliers who may draw water from groundwater sources.

22 Based on the low groundwater pumping rates needed for dewatering due to the generally low  
23 permeability of the aquifers in this area; relatively large distances to local groundwater supply  
24 wells; and the site location that is partially isolated from offsite users by surface waterbodies  
25 (Parr Reservoir, Mayo Creek, and Monticello Reservoir); the review team concludes that the  
26 impacts on groundwater use during the operation of Units 2 and 3 would be SMALL, and  
27 additional mitigation would not be warranted.

### 28 **5.2.3 Water-Quality Impacts**

29 This section discusses the impacts on the quality of water resources from the operation of  
30 proposed VCSNS Units 2 and 3. Surface-water impacts include thermal, chemical, and  
31 radiological wastes, and physical changes in the Monticello Reservoir and the Broad River  
32 and/or Parr Reservoir resulting from effluents discharged by the proposed nuclear plants.  
33 Section 5.2.3.1 discusses the impacts on surface-water quality and Section 5.2.3.2 discusses  
34 the impacts on groundwater quality.

### 1 5.2.3.1 Impacts on Surface-Water Quality

2 Impacts to surface water quality could result from blowdown discharge and stormwater runoff.  
3 Cooling towers concentrate solids and solutes from the raw makeup water during the process of  
4 evaporative heat loss. Other materials are introduced to the makeup water to inhibit scale,  
5 biofilm formation, and corrosion. These solids and solutes are contained in blowdown.  
6 Blowdown for the two proposed units at the VCSNS site would be discharged to Parr Reservoir.  
7 Stormwater runoff would be managed through engineering controls (SCE&G 2009a) based on  
8 BMPs as detailed in a stormwater pollution prevention plan (SWPPP).

9 The water-treatment methods to be used at VCSNS Units 2 and 3 are described in Section 3.4  
10 and are likely to be similar to those used for VCSNS Unit 1. In addition to the anti-scalants,  
11 biocides, and corrosion inhibitors described above, additional water treatment would be  
12 achieved through the use of algaecides, pH adjusters, and silt dispersants (see Table 3-5). The  
13 VCSNS Units 2 and 3 cooling towers would operate by recycling cooling water two to four times,  
14 which would concentrate any material present in the makeup water. While the amount of these  
15 materials would not differ, the dissolved concentration in the blowdown discharge to Parr  
16 Reservoir would be two to four times the initial concentration in the makeup water. Intake  
17 concentrations are listed in Table 2-9 through Table 2-11; estimated concentrations in  
18 blowdown are provided in Table 3-4. An NPDES permit is required before blowdown effluent  
19 can be discharged, and discharges must be in compliance with the permit. When the blowdown  
20 discharge mixes with the much larger flow of the Broad River, the downstream Broad River  
21 concentration would approach that of the upstream concentrations.

22 Temperature standards for fresh waters as well as guidelines for determining whether a mixing  
23 zone needs to be created around a thermal discharge are established in State Regulation 61-  
24 68, "*Water Classifications and Standards*" as follows: "...water temperature of all freshwaters  
25 which are free flowing [or lakes] shall not be increased more than 5°F (2.8°C) above natural  
26 conditions and shall not exceed 90°F (32.2°C) as a result of the discharge of heated liquids  
27 unless a different site-specific temperature standard as provided for in C.12 has been  
28 established, a mixing zone as provided in C.10 has been established, or a Section 316(a)  
29 determination under the Federal Clean Water Act has been completed" (SCDHEC 2008, at  
30 E(12)(a) and (c)). If a mixing zone is to be created, then its size should be minimized (SCDHEC  
31 2008). For chronic mixing permit conditions, SCDHEC has established that a mixing zone be  
32 no larger than half the river width and extend a distance no further than twice the river width  
33 (SCDHEC 2005b). Based on the Parr Reservoir width of 600 ft, the largest mixing zone size  
34 could be 300 ft across the river and 1200 ft along the river. SCE&G focused on simulations  
35 where either the 90°F or the +5°F criterion could be exceeded.

36 The blowdown discharge into Parr Reservoir would be, in most cases warmer than the ambient  
37 water. SCE&G used the Cornell Mixing Zone Expert System (CORMIX) modeling software,  
38 version 4.3, to estimate the thermal plume from the discharge in Parr Reservoir (SCE&G 2009a;

## Station Operation Impacts at the VC Summer Site

1 Toblin 2007). The blowdown flow and temperature were estimated using meteorological data,  
2 cooling tower performance curves, and historical Parr Reservoir water temperatures (Toblin  
3 2007). The largest blowdown flow and the highest blowdown temperature that were estimated  
4 were 64 cfs and 91.75°F.

5 The review team independently conducted a thermal plume analysis to estimate the thermal  
6 plume's extent across the reservoir and to maximize the plume size estimate. The 7Q10 flow  
7 for the Broad River estimated at Parr Shoals Dam as 834 cfs (SCE&G 2009a) and when limited  
8 to the spring time period a higher low flow of 1469 cfs was reported (Toblin 2007). These flows  
9 (834 cfs for summer and 1469 cfs for spring) were used to estimate the blowdown thermal  
10 plume dimensions for the spring and summer conditions. The review team examined the  
11 temperature records computed using 3-month rolling temperature averages for spring and  
12 summer. From these averages, a conservatively low ambient temperature during the spring of  
13 43.3°F and a conservatively high summer ambient temperature of 84.0°F were used to  
14 maximize the estimated difference between ambient water and plume water temperatures (in  
15 spring) as well as plume temperature itself (summer). To make the estimates conservative, the  
16 review team analysis used the maximum effluent discharge flow rate (blowdown plus other  
17 liquid effluents) and highest blowdown discharge temperature, low flow through Parr Reservoir,  
18 low ambient water temperatures in spring, and high ambient water temperatures in summer.

19 The review team's thermal plume analysis is based on the estimation of the completely mixed  
20 water temperature within a prescribed fraction of the cross section of Parr Reservoir. While the  
21 assumption of complete and instantaneous mixing is physically implausible, this approach is  
22 based exclusively on the principle of conservation of energy, and provides a bounding estimate  
23 of the portion of the water that could be raised to a specified temperature differential. The well-  
24 mixed assumption here extends the 5°F limit to be wider than it would actually be, because no  
25 accommodation is made for more of the heat to be stored at the core of the plume than at the  
26 edges. The NRC staff's calculations are not designed to distinguish these plume features;  
27 estimated plume temperatures in the context of this discussion refer solely to the well-mixed, or  
28 average temperature within the plume. The analysis is based on the assumption that a portion of  
29 the cross section of the Parr Reservoir is significantly affected by the blowdown discharge. That  
30 is, a portion of the ambient flow is completely mixed with the blowdown discharge. That portion  
31 is based on specification of the fraction of affected width and depth. In all of the analysis, the  
32 plume is assumed to be mixed over one-half of the depth, meaning that the upper half of the  
33 water column will contain the thermal plume because of its buoyancy. A range of plume widths  
34 was examined (10 percent, 25 percent, and 50 percent of the channel width). A fraction of the  
35 ambient flow is assumed to be entrained into the blowdown discharge flow and which, when  
36 mixed, adjusts to combined water temperature above the ambient water temperature and below  
37 the blowdown discharge temperature. The differences between the estimated plume water  
38 temperature and the ambient water temperature as well as the overall plume temperature were  
39 computed for these conditions and summarized in Table 5-2 and Table 5-3.

Station Operation Impacts at the VC Summer Site

1 **Table 5-2.** Estimated Spring and Summer Blowdown Plume Temperatures with Assumed  
 2 Plume Thickness Equal to 50 Percent of Water Depth

Plume Width	Plume Temperature (°F)			
	Spring (1469 cfs)		Summer (843 cfs)	
	Normal Operation	Maximum Operation	Normal Operation	Max Operation
10% of Channel Width	54	66	87	89
25% of Channel Width	48	56	85	87
50% of Channel Width	46	51	85	86

3

4 **Table 5-3.** Estimated Blowdown Plume Temperature Rise Above Ambient Water for Spring  
 5 and Summer with Assumed Plume Thickness Equal to 50 Percent of Water Depth

Plume Width	Plume Temperature Above Ambient (°F)			
	Spring (43.3°F ambient)		Summer (84.0°F ambient)	
	Normal Operation	Maximum Operation	Normal Operation	Maximum Operation
10% of Channel Width	11	23	3	5
25% of Channel Width	5	13	1	3
50% of Channel Width	3	8	1	2

6 During spring conditions, the difference between the plume water temperature and ambient  
 7 water temperature exceeds 5°F. The review team increased the width of the modeled plume  
 8 area to 75 percent of the channel width and found that the temperature difference was reduced  
 9 to 5°F. When the blowdown discharge was reduced to 40 cfs from the more conservative value  
 10 of 68 cfs, a 5°F temperature difference was estimated for a plume width that was 50 percent of  
 11 the channel width.

12 The discharge velocity is estimated to be in the range 2.3 to 3.8 fps (four-cycle operation) or 6.9  
 13 to 11.3 fps (two-cycle operation) at the diffuser ports (SCE&G 2009a). The ambient currents  
 14 range from 0.2 to 0.6 fps for low and average flow conditions (SCE&G 2009a). The diffuser has  
 15 an alternative port configuration to yield a net momentum balance of zero. SCE&G judged that  
 16 the momentum would dissipate within a limited area estimated to be 0.3 acre adjacent to the  
 17 diffuser (Toblin 2007). Within this zone some scouring of the reservoir bottom would be  
 18 expected. Because Parr Reservoir is characterized as depositional, SCE&G determined that  
 19 the scour caused by the diffuser would be minimal.

20 The discharges to Parr Reservoir and the much smaller discharges from the water-treatment  
 21 plant to Monticello Reservoir have low projected contaminant levels that would be controlled  
 22 through the NPDES permitting process. As such, the impacts on the water quality of the Broad  
 23 River, Monticello Reservoir, and Parr Reservoir from proposed VCSNS Units 2 and 3 discharges

## Station Operation Impacts at the VC Summer Site

1 are expected to be minor enough to not alter the SCDHEC 303(d) designated use of the three  
2 water resources and would comply with SCDHEC maximum contaminant levels (SCDHEC 2008)  
3 and (SCE&G 2009a).

4 Based on the review team's independent analysis of the temperature of, and chemical  
5 constituents in, plant discharges to Parr Reservoir and Monticello Reservoir, the review team  
6 concludes the impacts of the proposed Units 2 and 3 discharges on surface-water quality would  
7 be SMALL, and mitigation would not be warranted.

### 8 **5.2.3.2 Impacts on Groundwater Quality**

9 As discussed in Section 5.2.2.2, no groundwater would be used for the operation of VCSNS  
10 Units 2 and 3. Some localized dewatering may be necessary to reduce below-grade seepage in  
11 buildings. The small alterations of groundwater flow and usage during operations would not  
12 change groundwater quality.

13 SCE&G referred to its *Spill Prevention, Control, and Countermeasures Plan and Facility*  
14 *Response Plan*, as required by SCDHEC, that would "tend to mitigate impacts on local  
15 groundwater because spills are quickly attended to and not allowed to penetrate to  
16 groundwater" (SCE&G 2009a). Spills may include diesel fuel, hydraulic fluid, and lubricants  
17 (SCE&G 2009a).

18 Factors that limit the impacts of operations on groundwater quality in the area are (1) SCE&G's  
19 BMPs for spill prevention and control as mentioned above; (2) the relatively large distances to  
20 local groundwater supply wells; and (3) the partial isolation of onsite groundwater from offsite  
21 users by surface waterbodies (Parr Reservoir, Mayo Creek, and Monticello Reservoir).

22 Impacts on groundwater quality from the proposed operation of VCSNS Units 2 and 3 are  
23 limited by the lack of groundwater use and the factors identified above. Based on all these  
24 factors, the review team concludes that groundwater quality impacts of VCSNS Units 2 and 3  
25 operations would be SMALL, and additional mitigation would not be warranted.

### 26 **5.2.4 Water Monitoring**

27 SCE&G stated that "[w]hile specific requirements for radiological, hydrologic, and chemical  
28 monitoring programs for operation of Units 2 and 3 have not yet been established, they are  
29 expected to be similar to and tiered from or added to the ongoing Unit 1 monitoring programs..."  
30 (SCE&G 2009a). SCE&G also provided a map showing wells from the VCSNS Units 2 and 3  
31 subsurface investigation program (described in Section 2.3.1.2) that would remain available for  
32 groundwater monitoring (SCE&G 2009c). These wells are outside the footprint of the nuclear  
33 island. Additional groundwater monitoring wells would be installed "based on any needs  
34 determined during detailed design and discussions with SC Department of Health and



1 Environmental Control during site activity permitting” (SCE&G 2009c). SCE&G also committed  
2 to following the requirements for additional groundwater monitoring wells as part of the voluntary  
3 *Industry Groundwater Protection Initiative – Final Guidance Document* (NEI 2007) (SCE&G  
4 2009d). Hydrologic monitoring of groundwater involves measuring groundwater levels in wells.  
5 The operational chemical monitoring program “...would be implemented to identify any changes  
6 in water quality that may result from the operation of the new units...” (SCE&G 2009a).

## 7 **5.3 Ecological Impacts**

8 This section describes the potential impacts on ecological resources from the operation of the  
9 two proposed new units at the VCSNS site and transmission-line operation, which includes  
10 transmission-line corridor maintenance. The impacts are discussed for terrestrial ecosystems,  
11 aquatic ecosystems, and threatened and endangered species.

### 12 **5.3.1 Terrestrial and Wetland Impacts Related to Operation**

13 Impacts on terrestrial communities and species that could result from operation of the proposed  
14 units are generally related to either cooling-system operations or transmission-system  
15 operations. The operation of the cooling towers transfers heat to the atmosphere in the form of  
16 water vapor and can result in icing, fogging, increased humidity, increased noise levels, and the  
17 deposition of dissolved solids (i.e., cooling-tower drift). There is also a risk of avian collision  
18 mortality with permanent structures.

#### 19 **5.3.1.1 Terrestrial Resources – Site and Vicinity**

20 The impacts of the operation of proposed Units 2 and 3 on the VCSNS site and vicinity would be  
21 associated with the operation of four circular mechanical draft cooling towers (two per unit)  
22 (SCE&G 2009a). As described in Chapter 3 of this EIS, the proposed circulating-water system  
23 (CWS) for VCSNS Units 2 and 3 would return heated water from the heat exchangers to the  
24 cooling towers to transfer heat into the atmosphere. The cooling towers would each be 70 ft  
25 high with a base diameter of 275 ft (SCE&G 2009a). In this system, heat would be transferred  
26 to the ambient atmosphere in the form of water vapor and drift. Vapor plumes and drift may  
27 affect vegetation, such as native plant communities, ornamental vegetation, and crops, and  
28 water losses that cause reservoir draw-down could affect shoreline habitat. In addition, birds  
29 could collide with the mechanical draft cooling towers and other tall facility structures.

#### 30 ***Impacts of Cooling Tower Operations***

31 For each proposed unit, two mechanical draft cooling towers would be used to remove excess  
32 heat from the CWS by transferring it into the atmosphere. Through the process of evaporation  
33 followed by partial re-condensation, the total dissolved solids (TDS) concentration in the CWS  
34 would increase. Operation of the CWS would be based on four cycles of concentration, which

## Station Operation Impacts at the VC Summer Site

1 means the TDS in the makeup water would be concentrated approximately four times before  
2 being released. A small percentage of the water in the CWS would be released into the  
3 atmosphere as fine droplets containing elevated levels of TDS that could be deposited on  
4 nearby vegetation. CWS water losses from drift would be minor in comparison to evaporation  
5 and blowdown discharge losses; the cooling-tower design drift rate would be 0.001 percent of  
6 the circulating-water flow (SCE&G 2009a).

7 Depending on the source of makeup water, the TDS concentration in the drift can contain high  
8 levels of salts, which, under certain conditions and for certain species, can be damaging.  
9 Vegetation stress can be caused by drift with high levels of TDS deposition, either directly by  
10 deposition onto foliage or indirectly from the accumulation in the soils. Vegetation adjacent to  
11 the proposed cooling tower locations is a mix of recently harvested and forested communities  
12 (planted pine, mixed pine-hardwood, hardwood) (SCE&G 2009a). SCE&G estimated the  
13 combined cooling-tower plumes to have a maximum deposition rate of 0.28 lb/ac/mo, and that  
14 maximum deposition would occur 3280 ft east of the towers and approximately 1000 ft east of  
15 the site boundary (SCE&G 2009q). General guidelines for predicting the effects of drift  
16 deposition on plants suggest that sensitive species have a threshold for visible leaf damage of  
17 8.9 lb/ac/mo on leaves during the growing season (NRC 1996).<sup>(a)</sup> Because the maximum  
18 deposition for the proposed VCSNS is below the level that could cause leaf damage in many  
19 common species, the impacts would be negligible. No agricultural crops or silviculture in the  
20 region are expected to receive significant salt deposition from plume drift from proposed VCSNS  
21 Units 2 and 3. Where the maximum salt deposition is expected to occur, the maximum levels  
22 would be well below the levels known to cause adverse effects. In addition, the impact of drift  
23 on crops, ornamental vegetation, and native plant communities was evaluated for existing  
24 nuclear power plants (including plants with more than one cooling tower) in the *Generic*  
25 *Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NUREG-1437)  
26 and was found to be of minor significance (NRC 1996).

27 As described in Section 5.7.1, fogging and icing are not expected to occur from the operation of  
28 the four proposed mechanical draft cooling towers for VCSNS Units 2 and 3 and therefore  
29 would not be expected to affect habitat or wildlife (SCE&G 2009q). In addition, the potential for  
30 impacts related to cloud shadowing and increased precipitation are estimated to be minimal,  
31 and no adverse effects on terrestrial species or habitats are expected. Thus, the potential  
32 impacts on native plant communities, ornamental vegetation, and crops from the operation of  
33 cooling towers for proposed Units 2 and 3 would be minimal.

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(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999). Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

1 ***Bird Collisions with Cooling Towers and Structures***

2 A potential for avian mortality due to collision with proposed nuclear power plant structures  
3 exists and could pose a threat to species in decline and to threatened or endangered species.  
4 The height of the cooling towers associated with proposed new VCSNS Units 2 and 3 would be  
5 approximately 70 ft. The NRC previously concluded that the relatively low height of mechanical  
6 draft cooling towers causes negligible mortality (NRC 1996). In addition, the NRC concluded  
7 that avian collisions are unlikely to pose a biologically significant source of mortality due to the  
8 small fraction of total bird mortality that has been attributed to collision with nuclear power plant  
9 structures (NRC 1996). Thus, the review team concludes that the potential for impacts on bird  
10 species from collisions with cooling towers for proposed Units 2 and 3 would be minimal.

11 ***Noise Impacts of Operation***

12 Simultaneous operation of the four mechanical draft cooling towers for VCSNS Units 2 and 3  
13 would generate approximately 71 dBA at 200 ft and 55 dBA at 1000 ft for each cooling tower  
14 (SCE&G 2009a). This is below the 80- to 85-dBA threshold at which birds and small mammals  
15 are startled or frightened (Golden et al. 1980). Noise from operating mechanical draft cooling  
16 towers would not likely disturb wildlife in habitats away from the planned facilities and would not  
17 be expected to affect wildlife beyond 1000 ft. Thus, the potential impact on wildlife posed by  
18 incremental noise resulting from the operation of the four mechanical draft cooling towers for the  
19 proposed Units 2 and 3 and other facilities on the VCSNS site would be minimal, and additional  
20 mitigation would not be warranted.

21 ***Impacts of Increased Vehicle Traffic***

22 Increased traffic associated with operation of proposed VCSNS Units 2 and 3 has the potential  
23 to increase wildlife mortality resulting from vehicle-wildlife interactions. An estimated 800  
24 additional workers would be employed to operate proposed Units 2 and 3 and SCE&G has not  
25 determined the exact routes for access to the site. The Unit 1 workforce of 635 would access  
26 the site via State Highway 215 (SC-215) (SCE&G 2009a). The additional work trips during peak  
27 hours would occur on the rural roads and highways in the vicinity. Local wildlife populations  
28 could suffer declines if road-kill rates were to exceed the rates of reproduction and immigration.  
29 However, although road-kills occur frequently in the United States, they reportedly have minimal  
30 effect on wildlife populations (Forman and Alexander 1998). The review team concludes that  
31 these impacts would not be detectable beyond the local vicinity and would not destabilize  
32 regional populations.

33 ***Light Pollution During Facility Operation***

34 Light pollution during facility operation could potentially affect wildlife on the VCSNS site by  
35 altering behavioral patterns such as bird flight direction that are influenced by photoperiod

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1 (period of daylight) (FWS 2008). Possible mitigation measures could include the use of lower-  
2 wattage lights, hooded or down-turned lights, and turning unnecessary lights off at night to  
3 minimize potential impacts on wildlife (FWS 2008). If mitigation measures such as those noted  
4 above were implemented the impacts from light pollution would be expected to be minimal.

### 5 **5.3.1.2 Terrestrial Resources – Transmission Lines**

6 Electric power transmission systems have the potential to affect terrestrial ecological resources  
7 through corridor maintenance, bird collisions with transmission lines and structures,  
8 electrocution, and electromagnetic fields (EMFs). A total of six new offsite 230-kV transmission  
9 lines would be needed to distribute the power generated by proposed Units 2 and 3 at the  
10 VCSNS site. Santee Cooper would maintain two of the lines, and the other four lines would be  
11 maintained by SCE&G in three corridors (one double-circuit line and two single-circuit lines; see  
12 details about transmission lines in Table 4-1). Two of the SCE&G transmission-line corridors  
13 have been proposed as viable options, but the final routes have not yet been determined.  
14 Assuming that the proposed viable options would be the selected routes, there would be  
15 approximately 174 mi and 1916 ac of transmission-line corridor (SCE&G and Santee Cooper  
16 lines combined) that would be used to connect proposed VCSNS Units 2 and 3 to the regional  
17 grid (SCE&G 2009u, FP&S 2008; MACTEC 2008).

### 18 ***Corridor Maintenance – Vegetation***

19 Vegetation control in the transmission-line corridors would be the primary source of potential  
20 impacts on terrestrial resources. Both SCE&G and Santee Cooper have established  
21 maintenance procedures for power transmission systems (SCE&G 2006a; Sott 2006; MACTEC  
22 2008). Transmission-line corridors must be kept clear of woody growth through maintenance  
23 practices that prevent growth from becoming a safety hazard or potentially interrupting service.  
24 SCE&G and Santee Cooper have maintenance cycles for tree trimming that range from 1 to  
25 7 years depending on the activity. Both utilities use chemical and mechanical control methods  
26 appropriate for the location, terrain, and vegetation or habitat present. Chemical methods  
27 include the use of nonrestricted-use herbicides (only herbicides registered by the U.S.  
28 Environmental Protection Agency [EPA]) to control any vegetation that may interfere with the  
29 transmission-line corridor. In general, both companies spray herbicides on a 3-year rotation.  
30 The consistent use of herbicides results in the growth of low-growing, non-woody vegetation  
31 such as grasses and other native plants. Mechanical methods of vegetation control include  
32 hand clearing, pruning, mowing, and felling (SCE&G 2006a; Sott 2006; MACTEC 2008).

33 The impact of transmission-line corridor maintenance on wildlife and habitats, including  
34 floodplains and wetlands, was evaluated in the V.C. Summer supplement to the license renewal  
35 GEIS (NRC 2004a), and the impact was found to be of minimal significance at operating nuclear  
36 power plants with associated transmission-line corridors of variable widths (NRC 2004a).  
37 SCE&G and Santee Cooper have procedures in place that minimize adverse impacts on wildlife

1 and important habitats such as floodplains and wetlands (SCE&G 2009a). Corridor-  
2 maintenance activities would be performed by Santee Cooper and SCE&G (in their respective  
3 corridors) in compliance with applicable Federal, State, and local laws, regulations, and permit  
4 requirements. Therefore, the potential effects on terrestrial species and habitats from  
5 transmission-line maintenance in existing and new transmission-line corridors would be minimal,  
6 and mitigation beyond the use of standard BMPs would not be warranted.

### 7 ***Avian Mortality Impacts from Power Transmission Lines***

8 Potential avian impacts from operation of transmission lines include bird injury or morality  
9 through collision or electrocution. Avian interactions with power transmission lines and  
10 structures are species- and site-specific. The NRC's analysis in NUREG-1437 determined that  
11 bird collisions with transmission lines are of small significance at operating nuclear power  
12 plants, including transmission-line corridors with variable numbers of transmission lines  
13 (NRC 1996). In addition, the V.C. Summer supplement to the license renewal GEIS  
14 (NRC 2004a) stated that impacts from bird collisions were expected to be of small significance  
15 at all sites. SCE&G also stated that all new lines would be "raptor safe" under the guidelines  
16 recommended by the U.S. Fish and Wildlife Service (FWS) (FP&S 2008). Thus, the addition of  
17 the proposed transmission lines along existing corridors would likely present few new  
18 opportunities for bird collisions. The addition of new corridors may lead to an additional number  
19 of collisions in that corridor; however, it would not be expected to cause a measurable reduction  
20 in bird populations. The review team concludes that the potential for impacts on birds due to  
21 collision with transmission lines for the proposed VCSNS Units 2 and 3 would be minimal, and  
22 additional mitigation would not be warranted.

### 23 ***Impacts of Electromagnetic Fields on Flora and Fauna***

24 EMFs are unlike many other agents that have an adverse impact (e.g., toxic chemicals, ionizing  
25 radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they  
26 exist, are subtle (NRC 1996, 2004a). The NRC reviewed biological and physical studies of  
27 EMFs but found no consistent evidence linking harmful effects with field exposures (NRC1996,  
28 2004a). The NRC determined that EMFs produced by operating transmission lines for existing  
29 nuclear power plants up to 1100 kV were not linked to significant harmful effects on flora  
30 (NRC 1996, 2004a). Minor damage to plant foliage and buds can occur near strong electric  
31 fields, caused by heating of the leaf tips and margins. Damage does not appear within the stem  
32 and root systems of the plants and would not significantly affect growth (NRC 1996, 2004a).

33 EMFs have been demonstrated to affect some fauna. Voltage buildup can affect the overall  
34 health of honeybee hives (NRC 1996, 2004a). Birds that nest within transmission-line corridors  
35 experience chronic EMF exposure, but lines energized at levels less than 765-kV do not affect  
36 terrestrial biota (NRC 1996, 2004a). Since 1997, over a dozen studies have been published  
37 that looked at cancer in animals that were exposed to EMFs for all or most of their lives

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1 (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of  
2 cancer in rats or mice (Moulder 2003).

3 The conclusion presented in the GEIS for license renewal stated that the impacts of EMFs on  
4 terrestrial flora and fauna appear to be of small significance at operating nuclear power plants,  
5 including power transmission systems with variable numbers of transmission lines (NRC  
6 2004a). Therefore, the review team concludes that the increased EMF impact on flora and  
7 fauna posed by the operation of new 230-kV transmission lines proposed for the VCSNS project  
8 would be negligible, and additional mitigation would not be warranted.

### 9 ***Floodplains and Wetlands in Transmission-Line Corridors***

10 The effects of maintaining transmission-line corridors on floodplains and wetlands were  
11 evaluated in the V.C. Summer supplement to the license renewal GEIS, and, although periodic  
12 vegetation control is necessary in wetlands under power lines, it can be carried out with minimal  
13 damage to the wetlands (NRC 2004a). In addition, SCE&G and Santee Cooper have  
14 procedures in place that minimize adverse impacts on important habitats such as floodplains  
15 and wetlands in transmission-line corridors and all maintenance activities would be performed in  
16 compliance with applicable Federal, State, and local laws, regulations, and permit requirements  
17 (SCE&G 2009a). Thus, the ecological impacts from maintenance operations on transmission  
18 line corridors were found to be of small significance at operating nuclear power plants, including  
19 those of variable widths. The review team concludes that the incremental effects of  
20 transmission-line corridor maintenance on floodplains and wetlands within the existing  
21 transmission-line corridors would be minimal, and mitigation beyond use of standard BMPs  
22 would not be warranted.

### 23 **5.3.1.3 Important Terrestrial Species and Habitats**

24 This section discusses the potential impacts of operation of proposed VCSNS Units 2 and 3 on  
25 Federally and State-listed species, on the ecologically important species and/or habitats  
26 (including wetlands), and on commercially important species.

#### 27 ***Important Terrestrial Species – Site and Vicinity***

28 The Federally and State-listed species that potentially occur on the VCSNS site and in the four-  
29 county vicinity are described in Section 2.4.1 (Tables 2-17 and 2-18). Biologists conducted  
30 formal and informal surveys for species that could occur in terrestrial habitats or wetlands onsite  
31 as well as surveys of whether or not suitable habitat exists for species that may occur in those  
32 four counties. Surveys were conducted in 2002 (in support of license renewal), 2006, 2007,  
33 2008, and 2009. Nine Federally listed species were identified by the FWS that could potentially  
34 exist in the vicinity or that historically occurred onsite or in the vicinity of the proposed project:  
35 Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), bald eagle (*Haliaeetus leucocephalus*),

1 red-cockaded woodpecker (*Picoides borealis*), wood stork (*Mycteria americana*), pine barrens  
2 treefrog (*Hyla andersonii*), smooth coneflower (*Echinacea laevigata*), Schweinitz's sunflower  
3 (*Helianthus schweinitzii*), rough-leaved loosestrife (*Lysimachia asperulifolia*), and Canby's  
4 dropwort (*Oxypolis canbyi*). The bald eagle was the only Federally listed species found on the  
5 VCSNS site during each survey. Although bald eagles were de-listed by the FWS in August  
6 2007, the species is still protected under the Bald and Golden Eagle Protection Act and the  
7 Migratory Bird Treaty Act. Operation of Units 2 and 3 at the VCSNS site would not be expected  
8 to affect the Federally listed or State-listed species that are not found on the site or in the  
9 vicinity.

10 Game species, such as white-tailed deer (*Odocoileus virginianus*), wild turkey  
11 (*Meleagris gallopavo*), and a variety of waterfowl species, are common inhabitants of the  
12 VCSNS site. Increased noise levels near the cooling towers may cause these wildlife species to  
13 avoid the immediate area and increased activity and traffic would also cause wildlife to avoid the  
14 habitats immediately adjacent to the proposed units. Drift, fogging, and icing are expected to  
15 cause negligible or no impacts on habitats and would not be expected to affect important game  
16 species. Although animals may avoid habitats adjacent to the new units during operations, the  
17 VCSNS property and surrounding landscape contain large expanses of terrestrial and aquatic  
18 habitat to which these species could relocate. Thus, operational impacts on commercially and  
19 recreationally important species would be minimal, and no mitigation would be warranted.

#### 20 ***Important Terrestrial Habitats – Site and Vicinity***

21 No areas designated by the FWS as “critical habitat” for threatened or endangered species, or  
22 State or Federal parks, wildlife refuges, or preserves occur on or immediately adjacent to the  
23 VCSNS site (SCE&G 2009a). However, as described in Section 2.4.1.3, Parr Reservoir, which  
24 is adjacent to the VCSNS site, is managed for wildlife by the South Carolina Department of  
25 Natural Resources (SCDNR) as the Broad River Wildlife Management Area (BRWMA).  
26 Wetland habitat remaining on the site after development of the proposed units and associated  
27 facilities (see Chapter 4) would include a few emergent wetlands on the edge of Parr Reservoir  
28 (see EIS Sections 2.4.1 and 4.3.1), as well as several forested palustrine wetlands. None of the  
29 wetland habitats on the site or on the nearby BRWMA is likely to be adversely affected by salt  
30 deposition or fogging and icing as a result of drift from the mechanical draft cooling towers.

#### 31 ***Important Terrestrial Species – Transmission Lines***

32 The transmission lines associated with the proposed project do not travel through any areas  
33 designated by the FWS as “critical habitat” for endangered or threatened species (FP&S 2008;  
34 MACTEC 2008). However, Federally and State-listed species do inhabit portions of the  
35 transmission-line corridors that would be managed to transmit power from the proposed project.  
36 A complete list of Federally and State-listed species that are known to occur in counties crossed  
37 by transmission lines associated with the project is given in Chapter 2, Table 2-17. The list was

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1 compiled from the SCDNR Natural Heritage Database (SCDNR 2006) and the FWS list (FWS  
2 2008). Because the exact routes are not yet determined by SCE&G, ground surveys have not  
3 yet been conducted. SCE&G stated that it would perform detailed ecological surveys to protect  
4 Federally and State-listed threatened and endangered species that may occur along the  
5 transmission lines as part of the permitting process prior to commencing any activity (FP&S  
6 2008). Once final routes are determined, FWS and SCDNR would be consulted.

7 Transmission-line corridors that would transmit power generated from the proposed units would  
8 travel through a variety of habitats that support large and small game as well as waterfowl  
9 species. Because most of the new transmission lines would be constructed within or adjacent  
10 to existing corridors for operation of proposed VCSNS Units 2 and 3, no significant additional  
11 impacts would be expected to occur on any commercially or recreationally important species as  
12 a result of vegetation maintenance activities in the corridors.

13 No areas designated by the FWS as “critical habitat” for threatened or endangered species  
14 occur on or immediately adjacent to the proposed transmission-line corridors associated with  
15 proposed VCSNS Units 2 and 3. None of the transmission lines crosses State or Federal parks,  
16 wildlife refuges, or preserves or wildlife management areas. The effects of transmission-line  
17 corridor maintenance on floodplains and wetlands were evaluated in NUREG-1437 (NRC 1996).  
18 The impacts were found to be of small significance at operating nuclear power plants, and these  
19 included transmission-line corridors of variable widths. Because SCE&G and Santee Cooper  
20 have procedures in place to minimize impacts on important species and habitats, the potential  
21 impacts of maintaining existing corridors would be minimal.

### 22 **5.3.1.4 Terrestrial Monitoring During Operation**

23 SCE&G has stated that there would be no preoperational or operational monitoring of  
24 terrestrial ecological resources at the VCSNS site or associated transmission-line corridors  
25 (SCE&G 2009a). The review team has not identified any preoperational or operational  
26 monitoring of terrestrial ecological resources necessary to prevent impacts on those resources.

### 27 **5.3.1.5 Potential Mitigation Measures for Operations-Related Terrestrial Impacts**

28 SEC&G has committed to employing mitigation measures for operations-related terrestrial  
29 impacts including the implementation of BMPs associated with transmission-line and corridor-  
30 maintenance practices. As described in the above sections, these BMPs include the use of  
31 properly labeled herbicides in accordance with label instructions regarding the application rates,  
32 timing, and setting, as well as compliance with Federal, State, and local regulations.



1 **5.3.1.6 Summary of Operational Impacts on Terrestrial Resources**

2 The potential impacts of operating proposed VCSNS Units 2 and 3 on vegetation, birds, and  
3 terrestrial, wetland, and shoreline habitats are likely to be minimal. The potential impacts of  
4 transmission-line corridor maintenance and similar impacts on important habitats including  
5 floodplains and wetlands, birds, and biota because of EMFs are considered minimal assuming  
6 that BMPs are followed and State and Federal agencies are consulted, as appropriate.

7 The review team assessed the potential terrestrial ecological impacts of operating two new  
8 nuclear power-generation facilities at the VCSNS site, including the associated heat-dissipation  
9 system, transmission lines, and associated corridor maintenance. Given the information  
10 provided in SCE&G's ER (SCE&G 2009a), the response to RAIs (SCE&G 2009q), interactions  
11 with State and Federal agencies, the public scoping process, and the review team's  
12 independent assessment, the review team concludes that the impacts from operation of the new  
13 facilities and associated transmission-line corridors would be SMALL, and additional mitigation  
14 beyond the BMPs mentioned above would not be warranted.

15 **5.3.2 Aquatic Impacts Related to Operation**

16 The following sections discuss potential impacts resulting from the operation of proposed  
17 VCSNS Units 2 and 3 on the aquatic ecosystem in the Broad River and Parr Reservoir,  
18 Monticello Reservoir, onsite streams, and water courses crossed by transmission lines.

19 **5.3.2.1 Aquatic Resources – Site and Vicinity**

20 For aquatic resources, the primary concerns related to water intake and consumption are the  
21 impacts related to the relative amount of water drawn from the cooling-water source (Monticello  
22 Reservoir) and the potential for organisms to be impinged on the intake screens or entrained in  
23 the cooling-water system. Impingement occurs when organisms are trapped against the raw-  
24 water intake screens by the force of the water passing through the intake structure used for  
25 cooling water (66 FR 65256). Aquatic biota subjected to impingement can experience  
26 starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill  
27 movement or organisms may be removed from the water for prolonged periods of time), and  
28 descaling (66 FR 65256). Entrainment occurs when organisms are drawn through the raw-  
29 water intake into the proposed VCSNS Units 2 and 3 cooling-water system. Organisms that  
30 become entrained are typically small benthic, planktonic, and nektonic (organisms within the  
31 water column) forms, including early life stages of fish and shellfish, which often serve as prey  
32 for larger organisms (66 FR 65256). As entrained organisms pass through a facility's cooling  
33 system, they are subject to pressure, mechanical, thermal, and toxic stresses that are, in most  
34 cases, lethal.

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1 A number of factors, such as the type of cooling system, the design and location of the intake  
2 structure, and the amount of water withdrawn from the source waterbody, greatly influence the  
3 degree to which impingement and entrainment affect the aquatic biota.

4 SCE&G indicated in its ER that a closed-cycle recirculating cooling system with mechanical  
5 draft cooling towers would be used for proposed VCSNS Units 2 and 3 (SCE&G 2009a,).  
6 Closed-cycle recirculating cooling-water systems can, depending on the quality of the makeup  
7 water, reduce water withdrawals by 96 to 98 percent of the amount that the facility would use if it  
8 used a once-through cooling system (66 FR 65256). This significant reduction in water-  
9 withdrawal rate results in a corresponding reduction in impingement and entrainment.

### 10 ***Monticello Reservoir Intakes***

11 The intake design through-screen velocity greatly influences the rate of impingement of fish and  
12 shellfish at a facility. The higher the through-screen velocity, the greater the number of biota  
13 impinged. The EPA has established a national standard for the maximum design through-  
14 screen velocity of no more than 0.5 fps (66 FR 65256). The EPA determined that species and  
15 life stages evaluated in various studies could endure a velocity of 1.0 fps, and subsequently  
16 applied a safety factor of two to derive the threshold of 0.5 fps. SCE&G (2009a) stated that both  
17 the CWS raw-water intake and the water-treatment plant intake associated with proposed  
18 Units 2 and 3 would have a design through-screen velocity of less than or equal to 0.5 fps at a  
19 minimum water elevation of 414 ft Northern American Vertical Datum of 1988 (NAVD88)  
20 (SCE&G 2009a).

21 Impingement and entrainment of aquatic biota are also influenced by the application and use of  
22 design and construction technologies aimed at minimizing impingement mortality and  
23 entrainment. The EPA indicated (66 FR 65256) that the optimal design requirement for the  
24 intake location is to place the inlet of the cooling-water intake structure (CWIS) in an area of the  
25 source waterbody away from areas with the potential for high productivity, where impingement  
26 and entrainment of organisms are minimized. Dames and Moore (1985) noted a high diversity  
27 and abundance of fish in the southwest portion of Monticello Reservoir and suggested these  
28 trends may have been linked to the delivery of nutrient-rich water from the Parr Reservoir via  
29 the FPSF. Since those data were collected, large fluctuations in the composition of fishes within  
30 the reservoir have been observed (Christie and Stroud 1997). Since the creation of Monticello  
31 Reservoir in 1977, the aquatic biota within the reservoir may have adapted to environmental  
32 factors (e.g., frequently fluctuating water surface elevation because of FPSF operation), biotic  
33 interactions (e.g., predator-prey, invasive species), or a combination of both. Based on the  
34 2006–2009 fishery data collection effort led by SCE&G (e.g., Normandeau 2007, 2008, 2009a)  
35 and the aquatic surveys conducted by SCDNR (Christie and Stroud 1998, 1999), the community  
36 composition of fish within Monticello Reservoir consists of a diversity of species exhibiting an  
37 array of life-history requirements and habitat associations, such as shallow-water nesting for  
38 reproduction and benthic scavenging. The recent data documenting changes in fish community

1 composition and the diversity of fish present in the system do not indicate that the southwest  
2 portion of Monticello Reservoir is consistently more productive than any other part of the  
3 reservoir.

4 Beginning in October 1983, after VCSNS Unit 1 commenced operations, a study was conducted  
5 for VCSNS Unit 1 discharge permitting where ichthyoplankton were collected during a 12-month  
6 study at several discrete locations within Monticello Reservoir to determine the types of larvae  
7 that would be subjected to entrainment at the VCSNS Unit 1 intake (Dames and Moore 1985).  
8 Gizzard shad (*Dorosoma cepedianum*) accounted for 91 percent of the larval samples, followed  
9 by white bass (*Morone chrysops*) and perch species (*Perca* spp.), which accounted for 6 and  
10 2 percent of the collective samples, respectively. The remaining taxa encountered during the  
11 1983–1984 ichthyoplankton surveys included minnows (Cyprinidae), suckers (Catostomidae),  
12 centrarchids (Centrarchidae), and crappie species (*Pomoxis* spp.) with each accounting for less  
13 than 1 percent of the larvae sampled (Dames and Moore 1985).

14 The results of a 2008–2009 ichthyoplankton study conducted by Normandeau (2009b) indicated  
15 a predominance of threadfin shad (*D. petenense*), whereas gizzard shad predominated in the  
16 1983–1984 Dames and Moore (1985) study. In addition, overall densities of larval fish were  
17 lower in the 2009 study. Dames and Moore (1985) reported that the highest densities of larvae  
18 occurred during May and June, with an average annual estimate of 53.9 larvae/100 m<sup>3</sup> at the  
19 surface, and 11.8 larvae/100 m<sup>3</sup> at mid-depth. While there are similarities in the temporal trends  
20 of abundance between the two studies, the 2009 ichthyoplankton study results indicate  
21 dissimilar trends in that total annual larval densities across depths were only 7.47 larvae/100 m<sup>3</sup>  
22 (Normandeau 2009b). Therefore, the overall abundance of fish near the southern portion of  
23 Monticello Reservoir appears to be lower than it was over 20 years ago. Differences in  
24 ichthyoplankton abundance may be attributed to a shift in the community composition within  
25 Monticello Reservoir such that blue catfish (*Ictalurus furcatus*) are now predominant (Christie  
26 and Stroud 1996; Normandeau 2009b). Furthermore, Normandeau (2009b) speculated that  
27 nutrients within the Monticello Reservoir may be lower than they were during the time period  
28 that coincided with the Dames and Moore (1985) study. In assessing VCSNS license renewal  
29 for Unit 1, NRC determined that although fish community composition had changed since 1985  
30 with the introduction of white perch (*Morone americana*) and blue catfish, the potential impacts  
31 from entrainment on fish populations in Monticello Reservoir would remain small. Survival of  
32 larval and juvenile fish is largely compromised by predation and competition and results in low  
33 percentages of fish that may survive to become reproducing adults (NRC 2004a).

34 The projected annual entrainment of larval fish species for the VCSNS Units 2 and 3 CWS is  
35 between 15.3 million for a normal pumping rate of 36,214 gpm (81 cfs) and 24.9 million for a  
36 maximum pumping rate of 58,800 gpm (131 cfs) with a through-screen velocity of less than or  
37 equal to 0.5 fps (Normandeau 2009b). It should be noted that no eggs for any species were  
38 collected during the 2008–2009 ichthyoplankton surveys. The dominant entrained species is

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1 likely to be the threadfin shad, which is a prolific spawner, with females producing over 10,000  
2 eggs per fish and spawning in both spring and fall. Speculation as to the difference in  
3 population dynamics include a natural progression of community turnover, stabilization of  
4 reservoir water quality or alteration of incoming nutrients into the system, introduction of new  
5 species, and density-dependent interactions between predator-prey fish species (Normandeau  
6 2009b).

7 VCSNS Unit 1 was designed as a once-through cooling plant to withdraw approximately  
8 767 Mgd (1190 cfs) from Monticello Reservoir (Geosyntec 2007). Units 2 and 3 are designed  
9 as a closed-cycle recirculating cooling system with mechanical draft cooling towers and would  
10 withdraw between 7 and 12 percent of the water needed for Unit 1 operations (SCE&G 2009a).  
11 Based on the small percentage of water withdrawn, the planned low through-screen intake  
12 velocity, the closed-cycle cooling system design, and the high fecundity of the most likely  
13 entrained fish species, the review team concludes that the impacts on the fish populations of the  
14 Monticello Reservoir from entrainment would be minor.

15 Two impingement studies have been conducted at the VCSNS Unit 1 intake structure; the first  
16 occurred 10 months after Unit 1 began operation and the second study commenced during  
17 2005. In the first study, Dames and Moore (1985) collected a total of 5140 fish weighing 31 kg  
18 sampling at 2-week intervals between October 1983 and September 1984. The abundance of  
19 gizzard shad accounted for 82.6 percent of the impinged individuals and 51.8 percent of the  
20 overall impinged biomass. Yellow perch (*Perca flavescens*) accounted for 7.6 percent of the  
21 abundance and 8.0 percent of the overall biomass. However, numerically dominant taxa  
22 detected in the Dames and Moore (1985) study were not necessarily proportional to the  
23 biomass of impinged organisms. For example, white catfish (*Ameiurus catus*) accounted for  
24 2.4 percent of the abundance and 17.6 percent of the biomass. Species such as warmouth  
25 (*Lepomis gulosus*), white bass, and white crappie (*Pomoxis annularis*) each accounted for less  
26 than 1 percent of the impinged taxa, yet these fish species each constituted approximately  
27 3 percent of the overall impinged biomass (Dames and Moore 1985). Assessment of  
28 impingement impacts during license renewal for VCSNS Unit 1 noted that non-benthic species  
29 such as gizzard shad, threadfin shad, white perch, and white bass are most susceptible to  
30 impingement and that overall impingement impacts are small based on the high reproductive  
31 and growth rates of these fish, particularly gizzard shad (NRC 2004a).

32 As a result of EPA regulations stemming from Section 316(b) of the Clean Water Act, SCE&G  
33 implemented a 12-month impingement study, with bi-weekly sampling, at existing VCSNS Unit 1  
34 during 2005–2006. A total of 574 organisms weighing 7.9 kg were impinged between July 12,  
35 2005 and June 27, 2006 (Geosyntec 2007). The estimated annual impingement at the VCSNS  
36 Unit 1 during the 2005–2006 study period was 8042 organisms (Geosyntec 2007). Similar to  
37 the Dames and Moore (1985) impingement study, numerically dominant taxa detected in the  
38 Geosyntec study were not necessarily proportional to the biomass of impinged organisms

1 (Table 5-4). Threadfin shad were the most abundant, making up 50 percent of the impinged  
 2 samples, yet these fish only made up 6.9 percent of the overall biomass. Blue catfish and  
 3 channel catfish (*Ictalurus punctatus*) accounted for 12.2 and 11.8 percent of impinged samples  
 4 while accounting for 16.1 and 12.5 percent of the biomass, respectively. White perch  
 5 represented 9.4 percent of the abundance of impinged samples, and yielded the highest  
 6 biomass (36.6 percent) of impinged species. Representing less than 5 percent of the impinged  
 7 catch, gizzard shad and white catfish accounted for 12.9 and 7.4 percent of the impinged  
 8 biomass, respectively (Geosyntec 2007).

9 **Table 5-4.** Abundance and Biomass of Biota Sampled During the 2005-2006 Geosyntec  
 10 (2007) VCSNS Unit 1 Impingement Study

Common Name	Percent of Total Catch	Percent of Total Biomass
Threadfin shad	50.2	6.9
Blue catfish	12.2	16.1
Channel catfish	11.8	12.5
White perch	9.4	36.6
Yellow perch	6.1	3.4
Gizzard shad	4.4	12.9
White catfish	2.6	7.4
Bluegill	1	1.5
Crayfish	0.7	0.2
Flat bullhead	0.5	1.1
Snail bullhead	0.3	0.6
Flier	0.2	0
Grass shrimp	0.2	0
Hybrid sunfish	0.2	0.7
Warmouth	0.2	0.1

11 Both the Dames and Moore (1985) and the Geosyntec (2007) impingement studies detected  
 12 similar patterns with regard to the size class of fish impinged at the VCSNS Unit 1 intake  
 13 structure. The majority of impinged fish were of small size classes indicative of juvenile to  
 14 subadult life stages (Dames and Moore 1985; Geosyntec 2007). Dames and Moore (1985)  
 15 report that the majority of fish, such as gizzard shad, yellow perch, and bluegill  
 16 (*Lepomis macrochirus*), were impinged as juveniles. However, the size classes of white catfish  
 17 impinged during their study included juveniles as well as adult stages (Rohde et al. 2009). The  
 18 overall size-class distribution of fish impinged during the Geosyntec (2007) study suggests the  
 19 taxa typically subjected to impingement were relegated to small size classes (e.g., less than  
 20 140 mm). Impinged fish ranged from 38 to 349 mm in total length (Geosyntec 2007), which,

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1 depending on the particular species, can include a range of life stages (Rohde et al. 2009).  
2 While the majority of the impinged taxa were representative of juvenile or subadult life stages,  
3 an evaluation of the Geosyntec (2007) length frequency distributions indicated that impingement  
4 at the Unit 1 intake structure likely included adult threadfin shad, gizzard shad, white perch, and  
5 white catfish.

6 Both impingement studies also noted similar patterns associated with impingement rates linked  
7 to seasonal changes. Impingement rates were greatest during winter months. Dames and  
8 Moore (1985) and Geosyntec (2007) attributed this pattern to cold water temperatures, which  
9 are thought to impose stress on some fish species (e.g., gizzard shad, threadfin shad), making  
10 them more susceptible to impingement. Dames and Moore (1985) also postulated that the high  
11 rates of occurrence of some species may be linked to schooling and migratory behavior  
12 (e.g., gizzard shad, yellow perch), or associations with habitat features near the intake structure  
13 (e.g., white catfish).

14 Neither the Dames and Moore (1985) nor the Geosyntec (2007) study observed correlations  
15 between impingement rates and fluctuating elevations of the water surface in Monticello  
16 Reservoir resulting from the operation of the FPSF. While impingement rates were not linked to  
17 changing water-surface elevations, the size of the hydraulic zone of influence associated with  
18 the CWIS at Unit 1 was inversely correlated with the elevation of the reservoir water (Geosyntec  
19 2005). The hydraulic zone of influence was greatest during the lowest reservoir elevations,  
20 extending 555 ft from the CWIS and encompassing a surface area equal to 2.9 ac (Geosyntec  
21 2005).

22 The fish most vulnerable to impingement include small size classes of fish that exhibit weak  
23 swimming capabilities, are particularly sensitive to cold water temperatures, demonstrate an  
24 affinity for habitats near the intake structure, and/or maintain life-history requirements that  
25 increase the likelihood of contact within the CWIS hydraulic zone of influence. Based on these  
26 criteria and the results of the Geosyntec (2007) impingement study, the most vulnerable fish  
27 include clupeids (gizzard shad, threadfin shad), ictalurids (blue, channel, and white catfish), and  
28 white perch. Collectively, these fish are commonly encountered and represent appreciable  
29 proportions of the standing stocks of fish in Monticello Reservoir (Christie and Stroud 1997).  
30 Furthermore, these fish are typically highly fecund and prolific spawners (Rohde et al. 2009).  
31 Of the fish most vulnerable to impingement, blue catfish and white perch are non-native to  
32 Monticello Reservoir. Impingement impacts from operation of VCSNS Unit 1 were determined  
33 to be small during license renewal assessment (NRC 2004a). Given that the impingement and  
34 entrainment rates for Unit 1 are based on a flow rate of 1190 cfs, and the CWS flow rates for  
35 Units 2 and 3 would require between 81 and 131 cfs, the reduced flow rates should result in  
36 lower impingement rates compared with Unit 1 (SCE&G 2009a). Based on the planned low  
37 through-screen intake velocity (less than or equal to 0.5 fps), flow rates that are at least 9 times  
38 less than those of existing Unit 1, and the high fecundity of the species sampled in the Unit 1

1 impingement studies the review team concludes that impacts from impingement of fish related  
2 to the proposed VCSNS Units 2 and 3 would be minor.

### 3 ***Cooling-Water Discharge***

4 The effluent from proposed VCSNS Units 2 and 3 would be discharged directly to the Parr  
5 Reservoir on the Broad River. Section 3.2 discusses the location and design of the discharge  
6 and outfall structures; Section 3.4 discusses the effluent discharge rates (Table 3-6). Discharge  
7 from VCSNS Units 2 and 3 operations would be 21 cfs for normal operations (68 cfs maximum).  
8 As discussed in Section 5.2.2.1, this represents about 0.3 percent to 1 percent of the long-term  
9 average flow for normal and maximum operating conditions, respectively.

### 10 ***Aquatic Thermal Impacts***

#### 11 Heat Stress

12 Thermal conditions influence all aspects of aquatic ecology, which includes an array of  
13 processes: feeding, metabolic processes, growth, reproduction, development, distribution, and  
14 survival (Coutant 1976). In a general sense, biota are often able to persist (e.g., grow,  
15 reproduce, survive) under a range of thermal conditions. While many species exhibit similar  
16 tolerance for temperature regimes, growth and survival are linked to optimal thermal conditions  
17 that are driven by species-specific requirements (Kellog and Giff 1983). The thermal tolerance  
18 for aquatic organisms is defined in different ways. Some definitions relate to the temperature  
19 that causes fish to avoid the thermal plume, other definitions relate to the temperature that fish  
20 prefer for spawning, and others relate to the temperatures (upper and lower) that may cause  
21 mortality. The differing life stages of aquatic organisms often have different temperature  
22 tolerances and differing abilities to avoid temperature extremes. Spatially, thermal pollution may  
23 exist at the site or may include offsite waterbodies. Temporally, conditions that result in water  
24 temperatures that exceed ambient levels may be more pronounced during certain times of the  
25 year (i.e., winter). Finally, the consequences of thermal pollution within aquatic ecosystems  
26 may be confined to individuals or depending on ecosystem conditions, may result in a  
27 population-level response (Coutant 1976).

28 SCE&G, using the CORMIX Version 4.3 model, discusses a mixing zone (where discharge  
29 effluent combines with Parr Reservoir water) of less than 25 percent of the Parr Reservoir  
30 channel width during a maximum heat discharge scenario (winter) to bound the maximum  
31 potential for plume temperatures and temperature differentials with the ambient water of Parr  
32 Reservoir (SCE&G 2009a). In Section 5.2.3.1, the review team describes its independent  
33 assessment of the incremental impacts of proposed VCSNS Units 2 and 3 on the water  
34 temperatures in the Parr Reservoir. The review team used a range of mixing zone to channel  
35 width ratios (10, 25, and 50 percent) to independently assess thermal changes for comparison  
36 with SCE&G's thermal analysis. The following review team analysis was based on the

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1 assumption that complete mixing occurs over the portion of the channel width that is specified  
2 (10, 25, or 50 percent) over the upper half of channel depth (Table 5-2 and Table 5-3).

3 The 7Q10 flow rate during the summer season is used to assess potential extreme drought  
4 conditions, with only two cycles of concentration for a maximum discharge of 68 cfs. A mean  
5 low flow of 1469 cfs was calculated just for the months from November through April, analogous  
6 to a 7Q10 calculation (Toblin 2007) for flows relevant during the lowest ambient water  
7 temperatures through the beginning of spawning season. As noted in Table 3-6, blowdown and  
8 other liquid effluent would discharge to Parr Reservoir at a normal discharge flow rate of 21 cfs  
9 (assuming four cycles of concentration) and at maximum blowdown temperature of 91.8°F  
10 (SCE&G 2009a). Under normal operations with low flow conditions between November and  
11 April, the thermal plume would exceed the 5°F difference between ambient and plume  
12 temperature if the mixing zone occurs across 10 percent or less of the Parr Reservoir channel.  
13 If the mixing zone was extended to 25 percent, the thermal plume differential with ambient water  
14 would be less than 5°F. Under extreme 7Q10 conditions in the summer, none of the scenarios  
15 for mixing zone width violate criteria set by SCDHEC to not exceed 90°F, or be more than 5°F  
16 above ambient water temperature for the mixing zone (SCDHEC 2008). The flow reversal by  
17 FPSF operation is not expected to exceed the results presented above as representative of  
18 extreme flow conditions (Section 5.2.3.1).

19 Under the previous extreme assumptions used to assess the extent of the 5°F above ambient  
20 isotherm, a mixing zone that would occupy one-half of the Parr Reservoir channel width would  
21 still allow motile aquatic biota to avoid the affected mixing zone area. However, fish eggs and  
22 larvae would drift with the upstream or downstream current, depending on FPSF operation, and  
23 would not be able to avoid the 5°F above ambient isotherm. According to Schubel et al. (1977),  
24 some species of fish larvae may tolerate a temperature increase of up to 50°F above ambient  
25 for as much as 60 minutes, but no tested fish larval species has been documented to withstand  
26 increases of 68°F or more above ambient. These extreme temperature increases are not likely  
27 to occur within the mixing zone even under 7Q10 conditions during the spring season. One  
28 species present in abundance in Parr Reservoir, gizzard shad, is known to be particularly  
29 susceptible to mortality caused by sudden or extreme changes of temperature (Williamson and  
30 Nelson 1985). However, increases in temperature are generally more tolerated than decreases  
31 for this species as described below.

32 Based on the estimated model simulations, the thermal plume may exceed the criterion (> 90°F)  
33 established by SCDHEC during specific time periods that are not concurrent to critical life-  
34 history events of important aquatic biota (e.g., spawning, rearing). However, these  
35 exceedances may be very short in duration (<9 hr/yr), or may never occur (Toblin 2007). The  
36 most abundant fish in Parr Reservoir include gizzard shad, threadfin shad, bluegill, and white  
37 perch, all of which are prolific spawners (Dames and Moore 1985). Because at least three-  
38 quarters of the width of the Parr Reservoir channel would be unaffected by thermal plume



1 impacts, it is not expected that these populations would see noticeable impacts in reductions of  
2 eggs and larvae. Based on the foregoing, the review team concludes that the thermal impacts  
3 on the fish populations from the VCSNS Units 2 and 3 discharge of waste heat to Parr Reservoir  
4 would be minor, and additional mitigation would not be warranted.

#### 5 Cold Shock

6 Another factor related to thermal discharges that may affect aquatic biota is cold shock. Cold  
7 shock occurs when aquatic organisms that have been acclimated to warm water, such as fish in  
8 a power plant's discharge canal, are exposed to a sudden temperature decrease. This  
9 sometimes occurs when single-unit power plants shut down suddenly in winter. Cold shock  
10 mortalities at U.S. nuclear power plants have typically involved small numbers of fish and did  
11 not result in population-level effects (NRC 1996). Cold shock may also occur under extreme  
12 weather events and may adversely affect aquatic biota. For example, in January 1984 an  
13 extreme cold event resulted in the mortality of a large number of young-of-year gizzard shad  
14 within Monticello Reservoir (Dames and Moore 1985).

15 Impacts on aquatic biota stemming from cold shock most often occur in winter months. Life-  
16 history stages that can be particularly sensitive to perturbations in water temperature include  
17 larval and juvenile stages as well as spawning and egg development. Fish within the Parr  
18 Reservoir do not typically undergo these vulnerable life stages and life-history events during the  
19 winter months. Because there would be multiple units that are unlikely to shut down  
20 concurrently, the temperature decrease from shutting down one unit would be moderated by the  
21 heated discharge from the unit that continues to operate. In addition, gradual shutdown of plant  
22 operations generally precludes cold shock events (NRC 1996). Based on this analysis, the  
23 review team concludes that the thermal impacts on the fish populations due to cold shock would  
24 be minor and additional mitigation would not be warranted.

#### 25 Invasive Organisms

26 Invasive organisms found on the VCSNS site include two aquatic plant species (alligatorweed  
27 [*Alternanthera philoxeroides*] and water primrose [*Ludwigia uruguayensis*]), two fishes (blue  
28 catfish, white perch), and one mollusk (Asian clam [*Corbicula fluminea*]) (see Section 2.4.2.3).  
29 Neither these invasive organisms nor any other invasive species have been observed to have  
30 increased in numbers in the vicinity of the VCSNS Unit 1 thermal plume in Monticello Reservoir.  
31 Therefore, it is assumed that no large growths of invasive organisms are anticipated from the  
32 thermal plume for proposed Units 2 and 3 in Parr Reservoir.

33 Based on this analysis of the potential for thermal impacts on the aquatic ecosystem of the Parr  
34 Reservoir, the review team concludes that the impacts on aquatic organisms from thermal  
35 discharges from the proposed VCSNS Units 2 and 3 would be minor.

1 **Chemical Impacts**

2 Another discharge-related impact includes the chemical treatment of the cooling water. The ER  
3 indicates that chemicals would be added to the circulating-water and service-water systems that  
4 would be discharged into the blowdown lines and ultimately into Parr Reservoir. Biofouling  
5 would be controlled using metered pumps that inject chemicals into the raw-water pipeline and  
6 into the service-water pump discharge (SCE&G 2009a).

7 Chemical treatments proposed for use during the operation of VCSNS Units 2 and 3 are  
8 outlined in Table 3-5 in Section 3.4.4.1 of this EIS. These chemicals are the same that are in  
9 use for VCSNS Unit 1 (SCE&G 2009a). The water flow from the Parr Reservoir would further  
10 dilute the concentration of these chemicals occurring in the station blowdown discharge.

11 The use of chemicals in the existing VCSNS Unit 1 is regulated by an NPDES permit, which is  
12 granted under permit number SC0030856. The chemical concentrations at the outfall for the  
13 existing units meet the NPDES limits (SCE&G 2009a). A new NPDES permit would likely be  
14 needed for the new discharge into Parr Reservoir. Sampling efforts in Monticello Reservoir  
15 since the operation of Unit 1 have not indicated any impacts associated with chemical toxicity  
16 (Christie and Stroud 1996, 1997, 1998, 1999; Normandeau 2007, 2008, 2009a). Therefore, the  
17 impacts resulting from chemical discharges from proposed Units 2 and 3 to the Parr Reservoir  
18 would likely be minor.

19 **Physical Impacts from Discharge**

20 Physical impacts can occur from discharge in the form of scouring, siltation, sediment transport,  
21 increased dissolved oxygen, eutrophication, and increased turbidity. The maximum discharge  
22 velocity at the diffuser ports is anticipated to range from 6.9 to 11.3 fps, during periods of two-  
23 cycle operation (SCE&G 2009a). Discharge velocities are discussed further in Section 5.2.3.1.  
24 The diffuser line would be located near the bottom of the reservoir, approximately 10 ft below  
25 the normal minimum water surface (SCE&G 2009a). Riprap placed on the bottom of the  
26 reservoir to stabilize the diffuser would also likely reduce localized scouring. The maximum  
27 extent of scouring as a result of the discharge system is expected to encompass an area equal  
28 to 0.3 ac, or roughly one-sixth of the width of Parr Reservoir at the point of discharge (SCE&G  
29 2009a). Within this localized area, the benthic invertebrate community would likely be altered.

30 Because this potential scouring is limited to such a small portion of Parr Reservoir, and would  
31 likely only result in only localized disturbance to benthic invertebrates, the review team  
32 concludes that the physical impacts on aquatic biota from thermal discharges from proposed  
33 VCSNS Units 2 and 3 would be minor.

## 1 **Stormwater Drainage**

2 During the period of operation of proposed VCSNS Units 2 and 3, onsite streams (Mayo Creek  
3 and intermittent streams) as well as Monticello and Parr reservoirs could be affected by  
4 stormwater drainage. SCE&G has an existing SWPPP to manage stormwater prior to its  
5 discharge to Monticello Reservoir. SCE&G would revise the existing VCSNS Unit 1 SWPPP to  
6 reflect the addition of new paved areas and facilities and changes in drainage patterns (SCE&G  
7 2009a). The review team concludes that based on the use of a stormwater system comparable  
8 to the system currently used for the VCSNS Unit 1 site, the impacts on onsite streams (Mayo  
9 Creek and intermittent streams) as well as Monticello and Parr reservoirs from operation of  
10 proposed VCSNS Units 2 and 3 would be minimal.

### 11 **5.3.2.2 Aquatic Resources – Transmission Lines**

12 Maintenance activities along the six new 230-kV transmission lines could lead to periodic  
13 temporary impacts on the waterways being crossed. However, it is assumed that the same  
14 vegetation-management practices currently used by SCE&G and Santee Cooper for their  
15 existing transmission-line corridors would be applied to the proposed new and upgraded  
16 transmission-line corridors (MACTEC 2008; FP&S 2008). SCE&G and Santee Cooper use  
17 practices and procedures developed to minimize impacts on aquatic ecosystems from operation  
18 and maintenance of transmission lines. Santee Cooper would continue to use its Right-of-Way  
19 Management Unit Plan, which addresses vegetation clearing or maintenance for stream buffer  
20 zones (MACTEC 2008). Methods include selective application of herbicides aimed at the  
21 removal of large woody vegetation that may ultimately interfere with the operation of  
22 transmission lines. Herbicides applied in wetlands are EPA-approved and their application  
23 would be aimed at controlling woody vegetation while still promoting low-growing, native  
24 vegetation. Low-growing vegetation along waterbody shorelines would be maintained as buffer  
25 zones (MACTEC 2008). Both SCE&G and Santee Cooper restrict the use of heavy equipment  
26 around stream crossings to prevent erosion and sedimentation (SCE&G 2009a).

27 The review team concludes that the impacts of transmission-line corridor maintenance activities  
28 on aquatic resources would not adversely affect aquatic ecosystems, and additional mitigation  
29 beyond that described above would not be warranted.

### 30 **5.3.2.3 Important Aquatic Species and Habitats**

31 As described in Section 2.4.2.3, both Monticello and Parr reservoirs support a recreational  
32 fishery that consists mainly of largemouth bass (*Micropterus salmoides*), sunfish (*Lepomis*  
33 spp.), and catfish (*Ictalurus* spp.). No Federally listed threatened or endangered aquatic  
34 species are known to occur at the VCSNS site; however, six Federally protected threatened or  
35 endangered aquatic species occur within counties proposed for siting of new transmission lines  
36 (Table 2-20). Several aquatic taxa within Fairfield and Newberry Counties are State species of

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1 concern (Table 2-20). In addition, some of the aquatic taxa encountered during onsite aquatic  
2 inventories have been identified as State conservation priority species, such as the robust  
3 redbreast sunfish (*Moxostoma robustum*), or are important recreational fish that are stocked to establish  
4 a self-sustainable fishery, such as the smallmouth bass (*Micropterus dolomieu*). These taxa  
5 (identified in Section 2.4.2.3) demonstrate a range of life-history attributes and habitat  
6 requirements. Particularly sensitive life stages include larvae and juveniles that are more  
7 sensitive to water quality. The intake and discharge structures and their subsequent impacts on  
8 aquatic environments would likely exclude habitat access or use in the vicinity of these localized  
9 areas in the southwestern portion of Monticello Reservoir and eastern nearshore area of Parr  
10 Reservoir. However, most of these species are motile and would likely move to adjacent habitat  
11 and would not be affected by operational activities. Impacts are not anticipated on the Federally  
12 and State-listed species identified in Section 2.4.2.3 from maintenance of the transmission-line  
13 corridors because of the BMPs that SCE&G and Santee Cooper would use during maintenance  
14 activities.

### 15 ***Aquatic Threatened and Endangered Species Summary***

16 Based on threatened and endangered species surveys, historical records, life-history  
17 information, known threatened and endangered species locations, and information provided by  
18 SCE&G in its ER and in responses to RAIs, the review team concludes that there would be no  
19 impacts on aquatic Federally listed species from operational activities on the VCSNS site and  
20 associated transmission-line corridors. More detailed analysis can be found in Appendix F in  
21 the biological assessments prepared for the FWS and the National Marine Fisheries Service in  
22 accordance with the Endangered Species Act of 1973, as amended.

### 23 **5.3.2.4 Aquatic Monitoring During Operation**

24 SCE&G plans to perform operations-related monitoring for water quality as required by the  
25 NPDES permit (SCE&G 2009a). SCE&G will also continue the voluntary monitoring program  
26 for water quality in Monticello Reservoir (SCE&G 2009a). Monitoring associated with the  
27 SWPPP may also be implemented during operations (SCE&G 2009a), and SCDNR and  
28 SCDHEC may require specific monitoring activities as a part of their permitting process to  
29 assess potentially affected areas such as onsite waterbodies and transmission-line corridors.

### 30 **5.3.2.5 Summary of Operational Impacts on Aquatic Resources**

31 With regard to aquatic ecosystems, operational impacts associated with proposed VCSNS Units  
32 2 and 3 are centered on the intake and discharge structures, but also include stormwater  
33 management as well as maintenance and operation of transmission-line corridors. The aquatic  
34 community in the vicinity of the VCSNS site consists of a diversity of biota with a range of life-  
35 history requirements. Biota most vulnerable to entrainment and impingement include planktonic  
36 and nektonic life forms, respectively. As reviewed in Section 5.3.2.1, the low through-screen

1 intake velocity (less than or equal to 0.5 fps), the use of closed-cycle cooling, the population  
2 status, and reproductive potential of fish most vulnerable to impingement and entrainment would  
3 result in minimal adverse impacts on the aquatic ecosystem in Monticello Reservoir. The  
4 blowdown line would deliver effluent with thermal, chemical, and physical inputs to Parr  
5 Reservoir, which would be regulated by State and Federal agencies. With regard to thermal  
6 influence, a mixing zone that covers approximately 50 percent of the Parr Reservoir channel  
7 width would result in a thermal plume that would not exceed the maximum criteria established  
8 by SCDHEC. Furthermore, the temporal occurrence of such infrequent events (i.e., exceeding  
9 SCDHEC discharge criteria) is not concurrent to critical life-history events of important aquatic  
10 biota (e.g., spawning, rearing). Based on the foregoing, the review team concludes that the  
11 impacts on the aquatic resources of Monticello and Parr reservoirs and onsite streams from the  
12 operation of VCSNS Units 2 and 3 and associated transmission-line corridors would be SMALL.

## 13 **5.4 Socioeconomic Impacts**

14 Operations activities can affect individual communities, the surrounding region, and minority and  
15 low-income populations. This section assesses the impacts of operations-related activities and  
16 of the operations workforce on the region. Unless otherwise specified, the primary source of  
17 information for this section is the ER (SCE&G 2009a).

18 Although the review team considered the 50-mi region when assessing socioeconomic impacts,  
19 the primary geographic region for physical impacts is the four most local counties (Fairfield,  
20 Lexington, Newberry, and Richland). As described in EIS Section 2.5, the review team also  
21 uses these counties for the economic impact area when discussing economic impacts such as  
22 employment, income, and output impacts from operations.

23 The socioeconomic impacts of operating two new Westinghouse Electric Company, LLC  
24 (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water nuclear units at the  
25 VCSNS site include the activities and demands of the 800-person operating workforce  
26 supplemented by as many as 1000 outage workers onsite for about 45 to 90 days every 18  
27 months (SCE&G 2009a).

28 Construction at the site is planned to span a total of 123 months or 10.25 years, with 30 months  
29 dedicated to site clearing and preparation and 93 months for construction of Units 2 and 3, with  
30 Unit 3 construction starting 24 months after the start of Unit 2 operation. According to SCE&G's  
31 most recent Integrated Resource Plan (SCE&G 2009a), SCE&G expects to bring Unit 2 online  
32 in 2016 and Unit 3 online in 2019.

### 33 **5.4.1 Physical Impacts**

34 The potential physical impacts of operating the two nuclear units include noise, odors, exhausts,  
35 thermal emissions, and visual intrusions. The review team expects these impacts to be

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1 mitigated by operating the facility in accordance with all applicable Federal, State, and local  
2 environmental regulations without significantly affecting the region surrounding the VCSNS site.  
3 The following sections assess the potential operations-related physical impacts of two new units  
4 on specific segments of the population, the plant, and nearby communities.

### 5 **5.4.1.1 Impacts on Workers and the Local Public**

6 This section discusses potential air quality and noise impacts on workers and the local public  
7 from operation of VCSNS Units 2 and 3. The VCSNS site is located in western Fairfield County,  
8 South Carolina, in an attainment area for ozone and for carbon monoxide. A description of  
9 baseline air quality characteristics is included in Section 2.9.2. Once the two new reactors have  
10 begun operation, they are not expected to produce any known air pollutants, except for (1)  
11 some combustion-related air emissions during the periodic testing and operation of the standby  
12 diesel generators and auxiliary power systems, (2) particulate matter created by commuter  
13 vehicle dust and exhaust, (3) odors from operations, and (4) operations-based noise. Because  
14 certificates to operate diesel generators require that air emissions comply with all applicable  
15 regulations, and because the operation of the generators would be intermittent and brief, the  
16 review team expects that the impact of the operations of the two units on air quality would be  
17 minimal. By enforcing access road maintenance and speed limits, dust generated by  
18 commuting workers can be minimized. The review team expects that during normal plant  
19 operation, proposed Units 2 and 3 would not use chemicals in amounts that would generate  
20 odors exceeding Federal and State limits. If these practices are followed, the review team  
21 expects that the addition of two new reactors to the site would have only a minimal impact on air  
22 quality.

23 Most equipment would be located inside structures, thereby reducing the outdoor noise level. In  
24 addition, because Unit 1 is already located at the VCSNS site, SCE&G does not expect impacts  
25 to be significantly greater than current background levels (SCE&G 2009a). Ambient noise  
26 heard by recreational users at local parks under normal conditions typically does not include  
27 noise from the operation of Unit 1 because of the distance from the site, attenuation by the lake,  
28 vegetation, and topography. Units 2 and 3 would be located even farther away from the public  
29 than Unit 1. Noise levels below 60 to 65 dB are not considered to be significant (NRC 1996).  
30 The maximum sound level generated by the operation of Units 2 and 3 at a distance of 1000 ft  
31 would not exceed 60 dB, would not affect residents or the usage of nearby recreational areas,  
32 and would not warrant mitigation.

33 The baseline level of traffic noise on SC-213 and SC-215 is relatively low and includes tractor  
34 trailers and other heavy trucking equipment. The annual average daily traffic (AADT) for the  
35 routes near the plant is as much as 2400 vehicles. SCE&G estimated the incremental noise  
36 from VCSNS-related traffic on these routes would not be significant and would not occur outside  
37 of traditional operations shift changes.

1 **5.4.1.2 Impacts on Buildings**

2 Operations activities would not affect offsite buildings. Onsite buildings have been constructed  
3 to safely withstand any possible impact, including shock and vibration, from operations activities  
4 associated with the generation of electricity at a nuclear power plant (10 CFR Part 50, Appendix  
5 A). Except for VCSNS site structures, no other industrial, commercial, or residential structures  
6 would be affected.

7 **5.4.1.3 Impacts on Transportation**

8 This EIS assesses the impact of transporting workers and materials to and from the VCSNS site  
9 from three perspectives: the socioeconomic impacts, the air quality impacts of dust and  
10 particulate matter put into the air by vehicle traffic, and the potential health impacts from  
11 additional traffic-related accidents. The socioeconomic impacts are addressed here and in  
12 Section 5.4.4.1. The air quality impacts are addressed in Section 5.7.2, and human health  
13 impacts from traffic-related accidents are addressed in Section 5.8.6.

14 Public roads and railways would transport workers, construction materials, and equipment to the  
15 site during operations. During plant operations, roads in the vicinity of the site would experience  
16 an increase in traffic over baseline levels, but a reduction from the levels at peak construction.  
17 Peak road use would occur at the end of each operations shift and at the beginning and end of  
18 each outage support shift. All of the access roads are paved, which reduces both noise and  
19 dust. No new public roads would be constructed or be subject to major modifications due to the  
20 operation of VCSNS Units 2 and 3. Railroad deliveries during the operation phase would be  
21 less frequent than during construction.

22 **5.4.1.4 Impacts on Aesthetics**

23 As discussed in Sections 2.5 and 4.4, the existing 520-ft-tall Unit 1 containment building on the  
24 VCSNS site and the transmission line and towers leading into and out of the site are visible from  
25 a number of vantage points in the vicinity of the VCSNS site and have already aesthetically  
26 altered the area. The additional visual impact from operations compared with the construction  
27 phase would result from the steam plumes from the cooling towers, which would resemble  
28 cumulus clouds. The plumes would be most visible during cooler weather, and from on and  
29 around Monticello Reservoir (see Figure 5-2). The cooling towers and plumes would be most  
30 prominent to those using the Monticello Reservoir who could directly view the operation areas.  
31 Other recreation areas in the vicinity may also be aesthetically altered during weather conditions  
32 that increase plume size. Section 5.7.1 describes the effects of the plume in more detail.  
33 Because low-profile cooling towers would be used and weather conditions would vary the  
34 visibility of the cooling-tower plumes, the review team concludes that the marginal aesthetic  
35 impact of the new reactors and plumes would not be significant, and would be naturally  
36 mitigated by topography.

## Station Operation Impacts at the VC Summer Site



1  
2 **Figure 5-2.** Artist Rendering of Proposed VCSNS Unit 2 and Unit 3 Cooling-Tower Plumes as  
3 Viewed from Monticello Reservoir (SCE&G 2009e)

### 4 **5.4.1.5 Summary of Physical Impacts**

5 Based on the information provided by SCE&G, the review team's interviews with local public  
6 officials, and the review team's independent assessment of the physical impacts on workers and  
7 the local public, buildings, transportation and aesthetics, the review team concludes that the  
8 physical impacts of operations at the two new proposed units would be SMALL and additional  
9 mitigation would not be warranted.

### 10 **5.4.2 Demography**

11 This section evaluates the demographic, economic, infrastructure, and community impacts on  
12 the region as a result of the operation of VCSNS Units 2 and 3, with a particular focus on the  
13 four-county economic impact area and the communities in the vicinity of the VCSNS site.

#### 14 **5.4.2.1 Demographic Impacts**

15 The baseline population of the four most local counties is estimated to increase steadily over the  
16 40 years of operation under the license (see Table 2-23). SCE&G projects a Units 2 and 3  
17 workforce of 800 operations workers, who would start arriving onsite during site development,  
18 as discussed in Section 4.4. The operations workforce is projected to increase from 635  
19 workers currently operating Unit 1 to about 1435 workers for all three units. The review team  
20 estimates that the majority of the new operations workforce, up to 600 workers (75 percent),  
21 would come from within the economic impact area. The review team expects that up to 200  
22 (25 percent) of the new operations workforce would be highly specialized and would relocate to  
23 the economic impact area because the needed skill sets would not be readily available in the  
24 greater Columbia area. The remainder of the operations workforce would be recruited from  
25 within the 50 mi region. Based on these assumptions and because the review team assumes



1 that impacts outside of the economic impact area would be minimal, even if all 800 operations  
2 workers migrated into the area, they would constitute less than half a percent increase over the  
3 baseline population of the four-county economic impact area. Therefore, the review team  
4 concludes that the demographic impact of operations workers on the local area would be  
5 minimal.

6 In addition to the operations workers, each new unit would require an outage workforce of 1000  
7 temporary employees who would be onsite for periods of approximately 30 days for scheduled  
8 refueling outages every 18 months. The review team expects that outage workers would  
9 typically migrate to the area from all over the country and stay only during the outage period at  
10 temporary lodging as close to the site as possible. Having three units at the VCSNS site would  
11 increase the frequency of the refueling outages; however, the temporary nature of the work  
12 would generate only a minimal impact on the economic impact area, with little or no effects felt  
13 in the larger region.

#### 14 **5.4.2.2 Summary of Demographic Impacts**

15 Based on information provided by SCE&G and the review team's independent review, the  
16 review team concludes that operations workers and their families would be expected to have a  
17 SMALL beneficial impact on the local communities and governmental entities in Fairfield County  
18 and the economic impact area, and a SMALL beneficial impact on the region.

#### 19 **5.4.3 Economic Impacts on the Community**

20 This section evaluates the social and economic impacts on the four-county economic area  
21 expected as a result of operating proposed Units 2 and 3 at the VCSNS site. The evaluation  
22 assesses the impacts of the jobs, wages, project purchases, and tax payments on the local  
23 communities and surrounding region over the estimated 40-year duration of the nuclear power  
24 plant operating license.

##### 25 **5.4.3.1 Economy**

26 The primary economic impacts of nuclear power plant operation result from jobs created, wages  
27 paid, regional purchases, and tax payments made in the course of operating the power plant.  
28 The impacts of plant operation on the local and regional economy depend on the region's  
29 economy and population at that time and will be influenced by how the affected communities  
30 have responded to the impacts of the construction phase. Although future impacts cannot be  
31 predicted with certainty, consideration of historical patterns, projected economic and  
32 demographic trends, and consultation with local planners can provide some insight into the  
33 qualitative nature of these impacts over the 40-year period of plant operation.

## Station Operation Impacts at the VC Summer Site

1 Section 2.5 of this EIS presents a detailed description of local and regional employment trends  
2 and workforce characteristics. The economic impact area has a relatively diverse and stable  
3 economy, ranging from agricultural and manufacturing on the peripheries to health care and  
4 research in Columbia. The 800 new jobs at the VCSNS site during operations are expected to  
5 constitute only a very small percentage increase over baseline income in the economic impact  
6 area.

7 The jobs of operations and outage workers would have a multiplier effect in the local and  
8 regional economy, similar to that described in Section 4.4 for the construction phase workforce.  
9 The applicable Regional Input-Output Modeling System (RIMS II) employment multiplier  
10 provided to SCE&G from the U.S. Department of Commerce Bureau of Economic Analysis is  
11 3.13 (SCE&G 2009g). This means that about 1704 indirect jobs would be supported by VCSNS  
12 Units 2 and 3 operations in the economic impact area, increasing the total number of jobs  
13 supported to about 2504 (not counting outage workers and their temporary effects). The review  
14 team expects that only a minimal number of jobs would be created in the wider region. Because  
15 the review team expects that 25 percent of the operations workforce would migrate to the  
16 economic impact area, only 25 percent of the total employment effects would represent a net  
17 impact on the area. Employment effects representing upgraded employment for in-area  
18 workers also would count as impacts. However, the review team expects most of the  
19 operations workforce and associated indirect and induced employment would come from within  
20 the economic impact area. Therefore, the review team concludes that the new jobs would not  
21 increase the local baseline employment significantly. Because the indirect jobs typically would  
22 be service-related and not highly specialized, the review team expects that they would be filled  
23 primarily by residents of the region and would not induce new migration to the region.

24 Based on additional information supplied by SCE&G, total first-year operations costs for the new  
25 units are projected to be \$668 million. This represents new spending in the economic impact  
26 area. The new expenditures would result in an income multiplier impact felt in the economic  
27 impact area. The applicable income multiplier provided from RIMS II is 0.33 (SCE&G 2009g).  
28 This means that for each dollar of new expenditure for output from the power generation  
29 industry, 33 cents of new income is generated in the economic impact area. Using that number  
30 as a basis, the resulting income impact would be \$220 million in annual income attributable to  
31 the annual expenditures in at VCSNS Units 2 and 3, in addition to incomes received by new  
32 operations workers, which are part of the \$668 million annual expenditure. Similar to the  
33 employment impact, this is not significant in the context of the greater Columbia area.

34 Based on information provided by SCE&G and the review team's own independent review, the  
35 review team concludes that slight beneficial economic impacts would be experienced in the  
36 four-county economic impact area. The region also would expect minimal but beneficial  
37 impacts.

1 **5.4.3.2 Taxes**

2 The tax structure of the region is discussed in Section 2.5. Several types of taxes would be  
 3 generated during the operational life of proposed Units 2 and 3 at the VCSNS site. Employees  
 4 would pay sales, use, personal property, and income taxes; and vendors selling materials and  
 5 services to the facility would pay a variety of State, Federal, and local taxes. The VCSNS site  
 6 would be subject to property taxes paid to Fairfield County.

7 ***Sales, Use, Income, Property, and Corporate Taxes***

8 To the extent that new operations employees move into the area from outside the state to work  
 9 at the plant, the States, counties, and communities within the region would experience an  
 10 increase in sales and use taxes and income tax revenues. This increase in revenue would  
 11 come from both the taxes paid by VCSNS employees on their personal incomes, sales taxes on  
 12 goods they purchase within the region, and from SCE&G for property taxes on the VCSNS site.

13 Upon completion and operation of VCSNS Units 2 and 3, based on additional information  
 14 provided by SCE&G (SCE&G 2009f), the review team expects that SCE&G would enter an  
 15 agreement with Fairfield County to pay from \$13 to \$31 million annually in property taxes over  
 16 the 40-year operating life of the new units. Taxes in the new units would be in addition to  
 17 existing taxes being collected by Fairfield County on Unit 1 operations. Table 5-5 provides more  
 18 detailed information. Santee Cooper also contributes a minor amount of fee-in-lieu-of-property-  
 19 taxes to Fairfield County, but this amount represents only a negligible source of revenue.

20 **Table 5-5.** Expected Property Tax Payments to Fairfield County from Operation of VCSNS  
 21 Units 2 and 3

Operation Years	SCE&G Average Annual Fee-in-Lieu-of-Taxes Payments to Fairfield County
2017–2019	\$ 18,644,400
2020–2034	\$ 31,144,600
2035–2044	\$ 20,342,300
2045–2056	\$ 13,928,900
Sum over 40 yr	\$ 861,265,100

Source: SCE&G 2009f  
 (a) Dollars are nominal 2007 dollars;  
 (b) Assumes SCE&G's portion of construction costs amounts to \$3404/kW, excluding transmission costs.

22 The review team does not expect significant growth in the Fairfield County tax base between  
 23 now and the start of operations that could otherwise diminish the scale of the VCSNS tax impact  
 24 on county revenue. The VCSNS-attributable contribution to the total property tax revenue for  
 25 Fairfield County would increase by 150 percent to an amount that is more in each year than the

## Station Operation Impacts at the VC Summer Site

1 current overall total property tax revenue of the county. Therefore, the review team concludes  
2 that property tax revenue impacts would be substantial and beneficial for Fairfield County.

3 In addition to the property taxes paid on the value of the plant itself, the economic impact area  
4 would experience an increase in property tax revenues on new homes if the influx of workers  
5 results in any new residential construction and/or increases in existing home prices. This  
6 overall impact likely would not be noticeable because the operations workforce that is new to  
7 the community and their families would make up only a slight proportion of the property tax base  
8 in any county in the region.

9 The current South Carolina sales tax rate is 6 percent for most goods and services and each of  
10 the counties in the economic impact area adds a 1-percent use tax to the State sales tax  
11 (SCDOR 2009). However, impacts in the state would occur only to the degree that construction  
12 and operations workers would be relocating from out of state or otherwise significantly upgrading  
13 their disposable income compared to previous in-state employment. The review team concludes  
14 that, when viewed in the context of total sales tax revenue to the State of South Carolina, the net  
15 impact on sales tax revenue caused by potential relocations to South Carolina, or from the effect  
16 of upgrading disposable income through better employment, would be minimal.

17 SCE&G would be subject to Federal and State corporate income taxes on income generated  
18 from the new units (SCE&G 2009f). Table 5-6 lists the expected revenues from these sources.  
19 Santee-Cooper also would pay fee-in-lieu of income tax to Fairfield County. In all cases, when  
20 viewed in the context of the all income tax revenues received by Federal, State and County  
21 sources, these annual amounts would not be significant at any level of government.

22 **Table 5-6.** Expected Corporate Income Tax Payments to Affected Jurisdictions from  
23 Operation of VCSNS Units 2 and 3

Operations Years	Annual SCE&G Federal Income Tax Liability	Annual SCE&G State Income Tax Liability	Annual Santee-Cooper Portion of Sum-in-Lieu of (Income) Tax Paid to Fairfield County
2017-2030	\$ 89,490,000	\$ 15,004,500	\$ 1,030,000
2031-2040	\$ 89,490,000	\$ 15,004,500	\$ 1,270,000
2041-2050	\$ 89,490,000	\$ 15,004,500	\$ 1,520,000
2051-2056	\$ 89,490,000	\$ 15,004,500	\$ 1,780,000
Sum over 40 yr	\$3,579,580,000	\$600,180,000	\$56,000,000

Source: SCE&G 2009f

(a) Dollars are nominal 2007 dollars.

1 **5.4.3.3 Summary of Economic and Tax Impacts**

2 Based on the information provided by SCE&G, the review team interviews with local public  
3 officials, and the review team's review of the data on regional economy and taxes, the review  
4 team concludes that the economic and fiscal impacts of operations at the two new proposed  
5 units would be SMALL and beneficial for the region and LARGE and beneficial for Fairfield  
6 County.

7 **5.4.4 Infrastructure and Community Services**

8 Infrastructure and community services include transportation, recreation, housing, public  
9 services, and education. The operation of two new units at the VCSNS site would affect the  
10 transportation network because the additional workforce would use the local roads to commute  
11 to and from work and possibly additional truck deliveries would be made to support operation of  
12 the new units. These same commuters potentially could affect recreation in the area. As the  
13 workforce migrates to and settles in the region, there may be impacts on housing, education,  
14 and public sector services. These impacts are discussed further below.

15 **5.4.4.1 Transportation**

16 Based upon the SCE&G traffic analysis, the review team expects that even if there is only one  
17 employee per vehicle, traffic would remain within the capacity of the access roadways, except  
18 for brief periods during shift changes. SCE&G anticipates some congestion, lasting between 10  
19 and 15 minutes, to occur during these shift changes. SCE&G has indicated that it would work to  
20 mitigate transportation impacts where they occur with possible alternate routes that can be  
21 made available in the future. However, if some employees carpool, the review team expects  
22 operations-related traffic to have a lesser impact on traffic congestion at the regional, county,  
23 and local levels. In any case, there are few residents along access routes to the site, which  
24 further limits the socioeconomic impacts of operations-related traffic.

25 During refueling and other outages, about 1000 additional workers would be commuting to and  
26 from the site for approximately 30 days at a time. SCE&G stated that it would implement  
27 measures to stagger road use and reduce the number of vehicles by scheduling shift changes  
28 at times other than traditional high-traffic periods and minimizing drive time overlap with  
29 operations personnel. Mandatory carpooling, providing buses to transport employees, or other  
30 measures also may be warranted, particularly if the work schedule puts workers on these  
31 access roads during nighttime hours. Based on information from SCE&G and the review team's  
32 independent review, the review team concludes that if the mitigation measures discussed here  
33 are implemented, transportation impacts resulting from operation of Units 2 and 3 would not be  
34 significant, and additional mitigation would not be warranted.

1 **5.4.4.2 Recreation**

2 Recreational activities in the area include many outdoor activities such as recreational boating  
3 and fishing on Monticello Reservoir, as well as hiking, camping, and hunting. Several State and  
4 county parks in the region provide facilities and recreational opportunities as do a number of  
5 lakes and forests in the area, as discussed in Section 2.5.2.4. The review team expects  
6 impacts on area recreation resources to be minimal during operations because the operations  
7 would not affect recreational opportunities. The aesthetic impacts of the plant operations from  
8 the vantage point of local recreational areas also would not be significant.

9 **5.4.4.3 Housing**

10 Regional housing characteristics and availability are described in Section 2.5.2.5. The proximity  
11 of a number of population centers to the VCSNS site, including the City of Columbia, offers a  
12 variety of available housing types. The other urban areas in the vicinity include West Columbia,  
13 Lexington, Irmo, and Cayce, which are all within reasonable commuting distances of the site.  
14 The operations workers who start work during the construction phase would not likely  
15 experience housing shortages as a consequence of the large increase in demand initially  
16 created by the onsite workforce due to the high growth rate of the area. The review team  
17 expects the majority of operations workers to come from within the region, and consequently,  
18 they would not represent new net demand for housing. The review team also expects Richland  
19 and Lexington Counties to receive the greatest number of operations workers and their families,  
20 and therefore, the greatest portion of the benefits and costs attributable to operations of Units 2  
21 and 3. Richland and Lexington Counties would also experience the majority of the impacts from  
22 outage workers for Units 2 and 3. Outage workers typically find temporary housing as close as  
23 possible to the VCSNS site, although SCE&G anticipates that most outage workers would also  
24 come from within the region and may commute to the VCSNS site during maintenance.

25 The review team expects the loss of jobs after construction is completed would result in only a  
26 minimal decline in population or housing demand because the majority of construction and  
27 operation workers would come from within the area. For workers that do move into the area, a  
28 wide selection of housing is available throughout the area. Because the region continues to  
29 grow at a steady pace and is constantly developing new housing to meet the increased need,  
30 operations workers would have a minimal impact on housing in both the economic impact area  
31 and the region.

32 **5.4.4.4 Public Services**

33 This section describes the available public services and discusses the impacts of the operation  
34 of proposed VCSNS Units 2 and 3 on water supply and waste treatment; police, fire-protection  
35 and medical services; education; and social services in the region.

## 1 **Water-Supply Facilities**

2 Section 2.5.2.6 describes the water-supply systems and facilities in the vicinity of the VCSNS  
3 site. Potable water would be supplied to Units 2 and 3 by the onsite VCSNS water-treatment  
4 plant operated by SCE&G. Units 2 and 3 would use the Monticello Reservoir as their source of  
5 water. Monticello Reservoir does not supply any industrial, municipal, commercial, or  
6 agricultural organizations other than VCSNS Unit 1 and proposed Units 2 and 3. As discussed  
7 in Section 4.4.4.4, the local water systems in the four-county area are expected to be able to  
8 meet the demand for water from the peak population during construction. Therefore, because  
9 the planned operations workforce is less than a quarter of the expected construction workforce,  
10 the review team expects local water systems would have no difficulty meeting water demand  
11 during the operations phase.

12 Local water systems have already begun projects to expand capacity or are in the early stages  
13 of planning expansions in response to the population growth, especially in the area surrounding  
14 the VCSNS site. Based on information provided in Section 2.5.2.6, these water systems are  
15 generally not operating at or near capacity, and the system managers have been able to provide  
16 adequate water to their service territories and expand their systems when necessary. Because  
17 the overall population impact from the VCSNS site would not be a significant portion of the  
18 projected population growth, the VCSNS site is unlikely to cause water managers to implement  
19 their current water-supply plans. Consequently, because demand during the operations phase  
20 of the project would be substantially below the demand derived from peak construction levels,  
21 the review team expects the impacts of plant operation on municipal water suppliers would be  
22 minimal, and mitigation would not be needed. For additional discussion of water-resource  
23 impacts, see Section 4.2.

## 24 **Wastewater-Treatment Facilities**

25 As described in Sections 2.5.2.6 and 3.2.2, the VCSNS site has a wastewater-treatment facility  
26 onsite near Unit 1 and SCE&G proposes to construct another one to serve Units 2 and 3  
27 (NRC 2004a; SCE&G 2009a). The five wastewater-treatment systems in the surrounding  
28 counties have demonstrated an ability to expand when necessary. Because local planners  
29 expect the demand for wastewater treatment to grow during the period of construction as a  
30 result of natural regional population growth, any needed facility expansion would already have  
31 been put in place when operations begin at Units 2 and 3. Therefore, the local wastewater-  
32 treatment systems would have excess capacity sufficient to meet the new demand from in-  
33 migrating operations workers.

## 34 **Police, Fire-Protection, and Medical Facilities**

35 Based on analysis provided in Section 2.5.2, the review team expects that current levels of law  
36 enforcement and fire-protection personnel would be adequate to meet the need of the

## Station Operation Impacts at the VC Summer Site

1 communities throughout the construction phase, as discussed in Section 4.4.2. Therefore, even  
2 without adding capacity during the construction phase, the impact on law enforcement and  
3 firefighting services from the operation of Units 2 and 3 would not be significant. A similar  
4 analysis applies to medical services, where the impact of plant operations on medical services  
5 for the region would be minimal.

### 6 **Social Services**

7 The review team anticipates that demands placed on social services related to operations would  
8 occur in proportion to the settlement pattern of the operations workforce. Based on the  
9 expected settlement proportions, no single county would experience greater per capita  
10 increases in demand for social services than any other. The review team believes the fact that  
11 Fairfield County is the host county of the VCSNS site does not imply that Fairfield County would  
12 receive any more impact on its social services infrastructure than any other county in the  
13 economic impact area.

14 Once the transition to operations occurs, the review team expects the demands on social  
15 services during the operations phase to be less than during the construction phase.  
16 Consequently, because the construction phase impacts on social services were not significant,  
17 the review team expects the operations phase impacts also would not be significant.

### 18 **5.4.4.5 Education**

19 To meet the growing demands resulting from continued growth in the region, larger local  
20 districts already have begun to build and renovate schools. Because there would be relatively  
21 few new students coming from operations families, the review team believes the impact of plant  
22 operations on public schools would not be significant. The review team expects that school-age  
23 children typically would not accompany outage workers commuting temporarily into the area to  
24 work at the VCSNS site.

### 25 **5.4.4.6 Summary of Impacts on Infrastructure and Community Services**

26 The review team has reviewed information provided by SCE&G, visited the site and its environs,  
27 and performed its own independent review of potential infrastructure and community services  
28 impacts of operations on the local area and region of the VCSNS site. In all cases, the  
29 compelling argument in support of the review team's conclusions is that the operations  
30 workforce would be less than a quarter of the size of the workforce at VCSNS construction and  
31 preconstruction peak employment. Therefore, any impacts derived from operations must  
32 necessarily be less than the same impact derived from construction. The review team  
33 concludes that expected operations impacts on transportation, recreation, housing, public  
34 services, and education would be SMALL and require no mitigation.



1 **5.4.5 Summary of Socioeconomic Impacts**

2 VCSNS Units 2 and 3 operations would have no physical impacts on any non-SCE&G-owned  
3 buildings onsite or offsite and would have a SMALL impact on the physical characteristics of  
4 public roads and transportation in the vicinity of the nuclear plant. Given the plant's location and  
5 the presence of Unit 1, impacts on visual aesthetics would be SMALL at both the local and  
6 regional level and, with adherence to BMPs for controlling dust and emissions, impacts on air  
7 quality also would be SMALL. Noise from plant operations is expected to be limited to the site.  
8 Noise from truck and worker traffic is addressed in Section 5.8.2. Consequently, the review  
9 team concludes that the physical impacts of plant operations would be SMALL, and additional  
10 mitigation would not be warranted.

11 The presence of workers and their accompanying family members in the region and the  
12 economic impact area for operations would represent a SMALL impact on the economic  
13 characteristics of the region. The review team concludes that the social and economic impacts  
14 of plant operations would be SMALL at the regional level and SMALL on communities in the  
15 vicinity of the plant with the exception of economic and fiscal impacts, which would be LARGE  
16 and beneficial to Fairfield County. Community services and infrastructure impacts would be  
17 SMALL in the economic impact area and SMALL to those communities closest to the site.  
18 Traffic noise and congestion impacts would be SMALL and would not warrant additional  
19 mitigation beyond the commitments SCE&G has already made.

20 **5.5 Environmental Justice**

21 Environmental justice refers to a Federal policy under which each Federal agency identifies and  
22 addresses, as appropriate, disproportionately high and adverse human health or environmental  
23 effects of its programs, policies, and activities on minority or low-income populations. The NRC  
24 has a policy on the treatment of environmental justice matters in licensing actions  
25 (69 FR 52040). Section 2.6 discusses the locations of minority and low-income populations  
26 around the VCSNS site, vicinity, and region.

27 The review team evaluated whether the health or welfare of minority or low-income populations  
28 at the census blocks identified in Section 2.6 of this EIS could be disproportionately affected by  
29 the potential impacts of operating two new reactors at the proposed site. To perform this  
30 assessment, the review team used the same process applied in Section 4.5. Figure 2-17  
31 identifies minority populations within the 50-mi region surrounding the VCSNS site. Several  
32 minority and low-income census block groups were identified in the vicinity of the VCSNS site.  
33 Therefore, the review team concluded that more detailed analysis of these populations,  
34 communities, and pathways was warranted.

1 **5.5.1 Health Impacts**

2 The results of normal operation dose assessments (see Section 5.9) indicate that the maximum  
3 individual dose was found to be insignificant; i.e., well below the NRC and EPA regulatory  
4 guidelines in Appendix I of 10 CFR Part 50 and the regulatory standards of 10 CFR Part 20..  
5 Section 5.9 further concludes that radiological health impacts to the operational staff and the  
6 public for the proposed Units 2 and 3 would be SMALL. Section 5.8 of this EIS assesses the  
7 nonradiological health effects on the public from operation of the cooling system, noise  
8 generated by unit operations, EMFs, and transporting operations and outage workers. In  
9 Section 5.8, the review team concludes that the potential impacts of nonradiological effects  
10 resulting from the operation of two proposed additional units would be SMALL. The review  
11 team did not identify evidence of unique characteristics or practices in minority or low-income  
12 population that may result in different radiological or non-radiological health impacts compared  
13 to the general population. Therefore, there would be no disproportionately high and adverse  
14 impact on minority or low-income members of the operational staff or the general public as a  
15 result of operations.

16 **5.5.2 Physical Impacts**

17 **5.5.2.1 Soil-Related Impacts**

18 As discussed in Section 5.8, the review team does not expect there to be operations-related  
19 environmental impacts on soils at the VCSNS site that would affect nearby residents, and there  
20 are no populations living on the site. Because soil impacts attenuate rapidly with distance, the  
21 review team expects that there would not be soil-related disproportionate and adverse impact  
22 on minority or low-income populations. Land-use impacts in the transmission-line corridors from  
23 operation of new units would be minimal and is not expected to have adverse effects on the  
24 population. In addition, as discussed in Section 4.5.3.1 of this EIS, the review team did not  
25 identify evidence of unique characteristics or practices that may result in different soil-related  
26 impacts compared to the general population. Based on information from SCE&G and the  
27 review team's independent review, the review team concludes that the operations-related  
28 marginal impact from pathways related to soils from Units 2 and 3 would not impose  
29 disproportionate and adverse impacts on minority or low-income populations.

30 **5.5.2.2 Water-Related Impacts**

31 As discussed in Section 5.2, the review team determined that operating VCSNS Units 2 and 3  
32 would create a volume of cooling-tower blowdown that would not be significant when compared  
33 to the river flow and would comply with the existing NPDES permit and applicable State water-  
34 quality standards. These impacts would be regulated and monitored, and additional mitigation  
35 would not be warranted. As discussed in Section 2.6.2 of this EIS, the review team found  
36 evidence of some subsistence fishing in the site vicinity, but did not identify an operational

1 pathway that could result in different water-related impacts compared to the general population.  
2 The review team did not identify evidence of unique characteristics or practices in minority or  
3 low-income population that may result in different water-related impacts compared to the  
4 general population. Therefore, the review team expects no disproportionate and adverse  
5 impacts on identified minority or low-income populations.

6 Based on Section 5.2, the review team concludes that Units 2 and 3 water use would have little  
7 or no effect on the availability of water for other uses. Based on Section 5.3.2, Units 2 and 3  
8 water use would have minimal impacts on the fish population of Monticello Reservoir or the  
9 Broad River. Therefore, the impacts would not warrant mitigation or cause disproportionate and  
10 adverse impact on identified minority and low-income populations.

11 Based on information from SCE&G and the review team's independent evaluation, the review  
12 team concludes that given the relatively minimal impact on water quantity and quality in  
13 Monticello Reservoir, and the small consumptive water use of Units 2 and 3, there would be no  
14 operations-related disproportionate and adverse environmental impacts on minority and low-  
15 income populations.

### 16 **5.5.2.3 Air Quality-Related Impacts**

17 As discussed in Section 5.9, the total liquid and gas effluent doses from the new units would be  
18 well within the regulatory limits of the NRC and EPA. The primary air emissions from a nuclear  
19 power plant such as VCSNS are water vapor and salt, which do not pose health dangers to the  
20 general public. In addition, air quality impacts attenuate rapidly with distance from the source.  
21 As described in Section 5.7 the review team concludes that the potential impacts from sources  
22 of air emissions would be SMALL. Other than their location within the site vicinity, the review  
23 team did not identify any evidence of unique characteristics or practices that may result in  
24 different air-related impacts compared to the general population. Given that the total effluent  
25 doses from the new units would be well within regulatory limits and given that airborne  
26 pollutants released from the new units would rapidly disperse to near background levels, the  
27 review team concludes that the potential impacts from operations-related sources of air  
28 emissions would not result in disproportionately high and adverse impacts on minority or low-  
29 income populations within the site vicinity.

### 30 **5.5.3 Socioeconomic Impacts**

31 The review team determined that the addition of 800 new operations employees would have  
32 minimal impacts on local infrastructures and community services (transportation; recreation;  
33 housing; water and wastewater facilities; police, fire, and medical services; social services; and  
34 schools). In terms of environmental justice, and as discussed in Section 2.6.1, the review team  
35 identified several census blocks that meet the criteria for minority populations of interest within  
36 the vicinity of the VCSNS site and the site access roads. Further investigation by the review

## Station Operation Impacts at the VC Summer Site

1 team also revealed a high percentage of low-income families within the same region (NRC  
2 2010a). The review team determined these areas may have a greater potential for  
3 disproportionate and adverse operations impacts on minority and low-income populations.  
4 Consequently, the review team further analyzed these areas of potential impact to determine  
5 whether or not such impacts would be significant.

6 As discussed in Section 5.4.4.1, based upon the SCE&G traffic analysis, the review team  
7 expects operations-related traffic would remain within the capacity of the access roadways.  
8 SCE&G anticipates some shift-change congestion, lasting between 10 and 15 minutes and has  
9 indicated that it would work to mitigate transportation impacts where possible. Other than their  
10 location along access roads that may become congested, the review team did not identify  
11 evidence of any other unique characteristics or practices in the environmental justice community  
12 that may result in different impacts compared to the general population. Based on 1) the  
13 analysis presented in Sections 2.6.2, 4.5.4 and 5.4.4.1 of this EIS, 2) the intermittent nature of  
14 the operations-related traffic impacts, 3) the continued use of mitigation measures implemented  
15 by SCE&G to reduce construction-related traffic impacts, and 4) the lower traffic volume of  
16 operations in comparison to the volume associated with construction and preconstruction  
17 activities (i.e., hundreds of additional workers rather than thousands of workers), the review  
18 team determined that the operations-related impact from traffic would be less than the  
19 construction- and preconstruction-related impacts of traffic. Therefore, the review team  
20 concludes the traffic impacts of operations on minority and low-income populations would be  
21 minor, but not disproportionate.

### 22 **5.5.4 Subsistence and Special Conditions**

23 This segment of the review team's environmental justice analysis was performed using the  
24 same methodology as described in Section 4.5 of this EIS.

25 As part of its visits to the site and region, the review team interviewed public officials and  
26 community leaders of the minority populations within the socioeconomic impact area in relation  
27 to subsistence practices. The review team heard anecdotal information about local subsistence  
28 fishing by the members of the communities of Jenkinsville, Dawkins, and Blair, South Carolina.  
29 During scoping, the community submitted informal survey data to the record (see Appendix D).  
30 The data give anecdotal evidence of isolated subsistence fishing in the Broad River and  
31 Monticello Reservoir. The review team reviewed these accounts and determined that there  
32 were no operations-related disproportionate and adverse impacts on minority or low-income  
33 populations related to subsistence. Because adverse health impacts from the operation of the  
34 new units are not expected, potential subsistence fishing activity on Monticello Reservoir or in  
35 the Broad River would not have either a radiological or nonradiological adverse health effect  
36 (see Sections 5.8 and 5.9). The review team also determined that the impacts from chemical  
37 discharges to the Broad River would be minimal (see Section 5.3.2), and no additional

1 mitigation would be warranted. Therefore, minority or low-income individuals who may be  
2 engaged in subsistence fishing would not experience disproportionate and adverse impacts.

3 The review team also identified other subsistence and income-supplementing uses such as  
4 hunting and vegetable gardening taking place in the rural areas of the region (NRC 2010a).  
5 Potential sources of radiological or nonradiological impacts from operations on these activities  
6 have been analyzed as part of the air, soil, and water pathways, which have been discussed  
7 separately in this EIS section. The review team determined these physical pathways to have no  
8 potential for a disproportionate and adverse impact on minority or low-income populations.

### 9 **5.5.5 Summary of Environmental Justice Impacts**

10 As discussed in Section 2.6.1, the review team identified several census blocks that meet the  
11 criteria for minority populations within the site vicinity. The review team determined these areas  
12 may have a greater potential for disproportionate and adverse operations impacts on minority  
13 and low-income populations. Consequently, the review team further analyzed these areas of  
14 potential impacts to determine whether or not such impacts would be significant.

15 Based on information provided by SCE&G, the review team interviews with local public officials,  
16 the team's own independent assessment of the underlying assumptions of the analysis  
17 discussed in Section 2.6, and the analyses presented in the preceding sections, the review  
18 team did not find environmental pathways that would lead to disproportionate and adverse  
19 impacts on minority and low-income populations. Therefore, the review team concludes  
20 environmental justice impacts of operations would be SMALL, and no further mitigation would  
21 be warranted beyond that discussed in the ER.

## 22 **5.6 Historic and Cultural Resource Impacts from Operation**

23 The National Environmental Policy Act of 1969, as amended (NEPA), requires that Federal  
24 agencies take into account the potential effects of their undertakings on the cultural  
25 environment, which includes archaeological sites, historic buildings, and traditional places  
26 important to local populations. The National Historic Preservation Act (NHPA) of 1966, as  
27 amended, also requires Federal agencies to consider impacts on those resources if they are  
28 eligible for listing in the National Register of Historic Places (NRHP or National Register) (such  
29 resources are referred to as "Historic Properties" in NHPA). As outlined in 36 CFR 800.8,  
30 "Coordination with the National Environmental Policy Act of 1969," the NRC is coordinating  
31 compliance with Section 106 of the NHPA in fulfilling its responsibilities under NEPA. Operating  
32 new power units can affect either known or potential historic properties that may be located at  
33 the site. In accordance with the provisions of NHPA and NEPA, the NRC and the USACE are  
34 required to make a reasonable and good faith effort to identify historic properties in the areas of  
35 potential effect and, if such properties are present, determine whether or not significant impacts

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1 are likely to occur. Identification of historic properties is to occur in consultation with the State  
2 Historic Preservation Officer (SHPO), Native American Tribes, interested parties, and the public.  
3 If significant impacts are possible, then efforts should be made to mitigate them. As part of the  
4 NEPA/NHPA integration, even if no historic properties (i.e., places eligible for listing on the  
5 National Register of Historic Places) are present or affected, then NRC is still required to notify  
6 the SHPO before proceeding. If historic properties are present, then the NRC and the USACE  
7 are required to assess and resolve adverse effects of the undertaking.

8 For a description of the historic and cultural resource information about the VCSNS site, see  
9 Section 2.7 of this EIS. As explained in Section 2.7, the applicant conducted several cultural  
10 resource identification efforts resulting in the identification of a total of 39 archaeological sites  
11 within the VCSNS site Area of Potential Effect (APE), most of which have been recommended  
12 as ineligible for listing in the National Register. Four archaeological sites have either been  
13 recommended as National Register eligible, 38FA330 (General Pearson Cemetery) and  
14 38FA360; potentially eligible, 38FA366; or recommended for preservation, despite not being  
15 considered potentially eligible for inclusion in the National Register, 38FA349.

16 These four archaeological sites are located within the project APE but outside of the proposed  
17 footprint of disturbance identified by SCE&G (2009f). SCE&G currently has protective  
18 measures in place for these resources, including fencing at the Pearson Cemetery, temporary  
19 fencing at 38FA360, and delineation of all four sites as sensitive areas on management maps  
20 and plant layout and design drawings (SCE&G 2009i, j). Proposed signage would read  
21 “Environmentally Sensitive Area, Do Not Disturb” (SCE&G 2009j). These protective measures  
22 would be identified and added to SCE&G’s Environmental Management Plan for VCSNS Units 2  
23 and 3 (SCE&G 2009j). In addition, SCE&G would provide cultural awareness training for all  
24 workers including awareness of signage and inadvertent discovery procedures for Unit 1, which  
25 would also be applied to Units 2 and 3 and described in SCE&G’s Environmental Management  
26 Plan (SCE&G 2009i, j, k). These procedures indicate that work would stop and SHPO would be  
27 contacted if inadvertent discovery of cultural resources occurs (SCE&G 2009j, k).

28 The South Carolina SHPO concurred with a finding of no adverse effect on archaeological sites  
29 38FA330 and 38FA360 based on protective and avoidance measures being implemented by  
30 SCE&G, but would like to see the protective and avoidance measures formalized in a  
31 Programmatic Agreement (SCE&G 2009q). The SHPO also indicated that if archaeological site  
32 38FA366 cannot be avoided, additional archaeological testing would need to occur to evaluate  
33 this site for National Register eligibility. The SHPO also concurred with a finding of no historic  
34 properties affected for the 35 archaeological sites that are not eligible (SCE&G 2009q).

35 To address the SHPO’s request for a Programmatic Agreement, SCE&G has agreed to enter  
36 into a management agreement with the SHPO to formalize avoidance and protective measures  
37 listed above as well as any updates made to the Environmental Management Plan regarding  
38

1 cultural resources awareness training and inadvertent discovery procedures (SCE&G 2009j).  
2 Consultation between SCE&G and the SHPO regarding the management agreement is ongoing  
3 (NRC 2010b).

4 The review team has reviewed the construction and preconstruction activities related to building  
5 the proposed VCSNS Units 2 and 3 and the potential cultural and historic resources impacts.  
6 The review team has also considered the communication between the SHPO, NRC, USACE,  
7 and SCE&G and the consensus among all parties to pursue a management agreement that will  
8 formalize the protection and avoidance measures being undertaken by SCE&G to ensure  
9 protection of the onsite cultural resources (NRC 2009, 2010b).

10 For the purposes of NHPA 106 consultation, the NRC and USACE do not expect any significant  
11 impacts on cultural and historic resources during the operation of proposed Units 2 and 3 based  
12 on the commitment by the applicant to pursue a management agreement with the SHPO, which,  
13 once finalized and signed, will formalize protective measures and inadvertent discovery  
14 procedures so that they are enforceable. Therefore, the NRC and USACE conclude a finding of  
15 no adverse effect on historic properties.

16 For the purposes of the USACE NHPA 106 consultation regarding operation and maintenance  
17 activities in the transmission line corridors, because the cultural resource studies have not been  
18 completed for the transmission line corridors, the USACE cannot provide an official finding of  
19 effect conclusion for this portion of the project because the NHPA Section 106 process will not  
20 be complete until the management agreement is implemented. Consultation with the SHPO is  
21 ongoing,

22 For the purpose of the NEPA analysis, the review team does not expect any significant impacts  
23 on cultural and historic resources during operation of the proposed VCSNS Units 2 and 3. All  
24 proposed onsite operational activities would occur within areas already disturbed by Unit 1 or in  
25 areas already surveyed for cultural resources for areas to be disturbed for building activities  
26 (SCE&G 2009g). SCE&G would follow the protection and inadvertent discovery procedures  
27 described in Section 4.6 (SCE&G 2009h) to confirm that known onsite cultural resources would  
28 be protected from operation of VCSNS Units 2 and 3. In addition, SCE&G is pursuing a  
29 management agreement with the South Carolina SHPO that will formalize these protection and  
30 inadvertent discovery procedures (SCE&G 2009i).

31 Operational impacts associated with maintenance of proposed transmission lines would entail  
32 mostly vegetation maintenance with access on maintenance roads (SCE&G 2009j). Any future  
33 procedures for avoiding impacts on cultural resources associated with operations, including  
34 protective measures and inadvertent discovery procedures, will be covered in the management  
35 agreements being developed by SCE&G and the South Carolina SHPO and Santee Cooper and  
36 the South Carolina SHPO (SCE&G 2009j; NRC 2009, 2010b). With the procedures and

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1 management plan in place, the review team concludes that the impacts on cultural resources  
2 from operations would be SMALL.

### 3 **5.7 Meteorological and Air Quality Impacts**

4 The primary impacts of the operation of two new units on local meteorology and air quality  
5 would be from releases to the environment of heat and moisture from the primary cooling  
6 system, which consists of two mechanical draft cooling towers for each AP1000 unit (SCE&G  
7 2009a), the operation of auxiliary equipment, and emissions from workers' vehicles. The  
8 potential impacts of releases from operation of the cooling system are discussed in Section  
9 5.7.1. Section 5.7.2 covers potential air quality impacts from nonradioactive effluent gases  
10 releases at the VCSNS site.

#### 11 **5.7.1 Cooling-Tower Impacts**

12 The proposed cooling system for Units 2 and 3 at the VCSNS site consists of mechanical draft  
13 cooling towers. A total of four cooling towers would be constructed, two for each unit.  
14 Mechanical draft cooling towers remove excess heat by evaporating water. Upon exiting the  
15 cooling tower, water vapor mixes with the surrounding air and this process can lead to  
16 condensation and the formation of a visible plume. Aesthetic impacts from the visible plume as  
17 well as land-use impacts from cloud shadowing, fogging, icing, increased humidity, and drift  
18 from dissolved salts and chemicals found in the cooling water can result.

19 SCE&G used the Seasonal and Annual Cooling Tower Impacts (SACTI) computer code to  
20 estimate the impacts from the operation of the cooling towers. Engineering data for the  
21 Westinghouse AP1000 reactor design and 3 years (2006–2008) of data from the Columbia  
22 Metropolitan Airport were used as input to the SACTI model. The top of each cooling tower  
23 would be approximately 70 ft above ground (SCE&G 2009a, j).

24 Results from the SACTI analysis, as reported by SCE&G (SCE&G 2009j), indicate that the  
25 longest average plume lengths would occur in the winter and the shortest average plume  
26 lengths would occur in the summer. The average summer plume length is 0.34 mi (toward the  
27 east-northeast), and the average winter plume length is 0.74 mi (toward the east). Average  
28 plume height is also predicted by SACTI, and is found to range from 420 ft in the summer to 630  
29 ft in the winter. No cases of fogging were found in the simulations. Icing can occur when there  
30 is ground-level fogging and the ambient temperature is below freezing. No cases of icing were  
31 identified in the simulations. Deposition of salts from cooling-tower drift is estimated to be  
32 0.28 lb/ac/mo, which is well below the 8.9-lb/ac/mo threshold described in NUREG-1555 (NRC  
33 2000b). The predicted location of the maximum deposition is 3280 ft east of the towers.

34 A number of other pollution sources in the vicinity of proposed VCSNS Units 2 and 3 cooling  
35 towers include the auxiliary boilers and generators operated at Units 1, 2, and 3 and the



1 combustion turbines located at Parr Steam Plant (SCE&G 2009a). The turbines are more than  
 2 1.25 mi from the proposed cooling towers, and the boilers and generators at Unit 1 are  
 3 approximately 4500 ft north of the proposed cooling towers. This distance is larger than the  
 4 distance to the location of maximum salt deposition. The distance is also greater than the  
 5 average wintertime plume length (which will generally be in an easterly direction). The distance  
 6 between the VCSNS Units 2 and 3 cooling towers and these other sources, as well as the  
 7 orientation of the plumes, decrease the likelihood that there would be significant interaction of  
 8 the cooling towers with plumes from other pollution sources for an extended period of time.  
 9 Therefore, the NRC staff concludes that the impacts from the operation of the cooling towers,  
 10 including the interactions of the cooling-tower plumes and plumes from other sources, on air  
 11 quality would be minimal.

12 **5.7.2 Air Quality Impacts**

13 Standby diesel generators and auxiliary power systems would be used for emergency power  
 14 and auxiliary steam purposes. A small incinerator would be used periodically to dispose of used  
 15 oil (SCE&G 2009a). These systems would be used on an infrequent basis and pollutants  
 16 discharged (e.g., particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen  
 17 oxides) would be permitted in accordance with the SCDHEC, as described in the South Carolina  
 18 Code of Laws 48, Chapter 1,( SC Code Ann. 48-1 2009) and any applicable Federal regulatory  
 19 requirements. These systems include the following (SCE&G 2009a):

- 20 • four standby diesel generators rated at 4000 kW
- 21 • four ancillary diesel generators rated at 35 kW
- 22 • additional small generators
- 23 • small incinerator.

24 Based on estimates provided by SCE&G, the annual releases of criteria pollutants at the  
 25 VCSNS site related to the operation of the onsite generators are listed in Table 5-7 (excluding  
 26 the additional small generators and incinerator operated at various locations) (SCE&G 2009a).

27 **Table 5-7. Regulated Source Emissions (lb/yr)**

Source	PM <sup>(a)</sup>	SO <sub>x</sub> <sup>(b)</sup>	CO <sup>(c)</sup>	VOC <sup>(d)</sup>	NO <sub>x</sub> <sup>(e)</sup>
Four standby generators <sup>(f)</sup>	<1600	<5000	<1000	<1200	<24,000
Four ancillary diesel generators <sup>(f)</sup>	<20	<10	<60	<22	<280

(a) PM = particulate matter

(b) SO<sub>x</sub> = oxides of sulfur

(c) CO = carbon monoxide

(d) VOC = volatile organic compounds

(e) Oxides of nitrogen

(f) Assumes 4 hours of operation per month for each generator and use of No. 2 diesel fuel.

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1 In addition to the generators described above, particulate emissions would be associated with  
2 the operation of the cooling towers. These emissions would include particles with a range of  
3 different sizes, including particles smaller than 2.5 microns (PM<sub>2.5</sub>) and particles smaller than  
4 10 microns (PM<sub>10</sub>). As defined in the Clean Air Act, both PM<sub>2.5</sub> and PM<sub>10</sub> are considered criteria  
5 pollutants. The cooling towers would be required to adhere to the New Source Performance  
6 Standards (40 CFR 60.40Da) and a Prevention of Significant Deterioration (PSD) Permit for air  
7 emissions would be required before the cooling towers could be operated.

8 Because these generating systems would be used infrequently (i.e., typically a few hours per  
9 month) and the cooling towers would be operated in accordance with relevant State and Federal  
10 regulations, the review team concludes that the environmental impact of pollutants from these  
11 sources would be minimal.

12 The transportation of workers to and from the site would also result in both particulate and  
13 gaseous emissions associated with their vehicles. It is anticipated that the operations workforce  
14 would consist of 800 workers at VCSNS Units 2 and 3 (SCE&G 2009a). This workforce is much  
15 smaller than the combined preconstruction and construction workforce of up to 3600 workers  
16 that were concluded to have a minor impact; therefore, the impact from transportation of  
17 operational workers on the air quality would be minimal.

18 Impacts of existing transmission lines on air quality are addressed in the NUREG-1437 (NRC  
19 1996). Small amounts of ozone and even smaller amounts of oxides of nitrogen are produced  
20 by transmission lines. The production of these gases was found to be insignificant for 745-kV  
21 transmission lines (the largest lines in operation) and for a prototype 1200-kV transmission line.  
22 In addition, it was determined that potential mitigation measures, such as burying transmission  
23 lines, would be very costly and would not be warranted.

24 Six new 230-kV transmission lines would be constructed to accommodate the new power-  
25 generating capacity (SCE&G 2009a) from the proposed Units 2 and 3. This size is well within  
26 the range of transmission lines discussed in NUREG-1437, and the staff therefore concludes  
27 that air quality impacts from transmission lines would not be noticeable.

28 Finally, the operation of a nuclear power plant involves the emission of some greenhouse  
29 gases, primarily carbon dioxide (CO<sub>2</sub>). The review team has estimated that the total carbon  
30 footprint for actual plant operations for 40 years is of the order of 330,000 MT of CO<sub>2</sub> equivalent  
31 (see Appendix J). For two AP1000 reactors, the total carbon footprint would be on the order of  
32 650,000 MT, compared to a total United States annual CO<sub>2</sub> emissions rate of 6,000,000,000  
33 metric tons (EPA 2009). Periodic testing of diesel generators accounts for about 60 percent of  
34 the total. Workforce transportation accounts for most of the rest. Based on its assessment of  
35 the relatively small plant operations carbon footprint compared to the United States annual CO<sub>2</sub>  
36 emissions, the review team concludes that the atmospheric impacts of greenhouse gases from  
37 plant operations would not be noticeable.

### 1 **5.7.3 Transmission-Line Impacts**

2 The review team evaluated the potential impacts on air quality associated with criteria pollutants  
3 and greenhouse gas emissions from operating Units 2 and 3 at the VCSNS site. The review  
4 team also evaluated the potential impacts of cooling-system emissions and transmission lines.  
5 In each case, the review team determined that the impacts would be minimal. On this basis, the  
6 review team concludes that the impacts of operation of Units 2 and 3 on air quality from  
7 emissions of criteria pollutants, CO<sub>2</sub> emissions, and cooling-system emissions would be SMALL  
8 and that no further mitigation would be warranted.

## 9 **5.8 Nonradiological Health Impacts**

10 This section addresses the health impacts of operating proposed VCSNS Units 2 and 3.  
11 Nonradiological health impacts on the public from operation of the cooling system, noise  
12 generated by unit operations, EMFs, and transporting operations and outage workers are  
13 discussed. Nonradiological health impacts are also evaluated for workers at proposed VCSNS  
14 Units 2 and 3. Health impacts from radiological sources during operations are discussed in  
15 Section 5.9.

### 16 **5.8.1 Etiological (Disease-Causing) Agents**

17 Operation of VCSNS Units 2 and 3 would result in a thermal discharge to Parr Reservoir  
18 (SCE&G 2009a). Such discharges of warmer water have the potential to increase the growth of  
19 thermophilic microorganisms (microorganisms that favor warmer water), including etiological  
20 agents, both in the CWS and the Parr Reservoir. Thermophilic microorganisms include enteric  
21 (intestinal) pathogens such as *Salmonella* spp., *Pseudomonas aeruginosa*, thermophilic fungi,  
22 bacteria such as *Legionella* spp., and free-living amoeba such as *Naegleria fowleri* and  
23 *Acanthamoeba* spp. These microorganisms could result in potentially serious human health  
24 concerns, particularly at high exposure levels.

25 Available data assembled by the U.S. Centers for Disease Control and Prevention (CDC) for the  
26 years 1996 to 2007 (CDC 1997, 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007) report  
27 only two occurrences of waterborne outbreaks of disease from recreational water in the State of  
28 South Carolina. From 1989 to 2000, the CDC surveillance system for waterborne-disease  
29 outbreaks documented 24 fatal cases of primary amebic meningoencephalitis (PAM; a disease  
30 caused by *Naegleria fowleri*) in the United States, most occurring in southern states during the  
31 months of July and September (CDC 2008). Outbreaks of Legionellosis, Salmonellosis, or  
32 Shigellosis that occurred in South Carolina were within the range of national trends (CDC 1997,  
33 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007) in terms of cases per 100,000  
34 population or total cases per year, and the outbreaks were associated with pools, spas, or  
35 lakes.

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1 Epidemiological reports from the State of South Carolina indicate a very low risk of outbreaks  
2 from thermophilic microorganisms associated with recreational water (CDC 2006). Two  
3 SCDHEC water-quality monitoring stations along Parr Reservoir located in or near recreation  
4 areas monitor for species that are indicators for the presence of other pathogens that may be  
5 present in the water. The main recreational activities associated with Parr Reservoir are fishing  
6 and hunting (SCE&G 2009a). There are no public swimming beaches along Parr Reservoir.  
7 No reported cases of Legionellosis, Salmonellosis, or Shigellosis occurred in Fairfield County in  
8 2006 (CDC 2006).

9 *Naegleria fowleri* is common in freshwater ponds, lakes, and reservoirs throughout the southern  
10 states. While it is possible that the thermal discharge from Units 2 and 3 could have an impact  
11 on the abundance of this organism, the affected area of Parr Reservoir would be relatively small  
12 (Table 5-2 and Table 5-3) under normal operating conditions at most times of the year. In  
13 addition, because there are no swimming beaches on Parr Reservoir and limited public access  
14 to the outfall area, the likelihood of recreational exposure is expected to be minimal. Based on  
15 the historically low risk of diseases from etiological agents in South Carolina, the limited extent  
16 of thermal impacts in Parr Reservoir, and the limited opportunities for public exposure, the  
17 review team concludes that the impacts on human health would be minimal, and mitigation  
18 would not be warranted.

### 19 **5.8.2 Noise Impacts**

20 In NUREG-1437 (NRC 1996), the staff discusses the environmental impacts of noise at existing  
21 nuclear power plants. Common sources of noise from plant operation include cooling towers,  
22 transformers, turbines, and the operation of pumps along with intermittent contributions from  
23 loud speakers and auxiliary equipment such as diesel generators. There would also be noise  
24 from corona discharge associated with high-voltage transmission lines (SCE&G 2009a). These  
25 noise sources are discussed in this section.

26 The primary sources for background noise at the proposed VCSNS Units 2 and 3 location are  
27 railroad operations (~1 mi to the west), Unit 1 operations (~1 mi to the north), and occasionally  
28 from the Parr combustion turbines (~1.4 mi to the south-southeast) (SCE&G 2009a). The  
29 nearest residence to the site is 5800 ft away (SCE&G 2009a). SCE&G states in its ER that it  
30 has never received a complaint about the noise produced by Unit 1 (SCE&G 2009a).

31 The proposed units at the VCSNS site would use mechanical draft cooling towers. The ER  
32 states that noise levels as high as 55 dBA at distances of 1000 ft would be emitted from the  
33 cooling towers and intermittently run diesel generators (SCE&G 2009a). The exclusion area  
34 boundary is 3390 ft in all directions from the proposed site of VCSNS Units 2 and 3, and 1300 ft  
35 from the proposed site of the closest cooling tower (SCE&G 2009a). According to NUREG-  
36 1437 (NRC 1996), noise levels below 60 to 65 dBA are considered to be of small significance.  
37 More recently, the impacts of noise were considered in the *Generic Environmental Impact*

1 *Statement on Decommissioning of Nuclear Facilities* (NUREG-0586, Supplement 1) (NRC  
2 2002). The criterion for assessing the level of significance was not expressed in terms of sound  
3 levels but based on the effect of noise on human activities and on threatened and endangered  
4 species. The criterion in NUREG-0586, Supplement 1, is stated as follows:

5       The noise impacts ... are considered detectable if sound levels are sufficiently  
6       high to disrupt normal human activities on a regular basis. The noise impacts ...  
7       are considered destabilizing if sound levels are sufficiently high that the affected  
8       area is essentially unsuitable for normal human activities, or if the behavior or  
9       breeding of a threatened and endangered species is affected.

10 Noise sources during operation of the VCSNS Units 2 and 3 would be sufficiently distant from  
11 the plant boundaries so that noise generated by the plant would be attenuated to near ambient  
12 levels before reaching critical receptors, such as the nearest residence, outside the plant  
13 boundary. Given the postulated noise levels for cooling towers and diesel generators, the staff  
14 concludes that the noise impacts would be minimal, and mitigation would not be warranted.

### 15 **5.8.3 Acute Effects of Electromagnetic Fields**

16 Electric shock resulting from direct access to energized conductors or from induced charges in  
17 metallic structures is an example of an acute effect from EMFs associated with transmission  
18 lines (NRC 1999). Such acute effects are controlled and minimized by conformance with  
19 National Electrical Safety Code (NESC) criteria and adherence to the standards for transmission  
20 systems. The potential impacts from EMFs of the existing transmission lines for Unit 1 at the  
21 VCSNS site were evaluated as part of the environmental review for license renewal for  
22 operation (NRC 2004a). Upon review, the staff concluded that the potential impacts for electric  
23 shock during the renewal term were minimal. In its ER, SCE&G states that three new 230-kV  
24 transmission lines would be required for Unit 2 and three new 230-kV lines would be required  
25 for Unit 3 to service new power generation at the VCSNS site, along with a new switchyard  
26 (SCE&G 2009a). The ER states that all new structures would be designed and constructed to  
27 comply with all NESC provisions that limit the induced current due to electrostatic effects to 5  
28 mA (SCE&G 2009a).

29 With SCE&G's commitment to design new transmission lines to conform to the present NESC  
30 criteria, the staff concludes that the impact on the public from acute effects of EMFs would be  
31 negligible, and further mitigation would not be warranted.

### 32 **5.8.4 Chronic Effects of Electromagnetic Fields**

33 Operating power transmission lines in the United States produce EMFs of nonionizing radiation  
34 at 60 Hz, which is considered to be an extremely low frequency (ELF) EMF. Research on the  
35 potential for chronic effects of EMFs from energized transmission lines was reviewed and

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1 addressed by the NRC in NUREG-1437 (NRC 1996). At that time, research results were not  
2 conclusive. The National Institute of Environmental Health Sciences (NIEHS) directs related  
3 research through the U.S. Department of Energy. An NIEHS report (NIEHS 1999) contains the  
4 following conclusion:

5       The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely  
6 safe because of weak scientific evidence that exposure may pose a leukemia  
7 hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory  
8 concern. However, because virtually everyone in the United States uses  
9 electricity and therefore is routinely exposed to ELF-EMF, passive regulatory  
10 action is warranted such as a continued emphasis on educating both the public  
11 and the regulated community on means aimed at reducing exposures. The  
12 NIEHS does not believe that other cancers or non-cancer health outcomes  
13 provide sufficient evidence of a risk to currently warrant concern.

14 The review team reviewed available scientific literature on chronic effects to human health from  
15 ELF-EMF published since the NIEHS report, and found that several other organizations reached  
16 the same conclusions (AGNIR 2006; WHO 2007a). Additional work under the auspices of the  
17 World Health Organization (WHO) updated the assessments of a number of scientific groups  
18 reflecting the potential for transmission line EMF to cause adverse health impacts in humans.  
19 The monograph summarized the potential for ELF-EMF to cause disease such as cancers in  
20 children and adults, depression, suicide, reproductive dysfunction, developmental disorders,  
21 immunological modifications, and neurological disease. The results of the review by WHO  
22 (2007b) found that the extent of scientific evidence linking these diseases to EMF exposure is  
23 not conclusive.

24 The review team reviewed available scientific literature on chronic effects of EMF on human  
25 health and found that the scientific evidence regarding the chronic effects of ELF-EMF on  
26 human health does not conclusively link ELF-EMF to adverse health impacts.

### 27 **5.8.5 Occupational Health**

28 In general, occupational health risks for new units are expected to be dominated by  
29 occupational injuries (e.g., falls, electric shock, asphyxiation) to workers engaged in activities  
30 such as maintenance, testing, and plant modifications. The annual incidence rates (the number  
31 of injuries and illnesses per 100 full-time workers) for the State of South Carolina and the United  
32 States for electrical power production workers are approximately 1.7 and 1.9, respectively (BLS  
33 2008b). Historically, actual injury and fatality rates at nuclear reactor facilities have been lower  
34 than the average U.S. industrial rates, with a 2007 average incidence rate of approximately  
35 1.5 per 100 workers (BLS 2008a).

1 Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational  
2 Safety and Health Administration (OSHA) safety standards (29 CFR Part 1910), practices, and  
3 procedures. Appropriate State and local statutes must also be considered when assessing the  
4 occupational hazards and health risks for new nuclear unit operation. The staff expects SCE&G  
5 would adhere to NRC, OSHA, and State safety standards, practices and procedures during  
6 operation of the new units.

7 Additional occupational health impacts may result from exposure to hazards such as noise, toxic  
8 or oxygen-replacing gases, thermophilic microorganisms in the condenser bays, and caustic  
9 agents. SCE&G (SCE&G 2009a) reports that it maintains a health and safety program to  
10 protect workers from industrial safety risks at existing Unit 1 and would implement the program  
11 for the proposed new units. Health impacts on workers from nonradiological emissions, noise,  
12 and EMFs would be monitored and controlled in accordance with the applicable OSHA  
13 regulations and would be minimal. Additional mitigation would not be warranted.

#### 14 **5.8.6 Impacts of Transporting Operations Personnel to and from the VCSNS** 15 **Site and Alternative Sites**

16 The general approach used to calculate the nonradiological impacts of fuel and waste  
17 shipments is the same as that used to calculate the impacts of transporting operations and  
18 outage personnel to and from the VCSNS site and alternative sites. However, preliminary  
19 estimates are the only data available to estimate these impacts. The assumptions made to fill in  
20 reasonable estimates of the data needed to calculate nonradiological impacts are discussed  
21 below.

- 22 • The number of workers needed for operations was given in the ER (SCE&G 2009a) as  
23 800 (two units), so each Westinghouse AP1000 reactor at the VCSNS site requires about  
24 400 operating personnel). An additional 1000 temporary workers are estimated to be needed  
25 annually for refueling outages (SCE&G 2009a). It was assumed that outages for the two units  
26 would not occur simultaneously.
- 27 • The average commute distance for operations and outage workers was assumed to be 20 mi  
28 one way.
- 29 • To develop representative commuter traffic impacts, a source was located that provides  
30 South Carolina-specific fatality rates for all traffic for the years 2003 to 2007 (DOT 2009a).  
31 The average fatality rate for the 2003 to 2007 period in South Carolina was used as the basis  
32 for estimating South Carolina-specific injury and accident rates. Adjustment factors were  
33 developed using national-level traffic accident statistics in the U.S. Department of  
34 Transportation (DOT) publication *National Transportation Statistics 2007* (DOT 2007). The  
35 adjustment factors are the ratio of the national injury rate to the national fatality rate and the  
36 ratio of the national accident rate to the national fatality rate. These adjustment factors

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1 were multiplied by the South Carolina-specific fatality rate to approximate the injury and  
2 accident rates for commuters in the State of South Carolina.

3 The estimated impacts of transporting operations and outage workers to and from the VCSNS  
4 site are listed in Table 5-8. The total annual traffic fatalities during operations, including both  
5 operations and outage personnel, represent about a 0.8-percent increase above the 19 traffic  
6 fatalities that occurred in Fairfield County, South Carolina, in 2007 (DOT 2009b). This  
7 represents a small increase relative to the current traffic fatality risk in the area surrounding the  
8 proposed VCSNS site. The impacts of transporting operations workers to and from the  
9 alternative sites range from about a 0.3-percent (at the Savannah River alternative site) to a  
10 2-percent (at the Saluda alternative site) increase in traffic fatalities in the counties in which the  
11 alternative sites are located (DOT 2009c, d, e, f). These differences are solely because of  
12 differences in the average State-specific fatality rates used for operations workers and the  
13 county-specific baseline annual fatalities. Because these increases are small relative to the  
14 baseline traffic fatalities (that is, before the new units are constructed) in the counties where  
15 SCE&G has proposed to build the new units, the review team concludes that the impacts of  
16 transporting construction materials and personnel to the proposed VCSNS site and alternative  
17 sites would be minimal, and mitigation would not be warranted.

18 **Table 5-8.** Nonradiological Impacts of Transporting Operations Workers to and from the  
19 VCSNS Site and Alternative Sites for a Single AP1000 Reactor

	Accidents per Year per Unit	Injuries per Year per Unit	Fatalities per Year per Unit
Permanent workers	$1.2 \times 10^1$	$5.6 \times 10^0$	$8.4 \times 10^{-2}$
Outage workers	$3.7 \times 10^0$	$1.7 \times 10^0$	$2.5 \times 10^{-2}$

### 20 **5.8.7 Summary of Nonradiological Health Impacts**

21 The review team evaluated health impacts on the public and the workers from the cooling  
22 systems, noise generated by unit operations, acute and chronic impacts of EMFs at the higher  
23 power levels, and transporting operations and outage workers to and from the two additional  
24 units. Health risks to workers are expected to be dominated by occupational injuries at rates  
25 below the average U.S. industrial rates. Health impacts on the public and workers from  
26 thermophilic microorganisms, noise generated by operations, and acute impacts of EMFs would  
27 be minimal. Based on the information provided by SCE&G and the review team's independent  
28 evaluation, the review team concludes that the potential impacts of nonradiological effects  
29 resulting from the operation of two proposed additional units would be SMALL, and mitigation  
30 would not be warranted. The staff has not come to conclusions on the chronic impacts of EMFs  
31 on public health.



## 5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts of normal operations of proposed VCSNS Units 2 and 3, including a discussion of the estimated radiation dose to a member of the public and to the biota inhabiting the area around the VCSNS site. Estimated doses to workers at the proposed units are also discussed. Radiological impacts were determined using the Westinghouse AP1000 reactor design with expected direct radiation and liquid and gaseous radiological effluent rates in the evaluation (see discussion in Section 3.4.3).

Revision 15 of the AP1000 design (Westinghouse 2005) is a certified design as set forth in 10 CFR Part 52, Appendix D. Subsequently, Westinghouse submitted Revisions 16 and 17 of the AP1000 design. Revision 1 of SCE&G's ER incorporates Revision 17 of the Design Control Document (DCD); therefore, the COL application and evaluation of radiological impacts of normal operations presented here are based on Revision 17 of the DCD (Westinghouse 2008).

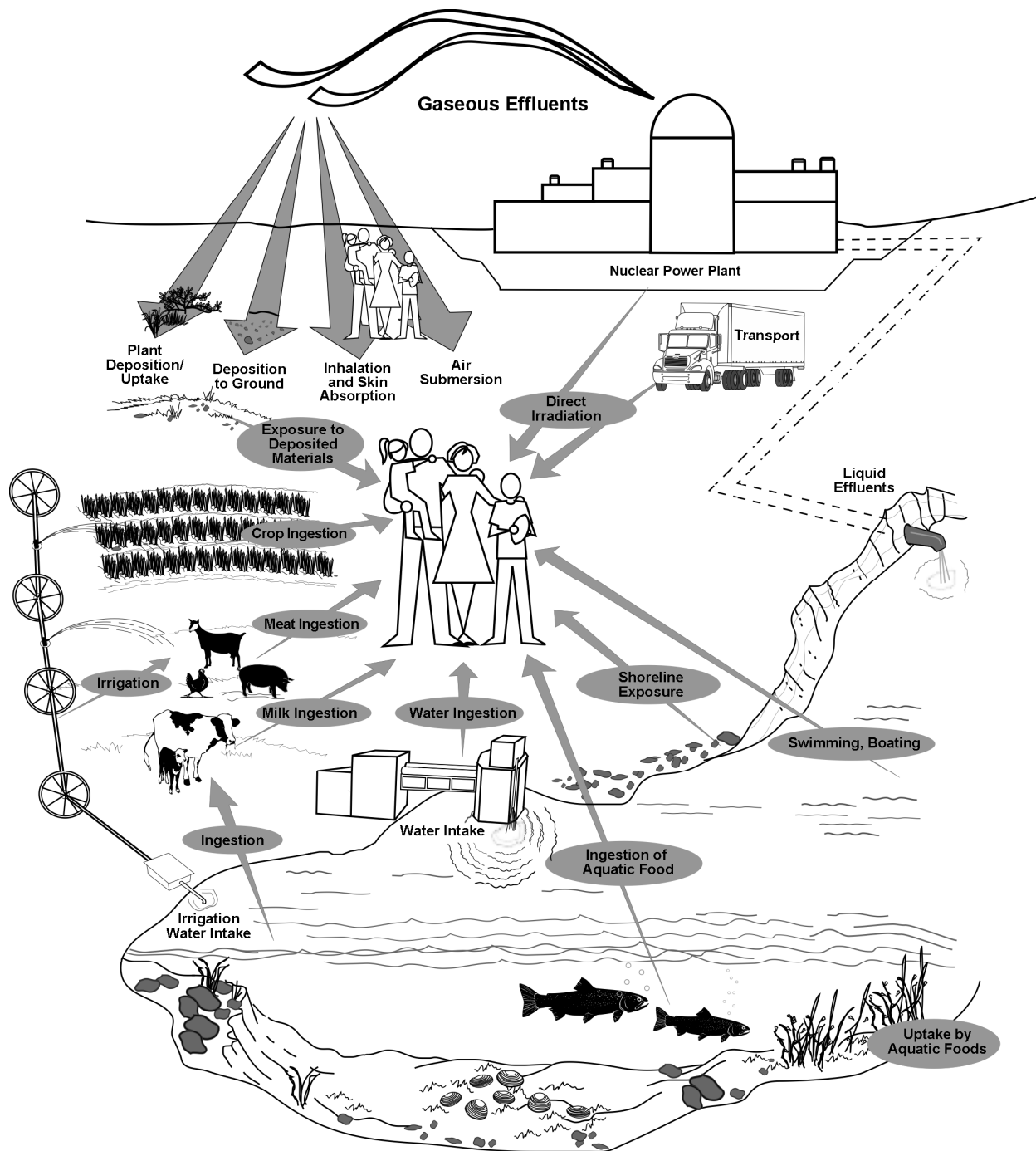
### 5.9.1 Exposure Pathways

The public and biota would receive radiation dose from a nuclear unit via the liquid effluent, gaseous effluent, and direct radiation pathways. SCE&G estimated the potential exposures to the public and biota by evaluating exposure pathways typical of those surrounding a nuclear unit at the VCSNS site. SCE&G considered pathways that could cause the highest calculated radiological dose based on the use of the environment by the residents located around the site (SCE&G 2009a). For example, factors such as the location of homes in the area, consumption of meat from the area, and consumption of vegetables grown in area gardens were considered.

For the liquid effluent release pathway, SCE&G considered the following exposure pathways in evaluating the dose to the maximally exposed individual (MEI): ingestion of aquatic food (i.e., commercial and sport fish); ingestion of drinking water; ingestion of meats, vegetables, and milk (assuming irrigation downstream of the plant using water from Parr Reservoir or the Broad River); and direct radiation exposure from shoreline activities, swimming, and boating (see Figure 5-3). The analysis for population dose considered the following exposure pathways: ingestion of aquatic food, ingestion of drinking water, and direct radiation exposure from shoreline, swimming, and boating activities. Liquid effluents were assumed to be released via the planned discharge structure into Parr Reservoir, which is part of the Broad River).

For the gaseous effluent release pathway, SCE&G (2009a) considered the following exposure pathways in evaluating the dose to the MEI: immersion in the radioactive plume, direct radiation exposure from deposited radioactivity, inhalation, ingestion of garden fruit and vegetables, ingestion of goat and cow milk, and ingestion of meat animals.

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1  
2

Figure 5-3. Exposure Pathways to Man (adapted from Soldat et al. 1974)

1 For population doses from the gaseous effluents, SCE&G (2009a) used the same exposure  
2 pathways as those used for the individual dose assessment (see Figure 5-3). All agricultural  
3 products grown within 50 mi of proposed Unit 3 were assumed to be consumed by the  
4 population dose within 50 mi of proposed new units at the VCSNS site.

5 SCE&G (2009a) stated that direct radiation from the reactor buildings and planned independent  
6 spent-fuel storage installation would be the primary sources of direct radiation exposure to the  
7 public from the VCSNS site. However, SCE&G assumes that contained sources of radiation at  
8 proposed VCSNS Units 2 and 3 would be shielded and would not contribute to the external  
9 dose of the MEI or the population. The assumption of negligible contribution from direct  
10 radiation beyond the site boundary is supported by the DCD (Westinghouse 2008). The  
11 containment and other plant buildings would be shielded and direct radiation from them would  
12 be negligible. The AP1000 design also provides for the storage of refueling water inside the  
13 containment building instead of in an outside storage tank that eliminates it as a  
14 source of significant direct radiation to offsite receptors.

15 Exposure pathways considered in evaluating dose to the biota are shown in Figure 5-4 and  
16 include the following:

- 17 • ingestion of aquatic foods
- 18 • ingestion of water
- 19 • external exposure from water immersion or surface effect
- 20 • inhalation of airborne radionuclides
- 21 • external exposure to immersion in gaseous effluent plumes
- 22 • surface exposure from deposition of iodine and particulates from gaseous effluents (NRC 1977).

23 The staff reviewed the exposure pathways for the public and biota identified by SCE&G (2009a)  
24 and found them to be appropriate, based on a documentation review, a tour of the environs, and  
25 interviews with SCE&G staff and contractors during the site visit in March 2009.

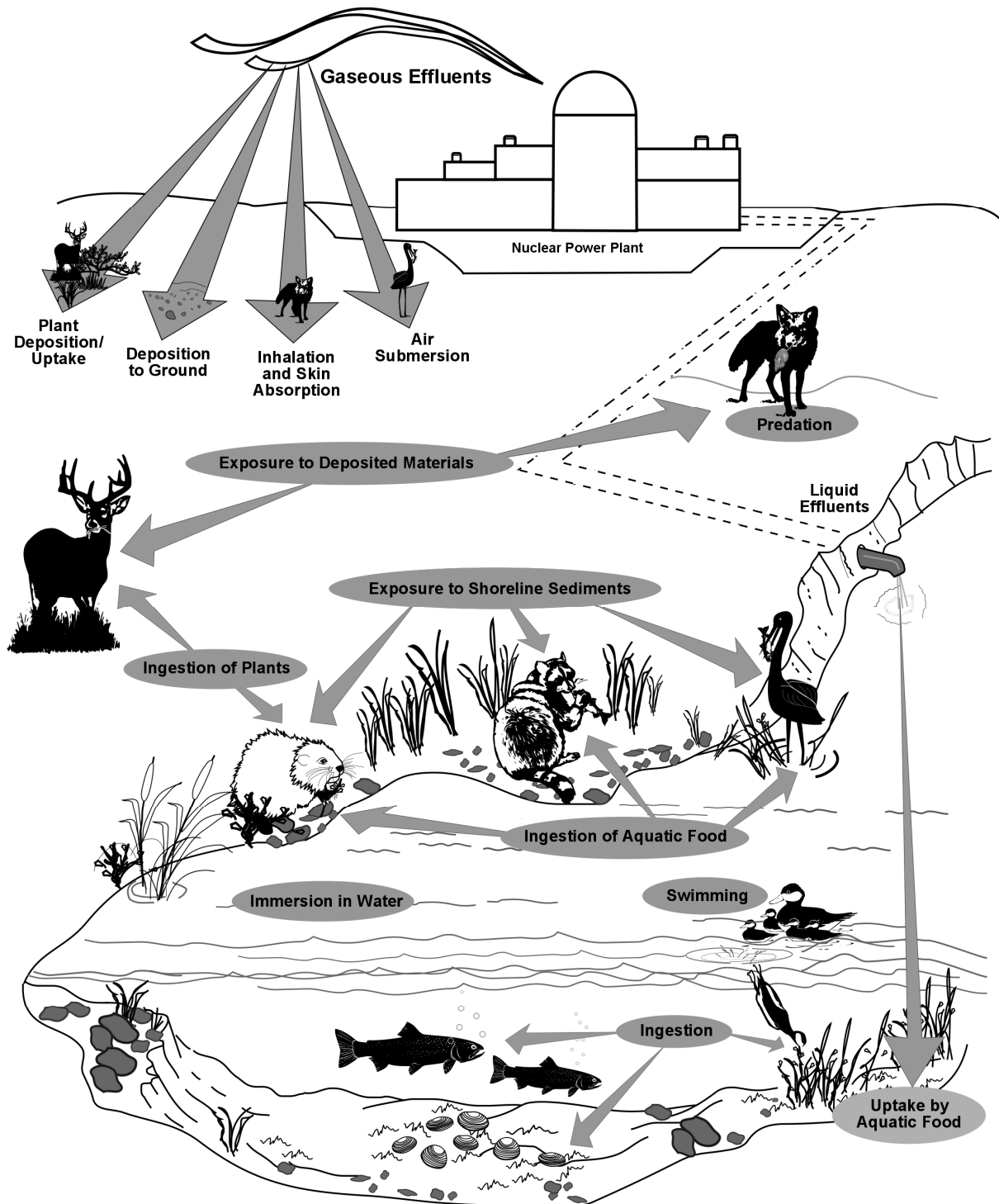
## 26 **5.9.2 Radiation Doses to Members of the Public**

27 SCE&G calculated the dose to the MEI and the population living within a 50-mi radius of the site  
28 from the liquid and gaseous effluent release pathways (SCE&G 2009a). As discussed in  
29 Section 5.9.1, direct radiation exposure to the MEI from sources of radiation at proposed  
30 VCSNS Units 2 and 3 would be negligible.

### 31 **5.9.2.1 Liquid Effluent Pathway**

32 Liquid pathway doses were calculated using the LADTAP II computer program (Strenge et al.  
33 1986). The following activities were considered in the dose calculations: (1) consumption of  
34 drinking water contaminated by liquid effluents, (2) consumption of fish from water sources

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1  
 2 **Figure 5-4.** Exposure Pathways to Biota Other Than Man (adapted from Soldat et al. 1974)

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1 contaminated by liquid effluents, (3) consumption of crops, milk, and meat produced on land  
 2 irrigated with water contaminated by liquid effluents, and (4) direct radiation from waterbodies  
 3 contaminated by liquid effluents during swimming, boating, and recreation along the shoreline.  
 4 The liquid effluent releases used in the estimates of dose are found in Table 3.5-1 of the ER  
 5 (SCE&G 2009a) and listed in Table G-1 of Appendix G of this EIS. Other parameters used as  
 6 inputs to the LADTAP II program include effluent discharge rate, dilution factor for discharge,  
 7 transit time to receptor, and liquid pathway consumption and usage factors (i.e., fish  
 8 consumption and drinking water consumption), and are found in Table 5.4-1 of the ER (SCE&G  
 9 2009a).

10 SCE&G calculated liquid pathway doses to the MEI as shown in Table 5-9 (SCE&G 2009k).  
 11 The MEI was an adult with the majority of the dose from fish and other organisms. The  
 12 maximally exposed organ was the gastrointestinal tract of an adult.

13 **Table 5-9.** Annual Doses to the Maximally Exposed Individual for Liquid Effluent Releases  
 14 from a New Unit

Pathway	Age Group	Maximum Organ		
		Total Body (mrem/yr)	(GI-LLI) (mrem/yr)	Thyroid (mrem/yr)
Drinking Water	Adult	0.029	0.035	0.041
	Teen	0.020	0.025	0.031
	Child	0.038	0.042	0.064
Fish and Other Organisms	Adult	0.058	0.006	0.006
	Teen	0.033	0.005	0.005
	Child	0.013	0.002	0.006
Irrigated Land	Adult	0.052	0.456	0.058
	Teen	0.056	0.330	0.071
	Child	0.078	0.252	0.122
Direct Radiation	Adult	0.0001	0.0001	0.0001
	Teen	0.0003	0.0003	0.0003
	Child	0.0001	0.0001	0.0001
Total	Adult	0.139	0.497	0.104
	Teen	0.110	0.360	0.108
	Child	0.129	0.296	0.192

Source: SCE&G 2009k (LADTAP output attached to NND-09-0203)  
 GI-LLI = gastrointestinal-lower large intestine

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1 The staff recognizes the LADTAP II computer program as an appropriate method for calculating  
2 dose to the MEI for liquid effluent releases. All input parameters used in SCE&G calculations  
3 were judged by the NRC staff to be appropriate.

4 The staff performed an independent evaluation of liquid pathway doses and found similar  
5 results. The results of the NRC staff's independent review are found in Appendix G.

### 6 **5.9.2.2 Gaseous Effluent Pathway**

7 Gaseous pathway doses to the MEI were calculated by SCE&G using the GASPAR II computer  
8 program (Streng et al. 1987) at the nearest residence and the exclusion area boundary. The  
9 GASPAR II computer program was also used to calculate annual population doses. The  
10 following activities were considered in the dose calculations: (1) direct radiation from immersion  
11 in the gaseous effluent cloud and from particulates deposited on the ground, (2) inhalation of  
12 gases and particulates, (3) ingestion of meat from animals eating contaminated grass,  
13 (4) ingestion of milk from animals eating contaminated grass, and (5) ingestion of garden  
14 vegetables contaminated by gases and particulates. The gaseous effluent releases used in the  
15 estimate of dose to the MEI and population are found in Table 3.5-2 of the ER (SCE&G 2009a)  
16 and Table G-4 of Appendix G. Other parameters used as inputs to the GASPAR II program,  
17 including population data, atmospheric dispersion factors, ground deposition factors, receptor  
18 locations, and consumption factors, are found in Tables 2.5-1, 2.7-19 through 2.7-25, and 5.4-3  
19 through 5.4-5 of the ER (SCE&G 2009a). Gaseous pathway doses to the MEI calculated by  
20 SCE&G are found in Table 5-10.

21 The staff recognizes the GASPAR II computer program as an appropriate tool for calculating  
22 dose to the MEI and population from gaseous effluent releases. The staff reviewed the input  
23 parameters and values used by SCE&G (SCE&G 2009a) for appropriateness, including  
24 references made to the AP1000 DCD (Westinghouse 2008). The staff concluded that the  
25 assumed input parameters and values used by SCE&G were appropriate. The staff performed  
26 an independent evaluation of the gaseous pathway doses and obtained similar results for the  
27 MEI (see Appendix G for details).

### 28 **5.9.3 Impacts on a Member of the Public**

29 This section describes the staff's evaluation of the estimated impacts from radiological releases  
30 and direct radiation of two units at the VCSNS site. The evaluation addresses dose from  
31 operations to the MEI located at the VCSNS site and the population dose (collective dose to the  
32 population within 50 mi) around the VCSNS site.

1 **Table 5-10.** Annual Doses to the Maximally Exposed Individual from Gaseous Effluent  
 2 Releases for a New Unit<sup>(a)</sup>

<b>Pathway</b>	<b>Age Group</b>	<b>Total Body Dose (mrem/yr)</b>	<b>Max Organ (mrem/yr)</b>	<b>Skin Dose (mrem/yr)</b>	<b>Thyroid Dose (mrem/yr)</b>
Plume (1.68 mi. SE)	All	0.060	0.065 (lung)	0.33	0.060
Ground (1.68 mi. SE)	All	0.030	0.030 (lung)	0.035	0.030
Inhalation (1.68 mi. SE)	Adult	0.0074	0.0094 (lung)	0.0072	0.066
	Teen	0.0075	0.011 (lung)	0.0072	0.083
	Child	0.0066	0.0092 (lung)	0.0064	0.096
	Infant	0.0038	0.0056 (lung)	0.0037	0.086
Vegetable (1.68 mi. SE)	Adult	0.056	0.29 (bone)	0.048	0.66
	Teen	0.083	0.44 (bone)	0.073	0.89
	Child	0.18	1.00 (bone)	0.17	1.7
Meat (1.68 mi. SE)	Adult	0.017	0.072 (bone)	0.016	0.040
	Teen	0.013	0.061 (bone)	0.013	0.030
	Child	0.024	0.11 (bone)	0.024	0.050
Cow milk (1.68 mi. SE)	Adult	0.025	0.086 <sup>(b)</sup> (bone)	0.020	0.70
	Teen	0.040	0.16 <sup>(b)</sup> (bone)	0.034	1.1
	Child	0.085	0.38 <sup>(b)</sup> (bone)	0.078	2.2
	Infant	0.17	0.73 <sup>(b)</sup> (bone)	0.16	5.3
Goat milk (1.68 mi. SE)	Adult	0.038	0.10 <sup>(b)</sup> (bone)	0.024	0.92
	Teen	0.054	0.18 <sup>(b)</sup> (bone)	0.040	1.5
	Child	0.10	0.43 <sup>(b)</sup> (bone)	0.088	2.9
	Infant	0.19	0.81 <sup>(b)</sup> (bone)	0.17	7.0

Source: SCE&G 2009a

(a) Maximally exposed total body individual is the child of resident gardener at 1.68 mi southeast of VCSNS Units 2 and 3. Adult, teen, and infant doses are presented as additional information. Ground-level releases were assumed. Doses are based on one year's meteorological data.

(b) SCE&G 2009k

### 3 5.9.3.1 Maximally Exposed Individual

4 SCE&G stated that total body and organ dose estimates to the MEI from liquid and gaseous  
 5 effluents from each new unit would be within the dose design objectives of 10 CFR Part 50,  
 6 Appendix I (SCE&G 2009a). Doses from liquid effluents from the use of Parr Reservoir to the  
 7 total body and maximum organ at the nearest residence from liquid effluents would be well  
 8 within the respective 3-mrem/yr and 10 mrem/yr Appendix I dose design objectives. Doses at  
 9 the exclusion area boundary from gaseous effluents would be well within the Appendix I dose  
 10 design objectives of 10 mrad/yr air dose from gamma radiation, 20 mrad/yr air dose from beta  
 11 radiation, 5 mrem/yr to the total body, and 15 mrem/yr to the skin. In addition, dose to the  
 12 thyroid from gaseous effluents would be within the 15 mrem/yr Appendix I dose design  
 13 objective. A comparison of dose estimates for each of two new units to the Appendix I dose  
 14

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1 design objectives is found in Table 5-11. The staff completed an independent evaluation of  
 2 compliance with Appendix I dose design objectives and found similar results, as shown in  
 3 Appendix G.

4 **Table 5-11.** Comparisons of MEI Dose Estimates from Liquid and Gaseous Effluents for a  
 5 Single New Nuclear Unit to 10 CFR Part 50, Appendix I Dose Design Objectives

Radionuclide Releases/Dose	SCE&G Dose Estimates	Appendix I Design Objectives
Liquid effluents <sup>(a)</sup>		
Total body dose	0.14 mrem	3 mrem
Maximum organ dose	0.50 mrem	10 mrem
Gaseous effluents <sup>(b)</sup> (noble gases only)		
Gamma air dose	0.74 mrad	10 mrad
Beta air dose	3.1 mrad	20 mrad
Total body dose	0.60 mrem	5 mrem
Skin dose	2.4 mrem	15 mrem
Gaseous effluents <sup>(c)</sup> (radioiodines and particulates)		
Maximum organ dose (thyroid)	7.2 mrem <sup>(d)</sup>	15 mrem

Source: SCE&G 2009a

(a) Total body and GI-LLI doses are for an adult using the Parr Reservoir.

(b) Southeast Site Boundary; ground-level releases assumed.

(c) Includes tritium, carbon-14, food chain, and inhalation doses.

(d) Infant drinking home-produced goat milk.

6 SCE&G compared the combined dose estimates from direct radiation and gaseous and liquid  
 7 effluents from existing Unit 1 and proposed Units 2 and 3 with the 40 CFR Part 190 standards  
 8 (Table 5-12) (SCE&G 2009a). SCE&G stated that the total body and organ dose estimates to  
 9 the MEI from liquid and gaseous effluents for VCSNS Unit 1 would be less than the estimates  
 10 from Units 2 and 3 and well within the design objectives of 10 CFR Part 50, Appendix I. Direct  
 11 radiation doses from the existing VCSNS Unit 1 at the site boundary do not vary significantly  
 12 from background radiation levels (SCE&G 2009s). As stated in Section 5.9.1, exposure at the  
 13 site boundary from direct radiation sources at the proposed new Units 2 and 3 would be  
 14 negligible and would not contribute significantly to the MEI dose. Table 5-12 shows SCE&G's  
 15 assessment that the total doses to the MEI from liquid and gaseous effluent as well as direct  
 16 radiation at the VCSNS site would be well below the 40 CFR Part 190 standards. The staff  
 17 completed an independent evaluation of compliance with 40 CFR Part 190 standards and found  
 18 similar results, as shown in Appendix G.



1 **Table 5-12.** Comparison of Maximally Exposed Individual Dose Rates with 40 CFR Part 190(a)  
 2 Criteria

	Unit 1	Units 2 and 3			Site Total (mrem/yr)	40 CFR Part 190 Dose Standards (mrem/yr)
	Combined Liquid and Gaseous (mrem/yr)	Liquid (mrem/yr)	Gaseous (mrem/yr)	Combined (mrem/yr)		
Whole body dose	1.2	0.28	0.80	1.1	2.3	25
Thyroid	0.043	0.38 (infant, goat milk)	14 (infant. goat milk)	15	15	75
Other organ	0.043 (bone)	3.3 (child bone)	3.3 (child bone)	3.6	3.6	25

Source: SCE&G 2009o

3 **5.9.3.2 Population Dose**

4 SCE&G estimated the collective total body dose within the 50-mi radius of the proposed VCSNS  
 5 Units 2 and 3 to be 29 person-rem/yr from liquid effluents and 5.8 person-rem/yr from gaseous  
 6 effluents (SCE&G 2009o). The staff estimated the collective dose to the same population from  
 7 background radiation to be 663,000 person-rem/yr (NCRP 2009). The dose from background  
 8 radiation was calculated by multiplying the 50-mi population estimate for 2060 of approximately  
 9 2,131,394 people by the annual background dose rate of 311 mrem/yr (NCRP 2009). SCE&G  
 10 calculated a higher dose from background because it included radiation from medical practice.

11 Collective dose from the gaseous and liquid effluent pathways was estimated using the  
 12 GASPAR II and LADTAP II computer codes, respectively. The staff performed an independent  
 13 evaluation of population doses and obtained similar results (see Appendix G).

14 Radiation protection experts assume that any amount of radiation may pose some risk of causing  
 15 cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures.  
 16 Therefore, a linear, no-threshold dose response relationship is used to describe the relationship  
 17 between radiation dose and detriments such as cancer induction. A recent report by the National  
 18 Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII report, uses the  
 19 linear, no-threshold dose response model as a basis for estimating the risks from low doses.  
 20 This approach is accepted by the NRC as a conservative method for estimating health risks from  
 21 radiation exposure, recognizing that the model may overestimate those risks. Based on this  
 22 method, the staff estimated the risk to the public from radiation exposure using the nominal  
 23 probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers,  
 24 nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv),  
 25 equal to 0.00057 effect per person-rem. The coefficient is taken from Publication 103 of the  
 26 International Commission on Radiological Protection (ICRP 2007).

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1 Both the National Council on Radiation Protection and Measurements (NCRP) and ICRP  
2 suggest that when the collective effective dose is smaller than the reciprocal of the relevant risk  
3 detriment (in other words, less than  $1/0.00057$ , which is less than 1754 person-rem), the risk  
4 assessment should note that the most likely number of excess health effects is zero (NCRP  
5 1995; ICRP 2007). The estimated collective whole body dose to the population living within  
6 50 mi of the proposed new units at the VCSNS site is 29 person-rem/yr (SCE&G 2009o), which  
7 is less than the value of 1754 person-rem/yr that ICRP and NCRP suggest would most likely  
8 result in zero excess health effects (NCRP 1995; ICRP 2007).

9 In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a  
10 study and published, "Cancer in Populations Living Near Nuclear Facilities," in 1990 (Jablon  
11 1990). The NCI report included an evaluation of health statistics around all nuclear power  
12 plants, as well as several other nuclear fuel cycle facilities, in operation in the United States in  
13 1981 and found "no evidence that an excess occurrence of cancer has resulted from living near  
14 nuclear facilities" (Jablon 1990).

### 15 **5.9.3.3 Summary of Radiological Impacts on Members of the Public**

16 The staff evaluated the health impacts from routine gaseous and liquid radiological effluent  
17 releases from the new units at the VCSNS site. Based on the information provided by SCE&G  
18 and NRC's independent evaluation, the staff concludes there would be no observable health  
19 impacts on the public from normal operation of the new units, the health impacts would be  
20 SMALL, and additional mitigation would not be warranted.

### 21 **5.9.4 Occupational Doses to Workers**

22 At the VCSNS site, the annual occupational collective dose for 2005 through 2008 averaged  
23 43 person-rem for the existing VCSNS Unit 1 (SCE&G 2006b, 2007a, 2008a, 2009I). The  
24 collective occupational dose for a single AP1000 reactor was estimated at 67.1 person-rem/yr in  
25 the DCD (Westinghouse 2008). This collective dose was based on an 18-month fuel cycle and  
26 would be bounding for a 24-month fuel cycle.

27 The licensee of a new plant would be required to maintain individual doses to workers to within  
28 5 rem annually as specified in 10 CFR 20.1201 and incorporate provisions to maintain doses as  
29 low as reasonably achievable (ALARA).

30 The staff concludes that the health impacts from occupational radiation exposure would be  
31 SMALL based on individual worker doses being maintained within 10 CFR 20.1201 limits and  
32 collective occupational doses being typical of doses found in current operating light water  
33 reactors. Additional mitigation would not be warranted because the operating plant would be  
34 required to maintain doses ALARA.

## 1 **5.9.5 Impacts on Biota Other Than Humans**

2 SCE&G estimated doses to biota in the VCSNS site environs using surrogate species.  
3 Surrogate species used in the ER are well-defined and provide an acceptable method for  
4 evaluating doses to the biota. Surrogate species analysis was performed for aquatic species  
5 such as fish, invertebrates, and algae, and for terrestrial species such as muskrats, raccoons,  
6 herons, and ducks (SCE&G 2009k). Aquatic species on the VCSNS site are represented by the  
7 freshwater fish, invertebrates, and algae surrogates. Although there is no significant harvesting  
8 of freshwater invertebrates, Asian clams in Monticello Reservoir have been monitored in the  
9 past and found to be free of radioactive contamination (SCE&G 2008b). Terrestrial species are  
10 represented by the muskrat and raccoon surrogates; birds are represented by the heron and  
11 duck surrogates. SCE&G performed no species-specific dose calculations. Exposure pathways  
12 considered in evaluating dose to the biota are discussed in Section 5.9.1 and shown in  
13 Figure 5-4. The NRC staff reviewed SCE&G's calculations (SCE&G 2009k) and performed an  
14 independent evaluation (see Appendix G) of the fish, invertebrates, algae, muskrat, raccoon,  
15 heron, and duck, and found similar results.

### 16 **5.9.5.1 Liquid Effluent Pathway**

17 SCE&G used the LADTAP II computer code to calculate doses to the biota from the liquid  
18 effluent pathway. In estimating the concentration of radioactive effluents in Parr Reservoir  
19 (Broad River), SCE&G assumed there would be no additional dilution in the reservoir. The biota  
20 dose estimates for the proposed units are also conservative because they do not consider  
21 radioactive decay during transit; therefore, actual doses to the biota are likely to be much less  
22 than estimated (SCE&G 2009a). All parameters used as input to LADTAP are shown in Table  
23 G-1 of Appendix G. Liquid pathway doses were higher for biota compared with man because of  
24 considerations for bioaccumulation of radionuclides, ingestion of aquatic plants, ingestion of  
25 invertebrates, and increased time spent in water and shoreline compared with man. The liquid  
26 effluent releases used in estimating biota dose are found in Table 3.5-1 of the ER (SCE&G  
27 2009a). Table 5-13 presents SCE&G's estimates of the doses to biota from the liquid and  
28 gaseous pathways from proposed new Units 2 and 3.

### 29 **5.9.5.2 Gaseous Effluent Pathway**

30 Gaseous effluents would contribute to the total body dose of the terrestrial surrogate species  
31 (i.e., muskrat, raccoon, heron, and duck). The exposure pathways include inhalation of airborne  
32 radionuclides, external exposure because of immersion in gaseous effluent plumes, and surface  
33 exposure from deposition of iodine and particulates from gaseous effluents. SCE&G used the  
34 calculation methods of dose to the MEI from gaseous effluent releases described in Section  
35 5.9.2 to calculate dose to terrestrial surrogate species, with two modifications (SCE&G 2009a).  
36 One modification increased the ground deposition factors by a factor of two to account for the  
37 closer proximity of terrestrial animals to the ground compared with the MEI. The second

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1 modification was to disable the vegetation intake pathway for muskrat and heron because they  
 2 are not known to consume vegetation. In addition, SCE&G assumed that biota could be inside  
 3 the exclusion area boundary at a distance of 0.25 mi southeast of the powerblock area circle to  
 4 estimate these doses (SCE&G 2009a). This assumption is conservative because it results in an  
 5 overestimation of the doses for almost all of the terrestrial biota. The gaseous effluent releases  
 6 used in estimating dose are found in Table 3.5-2 of the ER (SCE&G 2009a). Table 5-13  
 7 presents SCE&G's estimates of the doses to biota from the liquid and gaseous pathways from  
 8 proposed VCSNS Units 2 and 3 (SCE&G 2009a).

9 **Table 5-13.** Biota Doses for Proposed VCSNS Units 2 and 3

Biota	SCE&G Biota Dose Estimates		
	Liquid Pathway (mrad/yr)	Gaseous Pathway (mrad/yr)	Total Body Biota Dose All Pathways (mrad/yr)
Fish	0.82	0	0.82
Invertebrate	2.3	0	2.3
Algae	6.66	0	6.7
Muskrat	2.44	5.04	7.5
Raccoon	0.956	7.4	8.4
Heron	11.14	5.04	16
Duck	2.34	7.4	9.7

Source: SCE&G 2009k

### 10 5.9.5.3 Impact of Estimated Biota Doses

11 The International Atomic Energy Agency (IAEA 1992) and the NCRP (1991) reported that a  
 12 chronic dose rate of no greater than 10 mGy/d (1000 mrad/d) to the MEI in a population of  
 13 aquatic organisms would ensure protection of the population. IAEA (1992) also concluded that  
 14 chronic dose rates of 1 mGy/d (100 mrad/d) or less do not appear to cause observable changes  
 15 in terrestrial animal populations.

16 Table 5-14 compares estimated total body dose rates to surrogate biota species that would be  
 17 produced by releases from Units 2 and 3 to the IAEA/NCRP biota dose guidelines (IAEA 1992;  
 18 NCRP 1991).

19 The maximum total dose from both liquid and gaseous pathways from the bounding calculation  
 20 is about 16 mrad/yr, or about 0.044 mrad/d. Thus doses to biota calculated by both SCE&G  
 21 and the staff are far below the 100-mrad/d (0.1-rad/d) IAEA guidelines (IAEA 1992) for terrestrial  
 22 biota and the 1000-mrad/d (1-rad/d) IAEA guideline (IAEA 1992) for aquatic biota. Daily dose  
 23 rates would not exceed the IAEA guidelines for any surrogate species.

1 **Table 5-14.** Comparison of Biota Doses from Proposed VCSNS Units 2 and 3 to IAEA  
 2 Guidelines for Biota Protection

Biota	SCE&G Estimate of Dose to Biota (mrad/d) <sup>(a)</sup>	IAEA/NCRP Guidelines for Protection of Biota Populations (mrad/d) <sup>(b)</sup>
Fish	$2.2 \times 10^{-3}$	1000
Invertebrate	$6.3 \times 10^{-3}$	1000
Algae	$1.8 \times 10^{-2}$	1000
Muskrat	$2.0 \times 10^{-2}$	100
Raccoon	$2.3 \times 10^{-2}$	100
Heron	$4.4 \times 10^{-2}$	100
Duck	$2.7 \times 10^{-2}$	100

(a) Total dose from liquid and gaseous effluents in Table 5-13 converted to mrad/d.

(b) Guidelines in NCRP and IAEA reports expressed in Gy/d (1 mGy/d equals 100mrad/d).

3 Based on the information provided by SCE&G and the NRC's independent evaluation, the staff  
 4 concludes that the radiological impact on biota from the routine operation of the proposed  
 5 VCSNS Units 2 and 3 at the VCSNS site would be SMALL, and additional mitigation would not  
 6 be warranted.

### 7 **5.9.6 Radiological Monitoring**

8 A radiological environmental monitoring program (REMP) has been in place for the VCSNS Unit  
 9 1 site since its operation began in 1984, with preoperational sample collection activities  
 10 beginning in 1982 (SCE&G 2009a). The REMP includes monitoring of the airborne-exposure  
 11 pathway, direct-exposure pathway, water-exposure pathway, aquatic-exposure pathway from  
 12 Monticello Reservoir, and the ingestion-exposure pathway within a 5-mi radius of the station,  
 13 with indicator locations near the plant perimeter and control locations at distances greater than  
 14 10 mi. An annual survey is conducted for the area surrounding the site to verify the accuracy of  
 15 assumptions used in the analyses, including the occurrence of milk production (SCE&G 2006c,  
 16 2007b, 2008b). The preoperational REMP sampled various media in the environment to  
 17 determine a baseline from which to observe the magnitude and fluctuation of radioactivity in the  
 18 environment once Unit 1 began operation. The preoperational program included collection and  
 19 analysis of samples of air particulates, precipitation, crops, soil, well water, surface water, fish,  
 20 and silt as well as measurement of ambient gamma radiation. After operation of VCSNS Unit 1  
 21 began in 1984, the monitoring program continued to assess the radiological impacts on workers,  
 22 the public, and the environment. Radiological releases are summarized in the two annual  
 23 reports: the Annual Radiological Environmental Operating Report (SCE&G 2006c, 2007b,  
 24 2008b) and the Annual Radioactive Effluent Release Report (SCE&G 2006d, 2007c, 2008c,  
 25 2009m). The limits for all radiological releases are specified in the VCSNS Offsite Dose  
 26 Calculation Manual (ODCM) (SCE&G 2007d). No additional monitoring program has been  
 27 established for the proposed units. To the greatest extent practical, the REMP for the VCSNS

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1 program would use the procedures and sampling locations used by the existing VCSNS site.  
2 The staff reviewed the documentation for the existing REMP, the VCSNS ODCM, and recent  
3 monitoring reports from VCSNS, and determined that the current operational monitoring  
4 program is adequate to establish the radiological baseline for comparison with the expected  
5 impacts on the environment related to the construction and operation of the proposed new units  
6 at the VCSNS site.

7 The annual radioactive effluent release reports for 2005, 2006, and 2007 (SCE&G 2006d,  
8 2007c, 2008c) summarized results of groundwater sampling performed by SCE&G in various  
9 locations around the plant, which may be a source of groundwater contamination. One location  
10 indicated tritium activity very slightly above detection limits. For proposed VCSNS Units 2 and  
11 3, in the Final Safety Analysis Report (FSAR) (SCE&G 2009t), SCE&G adopts NEI 08-08,  
12 "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination" (NEI 2008).

### 13 **5.10 Nonradioactive Waste Impacts**

14 This section describes the potential impacts on the environment that could result from the  
15 generation, handling, and disposal of nonradioactive waste and mixed waste during the  
16 operation of proposed VCSNS Units 2 and 3. Section 3.4.4 of this EIS describes the  
17 nonradioactive waste systems. Types of nonradioactive waste that would be generated,  
18 handled, and disposed of during operational activities include solid wastes, liquid effluents, and  
19 air emissions. Solid wastes include municipal waste, sewage-treatment sludge, and industrial  
20 wastes. Liquid waste includes NPDES-permitted discharges such as effluents containing  
21 chemicals or biocides, wastewater effluents, site stormwater runoff, and other liquid wastes  
22 such as used oils, paints, and solvents that require offsite disposal. Air emissions would  
23 primarily be generated by vehicles and diesel generators. In addition, small quantities of  
24 hazardous waste, and mixed waste, which is waste that has both hazardous and radioactive  
25 characteristics, may be generated during plant operations. The assessment of potential impacts  
26 resulting from these types of wastes is presented in the following sections.

#### 27 **5.10.1 Impacts on Land**

28 Operational solid wastes such as office waste, cardboard, wood, or metal will be recycled or  
29 reused (SCE&G 2009a). SCE&G plans to dispose of municipal solid waste and resins from  
30 plant operations in a SCDHEC-approved disposal facility. In addition, a new sanitary  
31 wastewater-treatment plant would be installed to serve the operational needs of the new units;  
32 plant sludge would be applied at an SCDHEC-approved location onsite or shipped offsite for  
33 disposal at a permitted facility (SCE&G 2009a). Debris from trash racks and screens on the  
34 water-intake structure would be periodically collected and disposed at an onsite location.  
35 SCE&G would follow all applicable Federal, State, and local requirements and standards for  
36 handling, transporting, and disposing of solid waste (SCE&G 2009a).

1 Based on the plans to manage solid and liquid wastes in a similar manner in accordance with all  
2 applicable Federal, State, and local requirements and standards, and the effective practices for  
3 reusing, recycling, and minimizing waste, the review team expects that impacts on land from  
4 nonradioactive wastes generated during the operation of VCSNS Units 2 and 3 would be  
5 minimal, and no further mitigation would be warranted.

### 6 **5.10.2 Impacts on Water**

7 Water withdrawn from the Monticello Reservoir for cooling and other operational purposes for  
8 the proposed Units 2 and 3 would be discharged to the Parr Reservoir. These discharges  
9 would contain both chemicals and biocides and be controlled by the NPDES permit. Other  
10 potential nonradioactive liquid effluent from proposed Units 2 and 3 operations are stormwater  
11 runoff and sanitary wastewater discharges (SCE&G 2009a). In all cases, the NPDES permit  
12 would limit the volume and constituents concentrations. Sections 5.2.3.1 and 5.2.3.2 of this EIS  
13 discuss impacts on surface and groundwater quality from operation of VCSNS Units 2 and 3.

14 Based on the regulated practices for managing liquid discharges containing chemicals or  
15 biocides, wastewater, and the plans for managing stormwater, the review team expects that  
16 impacts on water from nonradioactive effluents during the operation of VCSNS Units 2 and 3  
17 would be minimal, and no further mitigation would be warranted.

### 18 **5.10.3 Impacts on Air**

19 Operation of proposed VCSNS Units 2 and 3 would result in gaseous emission from operation  
20 of diesel generators. Impacts on air quality are discussed in Section 5.7.2 of this EIS. In  
21 addition, vehicular traffic associated with personnel necessary to operate Units 2 and 3 would  
22 increase vehicle emissions in the area. Increases in air emissions from the operation of Units 2  
23 and 3 would require compliance with the Federal and State air quality control laws and  
24 regulations (SCE&G 2009a).

25 Based on the regulated practices for managing air emissions from stationary sources, the  
26 review team expects that impacts on air from nonradioactive emissions during the operation of  
27 VCSNS Units 2 and 3 would be minimal, and no further mitigation would be warranted.

### 28 **5.10.4 Mixed-Waste Impacts**

29 Mixed waste contains both low-level radioactive waste and hazardous waste. The generation,  
30 storage, treatment, or disposal of mixed waste is regulated by the Atomic Energy Act, the Solid  
31 Waste Disposal Act of 1965, as amended by the Resource, Conservation, and Recovery Act  
32 (RCRA) in 1976, and the Hazardous and Solid Waste Amendments (which amended RCRA in  
33 1984). Each new reactor at the VCSNS site can be expected to produce approximately 17 ft<sup>3</sup>/yr  
34 of liquid and 7.5 ft<sup>3</sup>/yr of solid mixed waste. In addition, SCE&G has implemented a waste-

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1 minimization plan to reduce the amount of mixed waste produced onsite. SCE&G stated that  
2 the treatment, storage, and disposal of mixed wastes generated by the proposed Units 2 and 3  
3 would be managed as the existing Unit 1 mixed wastes is managed (SCE&G 2009a).

4 Based on the practices for minimizing waste currently in place for VCSNS Unit 1 and the plans  
5 to manage mixed wastes in a similar manner in accordance with all applicable Federal, State,  
6 and local requirements and standards, the review team expects that impacts from the  
7 generation of mixed waste at VCSNS Units 2 and 3 would be minimal, and no further mitigation  
8 would be warranted.

### 9 **5.10.5 Summary of Nonradiological Impacts**

10 Solid, liquid, gaseous, and mixed wastes generated during operation of VCSNS Units 2 and 3  
11 would be handled according to county, State, and Federal regulations. County and State  
12 permits and regulations for handling and disposal of solid waste would be obtained and  
13 implemented. Discharges to the Monticello Reservoir of liquid effluents used for operations,  
14 including wastewater and stormwater, would be controlled and limited via an NPDES permit. Air  
15 emissions from Units 2 and 3 operations would be compliant with local, State, and Federal air  
16 quality standards and regulations. Mixed waste generation, storage, and disposal impacts  
17 during operation of proposed Units 2 and 3 would be compliant with requirements and  
18 standards.

19 Based on the information provided by SCE&G, the effective practices for recycling, minimizing,  
20 managing, and waste disposal planned to be used at the VCSNS site, the expectation that  
21 regulatory approvals will be obtained to regulate the additional waste that would be generated  
22 from proposed Unit 3, and the independent evaluations as discussed in the referenced sections  
23 of this EIS, the review team concludes that the potential impacts from nonradioactive waste  
24 resulting from the operation of the proposed additional units at the VCSNS site would be  
25 SMALL, and no further mitigation would be warranted.

26 Cumulative impacts on water and air from nonradiological effluents and emissions are  
27 discussed in Sections 7.2 and 7.6, respectively. For the purposes of Chapter 9, the review team  
28 expects that there would be no substantive differences between the impacts of nonradiological  
29 waste for the proposed Units 2 and 3 and the alternative sites and no substantive cumulative  
30 impacts that warrant further discussion beyond those discussed for the alternative sites in  
31 Section 9.3.

## 32 **5.11 Environmental Impacts of Postulated Accidents**

33 The NRC staff considered the radiological consequences on the environment of potential  
34 accidents at proposed VCSNS Units 2 and 3. SCE&G based its COL application on the  
35 proposed installation of AP1000 reactors for proposed Units 2 and 3. Revision 15 of the AP1000



1 design (Westinghouse 2005) is a certified design as set forth in the 10 CFR Part 52, Appendix D.  
2 Subsequently, Westinghouse submitted Revision 17 of the AP1000 design (Westinghouse  
3 2008). The SCE&G application references Revision 17 of the AP1000 DCD. The NRC staff is  
4 reviewing the Westinghouse application to amend the design certification rule for the AP1000.

5 The term “accident,” as used in this section, refers to any off-normal event not addressed in  
6 Section 5.9 that results in the release of radioactive materials into the environment. The focus  
7 of this review is on events that could lead to releases substantially in excess of permissible  
8 limits for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B,  
9 Table 2.

10 Numerous features combine to reduce the risk associated with accidents at nuclear power  
11 plants. Safety features in the design, construction, and operation of the plants, which compose  
12 the first line of defense, are intended to prevent the release of radioactive materials from the  
13 plant. The design objectives and the measures for keeping levels of radioactive materials in  
14 effluents to unrestricted areas ALARA are specified in 10 CFR Part 50, Appendix I. Additional  
15 measures are designed to mitigate the consequences of failures in the first line of defense.  
16 These measures include the NRC’s reactor siting criteria in 10 CFR Part 100, which require the  
17 site to have certain characteristics that reduce the risk to the public and the potential impacts of  
18 an accident, and emergency preparedness plans and protective action measures for the site  
19 and environs, as set forth in 10 CFR 50.47; 10 CFR Part 50, Appendix E; and NUREG-  
20 0654/FEMA-REP-1 (NRC 1980). All of these safety features, measures, and plans make up the  
21 defense-in-depth philosophy to protect the health and safety of the public and the environment.

22 This section discusses (1) the types of radioactive materials that may be released, (2) the  
23 potential paths for their release to the environment, (3) the relationship between radiation dose  
24 and health effects, and (4) the environmental impacts of reactor accidents, both design basis  
25 accidents (DBAs) and severe accidents. The environmental impacts of accidents during  
26 transportation of spent fuel are discussed in Chapter 6.

27 The potential for dispersion of radioactive materials in the environment depends on the  
28 mechanical forces that physically transport the materials and on the physical and chemical  
29 forms of the material. Radioactive material exists in a variety of physical and chemical forms.  
30 Most of the material in the fuel is in the form of nonvolatile solids. However, after operation, a  
31 significant fraction of the material is in the form of volatile solids or gases. The gaseous  
32 radioactive materials include the chemically inert noble gases (e.g., krypton and xenon), which  
33 have a high potential for release. Radioactive forms of iodine, which are created in substantial  
34 quantities, are volatile. Other radioactive materials formed during the operation of a nuclear  
35 power plant have lower volatilities and, therefore, have lower tendencies to escape from the fuel  
36 than the noble gases and isotopes of iodine.

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1 Radiation exposure to individuals is determined by their proximity to radioactive material, the  
2 duration of their exposure, and the extent to which they are shielded from the radiation.  
3 Pathways that lead to radiation exposure include (1) external radiation from radioactive material  
4 in the air, on the ground, and in the water, (2) inhalation of radioactive material, and  
5 (3) ingestion of food or water containing material initially deposited on the ground and in water.

6 Radiation protection experts assume that any amount of radiation may pose some risk of causing  
7 cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures.  
8 Therefore, a linear, no-threshold dose response relationship is used to describe the relationship  
9 between radiation dose and detriments such as cancer induction. A recent report by the National  
10 Research Council (2006), the BEIR VII report, uses the linear, no-threshold dose response  
11 model as a basis for estimating the risks from low doses. This approach is accepted by the NRC  
12 as a conservative method for estimating health risks from radiation exposure, recognizing that  
13 the model may overestimate those risks.

14 Physiological effects are clinically detectable if individuals receive radiation exposure resulting in  
15 a dose greater than about 25 rem over a short period of time (hours). Untreated doses of about  
16 250 to 500 rem received over a relatively short period (hours to a few days) can be expected to  
17 cause some fatalities.

### 18 **5.11.1 Design Basis Accidents**

19 SCE&G evaluated the potential consequences of postulated accidents to demonstrate that a  
20 AP1000 reactor could be constructed and operated at the VCSNS site without undue risk to the  
21 health and safety of the public (SCE&G 2009a). These evaluations used a set of DBAs that are  
22 representative for the reactor design being considered for the VCSNS site and site-specific  
23 meteorological data. The set of accidents covers events that range from relatively high  
24 probability of occurrence with relatively low consequences to relatively low probability with high  
25 consequences.

26 The DBA review focuses on the AP1000 reactor at the VCSNS site. The bases for analyses of  
27 postulated accidents for this design are well established because they have been considered as  
28 part of the NRC's reactor design certification process. Potential consequences of DBAs are  
29 evaluated by following procedures outlined in regulatory guides and standard review plans. The  
30 potential consequences of accidental releases depend on the specific radionuclides released,  
31 the amount of each radionuclide released, and the meteorological conditions. The source terms  
32 for the AP1000 reactor and methods for evaluating potential accidents are based on guidance in  
33 Regulatory Guide 1.183 (NRC 2000a).

34 For environmental reviews, consequences are evaluated assuming realistic meteorological  
35 conditions. Meteorological conditions are represented in these consequence analyses by an  
36 atmospheric dispersion factor, which is also referred to as relative concentration ( $\chi/Q$ ; units of

1 s/m<sup>3</sup>). Acceptable methods of calculating  $\chi/Q$  for DBAs from meteorological data are set forth in  
 2 Regulatory Guide 1.145 (NRC 1983).

3 Table 5-15 lists  $\chi/Q$  values pertinent to the environmental review of DBAs for the proposed  
 4 VCSNS site. Small  $\chi/Q$  values are associated with greater dilution capability. The first column  
 5 lists the time periods and boundaries for which  $\chi/Q$  and dose estimates are needed. For the  
 6 exclusion area boundary, the postulated DBA dose and its atmospheric dispersion factor are  
 7 calculated for a short-term period (i.e., 2 hours), and for the low-population zone, they are  
 8 calculated for the course of the accident (i.e., 30 days composed of four time periods). The  
 9 second column lists the  $\chi/Q$  values for the SCE&G's site (SCE&G 2009p); these values are  
 10 calculated at the exclusion area boundary and low-population zone using 2 years of  
 11 meteorological data (January 1, 2007 through December 31, 2008) for the SCE&G site. A  
 12 ground-level release was defined to occur at any point on the periphery of a circular area that  
 13 encompassed the shield buildings for proposed Units 2 and 3 (SCE&G 2009p). Building wake  
 14 effects were not taken into account (SCE&G 2009p), thereby resulting in more conservative  
 15 estimates of  $\chi/Q$ .

16 **Table 5-15.** Atmospheric Dispersion Factors for the VCSNS Site DBA Calculations

Time Period and Boundary	$\chi/Q$ (s/m <sup>3</sup> )
0 to 2 hr, Exclusion Area Boundary	$9.46 \times 10^{-5}$
0 to 8 hr, Low-Population Zone	$1.07 \times 10^{-5}$
8 to 24 hr, Low-Population Zone	$8.67 \times 10^{-6}$
1 to 4 d, Low-Population Zone	$5.52 \times 10^{-6}$
4 to 30 d, Low-Population Zone	$2.89 \times 10^{-6}$

Source: SCE&G 2009p

17 The NRC staff reviewed the meteorological data used by SCE&G and the method used to  
 18 calculate the atmospheric dispersion factors. Based on these reviews, the NRC staff concludes  
 19 that the atmospheric dispersion factors for the VCSNS site are acceptable for use in evaluating  
 20 potential environmental consequences of postulated DBAs for the AP1000 reactor design at the  
 21 VCSNS site.

22 Table 5-16 lists the set of DBAs considered by SCE&G and presents NRC staff estimates of the  
 23 environmental consequences of each accident in terms of total effective dose equivalent  
 24 (TEDE). TEDE is estimated by the sum of the committed effective dose equivalent from  
 25 inhalation and the effective dose equivalent from external exposure. Dose conversion factors  
 26 from Federal Guidance Report 11 (Eckerman et al. 1988) were used to calculate the committed  
 27 effective dose equivalent. Similarly, dose conversion factors from Federal Guidance Report 12  
 28 (Eckerman and Ryman 1993) were used to calculate the effective dose equivalent.

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1 **Table 5-16.** DBA Doses for an AP1000 Reactor for Proposed VCSNS Units 2 and 3

Accident	Standard Review Plan Section <sup>(b)</sup>	TEDE in rem <sup>(a)</sup>		
		EAB <sup>(c)</sup>	LPZ <sup>(d)</sup>	Review Criterion
Main Steam Line Break	15.1.5			
Pre-existing iodine spike		$9.5 \times 10^{-2}$	$1.9 \times 10^{-2}$	$2.5 \times 10^{+1(e)}$
Accident-initiated iodine spike		$1.0 \times 10^{-1}$	$5.2 \times 10^{-2}$	$2.5 \times 10^{+0(f)}$
Steam Generator Tube Rupture	15.6.3			
Pre-existing iodine spike		$2.1 \times 10^{-1}$	$2.7 \times 10^{-2}$	$2.5 \times 10^{+1(e)}$
Accident-initiated iodine spike		$1.0 \times 10^{-1}$	$1.8 \times 10^{-2}$	$2.5 \times 10^{+0(f)}$
Loss-of-Coolant Accident	15.6.5	$4.6 \times 10^{+0}$	$1.1 \times 10^{+0}$	$2.5 \times 10^{+1(e)}$
Rod Ejection	15.4.8	$3.4 \times 10^{-1}$	$1.2 \times 10^{-1}$	$6.25 \times 10^{+0(f)}$
Reactor Coolant Pump Rotor Seizure (locked rotor)	15.3.3			
No feedwater		$7.6 \times 10^{-2}$	$8.3 \times 10^{-3}$	$2.5 \times 10^{+0(f)}$
Feedwater available		$5.7 \times 10^{-2}$	$1.7 \times 10^{-2}$	$2.5 \times 10^{+0(f)}$
Failure of Small Lines Carrying Primary Coolant Outside Containment	15.6.2	$2.0 \times 10^{-1}$	$2.2 \times 10^{-2}$	$2.5 \times 10^{+0(f)}$
Fuel Handling	15.7.4	$4.9 \times 10^{-1}$	$5.5 \times 10^{-2}$	$6.25 \times 10^{+0(f)}$

- (a) To convert rem to Sv, divide by 100.  
 (b) NUREG-0800 (NRC 2007)  
 (c) EAB = exclusion area boundary.  
 (d) LPZ = low population zone.  
 (e) 10 CFR 52.79(a)(1) and 10 CFR 100.21 criteria.  
 (f) Standard Review Plan criterion.

2 The NRC staff reviewed SCE&G's selection of DBAs by comparing the accidents listed in the  
 3 COL application with the DBAs considered in Revision 17 of the AP1000 DCD, which is  
 4 currently in the design-certification process. The DBAs in the ER are the same set as those  
 5 considered in this design certification, therefore the NRC staff concludes that the set of DBAs is  
 6 appropriate.

7 There are no environmental criteria related to the potential consequences of DBAs.  
 8 Consequently, the review criteria used in the NRC staff's safety review of DBA doses are  
 9 included in Table 5-16 to illustrate the magnitude of the calculated environmental consequences  
 10 (TEDE doses). In all cases, the calculated TEDE values are considerably smaller than the  
 11 TEDE doses used as safety review criteria; therefore, the NRC staff concludes that, with respect  
 12 to DBAs, the VCSNS site is environmentally suitable for an AP1000 reactor.

1 **Summary of DBA Impacts**

2 The NRC staff reviewed the DBA analysis in the ER, which is based on analyses performed for  
3 design certification of the AP1000 reactor design with adjustment for VCSNS site-specific  
4 characteristics. The NRC staff also performed its own independent DBA analysis. The results  
5 of the SCE&G and the NRC staff analyses indicate that the environmental consequences  
6 associated with DBAs, if an AP1000 reactor were to be located at the VCSNS site, would be  
7 small. On this basis, the NRC staff concludes that the environmental consequences of DBAs at  
8 the VCSNS site would be of SMALL for an AP1000 reactor.

9 **5.11.2 Severe Accidents**

10 In its ER, SCE&G considers the potential consequences of severe accidents for an AP1000  
11 reactor at the VCSNS site. Three pathways are considered: (1) the atmospheric pathway, in  
12 which radioactive material is released to the air, (2) the surface-water pathway, in which  
13 airborne radioactive material falls out on open bodies of water, and (3) the groundwater  
14 pathway, in which groundwater is contaminated by a basemat melt-through with subsequent  
15 contamination of surface water by the groundwater.

16 SCE&G's consequence assessment is based on the probabilistic risk assessment (PRA) for  
17 Revision 15 of the AP1000 design (Westinghouse 2005), which is certified in 10 CFR Part 52,  
18 Appendix D. Westinghouse subsequently upgraded and updated the PRA model; however,  
19 Westinghouse reviewed the AP1000 PRA report submitted with Revision 15 of the DCD and  
20 concluded that the reported results and insights remain valid for proposed revisions of the DCD  
21 (Westinghouse 2007). The NRC staff evaluated the current PRA model and its results using  
22 "Probabilistic Risk Assessment Information to Support Design Certification and Combined  
23 License Applications" (DC/COL-ISG-3; NRC 2008a), and concluded that the Revision 15 results  
24 remain conservative and are an acceptable basis for evaluating severe accidents and strategies  
25 for mitigating them. SCE&G is required by regulation to upgrade and update the PRA prior to  
26 fuel loading. At that time, the NRC staff expects the PRA to be site-specific and that it will no  
27 longer use the bounding assumptions of the design-specific PRA.

28 The SCE&G evaluation (SCE&G 2009a) of the potential environmental consequences for the  
29 atmospheric and surface-water pathways incorporates the results of the Melcor Accident  
30 Consequence Code System (MACCS2) computer code Version 1.13 (Chanin and Young 1997)  
31 using AP1000 reactor source-term information and site-specific meteorological, population, and  
32 land-use data. SCE&G provided the NRC with copies of the input and output files for the  
33 MACCS2 computer code runs (SCE&G 2009n). The NRC staff reviewed the input and output  
34 files, ran confirmatory calculations, and determined that SCE&G's results are reasonable.

## Station Operation Impacts at the VC Summer Site

1 The MACCS computer code was developed to evaluate the potential offsite consequences of  
2 severe accidents for the sites covered by NUREG-1150 (NRC 1990). The MACCS2 code  
3 evaluates the consequences of atmospheric releases of material following a severe accident.  
4 The pathways modeled include exposure to the passing plume, exposure to material deposited  
5 on the ground and skin, inhalation of material in the passing plume and resuspended from the  
6 ground, and ingestion of contaminated food and surface water.

7 Three types of severe accident consequences were assessed in the MACCS2 analysis:  
8 (1) human health, (2) economic costs, and (3) land area affected by contamination. Human  
9 health effects are expressed in terms of the number of cancers that might be expected if a  
10 severe accident were to occur. These effects are directly related to the cumulative radiation  
11 dose received by the general population. MACCS2 estimates both early cancer fatalities and  
12 latent fatalities. Early fatalities are related to high doses or dose rates and can be expected to  
13 occur within a year of exposure (Jow et al. 1990).

14 Latent fatalities are related to exposure of a large number of people to low doses and dose rates  
15 and can be expected to occur after a latent period of several (2 to 15) years. Population health-  
16 risk estimates are based on the population distribution within a 50-mi radius of the site.  
17 Economic costs of a severe accident include the costs associated with short-term relocation of  
18 people; decontamination of property and equipment; interdiction of food supplies, land, and  
19 equipment use; and condemnation of property. The affected land area is a measure of the areal  
20 extent of the residual contamination following a severe accident. Farmland decontamination is  
21 an estimate of the area that has an average whole body dose rate for the 4-year period  
22 following the release that would be greater than 0.5 rem/yr if not reduced by decontamination  
23 and that would have a dose rate following decontamination of less than 0.5 rem/yr.  
24 Decontaminated land is not necessarily suitable for farming.

25 Risk is the product of the probability and the consequences of an accident. For example, the  
26 probability of a severe accident without loss of containment for an AP1000 reactor at the  
27 VCSNS site is estimated to be  $2.2 \times 10^{-7}/\text{Ryr}$ , and the cumulative population dose associated  
28 with a severe accident without loss of containment at the VCSNS site is calculated to be  
29  $5.91 \times 10^{+3}$  person-rem. The population dose risk for this class of accidents is the product of  
30  $2.2 \times 10^{-7}/\text{Ryr}$  and  $5.91 \times 10^{+3}$  person-rem, or  $1.30 \times 10^{-3}$  person-rem/Ryr. The following  
31 sections discuss the estimated risks associated with each pathway.

32 The risks presented in the tables that follow are risks per year of reactor operation. SCE&G  
33 plans to build two AP1000 reactors on the VCSNS site. The consequences of a severe  
34 accident would be the same regardless of whether one or two AP1000 reactors were built at the  
35 VCSNS site. However, if two AP1000 reactors were built, the risks would apply to each reactor,  
36 and the total risk for the two new reactors at the site would be double the risk for a single  
37 reactor. A discussion of these risks is presented in the following sections.

### 1 **5.11.2.1 Estimated Risks of Releases to the Air Pathway**

2 The MACCS2 code directly estimates consequences associated with releases to the air  
3 pathway. The risks calculated from the results of the MACCS2 runs are presented in  
4 Table 5-17 (SCE&G 2009a). The core damage frequencies (CDFs) given in these tables are for  
5 internally initiated accident sequences while the plant is at power. Internally initiated accident  
6 sequences include sequences that are initiated by human error, equipment failures, loss of  
7 offsite power, etc. Estimates of the CDFs for externally initiated events and during shutdown  
8 are discussed later.

9 Table 5-17 shows that the risks of severe accidents for an AP1000 reactor located on the  
10 VCSNS site are small for all risk categories considered. For perspective, Table 5-18 and  
11 Table 5-19 compare the health risks from severe accidents for an AP1000 reactor at the  
12 VCSNS site with the risks for current-generation reactors at various sites and with an AP1000  
13 reactor at the North Anna, Clinton, Grand Gulf, and Vogtle Early Site Permit sites. Table 5-19  
14 also provides the CDFs and population dose risk for the existing Unit 1 reactor at the VCSNS  
15 site.

16 In Table 5-18, the health risks estimated for an AP1000 reactor at the VCSNS site are  
17 compared with health-risk estimates for the five reactors considered in NUREG-1150  
18 (NRC 1990). Although risks associated with both internally and externally initiated events were  
19 considered for the Peach Bottom and Surry reactors in NUREG-1150, only risks associated with  
20 internally initiated events are presented in Table 5-18. Table 5-18 also compares health risks of  
21 an AP1000 reactor at the VCSNS site with health risks for an AP1000 reactor at four Early Site  
22 Permit sites (NRC 2006a, b, c, 2008c).

23 The last two columns of Table 5-18 provide average individual fatality risk estimates. To put  
24 these estimates into context for the environmental analysis, the NRC staff compares these  
25 estimates to the safety goals. The Commission has set safety goals for average individual early  
26 fatality and latent cancer fatality risks from reactor accidents in the Safety Goal Policy Statement  
27 (51 FR 30028). These goals are presented here solely to provide a point of reference for the  
28 environmental analysis and do not serve the purpose of a safety analysis. The Policy  
29 Statement expressed the Commission's policy regarding the acceptance level of radiological  
30 risk from nuclear power plant operation as follows (51 FR 30028):

- 31 • Individual members of the public should be provided a level of protection from the  
32 consequences of nuclear power plant operation such that individuals bear no  
33 significant additional risk to life and health.

34

**Table 5-17. Mean Environmental Risks from an AP1000 Reactor Severe Accident at the VCSNS Site**

Release Category Description (Accident Class)	Environmental Risk									
	Core Damage Frequency (Ryr)	Population Dose (person-rem/Ryr) <sup>(a)</sup>	Fatalities (per Ryr)		Cost <sup>(d)</sup> (\$/Ryr)	Farm Land Decontamination <sup>(e)</sup> (ac/Ryr)	Population Dose from Water Ingestion (person-rem/Ryr) <sup>(a)</sup>			
			Early <sup>(b)</sup>	Latent <sup>(c)</sup>						
IC Intact containment	$2.2 \times 10^{-7}$	$1.3 \times 10^{-3}$	$0.0 \times 10^{-0}$	$7.8 \times 10^{-7}$	$1.5 \times 10^{-1}$	$2.5 \times 10^{-6}$	$1.0 \times 10^{-3}$			
BP Containment bypass, fission products released directly to environment	$1.1 \times 10^{-8}$	$8.1 \times 10^{-2}$	$2.2 \times 10^{-8}$	$5.0 \times 10^{-5}$	$2.2 \times 10^{-2}$	$2.5 \times 10^{-3}$	$5.4 \times 10^{-3}$			
CI Containment isolation failure occurs prior to onset of core damage	$1.3 \times 10^{-9}$	$3.0 \times 10^{-3}$	$1.7 \times 10^{-10}$	$1.8 \times 10^{-6}$	$7.1 \times 10^{-0}$	$1.1 \times 10^{-4}$	$1.1 \times 10^{-4}$			
CFE Early containment failure, after onset of core damage but before core relocation	$7.5 \times 10^{-9}$	$1.8 \times 10^{-2}$	$1.4 \times 10^{-9}$	$1.1 \times 10^{-5}$	$4.4 \times 10^{-1}$	$6.1 \times 10^{-4}$	$8.2 \times 10^{-4}$			
CFI Intermediate containment failure, after core relocation but before 24 hours	$1.9 \times 10^{-10}$	$6.1 \times 10^{-4}$	$1.0 \times 10^{-11}$	$3.7 \times 10^{-7}$	$1.7 \times 10^{-0}$	$3.1 \times 10^{-5}$	$1.1 \times 10^{-5}$			
CFL Late containment failure occurring after 24 hours	$3.5 \times 10^{-13}$	$1.6 \times 10^{-6}$	$0.0 \times 10^{-0}$	$9.7 \times 10^{-10}$	$5.6 \times 10^{-3}$	$7.4 \times 10^{-8}$	$2.3 \times 10^{-9}$			
Total	$2.4 \times 10^{-7}$	$1.0 \times 10^{-1}$	$2.4 \times 10^{-8}$	$6.4 \times 10^{-5}$	$2.7 \times 10^{-2}$	$3.2 \times 10^{-3}$	$6.4 \times 10^{-3}$			

Source: SCE&G 2009a

(a) To convert person-rem to person-Sv, divide by 100.

(b) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).

(c) Latent fatalities are fatalities related to low doses or dose rates that can be expected to occur after a latent period of several (2 to 15) years.

(d) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).

(e) Land risk is the area where the average whole body dose rate for the 4-year period following the accident exceeds 0.5 rem/yr but can be reduced to less than 0.5 rem/yr by decontamination.



**Table 5-18. Comparison of Environmental Risks for an AP1000 Reactor at the VCSNS Site with Risks for Current-Generation Reactors at Five Sites Evaluated in NUREG-1150<sup>(a)</sup> and the AP1000 at Four Early Site Permit Sites**

	Core Damage Frequency (Ryr)	50-mi Population Dose Risk (person-rem/Ryr) <sup>(b)</sup>		Fatalities (per Ryr)		Average Individual Fatality Risk (per Ryr)	
			Risk (person-rem/Ryr) <sup>(b)</sup>	Early	Latent	Early	Latent Cancer
Grand Gulf <sup>(c)</sup>	4.0 x 10 <sup>-6</sup>	5 x 10 <sup>-1</sup>	8 x 10 <sup>-9</sup>	9 x 10 <sup>-4</sup>	3 x 10 <sup>-11</sup>	3 x 10 <sup>-10</sup>	
Peach Bottom <sup>(c)</sup>	4.5 x 10 <sup>-6</sup>	7 x 10 <sup>+2</sup>	2 x 10 <sup>-8</sup>	5 x 10 <sup>-3</sup>	5 x 10 <sup>-11</sup>	4 x 10 <sup>-10</sup>	
Sequoyah <sup>(c)</sup>	5.7 x 10 <sup>-5</sup>	1 x 10 <sup>+3</sup>	3 x 10 <sup>-5</sup>	1 x 10 <sup>-2</sup>	1 x 10 <sup>-8</sup>	1 x 10 <sup>-8</sup>	
Surry <sup>(c)</sup>	4.0 x 10 <sup>-5</sup>	5 x 10 <sup>+2</sup>	2 x 10 <sup>-6</sup>	5 x 10 <sup>-3</sup>	2 x 10 <sup>-8</sup>	2 x 10 <sup>-9</sup>	
Zion <sup>(c)</sup>	3.4 x 10 <sup>-4</sup>	5 x 10 <sup>+3</sup>	4 x 10 <sup>-5</sup>	2 x 10 <sup>-2</sup>	9 x 10 <sup>-9</sup>	1 x 10 <sup>-8</sup>	
AP1000 <sup>(d)</sup> Reactor at the VCSNS site	2.4 x 10 <sup>-7</sup>	1.0 x 10 <sup>-1</sup>	2.4 x 10 <sup>-8</sup>	6.4 x 10 <sup>-5</sup>	1.4 x 10 <sup>-10</sup>	3.5 x 10 <sup>-12</sup>	
AP1000 <sup>(e)</sup> Reactor at North Anna	2.4 x 10 <sup>-7</sup>	8.3 x 10 <sup>-2</sup>	1.2 x 10 <sup>-10</sup>	4.0 x 10 <sup>-5</sup>	2.6 x 10 <sup>-13</sup>	4.9 x 10 <sup>-11</sup>	
AP1000 <sup>(f)</sup> Reactor at Clinton	2.4 x 10 <sup>-7</sup>	2.2 x 10 <sup>-2</sup>	1.4 x 10 <sup>-8</sup>	1.2 x 10 <sup>-5</sup>	6.4 x 10 <sup>-13</sup>	5.5 x 10 <sup>-11</sup>	
AP1000 <sup>(g)</sup> Reactor at Grand Gulf	2.4 x 10 <sup>-7</sup>	1.4 x 10 <sup>-2</sup>	< 1.0 x 10 <sup>-12</sup>	6.9 x 10 <sup>-6</sup>	<1.0 x 10 <sup>-14</sup>	2.0 x 10 <sup>-11</sup>	
AP1000 <sup>(h)</sup> Reactor at Vogtle	2.4 x 10 <sup>-7</sup>	2.8 x 10 <sup>-2</sup>	1.9 x 10 <sup>-10</sup>	1.9 x 10 <sup>-5</sup>	1.6 x 10 <sup>-12</sup>	1.1 x 10 <sup>-11</sup>	

(a) NRC (1990)  
 (b) To convert person-rem to person-Sv, divide by 100.  
 (c) Risks were calculated using the MACCS code and presented in NUREG-1150 (NRC 1990).  
 (d) ER (SCE&G 2009a)  
 (e) NUREG-1811 (NRC 2006a)  
 (f) NUREG-1815 (NRC 2006b)  
 (g) NUREG-1817 (NRC 2006c)  
 (h) NUREG-1872 (NRC 2008b)

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1 **Table 5-19.** Comparison of Environmental Risks from Severe Accidents Initiated by Internal  
 2 Events for an AP1000 Reactor at the VCSNS Site with Risks Initiated by Internal  
 3 Events for Current Plants Undergoing Operating License Renewal Review and  
 4 Environmental Risks of the AP1000 Reactor at Other Sites

	Core Damage Frequency (per year)	50-mi Population Dose Risk (person-rem/Ryr) <sup>(a)</sup>
Current Reactor Maximum <sup>(b)</sup>	$2.4 \times 10^{-4}$	$6.9 \times 10^{+1}$
Current Reactor Mean <sup>(b)</sup>	$2.7 \times 10^{-5}$	$1.6 \times 10^{+1}$
Current Reactor Median <sup>(b)</sup>	$1.6 \times 10^{-5}$	$1.3 \times 10^{+1}$
Current Reactor Minimum <sup>(b)</sup>	$1.9 \times 10^{-6}$	$3.4 \times 10^{-1}$
VCSNS Unit 1 (Existing Reactor) <sup>(c)</sup>	$5.6 \times 10^{-5}$	$1.0 \times 10^{+0}$
AP1000 <sup>(d)</sup> Reactor at VCSNS	$2.4 \times 10^{-7}$	$1.0 \times 10^{-1}$
AP1000 <sup>(e)</sup> Reactor at North Anna	$2.4 \times 10^{-7}$	$8.3 \times 10^{-2}$
AP1000 <sup>(f)</sup> Reactor at Clinton	$2.4 \times 10^{-7}$	$2.2 \times 10^{-2}$
AP1000 <sup>(g)</sup> Reactor at Grand Gulf	$2.4 \times 10^{-7}$	$1.4 \times 10^{-2}$
AP1000 <sup>(h)</sup> Reactor at Vogtle	$2.4 \times 10^{-7}$	$2.8 \times 10^{-2}$

(a) To convert person-rem to person-Sv, divide by 100.

(b) Based on MACCS and MACCS2 calculations for 76 current-generation plants at 44 sites.

(c) NUREG-1437 Supplement 15 (NRC 2004a)

(d) Calculated with MACCS2 code using VCSNS site-specific input.

(e) NUREG-1811 (NRC 2006a)

(f) NUREG-1815 (NRC 2006b)

(g) NUREG-1817 (NRC 2006c)

(h) NUREG-1872 (NRC 2008b)

- 5 • Societal risks to life and health from nuclear power plant operation should be comparable to  
 6 or less than the risks of generating electricity by viable competing technologies and should  
 7 not be a significant addition to other societal risks.

8 The following quantitative health objectives are used when determining achievement of the  
 9 safety goals:

- 10 • The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities  
 11 that might result from reactor accidents should not exceed one-tenth of 1 percent  
 12 (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which  
 13 members of the U.S. population are generally exposed.
- 14 • The risk to the population in the area near a nuclear power plant of cancer fatalities that might  
 15 result from nuclear power plant operation should not exceed one-tenth of 1 percent  
 16 (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

1 These quantitative health objectives are translated into two numerical objectives as follows:

- 2 • The individual risk of a prompt fatality from all “other accidents to which members of the  
3 U.S. population are generally exposed” is about  $4.0 \times 10^{-4}/\text{yr}$ , including a  $1.6 \times 10^{-4}/\text{yr}$  risk  
4 associated with transportation accidents (NSC 2006). One-tenth of 1 percent of these figures  
5 implies that the individual risk of prompt fatality from a reactor accident should be less than  
6  $4 \times 10^{-7}/\text{Ryr}$ .
- 7 • “The sum of cancer fatality risks resulting from all other causes” for an individual is taken to  
8 be the cancer fatality rate in the United States, which is about 1 in 500 or  $2 \times 10^{-3}/\text{yr}$  (Reed  
9 2007). One-tenth of 1 percent of this implies that the risk of cancer to the population in the  
10 area near a nuclear power plant because of its operation should be limited to  $2 \times 10^{-6}/\text{Ryr}$ .

11 MACCS2 calculates average individual early and latent cancer fatality risks. The average  
12 individual early fatality risk is calculated using the population distribution within 1 mi of the plant  
13 boundary. The average individual latent cancer fatality risk is calculated using the population  
14 distribution within 10 mi of the plant. For the plants considered in NUREG-1150, these risks  
15 were well below the Commission’s safety goals. Risks calculated by SCE&G for the AP1000  
16 reactor design at the VCSNS site are also well below the Commission’s safety goals.

17 The NRC staff compared the CDF and population dose risk estimate for an AP1000 reactor at  
18 the VCSNS site with statistics summarizing the results of severe accident analyses performed  
19 for 76 current-generation reactors at 44 sites. The results of these analyses are included in the  
20 final site-specific Supplements 1 through 30 to the NUREG-1437 (NRC 1996, 1999), and in the  
21 ERs included with license renewal applications for the plants for which supplements have not  
22 been published. All of the analyses were completed after publication of NUREG-1150  
23 (NRC 1990) and the analyses for 72 of the reactors used MACCS2, which was released in  
24 1997. Table 5-17 shows that the CDF estimated for the AP1000 reactor is significantly lower  
25 than those of current-generation reactors. Similarly, the population doses estimated for a  
26 Westinghouse AP1000 reactor at the VCSNS site are well below the mean and median values  
27 for current-generation reactors undergoing license renewal and an order of magnitude lower  
28 than the existing VCSNS Unit 1 reactor.

29 Finally, the population dose risk from a severe accident for an AP1000 reactor at the VCSNS  
30 site,  $1.0 \times 10^{-1}$  person-rem/Ryr, may be compared with the dose risk for normal operation of a  
31 single AP1000 reactor at the VCSNS site,  $5.8 \times 10^0$  person-rem/Ryr (SCE&G 2009a);  
32 comparatively, the population dose risk for a severe accident is small.

### 33 **5.11.2.2 Estimated Risks of Releases to Surface-Water Pathways**

34 Surface-water dose pathways are an extension of the air pathway. These pathways cover the  
35 effects of radioactive material deposited on open bodies of water and include ingestion of water  
36 and aquatic foods as well as water submersion and activities occurring near the water. Of these

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1 surface-water pathways, the MACCS2 code evaluates the ingestion of contaminated water.  
2 The risks associated with this pathway were calculated for the VCSNS site and are included in  
3 the last column of Table 5-17. The water-ingestion dose risk of about  $6.4 \times 10^{-3}$  person-rem/Ryr  
4 is small compared with the total dose risk of  $1.0 \times 10^{-1}$  person-rem/Ryr.

5 The Broad River and Monticello Reservoir are used for fishing as well as other general  
6 recreational activities, such as swimming and boating. Doses from these surface-water  
7 pathways are not modeled in MACCS2. Population exposure risk from aquatic food ingestion  
8 was considered in NUREG-1437 for license renewals of current-generation reactors (NRC  
9 1996). In the analysis, nuclear plants were categorized as being sited on an estuary, one of the  
10 Great Lakes, a small river, or a large river. Exposure risk was then compared with that of the  
11 Fermi plant, located on Lake Erie, for which an analysis of an uninterdicted dose had been  
12 completed (NRC 1981). For the purpose of evaluating the surface-water pathway, the existing  
13 VCSNS site was classified as being on a small river (NRC 1996). For small river sites, the  
14 population dose from the aquatic food pathway was well below the population dose from the air  
15 pathway. Analysis of water-related exposure pathways at the Fermi reactor (NRC 1981)  
16 suggests that population exposures from swimming are significantly lower than exposures from  
17 the aquatic food pathway. If a severe accident occurred at an AP1000 reactor located at the  
18 VCSNS site, Federal, State, and local officials would likely restrict access to affected water  
19 areas. These interdiction actions would further reduce potential surface-water pathway  
20 exposures. Therefore, the NRC staff concludes that the population dose risk from surface-water  
21 pathways at the VCSNS site likely would be a small fraction of the air pathway risk

### 22 **5.11.2.3 Estimated Risks of Releases to the Groundwater Pathway**

23 The groundwater pathway involves a reactor core melt, reactor vessel failure, and penetration of  
24 the floor (basemat) below the reactor vessel. Ultimately, core debris reaches groundwater  
25 where soluble radionuclides are transported with the groundwater. In the NUREG-1437 (NRC  
26 1996), the NRC staff assumed that the probability of a severe accident with basemat  
27 penetration was  $1 \times 10^{-4}$ /Ryr and concluded that the groundwater contribution to risk is generally  
28 a small fraction of the risk attributable to the atmospheric pathway. The SCE&G ER (SCE&G  
29 2009a) summarizes the discussion in NUREG-1437 and reaches the same conclusion.

30 The NRC staff has re-evaluated its assumption of a  $1.0 \times 10^{-4}$  Ryr<sup>-1</sup> probability of a basemat  
31 melt-through. The NRC staff believes that the  $1.0 \times 10^{-4}$  probability is too large for new power  
32 stations. Design elements have been included in the AP1000 design to minimize the potential  
33 for reactor core debris to reach groundwater. These elements include external reactor vessel  
34 cooling and ex-vessel core debris cooling. Furthermore, the probability of core melt with  
35 basemat melt-through should be no larger than the total CDF estimate for the reactor.  
36 Table 5-17 gives a total CDF estimate of  $2.4 \times 10^{-7}$  Ryr<sup>-1</sup> for an AP1000 reactor. NUREG-1150  
37 indicates that the conditional probability of a basemat melt-through ranges from 0.05 to 0.25 for  
38 current-generation reactors. If the CDF for AP1000 severe accidents in which containment

1 remains intact are subtracted from the total AP1000 CDF to get the CDF for severe accidents in  
2 which basemat melt-through is a possibility, the CDF is on the order of  $2 \times 10^{-8}$ /Ryr. On this  
3 basis, the NRC staff believes that a basemat melt-through probability of  $2 \times 10^{-8}$ /Ryr is  
4 reasonable and still conservative.

5 The groundwater pathway is more tortuous and affords more time for implementing protective  
6 actions than the atmospheric pathway and, therefore, results in a lower risk to the public. As a  
7 result, the NRC staff concludes that the risks associated with releases to groundwater are low  
8 and that they would not have a significant effect on the overall plant risk.

#### 9 **5.11.2.4 Estimated Risks of Releases Related to External Events**

10 The analyses described above are specifically for internally initiated events. The AP1000  
11 reactor vendor and the NRC staff have addressed three externally initiated events during design  
12 certification of the AP1000 reactor: seismic, internal fire, and internal flooding events. The  
13 analyses are described Section 19.1.5 of the final Safety Evaluation Report (FSER) for the  
14 AP1000 reactor (NRC 2004b).

15 With respect to seismic events, the AP1000 reactor vendor performed a PRA-based seismic  
16 margin analysis. This analysis indicated that there is a high confidence (95 percent) that safety  
17 systems and components would survive a 0.5-g peak acceleration during a seismic event. The  
18 safe-shutdown earthquake for the AP1000 reactor design is 0.3 g. Consequently, the NRC staff  
19 concluded in the FSER that the AP1000 reactor design is acceptable (NRC 2004b).

20 With respect to internal fires, the AP1000 reactor vendor estimated the fire-induced CDFs to be  
21 about  $5.6 \times 10^{-8}$ /yr during power operation and about  $8 \times 10^{-8}$ /yr during shutdown, and the  
22 vendor considers these estimates to be conservative. While the staff believes that such a  
23 conclusion is not possible without a detailed PRA, the NRC staff, in its safety review, did  
24 conclude that the AP1000 reactor design is capable of withstanding severe accident challenges  
25 from internal fires in a manner superior to most, if not all, operating plant designs.

26 With respect to internal flooding, the AP1000 reactor vendor did not perform a detailed PRA to  
27 assess the risk from internal flooding. Instead, the vendor performed an internal flooding PRA  
28 commensurate with the level of detail available and, where detailed information was not  
29 available, made conservative assumptions to bound the flooding analysis. In its safety review,  
30 the NRC staff found that this analysis was adequate to identify potential vulnerabilities and to  
31 provide insight into the design that could be used to support design certification requirements.  
32 Quantification of potential scenarios with the plant at power resulted in a total CDF from internal  
33 floods of about  $1 \times 10^{-9}$ /yr. The CDF from internal floods when the plant is shutdown is  
34 estimated to be about  $3.2 \times 10^{-9}$ /yr. The vendor considers these estimates to be conservative.  
35 While the staff believes that such a conclusion is not possible without a detailed PRA, the NRC  
36 staff, in its safety review, did conclude that the AP1000 reactor design is capable of

1 withstanding severe accident challenges from internal floods in a manner superior to operating  
2 plants and is consistent with the conclusions from the vendor's internal flood risk analysis.

### 3 **5.11.3 Summary of Severe Accident Impacts**

4 The SCE&G application refers to proposed Revision 17 of the AP1000 reactor certified design  
5 (10 CFR Part 52, Appendix D). The consequence assessment is based on the PRA for  
6 Revision 15 of the AP1000 design (Westinghouse 2005), which is certified in 10 CFR Part 52,  
7 Appendix D. Westinghouse subsequently upgraded and updated the PRA; however,  
8 Westinghouse reviewed the AP1000 PRA report submitted with Revision 15 of the DCD and  
9 concluded that the reported results and insights remain valid for proposed revisions of the DCD  
10 (Westinghouse 2007). The NRC staff evaluated the current PRA model and its results using  
11 DC/COL-ISG-3 (NRC 2008a), "Probabilistic Risk Assessment Information to Support Design  
12 Certification and Combined License Applications," and concluded that the Revision 15 results  
13 remain conservative and are an acceptable basis for evaluating severe accidents and strategies  
14 for mitigating them. SCE&G is required by regulation to upgrade and update the PRA prior to  
15 fuel loading. At that time, the NRC staff expects the PRA to be site-specific and that it will no  
16 longer use the bounding assumptions of the design-specific PRA. The NRC staff concludes it is  
17 unlikely that the PRA would change sufficiently to cause the staff to materially change its  
18 conclusions related to severe accident risks.

19 The NRC staff reviewed the risk analysis in the ER and conducted a confirmatory analysis of the  
20 probability-weighted consequences of severe accidents for the proposed VCSNS Units 2 and 3  
21 using the MACCS2 code. The results of both the SCE&G analysis and the NRC analysis  
22 indicate that the environmental risks associated with severe accidents if an AP1000 reactor  
23 were to be located at the VCSNS site would be small compared with risks associated with  
24 operation of the current-generation reactors at the VCSNS site and other sites. These risks are  
25 within the Commission's safety goals. On these bases, the NRC staff concludes that the  
26 probability-weighted consequences of severe accidents at the VCSNS site would be SMALL for  
27 an AP1000 reactor.

### 28 **5.11.4 Severe Accident Mitigation Alternatives**

29 The purpose of the evaluation of severe accident mitigation alternatives (SAMAs) is to  
30 determine whether there are severe accident mitigation design alternatives (SAMDAs),  
31 procedural modifications, or training activities that can be justified to further reduce the risks of  
32 severe accidents (NRC 2000c). SCE&G based its COL application on the AP1000 reactor  
33 design (see Appendix D of 10 CFR Part 52, Design Certification Rule for the AP1000 Design),  
34 which incorporates many features intended to reduce severe accident CDFs and the risks  
35 associated with severe accidents. The effectiveness of the AP1000 reactor design features is  
36 evident in Table 5-18 and Table 5-19, which compare CDFs and severe-accident risks for the

1 AP1000 reactor with CDFs and risks for current-generation reactors. The CDFs and risks have  
2 been reduced considerably when compared with current-generation reactors.

3 Consistent with the direction from the Commission to consider the SAMDAs at the time of  
4 certification, the AP1000 reactor vendor (Westinghouse 2005) and the NRC staff (NRC 2004b,  
5 2005b) considered a number of design alternatives for an AP1000 reactor at a generic site. The  
6 conclusion of the NRC staff's review was

7 ...that none of the potential design modifications evaluated are justified on the  
8 basis of benefit-cost considerations. The NRC further concludes that it is unlikely  
9 that any other design changes would be justified in the future on the basis of  
10 person-rem exposure because the estimated CDFs are very low on an absolute  
11 scale.

12 Westinghouse reviewed the AP1000 PRA for Revision 15 and concluded that the PRA remains  
13 valid for a proposed revision of the DCD (Westinghouse 2007); this is unchanged for Revision  
14 17. Furthermore, the NRC staff evaluated the current PRA using DC/COL-ISG-3 (NRC 2008a),  
15 "Probabilistic Risk Assessment Information to Support Design Certification and Combined  
16 License Applications," and concluded that the PRA submitted with Revision 15 is a conservative  
17 and acceptable basis for evaluating severe accidents and strategies for mitigating them.  
18 Therefore, the NRC staff considers the PRA for DCD Revision 15 to be an adequate basis for a  
19 SAMDA analysis for an application referencing DCD Revision 17. Consequently, the NRC staff  
20 incorporates by reference the environmental assessment accompanying the design certification  
21 rulemaking for Appendix D to 10 CFR Part 52 (NRC 2005c).

22 Section 5.11.2 of this chapter presents the environmental risks from various classes of severe  
23 accidents for the VCSNS site. Site-specific information appears in SAMDA evaluations as  
24 population dose risk (person-rem/Ryr) and offsite economic costs (\$/Ryr). The NRC staff  
25 considers these two elements to be the appropriate metrics to use to determine if the site  
26 characteristics are bounded by the site parameters in the DCD because they are calculated  
27 from site-specific meteorology, population distribution, and land-use data. Appendix 1B of the  
28 AP1000 DCD lists the population dose risk (person-rem/Ryr) used in the DCD generic SAMDA  
29 review. While it does not specifically list the offsite economic costs, it does include a maximum  
30 attainable benefit that considers offsite economic costs, onsite exposure costs, onsite cleanup  
31 costs, and replacement power costs in addition to the cost associated with the offsite population  
32 dose risk. To perform a like-kind comparison, the NRC staff used the maximum attainable  
33 benefit cost for the VCSNS site characteristic. The probability-weighted, mean population dose  
34 risks derived from Table 1B-1 and the base case maximum attainable benefit listed in  
35 Table 1B-4 are the metrics used by the NRC staff to determine whether the VCSNS site  
36 characteristics are within the site parameters specified in Appendix 1B of the AP1000 DCD.

## Operational Impacts at the VC Summer Site

1 Table 5-20 presents the comparison of the VCSNS site-specific values (SCE&G 2009a) with the  
 2 generic values from Appendix 1B of the AP1000 DCD (Westinghouse 2008). Table 5-20 shows  
 3 that the population dose risk for the proposed VCSNS site is about 2.3 times larger than that  
 4 listed in DCD Appendix 1B, while the maximum attainable benefit for the VCSNS site is roughly  
 5 1.5 times greater than the DCD Appendix 1B value. Potential design modifications were  
 6 examined further to determine if they would be cost beneficial in reducing risk at the VCSNS  
 7 site.

8 **Table 5-20.** Comparison of VCSNS SAMDA Site Characteristics with Site Parameters  
 9 Specified in AP1000 DCD, Appendix 1B

	Population Dose Risk, person-rem/Ryr	Maximum Attainable Benefit
DCD Appendix 1B (internal events) <sup>(a)</sup>	$4.3 \times 10^{-2}$	\$21,000
VCSNS site (internal events) <sup>(b)</sup>	$1.0 \times 10^{-1}$	\$32,000
Ratio of VCSNS site-specific value to DCD value	2.3	1.52

(a) AP1000 DCD Appendix 1B (Westinghouse 2008)  
 (b) ER (SCE&G 2009a)

10 The generic AP1000 SAMDA analysis is presented in Appendix 1B of the DCD (Westinghouse  
 11 2008, Appendix 1B). Design alternatives considered by Westinghouse and their estimated  
 12 implementation costs are presented in Table 5-21 (Westinghouse 2008). In the base-case  
 13 analysis, the benefit-cost methodology of NUREG/BR-0184 (NRC 1997) is used to calculate the  
 14 maximum attainable benefit. The analysis assumes that the implementation of the design  
 15 alternative completely eliminates all potential for core damage. For the AP1000, the maximum  
 16 attainable benefit was valued at \$21,000 (Westinghouse 2008). Only one design alternative in  
 17 Table 5-21 – the self-actuating containment isolation valves – has a cost (\$33,000) that is  
 18 comparable to the maximum attainable benefit. To evaluate the benefit of this SAMDA, the  
 19 design change was assumed to eliminate the Containment Isolation severe accident release  
 20 category, which is only a small contributor to the total CDF. Therefore, this design alternative  
 21 provides almost no benefit in reducing the AP1000 CDF.

22 The SCE&G ER (SCE&G 2009a) updates the SAMDA analysis conducted for AP1000 design  
 23 certification using the results of the VCSNS site-specific consequence analysis (MACCS2) that  
 24 are discussed in Section 5.11.2. The results of the SCE&G analysis indicate that the maximum  
 25 attainable benefit, if the total risk for internal events for the VCSNS site could be reduced to  
 26 zero, has a value of approximately \$32,000 (SCE&G 2009a). Similar to the finding in the  
 27 AP1000 DCD SAMDA analysis, only the self-actuating containment isolation valves design  
 28 alternative (Table 5-21) has a value comparable to the maximum attainable benefit for the  
 29 VCSNS site.



1 **Table 5-21.** Design Alternatives Considered for SAMDA in the AP1000 DCD

No.	Design Alternative	Cost (\$)
1	Upgrade chemical, volume, and control system for small loss-of-coolant accident (LOCA)	1,500,000
2	Containment filtered vent	5,000,000
3	Self-actuating containment isolation valves	33,000
4	Safety grade passive containment spray	3,900,000
6	Steam generator shell-side heat removal	1,300,000
7	Steam generator relief flow to in-containment refueling water storage tank (IRWST)	620,000
8	Increased steam generator pressure capability	8,200,000
9	Secondary containment ventilation with filtration	2,200,000
10	Diverse IRWST injection valves	570,000
12	Ex-vessel core catcher	1,660,000
13	High-pressure containment design	50,000,000
14	More reliable diverse actuation system	470,000

Source: Westinghouse 2008,

2 Table 5-17, which lists the mean environmental risks from an AP1000 reactor severe accident at  
3 the VCSNS site, shows that the containment isolation severe accident category only contributes  
4 a small fraction to the total population dose (approximately 1 percent) and cost risk  
5 (approximately 0.1 percent) at the VCSNS site. Assuming that implementation of the self-  
6 actuating containment isolation valves completely eliminates the risks associated with this  
7 release category, then the value of the reduction in risk would only be about \$320. Thus, the  
8 site-specific SAMDA review conducted by SCE&G confirms the results of the design certification  
9 SAMDA review. Although the dose risk for the VCSNS site exceeds the DCD value, the site-  
10 specific SAMDA analysis for the VCSNS site shows that the resulting design alternative (self-  
11 actuating containment isolation valves) would only reduce this total risk by a small fraction. The  
12 next lowest cost design alternative has more than an order-of-magnitude higher cost than the  
13 self-actuating containment isolation valves. On this basis, the NRC staff concludes that, in fact,  
14 there are no potential design modifications that are justified on the basis of benefit-cost  
15 considerations, and it is unlikely that any other design changes would be justified in the future  
16 on the basis of person-rem exposure because the estimated CDFs are very low on an absolute  
17 scale.

18 The PRA upon which the AP1000 and SCE&G severe accident reviews are based was  
19 conducted for Revision 15 of the AP1000 design. Westinghouse subsequently upgraded and  
20 updated the PRA; however, Westinghouse reviewed the AP1000 PRA report submitted with  
21 Revision 15 of the DCD and concluded that the reported results and insights remain valid for  
22 proposed revisions of the DCD (Westinghouse 2007). The NRC staff evaluated the current  
23 PRA model and its results using DC/COL-ISG-3 (NRC 2008a), "Probabilistic Risk Assessment  
24 Information to Support Design Certification and Combined License Applications," and concluded

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1 that the Revision 15 results remain conservative and are an acceptable basis for evaluating  
2 severe accidents and strategies for mitigating them. SCE&G is required by regulation to update  
3 the PRA prior to fuel loading. The NRC staff expects the PRA to be site-specific rather than use  
4 the bounding assumptions used for the design-specific PRA. The NRC staff considers it  
5 unlikely that the PRA would change sufficiently to cause the NRC staff to conclude that any  
6 SAMDA considered in the design-certification process would become cost beneficial.

7 The SAMDA issue is a subset of the SAMA review. The other attributes of the SAMA review,  
8 namely procedural modifications and training activities, have not yet been addressed by  
9 SCE&G. However, SCE&G has stated (SCE&G 2009a) that risk insights would be considered  
10 in the development of plant procedures and training. Because the maximum attainable benefit  
11 is so low, a SAMA based on procedures or training for an AP1000 reactor at the VCSNS site  
12 would have to reduce the CDF or risk to near zero to become cost beneficial. Based on its  
13 evaluation, the staff concludes that it is unlikely that any of the SAMAs based on procedures or  
14 training would reduce the CDF or risk that much. Therefore, the staff further concludes it is  
15 unlikely that these SAMAs would be cost effective. Additionally, based on statements by  
16 SCE&G in the ER (SCE&G 2009a), the staff expects that SCE&G will consider risk insights in  
17 the development of procedures and training. However, this expectation is not crucial to the  
18 staff's conclusions because the staff already concluded procedural and training SAMAs would  
19 be unlikely to be cost effective. Therefore, the NRC staff concludes that SAMAs have been  
20 appropriately considered.

### 21 **5.11.5 Summary of Postulated Accident Impacts**

22 The NRC staff evaluated the environmental impacts from DBAs and severe accidents for an  
23 AP1000 reactor at the VCSNS site. Based on the information provided by SCE&G and the  
24 NRC's own independent review, the NRC staff concludes that the potential environmental  
25 impacts (risks) from a postulated accident from the operation of the proposed VCSNS Units 2  
26 and 3 would be SMALL, and no further mitigation would be warranted.

## 27 **5.12 Measures and Controls to Limit Adverse Impacts During** 28 **Operation**

29 In its evaluation of environmental impacts during operation of proposed Units 2 and 3 at the  
30 VCSNS site, the review team relied on SCE&G's compliance with the following measures and  
31 controls that would limit adverse environmental impacts:

- 32 • compliance with applicable Federal, State, and local laws, ordinances, and regulations  
33 intended to prevent or minimize adverse environmental impacts (e.g., solid waste  
34 management, erosion and sediment control, air emissions, noise control, stormwater  
35 management, spill response and cleanup, hazardous material management)

- 1 • compliance with applicable requirements of permits or licenses required for operation of the
- 2 new unit (e.g., USACE’s Section 404 Permit, NPDES)
- 3 • compliance with existing VCSNS Unit 1 processes and/or procedures applicable to proposed
- 4 Units 2 and 3 environmental compliance activities for the VCSNS site (e.g., solid waste
- 5 management, hazardous waste management, and spill prevention and response)
- 6 • incorporation of environmental requirements into construction contracts
- 7 • implementation of BMPs.

8 The review team considered these measures and controls in its evaluation of the impacts of  
 9 plant operation. Table 5-22 lists a summary of measures and controls to limit adverse impacts  
 10 during operation proposed by SCE&G.

11 **Table 5-22.** Summary of Measures and Controls Proposed by SCE&G to Limit Adverse  
 12 Impacts During Operation of Proposed Units 2 and 3 at the VCSNS Site

Impact Category	Specific Measures and Control
<b>Land-Use Impacts</b>	
The Site and Vicinity	SCE&G did not propose any additional measures or controls
Transmission-Line Corridors and Offsite Areas	<ul style="list-style-type: none"> <li>• Routing decisions would consider protected species and critical habitats.</li> <li>• Maintenance practices would protect sensitive habitats and protected species, including wetlands and water crossings.</li> </ul>
Historic Properties and Cultural Resources	<ul style="list-style-type: none"> <li>• Before site disturbance, conduct archaeological surveys.</li> <li>• Continue to have a fence barrier around Pearson Cemetery.</li> <li>• Continue any applicable mitigation measures for any National Register-eligible sites</li> <li>• Develop management agreement with SHPO.</li> <li>• Conduct earth-disturbing activities under existing procedures that prescribe actions to be taken in the event that significant archaeological or paleontological artifacts are encountered.</li> <li>• Conduct awareness training for procedures associated with inadvertent discoveries.</li> </ul>
<b>Water-Related Impacts</b>	
Water-Use Impacts	<ul style="list-style-type: none"> <li>• Monitor hydrologic impacts as required by NPDES permit.</li> </ul>
Water-Quality Impacts	<ul style="list-style-type: none"> <li>• Monitor constituent emissions as required by NPDES permit.</li> <li>• Implement SCE&amp;G’s Spill Prevention, Control, and Countermeasure Plan.</li> <li>• Conduct stormwater monitoring as required by stormwater permit.</li> </ul>
Future Water Use	SCE&G did not propose any additional measures or controls

**Table 5-22.** (contd)

Impact Category	Specific Measures and Control
<b>Cooling System Impacts</b>	
<u>Intake System:</u>	
Hydrodynamic Descriptions and Physical Impacts	<ul style="list-style-type: none"> <li>• Design and operate intake structures based on best available technology.</li> </ul>
Aquatic Ecosystems	<ul style="list-style-type: none"> <li>• Continue voluntary monitoring program for water quality in Monticello Reservoir.</li> </ul>
<u>Discharge System:</u>	
Thermal Description and Other Physical Impacts	<ul style="list-style-type: none"> <li>• Implement planned design that alternates discharge orientation.</li> </ul>
Aquatic Ecosystems	SCE&G did not propose any additional measures or controls
Terrestrial Ecosystems	SCE&G did not propose any additional measures or controls
Impacts on Members of the Public	<ul style="list-style-type: none"> <li>• No mitigation for noise will be required.</li> <li>• Control personnel and public access to the cooling towers by administrative controls and security patrols. Implement procedure to reduce the risk associated with exposure to thermophilic microorganisms by providing work practices and personal protective equipment to eliminate routes of exposure to thermophilic microorganisms that may produce illnesses.</li> </ul>
<b>Radiological Impacts of Normal Operation</b>	
Exposure Pathways	<ul style="list-style-type: none"> <li>• Implement radiological monitoring program as required.</li> </ul>
Radiation Doses to Members of the Public	<ul style="list-style-type: none"> <li>• Conduct radiological monitoring program as required.</li> </ul>
Impacts on Members of the Public	<ul style="list-style-type: none"> <li>• Conduct meteorological monitoring.</li> </ul>
Impacts on Biota Other than Members of the Public	<ul style="list-style-type: none"> <li>• Conduct radiological monitoring program as required.</li> </ul>
<b>Environmental Impact of Waste</b>	
Nonradioactive Waste System Impacts	<ul style="list-style-type: none"> <li>• All discharges would comply with NPDES permit and applicable water-quality standards.</li> <li>• Implement existing VCSNS waste-minimization program at new units.</li> </ul>
Mixed Waste Impacts	<ul style="list-style-type: none"> <li>• Implement existing VCSNS waste-minimization program at new units.</li> </ul>
Waste Minimization	<ul style="list-style-type: none"> <li>• Implement existing VCSNS waste-minimization program at new units.</li> </ul>
Radioactive Waste	<ul style="list-style-type: none"> <li>• Implement existing VCSNS waste-minimization program at new units.</li> </ul>

1

**Table 5-22.** (contd)

<b>Impact Category</b>	<b>Specific Measures and Control</b>
<b>Transmission System Impacts</b>	
Terrestrial Ecosystems	<ul style="list-style-type: none"> <li>• Train personnel in the handling of fuel and lubricants and the cleanup and reporting of any incidental spills.</li> <li>• Have adequate spill response equipment on hand during maintenance activities in the corridors.</li> <li>• Maintenance practices would protect sensitive habitats and protected species, including wetland and water crossings.</li> </ul>
Aquatic Ecosystems	<ul style="list-style-type: none"> <li>• Implement existing SCE&amp;G and Santee Cooper procedures intended to prevent impacts on water quality and be protective of wetlands and stream crossings, including restriction of heavy equipment to prevent erosion, use of approved herbicides only, and spill-prevention practices when fueling or lubricating equipment.</li> </ul>
Impacts on Members of the Public	<ul style="list-style-type: none"> <li>• Build new transmission lines to national electrical standards to limit shock from induced currents.</li> </ul>
<b>Socioeconomic Impacts</b>	
Physical Impacts of Proposed Units	<ul style="list-style-type: none"> <li>• Pave access roads and set speed limits for vehicle traffic to minimize noise impacts.</li> </ul>
Social and Economic Impacts of Proposed Units	<ul style="list-style-type: none"> <li>• Stagger outage schedules to minimize traffic congestion.</li> <li>• Before the start of Unit 2 operation, develop an operations management traffic plan.</li> <li>• Minimize the visual impact of the structures through use of topography, design, materials, and color.</li> <li>• No mitigation would be required.</li> </ul>
Environmental Justice	<ul style="list-style-type: none"> <li>• No mitigation would be required.</li> </ul>
<b>Decommissioning</b>	
Decommissioning	<ul style="list-style-type: none"> <li>• Continue applicable mitigation measures used during the operations period for decommissioning activities or for transportation of waste and materials to disposal sites.</li> <li>• SCE&amp;G would assure that adequate funding for decommissioning would be available.</li> </ul>
<b>Transportation of Radioactive Waste</b>	
Transportation of Radioactive Waste	<ul style="list-style-type: none"> <li>• No mitigation would be required.</li> </ul>
<b>Nonradiological Health Impacts</b>	
Nonradiological Health Impacts	<ul style="list-style-type: none"> <li>• Implement existing SCE&amp;G industrial safety program at Units 2 and 3.</li> </ul>

## 2 **5.13 Summary of Operational Impacts**

3 The staff's evaluation of the environment impacts of operations is summarized in Table 5-23.  
4 Impact level categories are denoted in the table as SMALL, MODERATE, or LARGE as a  
5 measure of their expected adverse impacts, if any. With the socioeconomic issues for which the  
6 impacts are likely to be beneficially MODERATE or LARGE, this is noted in the Comments  
7 column.

Operational Impacts at the VC Summer Site

1 **Table 5-23.** Characterization of Operational Impacts at the VCSNS Site

<b>Category</b>	<b>Comments</b>	<b>Impact Level</b>
<b>Land-Use Impacts</b>		SMALL
The Site and Vicinity	Operational activities would have minimal impact on land use	SMALL
Transmission-Line Corridors	Operational activities would have minimal impact on land use.	SMALL
<b>Water-Related Impacts</b>		SMALL
Water Use	Operational activities would have negligible impacts on groundwater availability and small impacts on surface-water availability.	SMALL
Water Quality	Operational activities would have negligible impacts on surface and groundwater quality.	SMALL
<b>Ecological Impacts</b>		SMALL
Terrestrial and Wetland Ecosystems	Operational activities would have minimal impact on terrestrial and wetland ecological resources and habitat.	SMALL
Aquatic Ecosystems	Operational activities would have minimal impact on aquatic ecological resources and habitat.	SMALL
<b>Socioeconomic Impacts</b>		SMALL to LARGE
Physical Impacts	Operational activities would have negligible physical impacts.	SMALL
Demography	Operational activities would have minimal demographic characteristics of the vicinity and region.	SMALL
Economic Impacts on the Community	Operational activities would have substantial tax revenue impacts in Fairfield County.	LARGE (beneficial)
Infrastructure and Community Service	Operational activities would have negligible impacts on local and regional transportation networks, recreation resources, housing, public services, or education.	SMALL
<b>Environmental Justice</b>		SMALL
Health and Physical Impacts	No disproportionate and adverse health or physical impacts to low-income and minority populations would be expected from operations	SMALL
Socioeconomic	No disproportionate and adverse impacts on any minority or low-income population would be expected from operations	SMALL

1

**Table 5-23.** (contd)

<b>Category</b>	<b>Comments</b>	<b>Impact Level</b>
Subsistence and Special Conditions	No disproportionate and adverse impacts on any minority or low-income population would be expected from operations	SMALL
<b>Historic and Cultural Resources</b>	Operational activities would have minimal impact on historic and cultural resources.	SMALL.
<b>Meteorological and Air-Quality Impacts</b>		SMALL
Cooling Towers	Operational activities would not have a significant meteorological or air quality impacts	SMALL
Air Quality	Operational activities would not have a significant meteorological or air quality impacts	SMALL
Transmission Lines	Operational activities would not have a significant meteorological or air quality impacts	SMALL
<b>Nonradiological Health Impacts</b>	Operational activities would not have significant nonradiological health impacts to the public	SMALL
<b>Radiological Health Impacts</b>		SMALL
Members of Public	Operational activities would result in no observable radiological health impacts to the public	SMALL
VCSNS Workers	Occupational doses to workers would be within regulatory limits	SMALL
Biota Other Than Humans	Doses to terrestrial and aquatic biota would be far below IAEA guidelines	SMALL
<b>Nonradiological Waste Impacts</b>	Solid, liquid, gaseous, and mixed wastes generated during operations would be handled according to county, State, and Federal regulations.	SMALL
<b>Impacts of Postulated Accidents</b>		SMALL
Design Basis Accidents	The environmental consequences of DBAs would not be significant	SMALL
Severe Accidents	The environmental risks of severe accidents are well below the NRC safety criteria	SMALL

## 1 **5.14 References**

- 2 10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, “Standards for  
3 Protection against Radiation.”
- 4 10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, “Domestic Licensing of  
5 Production and Utilization Facilities.”
- 6 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, “Licenses,  
7 Certifications, and Approvals for Nuclear Power Plants.”
- 8 10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, “Reactor Site  
9 Criteria.”
- 10 29 CFR Part 1910. Code of Federal Regulations, Title 29, *Labor*, Part 1910, “Occupational  
11 Safety and Health Standards.”
- 12 36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*,  
13 Part 800, “Protection of Historic Properties.”
- 14 40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60,  
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- 18 51 FR 30028. August 21, 1986. “Safety Goals for the Operation of Nuclear Power Plants;  
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## 1 **6.0 Fuel Cycle, Transportation, and Decommissioning**

2 This chapter addresses the environmental impacts from (1) the uranium fuel cycle and solid-  
3 waste management, (2) the transportation of radioactive material, and (3) the decommissioning  
4 of two new nuclear units at the Virgil C. Summer Nuclear Station (VCSNS) site.

5 In its evaluation of uranium fuel-cycle impacts from two new units at the VCSNS site, South  
6 Carolina Electric and Gas (SCE&G) used the Westinghouse Electric Company, LLC  
7 (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water reactor design. SCE&G's  
8 assessment of fuel-cycle impacts is based on values in Table S-3 in Title 10 of the Code of  
9 Federal Regulations (CFR) 51.51(b), which in turn assumes an 80-percent annual capacity  
10 factor referenced to a 1000-MW(e) light water reactor (LWR), resulting in 800 MW of electrical  
11 output. SCE&G then assumed a 93-percent capacity factor for each of the two new  
12 1200-MW(e) AP1000 reactors and scaled the impact values from Table S-3 by 34 percent  
13 (SCE&G 2009a). The results reported here apply to the impacts from two AP1000 units, each  
14 with the capacity factor of 93 percent assumed by SCE&G.

### 15 **6.1 Fuel-Cycle Impacts and Solid-Waste Management**

16 This section discusses the environmental impacts from the uranium fuel-cycle and solid-waste  
17 management for the AP1000 reactor design. The environmental impacts of this design are  
18 evaluated against specific criteria for LWR designs at 10 CFR 51.51.

19 The regulations in 10 CFR 51.51(a) state the following:

20 Under § 51.50, every environmental report prepared for the construction permit stage  
21 or Early Site Permit stage or combined license stage of a light-water-cooled nuclear  
22 power reactor, and submitted on or after September 4, 1979, shall take Table S-3,  
23 Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the  
24 contribution of the environmental effects of uranium mining and milling, the production  
25 of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of  
26 irradiated fuel, transportation of radioactive materials and management of low-level  
27 wastes and high-level wastes related to uranium fuel cycle activities to the  
28 environmental costs of licensing the nuclear power reactor. Table S-3 shall be  
29 included in the environmental report and may be supplemented by a discussion of the  
30 environmental significance of the data set forth in the table as weighed in the analysis  
31 for the proposed facility.

## Fuel Cycle, Transportation, and Decommissioning

1 The AP1000 reactors proposed for Units 2 and 3 at the VCSNS site are light-water-cooled  
 2 reactors that use uranium dioxide fuel; therefore, Table S-3 (10 CFR 51.51(b)) can be used to  
 3 assess the environmental impacts of the uranium fuel cycle. Table S-3 values are normalized  
 4 for a reference 1000-MW(e) LWR at an 80-percent capacity factor. The 10 CFR 51.51(a)  
 5 Table S-3 values are reproduced in Table 6-1.

6 Each AP1000 reactor unit is rated at 3400 MW(t) (Westinghouse 2008). Assuming that two  
 7 AP1000 reactors would be located on the VCSNS site (SCE&G 2009a), the power rating for the  
 8 new units at the VCSNS site would be 6800 MW(t). Each AP1000 reactor unit is rated at  
 9 1200 MW(e), of which 93 MW(e) are used for station and auxiliary loads, leaving 1107 MW(e)  
 10 net electric output when the reactor is operating (Westinghouse 2008). With a capacity factor of  
 11 93 percent (SCE&G 2009a), each AP1000 unit produces an average of 1070 MW(e). For two  
 12 AP1000 units, this corresponds to 2140 MW(e).

13 Specific categories of environmental considerations are included in Table S-3 (see Table 6-1).  
 14 These categories relate to land use, water consumption and thermal effluents, radioactive  
 15 releases, burial of transuranic, high-level waste (HLW) and low-level waste (LLW), and radiation  
 16 doses from transportation and occupational exposures. In developing Table S-3, the staff  
 17 considered two fuel-cycle options that differed in the treatment of irradiated (spent) fuel removed  
 18 from a reactor. The “no-recycle” option treats all spent fuel as waste to be stored at a Federal  
 19 waste repository, whereas the “uranium-only recycle” option involves reprocessing spent fuel to  
 20 recover unused uranium and return it for use in new fuel. Neither cycle involves the recovery of  
 21 plutonium. The contributions in Table S-3 resulting from reprocessing, waste management, and  
 22 transportation of wastes are maximized for both of the two fuel cycles (uranium-only and no-  
 23 recycle); that is, the identified environmental impacts are based on the cycle that results in the  
 24 greater impact. The uranium fuel cycle is defined as the total of the operations and processes  
 25 associated with provision, use, and ultimate disposition of fuel for nuclear power reactors.

26 **Table 6-1.** Table of Uranium Fuel Cycle Environmental Data<sup>(a)</sup>

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Natural Resource Use		
<b>Land (ac)</b>		
Temporarily committed <sup>(b)</sup> .....	100	
Undisturbed area .....	79	
Disturbed area .....	22	Equivalent to a 100-MW(e) coal-fired power plant.
Permanently committed .....	13	
Overburden moved (millions of MT) .....	2.8	Equivalent to a 95-MW(e) coal-fired power plant.

27

**Table 6-1. (contd)**

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
<b>Water (millions of gallons)</b>		
Discharged to air .....	160	=2 percent of model 1000-MW(e) LWR with cooling tower.
Discharged to waterbodies .....	11,090	
Discharged to ground.....	127	
<b>Total</b>	<b>11,377</b>	<4 percent of model 1000 MW(e) with once-through cooling.
<b>Fossil Fuel</b>		
Electrical energy (thousands of MW-hr) ....	323	<5 percent of model 1000-MW(e) LWR output.
Equivalent coal (thousands of MT) .....	118	Equivalent to the consumption of a 45-MW(e) coal-fired power plant.
<b>Natural Gas (millions of standard cubic feet)</b>	<b>135</b>	<0.4 percent of model 1000 MW(e) energy output.
<b>Effluents--Chemical (MT)</b>		
<b>Gases (including entrainment)<sup>(c)</sup></b>		
SO <sub>x</sub> <sup>-1</sup>	4400	
NO <sub>x</sub> <sup>-1(d)</sup>	1190	Equivalent to emissions from 45-MW(e) coal-fired plant for a year.
Hydrocarbons .....	14	
CO	29.6	
Particulates.....	1154	
<b>Other Gases</b>		
F	0.67	Principally from uranium hexafluoride (UF <sub>6</sub> ) production, enrichment, and reprocessing. The concentration is within the range of state standards—below level that has effects on human health.
HCl	0.014	
<b>Liquids</b>		
SO <sub>4</sub> <sup>-</sup>	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH <sub>3</sub> – 600 cfs, NO <sub>3</sub> – 20 cfs, Fluoride – 70 cfs.
NO <sub>3</sub> <sup>-</sup>	25.8	
Fluoride	12.9	
Ca <sup>++</sup>	5.4	
Cl <sup>-</sup>	8.5	
Na <sup>+</sup>	12.1	
NH <sub>3</sub>	10	
Fe	0.4	
Tailings solutions (thousands of MT).....	240	From mills only – no significant effluents to environment.
Solids	91,000	Principally from mills – no significant effluents to environment.
<b>Effluents--Radiological (curies)</b>		

Fuel Cycle, Transportation, and Decommissioning

**Table 6-1.** (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
<b>Gases (including entrainment)</b>		
Rn-222		Presently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands) .....	18.1	
C-14	24	
Kr-85 (thousands).....	400	
Ru-106	0.14	Principally from fuel-reprocessing plants.
I-129	1.3	
I-131	0.83	
Tc-99		Presently under consideration by the Commission.
Fission products and transuranic elements	0.203	
<b>Liquids</b>		
Uranium and daughters.....	2.1	Principally from milling – included tailings liquor and returned to ground – no effluents; therefore, no effect on environment.
Ra-226	0.0034	From UF <sub>6</sub> production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants – concentration 10 percent of 10 CFR Part 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products .....	$5.9 \times 10^{-6}$	
<b>Solids (buried onsite)</b>		
Other than high level (shallow).....	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning – buried at land burial facilities. 600 Ci comes from mills – included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent-fuel storage. No significant effluent to the environment.
TRU and HLW (deep).....	$1.1 \times 10^7$	Buried at Federal Repository.
<b>Effluents – thermal (billions of British thermal units)</b>		
Transportation (person-rem)		
Exposure of workers and general public ...	2.5	
Occupational Exposure (person-rem).....	22.6	From reprocessing and waste management.

**Table 6-1. (contd)**

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
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Source: Table S-3 from 10 CFR 51.51(b),

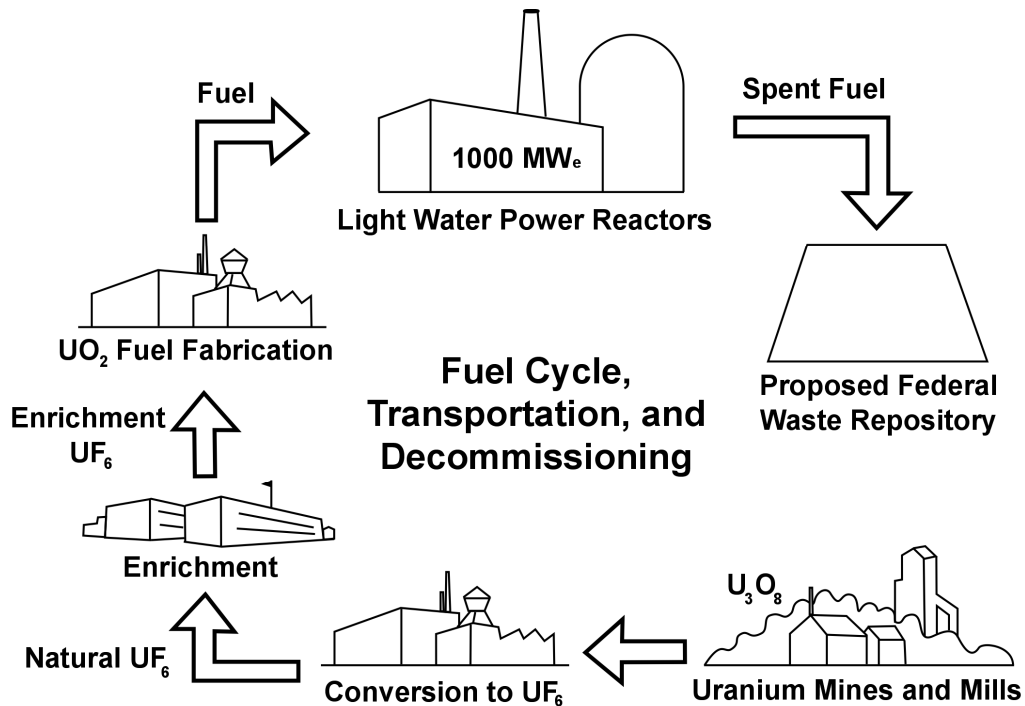
- (a) In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of radon-222 from the uranium fuel cycle or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.  
Data supporting this table are given in *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248 (AEC 1974); *Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle*, NUREG-0116 (Supp.1 to WASH-1248) (NRC 1976); NUREG-0216 (Supp. 2 to WASH-1248) (NRC 1977b); and in the record of the final rulemaking pertaining to *Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management*, Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium-only and no-recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of Sec. 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.
- (b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.
- (c) Estimated effluents based upon combustion of equivalent coal for power generation.
- (d) 1.2 percent from natural gas use and process.

HLW = high-level waste; LWR = light water reactor; TRU = transuranic elements

1 The Nuclear Nonproliferation Act of 1978 (22 USC 3201, et seq.) significantly affected the  
 2 disposition of spent nuclear fuel by deferring indefinitely the commercial reprocessing and  
 3 recycling of spent fuel produced in the U.S. commercial nuclear power program. While the ban  
 4 on the reprocessing of spent fuel was lifted during the Reagan administration, economic  
 5 circumstances changed, reserves of uranium ore increased, and the stagnation of the nuclear  
 6 power industry in the United States provided little incentive for industry to resume reprocessing.  
 7 During the 109th Congress, the Energy Policy Act of 2005 (119 Statute 594) was enacted. It  
 8 authorized the U.S. Department of Energy (DOE) to conduct an advanced fuel-recycling  
 9 technology research and development program to evaluate proliferation-resistant fuel-recycling  
 10 and transmutation technologies that minimize environmental or public health and safety  
 11 impacts. Consequently, while Federal policy does not prohibit reprocessing, additional DOE  
 12 efforts would be necessary before commercial reprocessing and recycling of spent fuel  
 13 produced in the U.S. commercial nuclear power plants could commence.

14 The no-recycle option is presented schematically in Figure 6-1. Natural uranium is mined in  
 15 either open-pit or underground mines or by an in situ leach-solution mining process. In situ  
 16 leach mining, presently the primary form of mining in the United States, involves injecting a  
 17 lixiviant solution into the uranium ore body to dissolve uranium and then pumping the solution to  
 18 the surface for further processing. The ore or in situ leach solution is transferred to mills where  
 19 it is processed to produce "yellowcake" (U<sub>3</sub>O<sub>8</sub>). A conversion facility prepares the uranium oxide  
 20 by converting it to uranium hexafluoride, which is then processed by an enrichment facility to  
 21 increase the percentage of the more fissile isotope uranium-235 and decrease the percentage  
 22 of the nonfissile isotope uranium-238. At a fuel-fabrication facility, the enriched uranium, which

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1

2 **Figure 6-1.** The Uranium Fuel Cycle: No-Recycle Option (derived from NRC 1996)

3 is approximately 5 percent uranium-235, is then converted to uranium dioxide ( $UO_2$ ). The  $UO_2$   
4 is pelletized, sintered, and inserted into tubes to form fuel assemblies, which are placed in a  
5 reactor to produce power. When the content of the uranium-235 reaches a point where the  
6 nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are  
7 withdrawn from the reactor. After onsite storage for sufficient time to allow for short-lived  
8 fission-product decay and to reduce the heat-generation rate, the fuel assemblies are  
9 transferred to a waste repository for interment. Disposal of spent-fuel elements in a repository  
10 constitutes the final step in the no-recycle option.

11 The following assessment of the environmental impacts of the fuel cycle as related to the  
12 operation of the proposed project is based on the values given in Table S-3 (Table 6-1) and the  
13 staff's analysis of the radiological impact from radon-222 and technetium-99. In NUREG-1437,  
14 *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)*  
15 (NRC 1996, 1999),<sup>(a)</sup> the staff provides a detailed analysis of the environmental impacts from  
16 the uranium fuel cycle. Although NUREG-1437 is specific to the impacts related to license  
17 renewal, the information is relevant to this review because the advanced LWR design  
18

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

1 considered here uses the same type of fuel as considered in the staff's evaluation in  
2 NUREG-1437. The staff's analyses in Section 6.2.3 of NUREG-1437 are summarized and set  
3 forth here.

4 The fuel-cycle impacts in Table S-3 are based on a reference 1000-MW(e) LWR operating at an  
5 annual capacity factor of 80 percent for a net electric output of 800 MW(e). As explained above,  
6 the total net electric output for the proposed two new units at the VCSNS site is 2140 MW(e),  
7 which is about 2.68 times (i.e., 2140 MW(e) divided by 800 MW(e) yields 2.68) the output value  
8 in Table S-3 (see Table 6-1). For added conservatism in its review and evaluation of the  
9 environmental impacts of the nuclear fuel cycle, the staff multiplied the values in Table S-3 by a  
10 factor of 3, rather than a factor of 2.68, scaling the impacts upward to account for the increased  
11 electric generation of the two proposed AP1000 units. Scaling up by a factor of 3 is referred to  
12 as using the 1000-MW(e) LWR-scaled model.

13 Recent changes in the fuel cycle may have some bearing on environmental impacts; however,  
14 as discussed below, the staff is confident that the contemporary fuel-cycle impacts are below  
15 those identified in Table S-3. This is especially true in light of the following recent fuel cycle  
16 trends in the United States:

- 17 • Increasing use of in situ leach uranium mining, which does not produce mine tailings.
- 18 • Transitioning of U.S. uranium enrichment technology from gaseous diffusion to gas  
19 centrifuge. The centrifuge process uses only a small fraction of the electrical energy per  
20 separation unit compared to gaseous diffusion. (U.S. gaseous diffusion plants relied on  
21 electricity derived mainly from the burning of coal.)
- 22 • Current LWRs use nuclear fuel more efficiently due to higher fuel burnup. Therefore, less  
23 uranium fuel per year of reactor operation is required than in the past to generate the same  
24 amount of electricity.
- 25 • Fewer spent-fuel assemblies per reactor-year are discharged, hence the waste  
26 storage/repository impact is lessened.

27 The values in Table S-3 were calculated from industry averages for the performance of each  
28 type of facility or operation within the fuel cycle. Recognizing that this approach meant that  
29 there would be a range of reasonable values for each estimate, the staff followed the policy of  
30 choosing the assumptions or factors to be applied so that the calculated values would not be  
31 underestimated. This approach was intended to make sure that the actual environmental  
32 impacts would be less than the quantities shown in Table S-3 for all LWR nuclear power plants  
33 within the widest range of operating conditions. Many subtle fuel-cycle parameters and  
34 interactions were recognized by the staff as being less precise than the estimates and were not  
35 considered or were considered but had no effect on the Table S-3 calculations. For example, to  
36 determine the quantity of fuel required for a year's operation of a nuclear power plant in

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1 Table S-3, the staff defined the model reactor as a 1000-MW(e) LWR operating at 80-percent  
2 capacity with a 12-month fuel-reloading cycle and an average fuel burnup of 33,000 MWd/MTU.  
3 This is a “reactor reference year” or “reference reactor year” depending on the source (either  
4 Table S-3 or NUREG-1437), but it has the same meaning.

5 If approved, the COLs for the proposed two units would allow 40 years of operation. In  
6 NUREG-1437, the sum of the initial fuel loading plus all of the reloads for the lifetime of the  
7 reactor was divided by a 60-year lifetime (40-year initial license term and 20-year license  
8 renewal term) to obtain an average annual fuel requirement. This approach was followed in  
9 NUREG-1437 for both boiling water reactors and pressurized water reactors; the higher annual  
10 requirement, 35 MT of uranium made into fuel for a boiling water reactor, was chosen in  
11 NUREG-1437 as the basis for the reference reactor year (NRC 1996). The average annual fuel  
12 requirement presented in NUREG-1437 would only be increased by 2 percent if a 40-year  
13 lifetime was evaluated. However, a number of fuel-management improvements have been  
14 adopted by nuclear power plants to achieve higher performance and to reduce fuel and  
15 separative-work (enrichment) requirements. Since the time when Table S-3 was promulgated,  
16 these improvements have reduced the annual fuel requirement, which means the Table S-3  
17 assumptions remain bounding as applied to the proposed two units.

18 Another change supporting the bounding nature of the S-3 assumptions with respect to Units 2  
19 and 3 impacts is the elimination of the U.S. restrictions on the importation of foreign uranium.  
20 Until recently, the economic conditions of the uranium market favored use of foreign uranium at  
21 the expense of the domestic uranium industry. From the mid-1980s to 2004, the price of  $U_3O_8$   
22 remained below \$20/lb. These market conditions resulted in the closing of most U.S. uranium  
23 mines and mills, thereby substantially reducing the environmental impacts in the United States  
24 from these activities. However, more recently the spot price of uranium has increased  
25 dramatically from \$24/lb in April 2005 to \$135/lb in July 2007 and has decreased to near \$44/lb  
26 as of April 2009 (VxC 2009). As a result, there is a renewed interest in uranium mining and  
27 milling in the United States and the U.S. Nuclear Regulatory Commission (NRC) anticipates  
28 receiving multiple license applications for uranium mining and milling in the next several years.  
29 The majority of these applications are expected to be for in situ leach solution mining that does  
30 not produce tailings. Factoring in changes to the fuel cycle suggests that the environmental  
31 impacts of mining and tail millings could drop to levels below those given in Table S-3; however,  
32 Table S-3 estimates remain bounding as applied to the proposed two units.

33 In summation, these reasons highlight why Table S-3 is likely to overestimate impacts from the  
34 proposed two units and therefore remains a bounding approach for this analysis.

35 Section 6.2 of NUREG-1437 discusses in greater detail the sensitivity to changes in the fuel  
36 cycle since issuance of Table S-3 on the environmental impacts.



### 1 **6.1.1 Land Use**

2 The total annual land requirement for the fuel cycle supporting the 1000-MW(e) LWR-scaled  
3 model is about 339 ac. Approximately 39 ac are permanently committed land, and 300 ac are  
4 temporarily committed. A “temporary” land commitment is a commitment for the life of the  
5 specific fuel-cycle plant (e.g., a mill, enrichment plant, or succeeding plants). After  
6 decommissioning, such land can be released for unrestricted use. “Permanent” commitments  
7 represent land that may not be released for use after plant shutdown and decommissioning  
8 because decommissioning activities do not result in the removal of sufficient radioactive material  
9 to meet the limits in 10 CFR Part 20, Subpart E, for release of that area for unrestricted use. Of  
10 the 300 ac of temporarily committed land, 66 ac are assumed to be disturbed. In comparison, a  
11 coal-fired power plant using the same megawatt electric output as the LWR-scaled model and  
12 using strip-mined coal requires the disturbance of about 528 ac/yr for fuel alone. The staff  
13 concludes that the impacts on land use to support the 1000-MW(e) LWR-scaled model would be  
14 SMALL.

### 15 **6.1.2 Water Use**

16 The principal water use for the fuel cycle supporting a 1000-MW(e) LWR-scaled model is that  
17 required to remove waste heat from the power stations supplying electrical energy to the  
18 enrichment step of this cycle. Scaling from Table S-3, of the total annual water use of  
19  $3.41 \times 10^{10}$  gal, about  $3.33 \times 10^{10}$  gal are required for the removal of waste heat, assuming that  
20 a new unit uses once-through cooling. Also, scaling from Table S-3, other water uses involve  
21 the discharge to air (e.g., evaporation losses in process cooling) of about  $4.80 \times 10^8$  gal/yr and  
22 discharge to the ground (e.g., mine drainage) of about  $3.81 \times 10^8$  gal/yr.

23 On a thermal-effluent basis, annual discharges from the nuclear fuel cycle are about 4 percent  
24 of the 1000-MW(e) LWR-scaled model using once-through cooling. The consumptive water use  
25 is about 2 percent of the 1000-MW(e) LWR-scaled model using cooling towers. The maximum  
26 consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel  
27 cycle use cooling towers) would be about 4 percent of the 1000-MW(e) LWR-scaled model  
28 using cooling towers. Under this condition, thermal effluents would be negligible. The staff  
29 concludes that the impacts on water use for these combinations of thermal loadings and water  
30 consumption would be SMALL.

### 31 **6.1.3 Fossil Fuel**

32 Electric energy and process heat are required during various phases of the fuel-cycle process.  
33 The electric energy is usually produced by the combustion of fossil fuel at conventional power  
34 plants. Electric energy use associated with the fuel cycle represents about 5 percent of the  
35 annual electric power production of the 1000-MW(e) LWR-scaled model. Process heat is  
36 primarily generated by the combustion of natural gas. This gas consumption, if used to

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1 generate electricity, would be less than 0.4 percent of the electrical output from the model plant.  
2 The staff concludes that the fossil fuel impacts from the direct and indirect consumption of  
3 electric energy for fuel-cycle operations would be SMALL relative to the net power production of  
4 the proposed project.

5 The largest source of carbon dioxide (CO<sub>2</sub>) emissions in the fuel cycle is production of electric  
6 energy from combustion of fossil fuel in conventional power plants. This energy is used to  
7 power components of the fuel cycle such as enrichment. The CO<sub>2</sub> emissions from the fuel cycle  
8 are about 5 percent of the CO<sub>2</sub> emissions from an equivalent fossil fuel-fired plant.

9 The largest use of electricity in the fuel cycle comes from the enrichment process. It appears  
10 that gas centrifuge (GC) technology is likely to eventually replace gaseous diffusion (GD)  
11 technology for uranium enrichment in the United States. The same amount of enrichment from  
12 a GC facility uses less electricity and therefore results in lower amounts of air emissions such as  
13 carbon dioxide than a GD facility. Therefore, the NRC staff concludes that the values for  
14 electricity use and air emissions in Table S-3 continue to be appropriately bounding values.

15 In Appendix J, the staff estimates that the carbon footprint of the fuel cycle to support a  
16 reference 1000-MW(e) LWR for a 40-year plant life is on the order of  $1.8 \times 10^7$  MT of CO<sub>2</sub>,  
17 including a very small contribution from other greenhouse gases. Scaling this footprint to the  
18 power level of the AP1000 reactor and two proposed units using the scaling factor of 3  
19 discussed earlier, the NRC staff estimates the carbon footprint for 40 years of fuel-cycle  
20 emissions to be approximately  $5.3 \times 10^7$  MT of CO<sub>2</sub>.

21 On this basis, the NRC staff concludes that the fossil fuel impacts including greenhouse gas  
22 emissions from the direct and indirect consumption of electric energy for fuel cycle operations  
23 would be SMALL.

### 24 **6.1.4 Chemical Effluents**

25 The quantities of gaseous and particulate chemical effluents produced in fuel-cycle processes  
26 are given in Table S-3 (Table 6-1) for the reference 1000-MW(e) LWR and, according to  
27 WASH-1248 (AEC 1974), result from the generation of electricity for fuel-cycle operations. The  
28 principal effluents are sulfur oxides, nitrogen oxides, and particulates. Table S-3 states that the  
29 fuel cycle for the reference 1000-MW(e) LWR requires 323,000 MWh of electricity. The fuel  
30 cycle for the 1000-MW(e) LWR-scaled model would therefore require 969,000 MWh of  
31 electricity, or less than 0.024 percent of the 4.1 billion MWh of electricity generated in the United  
32 States in 2008 (DOE 2009). Therefore, the gaseous and particulate chemical effluents from  
33 fuel-cycle processes to support the operation of the 1000-MW(e) LWR-scaled model would add  
34 less than 0.024 percent to the national gaseous and particulate chemical effluents for electricity  
35 generation.

1 Liquid chemical effluents produced in fuel-cycle processes are related to fuel enrichment and  
2 fabrication and may be released to receiving waters. These effluents are usually present in  
3 dilute concentrations such that only small amounts of dilution water are required to reach levels  
4 of concentration that are within established standards. Table S-3 (Table 6-1) specifies the  
5 amount of dilution water required for specific constituents. In addition, all liquid discharges into  
6 the navigable waters of the United States from facilities associated with the fuel-cycle  
7 operations would be subject to requirements and limitations set by appropriate Federal, State,  
8 Tribal, and local agencies.

9 Tailings solutions and solids are generated during the milling process, but as Table S-3  
10 indicates, effluents are not released in quantities sufficient to have a significant impact on the  
11 environment.

12 Based on the above analysis, the NRC staff concludes that the impacts of these chemical  
13 effluents (gaseous, particulate and liquid) would be SMALL.

#### 14 **6.1.5 Radiological Effluents**

15 Radioactive effluents estimated to be released to the environment from waste management  
16 activities and certain other phases of the fuel-cycle process are listed in Table S-3 (Table 6-1).  
17 NUREG-1437 (NRC 1996) provides the 100-year environmental dose commitment to the U.S.  
18 population from fuel cycle activities for 1 year of operation of the model 1000-MW(e) LWR using  
19 the radioactive effluents in Table S-3. Excluding reactor releases and dose commitments  
20 because of exposure to radon-222 and technetium-99, the total overall whole body gaseous  
21 dose commitment and whole body liquid dose commitment from the fuel cycle were calculated  
22 to be approximately 400 person-rem and 200 person-rem, respectively. Scaling these dose  
23 commitments by a factor of about 3 for the 1000-MW(e) LWR-scaled model results in  
24 whole body dose commitment estimates of 1200 person-rem for gaseous releases and  
25 600 person-rem for liquid releases. Therefore, for both pathways, the estimated 100-year  
26 environmental dose commitment to the U.S. population would be approximately 1800 person-  
27 rem for the 1000-MW(e) LWR-scaled model.

28 Currently, the radiological impacts associated with radon-222 and technetium-99 releases are  
29 not addressed in Table S-3. Principal radon releases occur during mining and milling  
30 operations and as emissions from mill tailings, whereas principal technetium-99 releases occur  
31 from gaseous-diffusion enrichment facilities. SCE&G provided an assessment of radon-222 and  
32 technetium-99 in its Environmental Report (ER) (SCE&G 2009a). SCE&G's evaluation relied on  
33 the information discussed in NUREG-1437 (NRC 1996).

34 In Section 6.2 of NUREG-1437 (NRC 1996), the staff estimated the radon-222 releases from  
35 mining and milling operations and from mill tailings for each year of operation of the reference  
36 1000-MW(e) LWR. The estimated release of radon-222 for the 1000-MW(e) LWR-scaled model

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1 is approximately 16,000 Ci. Of this total, about 78 percent would be from mining, 15 percent  
2 from milling operations, and 7 percent from inactive tailings before stabilization. For radon  
3 releases from stabilized tailings, the staff assumed that the LWR-scaled model would result in  
4 an emission of 3 Ci/Ryr, (i.e., about three times the NUREG-1437 [NRC 1996] estimate for the  
5 reference reactor year). The major risks from radon-222 are from exposure to the bone and the  
6 lung, although there is a small risk from exposure to the whole body. The organ-specific dose-  
7 weighting factors from 10 CFR Part 20 were applied to the bone and lung doses to estimate the  
8 100-year dose commitment from radon-222 to the whole body. The estimated 100-year  
9 environmental dose commitment from mining, milling, and tailings before stabilization for each  
10 reactor year (assuming the 1000-MW(e) LWR-scaled model) would be approximately  
11 1800 person-rem to the whole body. From stabilized tailings piles, the estimated 100-year  
12 environmental dose commitment would be approximately 34 person-rem to the whole body.  
13 Additional insights regarding Federal policy/resource perspectives concerning institutional  
14 controls comparisons with routine radon-222 exposure and risk and long-term releases from  
15 stabilized tailing piles are discussed in NUREG-1437 (NRC 1996).

16 Also as discussed in NUREG-1437, the staff considered the potential doses associated with the  
17 releases of technetium-99. The estimated releases of technetium-99 for the reference reactor  
18 year for the 1000-MW(e) LWR-scaled model are 0.021 Ci from chemical processing of recycled  
19 uranium hexafluoride before it enters the isotope-enrichment cascade and 0.015 Ci into the  
20 groundwater from a HLW repository. The major risks from technetium-99 are from exposure of  
21 the gastrointestinal tract and kidney, although there is a small risk from exposure to the whole  
22 body. Applying the organ-specific dose-weighting factors from 10 CFR Part 20 to the  
23 gastrointestinal tract and kidney doses, the total-body 100-year dose commitment from  
24 technetium-99 to the whole body was estimated to be 300 person-rem for the 1000-MW(e)  
25 LWR-scaled model.

26 Radiation protection experts assume that any amount of radiation may pose some risk of  
27 causing cancer or a severe hereditary effect and that the risk is higher for higher radiation  
28 exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the  
29 relationship between radiation dose and detriments such as cancer induction. A recent report  
30 by the National Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII  
31 report, uses the linear, no-threshold dose response model as a basis for estimating the risks  
32 from low doses. This approach is accepted by the NRC as a conservative method for  
33 estimating health risks from radiation exposure, recognizing that the model may overestimate  
34 those risks. Based on this method, the staff estimated the risk to the public from radiation  
35 exposure using the nominal probability coefficient for total detriment. This coefficient has  
36 the value of 570 fatal cancers, nonfatal cancers, and severe hereditary effects per  
37 1,000,000 person-rem (10,000 person-Sv), equal to 0.00057 effect per person-rem. The  
38 coefficient is taken from Publication 103 of the International Commission on Radiological  
39 Protection (ICRP 2007).

1 The nominal probability coefficient was multiplied by the sum of the estimated whole body  
2 population doses from gaseous effluents, liquid effluents, radon-222, and technetium-99  
3 discussed above (approximately 3900 person-rem/yr) to calculate that the U.S. population  
4 would incur a total of approximately 2.2 fatal cancers, nonfatal cancers, and severe hereditary  
5 effects annually.

6 Radon-222 releases from tailings are indistinguishable from background radiation levels at a  
7 few miles from the tailings pile (at less than 0.6 mi in some cases) (NRC 1996). The public  
8 dose limit in the U.S. Environmental Protection Agency's (EPA's) regulation, 40 CFR Part 190,  
9 is 25 mrem/yr to the whole body from the entire fuel cycle, but most NRC licensees have  
10 airborne effluents resulting in doses of less than 1 mrem/yr (61 FR 65120).

11 In addition, at the request of the U.S. Congress, the National Cancer Institute conducted a study  
12 and published *Cancer in Populations Living Near Nuclear Facilities* in 1990 (Jablon et al. 1990).  
13 This report included an evaluation of health statistics around all nuclear power plants, as well as  
14 several other nuclear fuel-cycle facilities, in operation in the United States in 1981 and found "no  
15 evidence that an excess occurrence of cancer has resulted from living near nuclear facilities"  
16 (Jablon et al. 1990). The contribution to the annual average dose received by an individual from  
17 fuel-cycle-related radiation and other sources as reported in a publication of the National  
18 Council on Radiation Protection and Measurements (NCRP 2009) is listed in Table 6-2. The  
19 contribution from the nuclear fuel cycle to an individual's annual average radiation dose is  
20 extremely small (less than 0.01 mrem/yr) compared to the annual average background radiation  
21 dose (about 311 mrem/yr).

22 Based on the analyses presented above, the staff concludes that the environmental impacts of  
23 radioactive effluents from the fuel cycle, including gaseous and liquid releases, are SMALL.

#### 24 **6.1.6 Radiological Wastes**

25 The estimated quantities of buried radioactive waste material (LLW, HLW, and transuranic  
26 waste) generated by the reference 1000-MW(e) LWR are specified in Table S-3 (Table 6-1).  
27 For LLW disposal at land burial facilities, the Commission<sup>(a)</sup> notes in Table S-3 that there would  
28 be no significant radioactive releases to the environment. The VCSNS site is in the State of  
29 South Carolina, and thus has continuing access to the LLW disposal facility at Barnwell, South  
30 Carolina.

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(a) The Commission is the body of up to five NRC commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.

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1 **Table 6-2.** Comparison of Annual Average Dose Received by a U.S. Resident from All  
2 Sources

Source		Dose (mrem/yr) <sup>(a)</sup>	Percent of Total
Ubiquitous background	Radon and thoron	228	37
	Space	33	5
	Terrestrial	21	3
	Internal (body)	29	5
	Subtotal	311	50
Medical	Computed tomography	147	24
	Medical x-ray	76	12
	Nuclear medicine	77	12
	Subtotal	300	48
Consumer	Construction materials, smoking, air travel, mining, agriculture, fossil fuel combustion	13	2
Other	Occupational	0.5 <sup>(b)</sup>	0.1
	Nuclear fuel cycle	0.05 <sup>(c)</sup>	0.01
Total		624	100

Source: NCRP Report 160, *Ionizing Radiation Exposure of the Population of the United States* (NCRP 2009)

(a) NCRP Report 160 table expressed in mSv/yr (1 mSv/yr equals 100 mrem/yr).

(b) Occupational dose is regulated separately from public dose and is provided here for informational purposes.

(c) Calculated using 153 person-Sv/yr from Table 6.1 of NCRP Report 160 using a 2006 U.S. population of 300 million.

3 The Commission notes that high-level and transuranic wastes are to be buried at a repository,  
4 such as the candidate repository at Yucca Mountain, Nevada, and that no release to the  
5 environment is expected to be associated with such disposal, because it has been assumed  
6 that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the  
7 atmosphere before the disposal of the waste. In NUREG-0116 (NRC 1976), which provides  
8 background and context for the Table S-3 values established by the Commission, the staff  
9 indicates that these high-level and transuranic wastes will be buried and will not be released to  
10 the environment.

11 As part of the Table S-3 rulemaking, the staff evaluated, along with more conservative  
12 assumptions, this zero-release assumption associated with waste burial in a repository, and the  
13 NRC reached an overall generic determination that fuel-cycle impacts would not be significant.  
14 In 1983, the Supreme Court affirmed the NRC's position that the zero-release assumption was  
15 reasonable in the context of the Table S-3 rulemaking to address generically the impacts of the  
16 uranium fuel cycle in individual reactor licensing proceedings (*Baltimore Gas & Electric v.*  
17 *National Resources Defense Council*).

1 Furthermore, in the Commission's Waste Confidence Decision, 10 CFR 51.23, the Commission  
2 has made the generic determination that "if necessary, spent fuel generated in any reactor can  
3 be stored safely and without significant environmental impacts for at least 30 years beyond the  
4 licensed life for operation [...] of that reactor at its spent fuel storage basin or at either onsite or  
5 offsite independent spent fuel storage installations." That regulation also states that "the  
6 Commission believes there is reasonable assurance that at least one mined geologic repository  
7 will be available [...] within 30 years beyond the licensed life for operation of any reactor to  
8 dispose of the commercial high-level waste and spent fuel originating in such reactor and  
9 generated up to that time." The regulation provides that, accordingly, no discussion of any  
10 environmental impact of spent fuel storage for the period following the term of a reactor  
11 combined license is required in any EIS prepared in connection with the issuance of that  
12 combined license.

13 In October 2008, the Commission proposed a rulemaking to update and revise the Waste  
14 Confidence Decision (73 FR 59551 [Oct. 9, 2008]). Public comments were received on the  
15 rulemaking, and the public comment period for the rule was extended through February 2009  
16 (73 FR 72370 [Nov. 28, 2008]). At this time, however, the Commission has not approved  
17 publication of a final rule. If a revised rule concerning the waste confidence determination is  
18 ultimately issued by the Commission, the staff will be required to follow that determination.  
19 Absent further developments with respect to the Waste Confidence rulemaking, Table S-3 and  
20 the existing Waste Confidence Decision indicates that any environmental impacts associated  
21 with the HLW that would be generated by Units 2 and 3 would be small.

22 In the context of operating license renewal, Sections 6.2 and 6.4 of NUREG-1437 (NRC 1996)  
23 provide additional description of the generation, storage, and ultimate disposal of LLW, mixed  
24 waste, and spent fuel from power reactors, concluding that environmental impacts from these  
25 activities are small. For the reasons stated above, the staff concludes that the environmental  
26 impacts of radioactive waste storage and disposal associated with proposed Units 2 and 3  
27 would be SMALL.

### 28 **6.1.7 Occupational Dose**

29 The annual occupational dose attributable to all phases of the fuel cycle for the 1000-MW(e)  
30 LWR-scaled model is about 1800 person-rem. This is based on the NUREG-1437 occupational  
31 dose estimate of 600 person-rem attributable to all phases of the fuel cycle for the model  
32 1000-MW(e) LWR (NRC 1996). The environmental impact from this occupational dose is  
33 considered SMALL because the dose to any individual worker would be maintained within the  
34 limits of 10 CFR Part 20, which is 5 rem/yr.

1 **6.1.8 Transportation**

2 The transportation dose to workers and the public related to the uranium fuel cycle is  
3 approximately 2.5 person-rem annually for the reference 1000-MW(e) LWR in accordance with  
4 Table S-3 (Table 6-1). This corresponds to a dose of 7.5 person-rem for the 1000-MW(e) LWR-  
5 scaled model. For purposes of comparison, in the year 2010 the population within 50 mi of the  
6 VCSNS site is estimated to be 1.15 million people (SCE&G 2009b). Using 0.311 rem/yr as the  
7 average dose to a U.S. resident from natural background radiation (NCRP 2009), the collective  
8 dose to that population is estimated to be 358,000 person-rem/yr. On the basis of this  
9 comparison, the staff concludes that the environmental impacts of transportation would be  
10 SMALL.

11 **6.1.9 Conclusions**

12 The staff evaluated the environmental impacts of the uranium fuel cycle, as given in Table S-3  
13 (Table 6-1), considered the effects of radon-222 and technetium-99, and appropriately scaled  
14 the impacts for the 1000-MW(e) LWR-scaled model. Based on this evaluation, the staff  
15 concludes that the impacts of the uranium fuel cycle would be SMALL.

16 **6.2 Transportation Impacts**

17 This section addresses both the radiological and nonradiological environmental impacts from  
18 normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to the  
19 VCSNS site and alternative sites, (2) shipment of irradiated (spent) fuel to a monitored  
20 retrievable storage facility or a permanent repository, and (3) shipment of low-level radioactive  
21 waste and mixed waste to offsite disposal facilities. Alternative sites evaluated in this  
22 environmental impact statement (EIS) include the existing VCSNS site (proposed), Cope  
23 Generating Station (CGS) site, Saluda County site, and the Savannah River (SR) project site.  
24 Note that the transportation impacts for the Fairfield Unit 1 (FA-1) site are not explicitly analyzed  
25 in this EIS. This is because the FA-1 site is less than 10 mi from the existing VCSNS site and  
26 the transportation impacts would be approximately equal to those for the VCSNS site.

27 The NRC performed a generic analysis of the environmental effects of transportation of fuel and  
28 waste to and from LWRs in the *Environmental Survey of Transportation of Radioactive Materials*  
29 *to and from Nuclear Power Plants*, WASH-1238 (AEC 1972) and in a supplement to  
30 WASH-1238, NUREG-75/038 (NRC 1975), and found the impact to be SMALL. These  
31 documents provided the basis for Table S-4 in 10 CFR 51.52 that summarizes the  
32 environmental impacts of transportation of fuel and waste to and from one LWR of 3000 to  
33 5000 MW(t) (1000 to 1500 MW(e)). Impacts are provided for normal conditions of transport and



1 accidents in transport for a reference 1100-MW(e) LWR.<sup>(a)</sup> Dose to transportation workers  
2 during normal transportation operations was estimated to result in a collective dose of 4 person-  
3 rem per reference reactor year. The combined dose to the public along the route and dose to  
4 onlookers were estimated to result in a collective dose of 3 person-rem per reference  
5 reactor year.

6 Environmental risks of radiological effects during accident conditions, as stated in Table S-4, are  
7 SMALL. Nonradiological impacts from postulated accidents were estimated as one fatal injury  
8 in 100 reactor years and one nonfatal injury in 10 reference reactor years. Subsequent reviews  
9 of transportation impacts in NUREG-0170 (NRC 1977a) and by Sprung et al. (2000) concluded  
10 that impacts were bounded by Table S-4 in 10 CFR 51.52.

11 In accordance with 10 CFR 51.52(a), a full description and detailed analysis of transportation  
12 impacts is not required when licensing an LWR (i.e., impacts are assumed to be bounded by  
13 Table S-4) if the reactor meets the following criteria:

- 14 • The reactor has a core thermal power level not exceeding 3800 MW(t).
- 15 • Fuel is in the form of sintered UO<sub>2</sub> pellets having a uranium-235 enrichment not exceeding  
16 4 percent by weight; and pellets are encapsulated in zircaloy-clad fuel rods.
- 17 • The average level of irradiation of the fuel from the reactor does not exceed  
18 33,000 MWd/MTU, and no irradiated fuel assembly is shipped until at least 90 days after it is  
19 discharged from the reactor.
- 20 • With the exception of irradiated fuel, all radioactive waste shipped from the reactor is  
21 packaged and in solid form.
- 22 • Unirradiated fuel is shipped to the reactor by truck; irradiated (spent) fuel is shipped from the  
23 reactor by truck, railroad, or barge; and radioactive waste other than irradiated fuel is  
24 shipped from the reactor by truck or railroad.

25 The environmental impacts of the transportation of fuel and radioactive wastes to and from  
26 nuclear power facilities were resolved generically in 10 CFR 51.52, provided that the specific  
27 conditions in the rule (see above) are met; if not, then a full description and detailed analysis is  
28 required for initial licensing. The NRC may consider requests for licensed plants to operate at  
29 conditions beyond those in the facility's licensing basis; for example, higher burnups (above

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(a) The transportation impacts associated with the VCSNS site and alternative sites were normalized for a reference 1100-MW(e) LWR at an 80-percent capacity factor for comparison with Table S-4. Note that the basis for Table S-4 is an 1100-MW(e) LWR at an 80-percent capacity factor (AEC 1972; NRC 1975). The basis for Table S-3 in 10 CFR 51.51(b) that was discussed in Section 6.1 of this EIS is an 1000-MW(e) LWR with an 80-percent capacity factor (NRC 1976). However, because fuel cycle and transportation impacts are evaluated separately, this difference does not affect the results and conclusions in this EIS.

## Fuel Cycle, Transportation, and Decommissioning

1 33,000 MWd/MTU), enrichments (above 4 percent uranium-235), or thermal power levels  
2 (above 3800 MW(t)). Departures from the conditions itemized in 10 CFR 51.52(a) must be  
3 supported by a full description and detailed analysis of the environmental effects, as specified in  
4 10 CFR 51.52(b). Departures found to be acceptable for licensed facilities cannot serve as the  
5 basis for initial licensing for new reactors.

6 In its application, SCE&G requested combined construction permits and operating licenses  
7 (COLs) for two additional reactors at its VCSNS site in Fairfield County, South Carolina. Each  
8 proposed new reactor would be an AP1000 unit, which has a thermal power rating of  
9 3400 MW(t) and a net electrical output of 1107 MW(e). The thermal power rating is less than  
10 the 3800-MW(t) condition given in 10 CFR 51.52(a). Westinghouse AP1000 reactors are  
11 expected to operate with a 93-percent capacity factor, so the net electrical output (annualized) is  
12 about 1030 MW(e) (SCE&G 2009a). Fuel for the reactors would be enriched up to about  
13 4.54 weight percent uranium-235, which exceeds the 10 CFR 51.52(a) condition. In addition,  
14 the expected irradiation level of about 50,533 MWd/MTU (SCE&G 2009a) exceeds the  
15 10 CFR 51.52(a) condition. Therefore, a full description and detailed analysis of transportation  
16 impacts is required.

17 In its ER (SCE&G 2009a), SCE&G provided a full description and detailed analysis of  
18 transportation impacts. In the analysis, the radiological impacts of transporting fuel and waste  
19 to and from the VCSNS site were calculated using the RADTRAN 5.6 computer code (Weiner et  
20 al. 2008). RADTRAN 5.6 was used in this EIS and is the most commonly used transportation  
21 impact analysis software in the nuclear industry.

### 22 **6.2.1 Transportation of Unirradiated Fuel**

23 The NRC staff performed an independent analysis of the environmental impacts of transporting  
24 unirradiated (i.e., fresh) fuel to the VCSNS site and alternative sites. The radiological impacts of  
25 normal operating conditions and transportation accidents as well as nonradiological impacts are  
26 discussed in this section. Radiological impacts to populations and maximally exposed  
27 individuals (MEIs) are presented. Because the specific fuel fabrication plant for VCSNS  
28 unirradiated fuel is not known at this time, the staff's analysis assumes a "representative" route  
29 between the fuel fabrication facility and the VCSNS site or alternative sites. This means that  
30 there are no differences between the impacts calculated for the VCSNS site and the three  
31 alternative sites. However, site-specific differences would be small because the radiation doses  
32 from unirradiated fuel transport and the shipping distances between potential fuel fabrication  
33 plants and the VCSNS site and alternative sites are small.

#### 34 **6.2.1.1 Normal Conditions**

35 Normal conditions, sometimes referred to as "incident-free" transportation, are transportation  
36 activities in which shipments reach their destinations without releasing any radioactive material

1 to the environment. The impacts of these shipments would be from the low levels of radiation  
 2 that penetrate the shipping containers of unirradiated fuel. Radiation exposures at some level  
 3 would occur to the following populations: (1) persons residing along the transportation corridors  
 4 between the fuel fabrication facility and the VCSNS site; (2) persons in vehicles traveling on the  
 5 same route as a shipment of unirradiated fuel; (3) persons at vehicle stops for refueling, rest,  
 6 and vehicle inspections; and (4) the transportation crew (including drivers).

7 **Truck Shipments**

8 Table 6-3 provides an estimate of the number of truck shipments of unirradiated fuel for the  
 9 Westinghouse AP1000 reactor design compared to those of the reference 1100-MW(e) reactor  
 10 specified in WASH-1238 (AEC 1972) operating at 80-percent capacity (880 MW(e)). After  
 11 normalization to electric generation capacity, the number of truck shipments of unirradiated fuel  
 12 to the VCSNS site and alternative sites is fewer than the number of truck shipments of  
 13 unirradiated fuel estimated for the reference LWR in WASH-1238.

14 **Table 6-3.** Number of Truck Shipments of Unirradiated Fuel for the Reference LWR and the  
 15 Westinghouse AP1000 Reactor

Reactor Type	Number of Shipments	Unit Electric Generation, MW(e) <sup>(b)</sup>	Capacity Factor <sup>(b)</sup>	Normalized, Shipments per 1100 MW(e) <sup>(c)</sup>
	per Reactor Total <sup>(a)</sup>			
Reference LWR (WASH-1238)	252	1100	0.8	252
VCSNS Westinghouse AP1000	233	1107	0.93	199

(a) Total shipments of unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 39 years of average annual reload quantities).  
 (b) Unit capacities and capacity factors were taken from WASH-1238 for the reference light water reactor (LWR) and the ER (SCE&G 2009a) for the Westinghouse AP1000 reactor.  
 (c) Normalized to net electric output for WASH-1238 reference LWR (i.e., 1100-MW(e) plant at 80 percent or net electrical output of 880 MW(e)).

16 **Shipping Mode and Weight Limits**

17 In 10 CFR 51.52, one identified condition is that all unirradiated fuel is to be shipped to the  
 18 reactor by truck; SCE&G specifies that unirradiated fuel would be shipped to the proposed  
 19 reactor site by truck (SCE&G 2009a). Table S-4 in 10 CFR 51.52 includes a condition that the  
 20 truck shipments not exceed 73,000 lb as governed by Federal or State gross vehicle-weight  
 21 restrictions; SCE&G states in its ER that the unirradiated fuel shipments to the proposed  
 22 VCSNS site and alternative sites would comply with applicable weight restrictions (SCE&G  
 23 2009a).

1 ***Radiological Doses to Transport Workers and the Public***

2 10 CFR 51.52, Table S-4, includes conditions related to radiological dose to transport workers  
3 and members of the public along transport routes. These doses are a function of many  
4 variables, including the radiation dose rate emitted from the unirradiated fuel shipments, the  
5 number of individuals exposed and their locations relative to the shipment, the time in transit  
6 (including travel and stop times), and the number of shipments to which the individuals are  
7 exposed. For this EIS, the NRC staff independently calculated the radiological dose impacts to  
8 transport workers and the public from the transportation of unirradiated fuel using the  
9 RADTRAN 5.6 computer code (Weiner et al. 2008).

10 One of the key assumptions in WASH-1238 (AEC 1972) for the reference-LWR unirradiated fuel  
11 shipments is that the radiation dose rate at 1 m (3.3 ft) from the transport vehicle is about  
12 0.1 mrem/hr. This assumption was also used in the NRC staff's analysis of the Westinghouse  
13 AP1000 reactor unirradiated fuel shipments. This assumption is reasonable because the  
14 AP1000 reactor fuel material would be low-dose-rate uranium radionuclides and would be  
15 packaged similarly to the practice described in WASH-1238 (i.e., inside a metal container that  
16 provides little radiation shielding). The numbers of shipments per year were obtained by  
17 dividing the normalized shipments in Table 6-3 by 40 years of reactor operation. Other key  
18 input parameters used in the radiation-dose analysis for unirradiated fuel are shown in  
19 Table 6-4.

20 The RADTRAN 5.6 results for this "generic" unirradiated fuel shipment are as follows:

- 21 • worker dose:  $1.71 \times 10^{-3}$  person-rem/shipment
- 22 • general public dose (onlookers/persons at stops and sharing the highway):  
23  $3.62 \times 10^{-3}$  person-rem/shipment)
- 24 • general public dose (along route/persons living near a highway or truck stop):  $5.12 \times 10^{-5}$   
25 person-rem/shipment.

26 These values were combined with the average annual shipments of unirradiated fuel for the  
27 Westinghouse AP1000 reactor to calculate annual doses to the public and workers. Table 6-5  
28 presents the annual radiological impacts on workers, public onlookers (persons at stops and  
29 sharing the road), and members of the public along the route (i.e., residents within 0.5 mi of the  
30 highway) for transportation of unirradiated fuel to the VCSNS site and alternative sites. The  
31 cumulative annual dose estimates in Table 6-5 were normalized to 1100 MW(e) (880 MW(e) of  
32 net electrical output). The NRC staff performed an independent review and determined that  
33 all dose estimates calculated by the staff are bounded by the Table S-4 conditions of  
34 4 person-rem/yr to transportation workers, 3 person-rem/yr to onlookers, and 3 person-rem/yr  
35 to members of the public along the route.

1 **Table 6-4.** RADTRAN 5.6 Input Parameters for Unirradiated Fuel Shipments

Parameter	RADTRAN 5.6	
	Input Value	Source
Shipping distance, km	3200	AEC (1972) <sup>(a)</sup>
Travel fraction – rural	0.90	NRC (1977a)
Travel fraction – suburban	0.05	
Travel fraction – urban	0.05	
Population density – rural, persons/km <sup>2</sup>	10	DOE (2002a)
Population density – suburban, persons/km <sup>2</sup>	349	
Population density – urban, persons/km <sup>2</sup>	2260	
Vehicle speed – km/hr	88.5	Conservative in-transit speed of 88.5 km/hr (55 mph) assumed; predominantly interstate highways used.
Traffic count – rural, vehicles/hr	530	DOE (2002a)
Traffic count – suburban, vehicles/hr	760	
Traffic count – urban, vehicles/hr	2400	
Dose rate at 1 m from vehicle, mrem/hr	0.1	AEC (1972)
Packaging length, m	9.1	Approximate length of two AP1000 fuel assemblies placed end to end (Westinghouse 2007).
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a)
Stop time, hr/trip	4	Based on one 30-minute stop per 400 km (Johnson and Michelhaugh 2003).
Population density at stops, persons/km <sup>2</sup>	See Table 6-8 for truck stop parameters	

(a) AEC (1972) provides a range of shipping distances between 25 mi and 3000 mi for shipments of fresh fuel. A 3200-km (2000-mi) “representative” shipping distance was assumed here.

2 **Table 6-5.** Radiological Impacts Under Normal Conditions of Transporting Unirradiated Fuel to  
 3 the VCSNS Site and Alternative Sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose; person-rem/yr per 1100 MW(e) <sup>(a)</sup> (880 MW(e) net)		
		Transportation Workers	Public – Onlookers	Public – Along Route
Reference LWR (WASH-1238)	6.3	$1.1 \times 10^{-2}$	$2.3 \times 10^{-2}$	$3.2 \times 10^{-4}$
VCSNS and alternative sites AP1000	5.0	$8.5 \times 10^{-3}$	$1.8 \times 10^{-2}$	$2.5 \times 10^{-4}$
10 CFR 51.52, Table S-4 condition	<1 per day	4	3	3

(a) Multiply person-rem/yr times 0.01 to obtain doses in person-Sv/yr.  
 LWR = light water reactor

## Fuel Cycle, Transportation, and Decommissioning

1 Radiation protection experts assume that any amount of radiation may pose some risk of causing  
2 cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures.  
3 Therefore, a linear, no-threshold dose response relationship is used to describe the relationship  
4 between radiation dose and detriments such as cancer induction. A report by the National  
5 Research Council (2006), the BEIR VII report, uses the linear, no-threshold dose response  
6 model as a basis for estimating the risks from low doses. This approach is accepted by the NRC  
7 as a conservative method for estimating health risks from radiation exposure, recognizing that  
8 the model may overestimate those risks. Based on this method, the NRC staff estimated the risk  
9 to the public from radiation exposure using the nominal probability coefficient for total detriment.  
10 This coefficient has the value of 570 fatal cancers, nonfatal cancers, and severe hereditary  
11 effects per 1,000,000 person-rem (10,000 person-Sv), equal to 0.00057 effect per person-rem.  
12 The coefficient is taken from ICRP Publication 103 (ICRP 2007).

13 Both the NCRP and ICRP suggest that when the collective effective dose is smaller than the  
14 reciprocal of the relevant risk detriment (in other words, less than  $1/0.00057$ , which is less than  
15 1754 person-rem), the risk assessment should note that the most likely number of excess health  
16 effects is zero (NCRP 1995; ICRP 2007). The largest annual collective dose estimate for  
17 transporting unirradiated fuel to the VCSNS site and alternative sites was 0.018 person-rem,  
18 which is less than the value of 1754 person-rem that NCRP and ICRP suggest would most likely  
19 result in zero excess health effects.

20 To place these impacts in perspective, the average U.S. resident receives about 311 mrem/yr  
21 effective dose equivalent from natural background radiation (i.e., exposures from cosmic  
22 radiation, naturally occurring radioactive materials such as radon, and global fallout from testing  
23 of nuclear explosive devices (NCRP 2009). Using this average effective dose, the collective  
24 population dose from natural background radiation to the population along this representative  
25 route would be about  $2.2 \times 10^5$  person-rem. Therefore, the radiation doses from transporting  
26 unirradiated fuel to the VCSNS site and alternative sites are small compared to the collective  
27 population dose to the same population from exposure to natural sources of radiation.

### 28 ***MEIs Under Normal Transport Conditions***

29 The NRC staff conducted a scenario-based analysis to develop estimates of incident-free  
30 radiation doses to MEIs for fuel and waste shipments to and from the VCSNS site and  
31 alternative sites. An MEI is a person who may receive the highest radiation dose from a  
32 shipment to and/or from the VCSNS site and alternative sites. The following discussion applies  
33 to shipments of unirradiated fuel to, and spent fuel and radioactive waste shipments from, any of  
34 the alternative sites. The analysis is based on data in the Yucca Mountain Final EIS (DOE  
35 2002b) and incorporates data about exposure times, dose rates, and the number of times an  
36 individual may be exposed to an offsite shipment. Adjustments were made where necessary to  
37 reflect the normalized fuel and waste shipments addressed in this EIS. In all cases, the NRC  
38 staff assumed that the dose rate emitted from the shipping containers is 10 mrem/hr at 2 m

1 (6.6 ft) from the side of the transport vehicle. This is conservative in that the assumed dose rate  
2 is the maximum dose rate allowed by U.S. Department of Transportation (DOT) regulations  
3 (see 49 CFR 173.441). Most unirradiated fuel and radioactive waste shipments would have  
4 much lower dose rates than the regulations allow (AEC 1972; DOE 2002a). The analysis is  
5 described below.

6 Truck crew member. Truck crew members would receive the highest radiation doses during  
7 incident-free transport because of their proximity to the loaded shipping container for an  
8 extended period. The NRC staff's analysis assumed that crew-member doses are limited to  
9 2 rem/yr, which is the DOE administrative control level presented in DOE-STD-1098-99, *DOE*  
10 *Standard, Radiological Control*, Chapter 2, Article 211 (DOE 2005). This limit is anticipated to  
11 apply to shipments of spent nuclear fuel to a disposal facility, because DOE would take title to  
12 the spent fuel at the reactor site. There would be more shipments of spent nuclear fuel from the  
13 VCSNS site (or alternative sites) than there would be shipments of unirradiated fuel to, and  
14 radioactive waste other than spent fuel from, these sites. This is because the capacities of  
15 spent-fuel shipping casks are limited due to their substantial radiation shielding and accident  
16 resistance requirements. Spent-fuel shipments would also have significantly higher radiation  
17 dose rates than unirradiated fuel and radioactive waste (DOE 2002a). As a result, crew doses  
18 from shipments of unirradiated fuel and radioactive waste would be lower than the doses from  
19 shipments of spent nuclear fuel. The DOE administrative limit of 2 rem/yr (see DOE 2005) is  
20 less than the NRC limit for occupational exposures of 5 rem/yr (see 10 CFR Part 20).

21 The DOT does not regulate annual occupational exposures. It does recognize that air crews  
22 are exposed to elevated cosmic radiation levels and recommends dose limits to air-crew  
23 members from cosmic radiation (DOT 2003). Air passengers are less of a concern because  
24 they do not fly as frequently as air crews. The recommended limits are a 5-year effective dose  
25 of 2 rem/yr with no more than 5 rem in a single year (DOT 2003). As a result, a 2-rem/yr MEI  
26 dose to truck crews is a reasonable estimate to apply to shipments of fuel and waste from the  
27 VCSNS site and alternative sites.

28 Inspectors. Radioactive shipments are inspected by Federal or State vehicle inspectors, for  
29 example, at State ports of entry. The Yucca Mountain Final EIS (DOE 2002b) assumed that  
30 inspectors would be exposed for 1 hour at a distance of 1 m (3.3 ft) from the shipping  
31 containers. The dose rate at 1 m (3.3 ft) is conservatively assumed to be at the regulatory limit,  
32 or equivalent to about 14 mrem/hr; therefore, the dose per shipment is about 14 mrem. This is  
33 independent of the location of the reactor site. Based on this conservative value and the  
34 assumption that the same person inspects all shipments of fuel and waste to and from the  
35 VCSNS site and alternative sites, the annual doses to vehicle inspectors were calculated by the  
36 NRC staff to be about 0.9 rem/yr, based on a combined total of 66 shipments of unirradiated  
37 fuel, spent fuel, and radioactive waste per year. This value is less than one-half of the 2-rem/yr

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1 DOE administrative control level on individual doses (DOE 2005) and one-fifth of the 5-rem/yr  
2 NRC occupational dose limit.

3 Resident. The analysis assumed that residents living adjacent to a highway where a shipment  
4 would pass would be exposed to all shipments along that particular route. Exposures to  
5 residents on a per-shipment basis were obtained from the NRC staff's RADTRAN 5.6 output  
6 files developed for this EIS. These dose estimates are based on an individual located 100 ft  
7 from shipments that are traveling 15 mph. The potential radiation dose to the maximally  
8 exposed resident is about 0.04 mrem/yr for shipments of fuel and waste to and from the site.

9 Individual stuck in traffic. This scenario addresses potential traffic interruptions that could lead  
10 to a person being exposed to a loaded shipment for 1 hour at a distance of 4 ft. The NRC staff's  
11 analysis assumed that this exposure scenario would occur only one time to any individual, and  
12 that the dose rate was at the regulatory limit of 10 mrem/hr at 6.6 ft from the shipment, so the  
13 dose rate will be higher at the assumed exposure distance of 4 ft. The dose to the MEI was  
14 calculated to be 16 mrem in DOE's Yucca Mountain EIS (DOE 2002b).

15 Person at a truck service station. This scenario estimates doses to an employee at a service  
16 station where all truck shipments to and from the VCSNS site and alternative sites are assumed  
17 to stop. The NRC staff's analysis assumed that this person is exposed for 49 minutes at a  
18 distance of 52 ft from the loaded shipping container (DOE 2002b). The exposure time and  
19 distance were based on the observations discussed by Griego et al. (1996). This results in a  
20 dose of about 0.34 mrem/shipment and an annual dose of about 22 mrem/yr for the VCSNS site  
21 and alternative sites, assuming that a single individual services all shipments of unirradiated  
22 fuel, spent fuel, and radioactive waste to and from the VCSNS site and alternative sites.

### 23 **6.2.1.2 Radiological Impacts of Transportation Accidents**

24 Accident risks are a combination of accident frequency and consequence. Accident frequencies  
25 for transportation of unirradiated fuel to the VCSNS site and alternative sites are expected to be  
26 lower than those used in the analysis in WASH-1238 (AEC 1972), which forms the basis for  
27 Table S-4 of 10 CFR 51.52, because of improvements in highway safety and security, and an  
28 overall reduction in traffic accident, injury, and fatality rates since WASH-1238 was published.  
29 There is no significant difference between the Westinghouse AP1000 and current-generation  
30 LWRs in consequences of transportation accidents severe enough to result in a release of  
31 unirradiated fuel particles to the environment because the fuel form, cladding, and packaging  
32 are similar to those analyzed in WASH-1238. Consequently, consistent with the conclusions of  
33 WASH-1238 (AEC 1972), the impacts of accidents during transport of unirradiated fuel for the  
34 Westinghouse AP1000 at the VCSNS site and alternative sites are expected to be negligible.



### 1 **6.2.1.3 Nonradiological Impacts of Transportation Accidents**

2 Nonradiological impacts are the human-health impacts projected to result from traffic accidents  
3 involving shipments of unirradiated fuel to the VCSNS site and alternative sites; that is, the  
4 analysis does not consider the radiological or hazardous characteristics of the cargo.  
5 Nonradiological impacts include the projected number of traffic accidents, injuries, and fatalities  
6 that could result from shipments of unirradiated fuel to the site and return shipments of empty  
7 containers from the site.

8 Nonradiological impacts are calculated using accident, injury, and fatality rates from published  
9 sources; the rates (i.e., impacts per vehicle-km traveled) are then multiplied by estimated travel  
10 distances for workers and materials. The general formula for calculating nonradiological  
11 impacts is as follows:

$$12 \quad \text{Impacts} = (\text{unit rate}) \times (\text{round-trip shipping distance}) \times (\text{annual number of shipments})$$

13 In this formula, impacts are presented in terms of the number of accidents, number of injuries,  
14 and number of fatalities per year. Corresponding unit rates (i.e., impacts per vehicle-km  
15 traveled) are used in the calculations.

16 Accident, injury, and fatality rates were taken from Table 4 in *State-Level Accident Rates for*  
17 *Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Nationwide  
18 median rates were used for shipments of unirradiated fuel to the site. The data are  
19 representative of traffic-accident, injury, and fatality rates for heavy truck shipments similar to  
20 those to be used to transport unirradiated fuel to the VCSNS site and proposed alternative sites.  
21 In addition, the DOT Federal Motor Carrier Safety Administration evaluated the data underlying  
22 the Saricks and Tompkins (1999) rates, which were taken from the Motor Carrier Management  
23 Information System, and determined that the rates were under-reported. Therefore, the  
24 accident, injury, and fatality rates reported by Saricks and Tompkins (1999) were adjusted using  
25 factors derived from data provided by the University of Michigan Transportation Research  
26 Institute (UMTRI 2003). The UMTRI data indicate that accident rates for 1994 to 1996, the  
27 same data used by Saricks and Tompkins (1999), were under-reported by about 39 percent.  
28 Injury and fatality rates were under-reported by 16 and 36 percent, respectively. As a result, the  
29 accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57,  
30 respectively, to account for the under-reporting.

31 The nonradiological accident impacts for transporting unirradiated fuel to (and empty shipping  
32 containers from) the VCSNS site and alternative sites are shown in Table 6-6. The  
33 nonradiological impacts associated with the WASH-1238 reference LWR are also shown for  
34 comparison purposes. Note that there are only small differences between the impacts  
35 calculated for a Westinghouse AP1000 at the VCSNS site and alternative sites and the  
36 reference LWR in WASH-1238 due entirely to the smaller number of shipments.

1 **Table 6-6.** Nonradiological Impacts of Transporting Unirradiated Fuel to the VCSNS Site and  
 2 Alternative Sites, Normalized to the Reference LWR

Plant Type	Annual Shipments Normalized to Reference LWR	One-Way Shipping Distance, km	Round-trip Distance, km per Year	Annual Impacts		
				Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	6.3	3200	$4.0 \times 10^4$	$1.9 \times 10^{-2}$	$9.3 \times 10^{-3}$	$5.8 \times 10^{-4}$
VCSNS and alternative sites AP1000 reactors	5.0	3200	$3.2 \times 10^4$	$1.5 \times 10^{-2}$	$7.4 \times 10^{-3}$	$4.6 \times 10^{-4}$

LWR = light water reactor

3 **6.2.2 Transportation of Spent Fuel**

4 The NRC staff performed an independent analysis of the environmental impacts of transporting  
 5 spent fuel from the proposed VCSNS site and alternative sites to a spent-fuel disposal  
 6 repository. For the purposes of these analyses, the staff considered the proposed Yucca  
 7 Mountain, Nevada, site as a surrogate destination. Currently, the NRC has not made a decision  
 8 about the proposed geologic repository at Yucca Mountain. However, the NRC staff considers  
 9 an estimate of the impacts of the transportation of spent fuel to a possible repository in Nevada  
 10 to be a reasonable bounding estimate of the transportation impacts on a storage or disposal  
 11 facility because of the distances involved and the representativeness of the distribution of  
 12 members of the public in urban, suburban, and rural areas (i.e., population distributions) along  
 13 the shipping routes. Radiological impacts of normal operating conditions and transportation  
 14 accidents, as well as nonradiological impacts of accidents, are discussed in this section.

15 This analysis is based on shipment of spent fuel by legal-weight trucks in shipping casks with  
 16 characteristics similar to currently available casks (i.e., massive, heavily shielded, cylindrical  
 17 metal pressure vessels). Due to the large size and weight of spent-fuel shipping casks, each  
 18 shipment is assumed to consist of a single shipping cask loaded on a modified trailer. These  
 19 assumptions are consistent with those made in the evaluation of the environmental impacts of  
 20 transportation of spent fuel in Addendum 1 to NUREG-1437 (NRC 1996). Because the  
 21 alternative transportation methods involve railroad transportation or heavy-haul trucks, which  
 22 would reduce the overall number of spent-fuel shipments (NRC 1996), thereby reducing  
 23 impacts, these assumptions are conservative. Also, the use of current shipping-cask designs  
 24 for this analysis results in conservative impact estimates because the current designs are based  
 25 on transporting short-cooled spent fuel (approximately 120 days out of reactor). Future shipping  
 26 casks would be designed to transport longer-cooled fuel (greater than 5 years out of reactor)  
 27 and would require much less shielding to meet external dose limitations. Therefore, future

1 shipping casks are expected to have higher cargo capacities, thereby reducing the numbers of  
2 shipments and associated impacts.

3 The NRC staff calculated radiological impacts of transportation of spent fuel using the  
4 RADTRAN 5.6 computer code (Weiner et al. 2008). Routing and population data used in  
5 RADTRAN 5.6 for truck shipments were obtained from the TRAGIS routing code (Johnson and  
6 Michelhaugh 2003). The population data in the TRAGIS code are based on the 2000 census.  
7 Nonradiological impacts were calculated using published traffic accident, injury, and fatality data  
8 (Saricks and Tompkins 1999) in addition to route information from TRAGIS (Johnson and  
9 Michelhaugh 2003). Traffic accident rates used the RADTRAN 5.6 and nonradiological impact  
10 calculations were adjusted to account for under-reporting, as discussed in Section 4.8.3.

### 11 **6.2.2.1 Normal Conditions**

12 Normal conditions, sometimes referred to as “incident-free” conditions, are transportation  
13 activities in which shipments reach their destination without an accident occurring en route.  
14 Impacts from these shipments would be from the low levels of radiation that penetrate the  
15 heavily shielded spent-fuel shipping cask. Radiation exposures would occur to the following  
16 populations: (1) persons residing along the transportation corridors between the VCSNS site (or  
17 alternative sites) and the proposed repository location; (2) persons in vehicles traveling on the  
18 same route as a spent-fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle  
19 inspections; and (4) the transportation crew (drivers). For the purposes of this analysis, the  
20 NRC staff assumed that the destination for the spent-fuel shipments is the proposed Yucca  
21 Mountain disposal facility in Nevada. This assumption is conservative because it tends to  
22 maximize the shipping distance from the VCSNS site and alternative sites.

23 Shipping casks have not been designed for the spent fuel from advanced reactor designs such  
24 as the Westinghouse AP1000. Information in *Early Site Permit Environmental Report Sections*  
25 *and Supporting Documentation* (INEEL 2003) indicated that advanced LWR fuel designs would  
26 not be significantly different from existing LWR designs; therefore, current shipping-cask  
27 designs were used for the analysis of Westinghouse AP1000 reactor spent-fuel shipments. The  
28 NRC staff assumed that the capacity of a truck shipment of Westinghouse AP1000 reactor  
29 spent fuel was 0.5 MTU/shipment, the same capacity as that used in WASH-1238 (AEC 1972).  
30 In its ER (SCE&G 2009a), SCE&G assumed a shipping-cask capacity of 1.8 MTU/shipment,  
31 representative of future shipping-cask designs.

32 Input to RADTRAN 5.6 includes the total shipping distance between the origin and destination  
33 sites and the population distributions along the routes. This information was obtained by  
34 running the TRAGIS computer code (Johnson and Michelhaugh 2003) for highway routes from  
35 the proposed VCSNS site and alternative sites to Yucca Mountain. The resulting route-  
36 characteristics information is listed in Table 6-7. Note that for truck shipments, all of the spent  
37 fuel is assumed to be shipped to the proposed Yucca Mountain site over designated highway-

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1 **Table 6-7.** Transportation-Route Information for Shipments from the VCSNS Site and  
 2 Alternative Sites to the Proposed Geologic Repository at Yucca Mountain, Nevada

Advance Reactor Site <sup>(a)</sup>	One-Way Shipping Distance, km				Population Density, persons/km <sup>2</sup>			Stop time per trip, hr
	Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
VCSNS Site	4096	3284	735	77	9.5	311.4	2209.8	5
CGS	4202	3331	790	81	9.6	315.5	2213.1	5
Saluda	4077	3271	729	77	9.4	312.8	2209.8	5
SR	4094	3232	754	107	9.3	335.0	2272.1	5

Source: Johnson and Michelhaugh (2003)

Note: This table presents aggregated route characteristics provided by TRAGIS (Johnson and Michelhaugh 2003), including estimated distances from the alternative sites to the nearest TRAGIS highway node. Input to the RADTRAN 5.6 computer code was disaggregated to a state-by-state level.

(a) The transportation impacts for the FA-1 site is not explicitly analyzed in this EIS. Shipping distances and population distributions are approximately the same as those for the VCSNS Site.

3 route controlled-quantity routes. In addition, TRAGIS data were loaded into RADTRAN 5.6 on a  
 4 state-by-state basis, which increases precision and allows the results to be presented for each  
 5 state along the route between the VCSNS site and alternative sites and Yucca Mountain, if  
 6 desired.

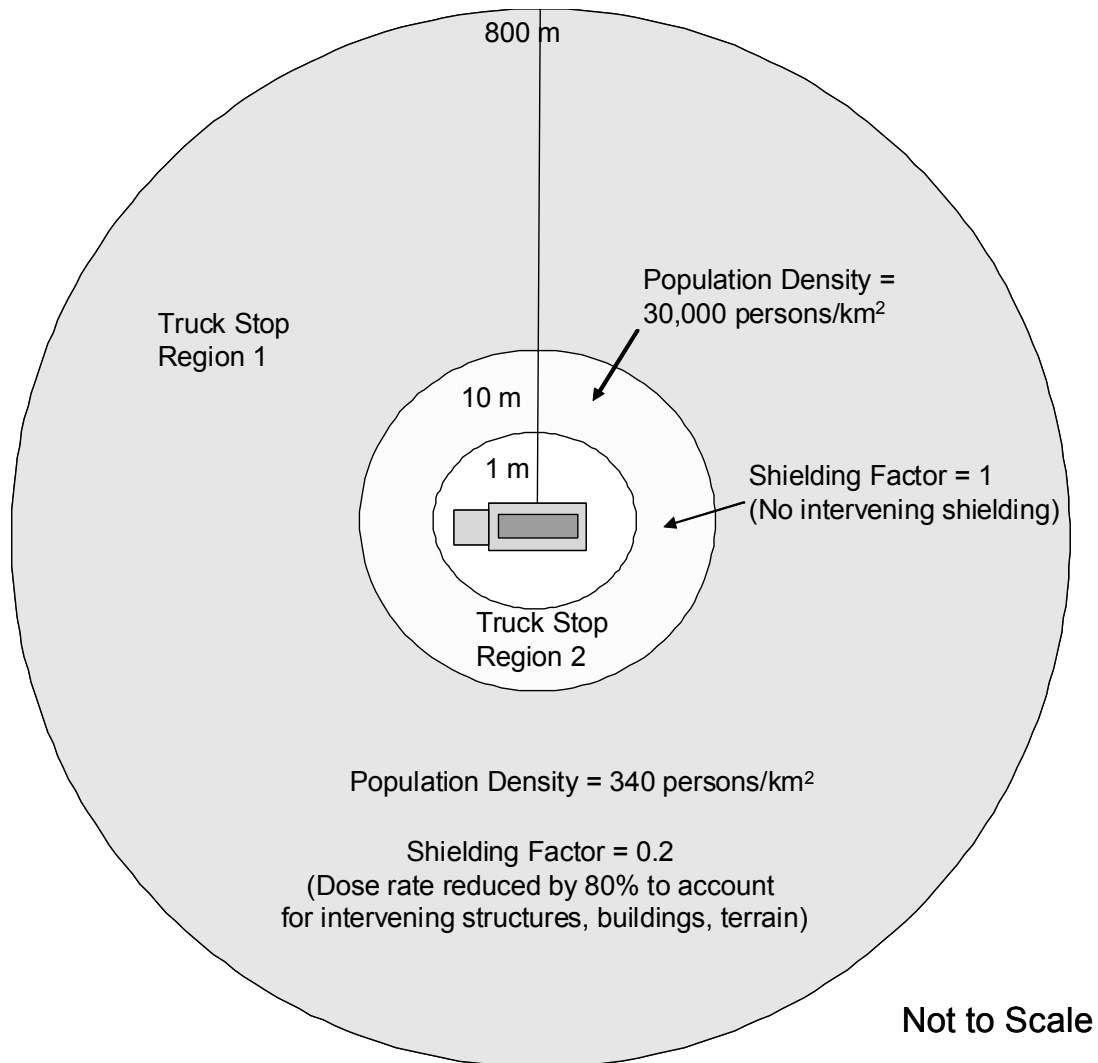
7 Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose  
 8 rate, packaging dimensions, number in the truck crew, stop time, and population density at  
 9 stops. A list of the values for these and other parameters and the sources of the information is  
 10 provided in Table 6-8.

11 For the purposes of this analysis, the transportation crew for spent-fuel shipments delivered by  
 12 truck is assumed to consist of two drivers. Escort vehicles and drivers were considered, but  
 13 they were not included in the analysis because their distance from the shipping cask would  
 14 reduce the dose rates to levels well below the dose rates experienced by the drivers and would  
 15 be negligible. Stop times for refueling and rest were assumed to accrue at the rate of  
 16 30 minutes per 4 hours of driving time. TRAGIS outputs were used to estimate the number of  
 17 stops. For this analysis, doses to the public at refueling and rest stops (“stop doses”) are the  
 18 sum of the doses to individuals located in two annular rings centered at the stopped vehicle, as  
 19 illustrated in Figure 6-2. The inner ring represents persons who may be at the truck stop at the  
 20 same time as a spent-fuel shipment and extends 1 to 10 m from the edge of the vehicle. The  
 21 outer ring represents persons who reside near a truck stop and extends from 10 to 800 m from  
 22 the vehicle. This scheme is similar to that used by Sprung et al. (2000). Population densities  
 23 and shielding factors were also taken from Sprung et al. (2000), which were based on the  
 24 observations of Griego et al. (1996).

1

**Table 6-8.** RADTRAN 5.6 Normal (Incident-Free) Exposure Parameters

<b>Parameter</b>	<b>RADTRAN 5.6 Input Value</b>	<b>Source</b>
Vehicle speed, km/hr	88.49	Based on average speed in rural areas given in DOE (2002a). Conservative in-transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count – rural, vehicles/hr	State-specific	State-specific rural, suburban, and urban traffic counts are taken from Weiner et al. (2008).
Traffic count – suburban, vehicles/hr		
Traffic count – urban, vehicles/hr		
Vehicle occupancy, persons/vehicle	1.5	DOE (2002a)
Dose rate at 1 m from vehicle, mrem/hr	14	DOE (2002a, b) – approximate dose rate at 1 m that is equivalent to maximum dose rate allowed by Federal regulations (i.e., 10 mrem/hr at 2 m from the side of a transport vehicle).
Packaging dimensions, m	Length – 5.2 Diameter – 1.0	DOE (2002b)
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a, b)
Stop time, hr/trip	Route-specific	See Table 6-5
Population density at stops, persons/km <sup>2</sup>	30,000	Sprung et al. (2000). Equivalent to nine persons within 10 m of vehicle. See Figure 6-2.
Min/max radii of annular area around vehicle at stops, m	1 to 10	Sprung et al. (2000)
Dimensionless shielding factor applied to annular area surrounding vehicle at stops	1 (no shielding)	Sprung et al. (2000)
Population density surrounding truck stops, persons/km <sup>2</sup>	340	Sprung et al. (2000)
Min/max radius of annular area surrounding truck stop, m	10 to 800	Sprung et al. (2000)
Dimensionless shielding factor applied to annular area surrounding truck stop	0.2	Sprung et al. (2000)



1 **Figure 6-2.** Illustration of Truck Stop Model

2 The results of these normal (incident-free) exposure calculations are shown in Table 6-9 for the  
3 proposed VCSNS site and alternative sites. Population dose estimates are given for workers  
4 (i.e., truck crew members), onlookers (doses to persons at stops and persons on highways  
5 exposed to the spent-fuel shipment), and persons along the route (persons living near the  
6 highway). Shipping schedules for spent fuel generated by the proposed new unit have not been  
7 determined. The NRC staff judged it to be reasonable to calculate annual doses assuming that  
8 the annual number of spent-fuel shipments is equivalent to the annual refueling requirements.  
9 Population doses were normalized to the reference LWR in WASH-1238 (880 net MW(e)). This  
10 corresponds to an 1100-MW(e) LWR operating at 80-percent capacity.

1 **Table 6-9.** Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from  
 2 Shipping Spent Fuel from the VCSNS Site and Alternative Sites to the Proposed  
 3 High-Level Waste Repository at Yucca Mountain

	Normalized Impacts (Person-rem/yr) <sup>(a)</sup>		
	Worker (Crew)	Along Route	Onlookers
Reference LWR (WASH-1238)	$1.1 \times 10^{+1}$	$5.3 \times 10^{-1}$	$2.4 \times 10^{+1}$
VCSNS COL normalized impacts <sup>(b)</sup>	$7.4 \times 10^0$	$3.5 \times 10^{-1}$	$1.5 \times 10^{+1}$
CGS	$7.5 \times 10^0$	$3.9 \times 10^{-1}$	$1.6 \times 10^{+1}$
Saluda	$7.3 \times 10^0$	$3.6 \times 10^{-1}$	$1.5 \times 10^{+1}$
SR	$7.3 \times 10^0$	$3.9 \times 10^{-1}$	$1.6 \times 10^{+1}$
Table S-4 condition	$4 \times 10^0$	$3 \times 10^0$	$3 \times 10^0$

(a) To convert person-rem to person-Sv, divide by 100.  
 (b) The transportation impacts for the FA-1 site are not explicitly analyzed in this EIS. Shipping distances, population distributions, and transportation impacts are approximately the same as those for the VCSNS Site.  
 LWR = light water reactor

4 There are only small differences in transportation impacts among the four alternative sites  
 5 evaluated. The differences are due to the route characteristics (distance, population density) for  
 6 shipments from the VCSNS site and alternative sites to Yucca Mountain, Nevada.

7 The bounding cumulative doses to the exposed population given in Table S-4 are

- 8
- 4 person-rem/reactor-year to transport workers
  - 3 person-rem/reactor-year to general public (onlookers) and to members of the public along  
 9 the route.
- 10

11 The calculated population doses to the crew and onlookers for the reference LWR and the  
 12 VCSNS and alternative site shipments exceed Table S-4 values. A key reason for the higher  
 13 population doses relative to Table S-4 is the longer shipping distances assumed for this COL  
 14 analysis (i.e., to a proposed repository in Nevada) than the distance used in WASH-1238.  
 15 WASH-1238 assumed that each spent-fuel shipment would travel a distance of 1000 mi,  
 16 whereas the shipping distances used in this assessment were about 2500 to 2600 mi. If the  
 17 shorter distance were used to calculate the impacts for the VCSNS spent-fuel shipments, the  
 18 doses in Table 6-9 could be reduced by half or more. Other important differences are the model  
 19 related to vehicle stops described above and the additional precision that results from  
 20 incorporating state-specific route characteristics and vehicle densities on highways (vehicles per  
 21 hour).

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1 Where necessary, the NRC staff made conservative assumptions to calculate impacts  
2 associated with transportation of spent fuel. Some of the key conservative assumptions are as  
3 follows:

- 4 • Use of the regulatory maximum dose rate (10 mrem/hr at 2 m) in the RADTRAN 5.6  
5 calculations. The shipping casks assumed in the EIS prepared by DOE in support of the  
6 application for the proposed geologic repository at Yucca Mountain (DOE 2002b) were  
7 designed to transport spent fuel that has cooled for a minimum of 5 years (see 10 CFR Part  
8 961, Subpart B). Most spent fuel would have cooled for much longer than 5 years before  
9 being shipped to a possible geologic repository. For this reason, shipments from the  
10 VCSNS site and alternative sites are also expected to be cooled for longer than 5 years.  
11 Consequently, the estimated population doses in Table 6-9 could be further reduced if more  
12 realistic dose-rate projections and shipping-cask capacities are used.
- 13 • Use of 30 minutes as the average time at a truck stop in the calculations. Many stops made  
14 for actual spent-fuel shipments are of short duration (i.e., 10 minutes) for brief visual  
15 inspections of the cargo (e.g., checking the cask tie-downs). These stops typically occur in  
16 minimally populated areas, such as an overpass or freeway ramp in an unpopulated area.  
17 Furthermore, empirical data provided by Griego et al. (1996) indicate that a 30-minute  
18 duration is toward the high end of the stop-time distribution. Average stop times observed  
19 by Griego et al. (1996) are on the order of 18 minutes.

20 A sensitivity study was performed to demonstrate the effects of using more realistic dose rates  
21 and stop times on the incident-free population dose calculations. For this sensitivity study, the  
22 dose rate was reduced to 5 mrem/hr, the approximate 50-percent confidence interval of the  
23 dose rate distribution estimated by Sprung et al. (2000) for future spent-fuel shipments. The  
24 stop time was reduced to 18 minutes per stop. All other RADTRAN 5.6 input values were  
25 unchanged. The result is that the annual crew doses were reduced to 2.6 person-rem/yr or  
26 about 35 percent of the annual dose shown in Table 6-9. The annual onlooker doses were  
27 reduced to 4.0 person-rem/yr (26 percent) and the annual doses to persons along the route  
28 were reduced to 0.13 person-rem/yr (38 percent). The NRC concluded that using more realistic  
29 parameters for shipment capacities, stop times, and dose rates would reduce the annual doses  
30 in Table 6-9 to below the Table S-4 values.

31 SCE&G described the results of a RADTRAN 5.6 analysis of the impacts of incident-free  
32 transport of spent fuel to Yucca Mountain (SCE&G 2009a). Although the overall approaches  
33 are the same (e.g., use of TRAGIS and RADTRAN 5.6), there are some differences in the  
34 modeling details. For example, the NRC staff's analysis used state-by-state route  
35 characteristics and a shipment capacity of 0.5 MTU, whereas SCE&G elected to use  
36 aggregated route information and a shipment capacity of 1.8 MTU. After adjusting for these key  
37 differences, the results are similar to those calculated by the NRC staff in this EIS.



1 Using the linear no-threshold dose-response relationship discussed in Section 6.2.1.1, the  
2 annual public dose impacts for transporting spent fuel from the VCSNS site and alternative sites  
3 to Yucca Mountain are less than the value of 1754 person-rem that ICRP (ICRP 2007) and  
4 NCRP (NCRP 1995) suggest would most likely result in zero excess health effects. This risk is  
5 very small compared to the estimated  $2.1 \times 10^5$  person-rem that the same population along the  
6 route from the proposed VCSNS site to Yucca Mountain would incur annually from exposure to  
7 natural background radiation. Note that the estimated dose to persons along the Summer-to-  
8 Yucca-Mountain route from natural background radiation is different than the natural  
9 background dose calculated by the NRC staff for unirradiated fuel shipments in Section 6.2.1.1  
10 of this EIS because the route characteristics are different. A generic route was used in  
11 Section 6.2.1.1 for unirradiated fuel shipments and an actual highway route was used in this  
12 section for spent-fuel shipments.

13 Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and wastes under  
14 normal conditions are presented in Section 6.2.1.1.

#### 15 **6.2.2.2 Radiological Impacts of Accidents**

16 As discussed previously, the NRC staff used the RADTRAN 5.6 computer code to estimate the  
17 impacts of transportation accidents involving spent-fuel shipments. RADTRAN 5.6 considers a  
18 spectrum of postulated transportation accidents, ranging from those with high frequencies and  
19 low consequences (e.g., “fender benders”) to those with low frequencies and high  
20 consequences (i.e., accidents in which the shipping container is exposed to severe mechanical  
21 and thermal conditions).

22 Radionuclide inventories are important parameters in the calculation of accident risks. The  
23 radionuclide inventories used in this analysis were taken from SCE&G’s ER (SCE&G 2009a).  
24 Spent-fuel radionuclide inventories used in the NRC staff analysis are presented in Table 6-10.  
25 The radionuclides listed in the table include all of the radionuclides that were included in the  
26 analysis conducted by Sprung et al. (2000). The staff’s analysis also included the estimated  
27 inventory of “crud,” or radioactive material deposited on the external surfaces of LWR spent-fuel  
28 rods. Because crud is deposited from corrosion products generated elsewhere in the reactor  
29 cooling system and the complete reactor design and operating parameters are uncertain, the  
30 quantities and characteristics of crud deposited on Westinghouse AP1000 reactor spent fuel are  
31 not available at this time. The VCSNS Westinghouse AP1000 spent-fuel transportation accident  
32 impacts were calculated in this EIS and in SCE&G’s ER assuming that the cobalt-60 inventory  
33 in the form of crud is 4.09 Ci/MTU, based on information provided in the ER (SCE&G 2009a)

1 **Table 6-10.** Radionuclide Inventories Used in Transportation-Accident Risk Calculations for the  
 2 Westinghouse AP1000 Reactor<sup>(a)(b)</sup>

Radionuclide	Ci/MTU	Bq/MTU	Physical-Chemical Group
Am-241	7.27E+02	2.7E+13	Particulate
Am-242m	1.31E+01	4.9E+11	Particulate
Am-243	3.34E+01	1.2E+12	Particulate
Ce-144	8.87E+03	3.3E+14	Particulate
Cm-242	2.83E+01	1.0E+12	Particulate
Cm-243	3.07E+01	1.1E+12	Particulate
Cm-244	7.75E+03	2.9E+14	Particulate
Cm-245	1.21E+00	4.5E+10	Particulate
Co-60	4.09E+00	2.9E+12	Crud
Cs-134	4.80E+04	1.8E+15	Cesium
Cs-137	9.31E+04	3.4E+15	Cesium
Eu-154	9.13E+03	3.4E+14	Particulate
Eu-155	4.62E+03	1.7E+14	Particulate
I-129	4.65E-02	1.7E+09	Gas
Kr-85	8.90E+03	3.3E+14	Gas
Pm-147	1.76E+04	6.5E+14	Particulate
Pu-238	6.07E+03	2.2E+14	Particulate
Pu-239	2.55E+02	9.4E+12	Particulate
Pu-240	5.43E+02	2.0E+13	Particulate
Pu-241	6.96E+04	2.6E+15	Particulate
Pu-242	1.82E+00	6.7E+10	Particulate
Ru-106	1.55E+04	5.7E+14	Ruthenium
Sb-125	3.83E+03	1.4E+14	Particulate
Sr-90	6.19E+04	2.3E+15	Particulate
Y-90	6.19E+04	2.3E+15	Particulate

(a) Divide becquerel per metric ton uranium (Bq/MTU) by  $3.7 \times 10^{10}$  to obtain curies per MTU (Ci/MTU)

(b) The source of the spent-fuel inventories is SCE&G (2009a).

3 Robust shipping casks are used to transport spent fuel because of the radiation shielding and  
 4 accident resistance required by 10 CFR Part 71. Spent-fuel shipping casks must be certified  
 5 Type-B packaging systems, meaning they must be designed to withstand a series of severe  
 6 postulated hypothetical accident conditions with essentially no loss of containment or shielding  
 7 capability. These casks are also designed with fissile-material controls to verify that the spent  
 8 fuel remains subcritical under normal and accident conditions. According to Sprung et al.  
 9 (2000), the probability of encountering accident conditions during transport that would lead to  
 10 shipping-cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents  
 11 would result in no release of radioactive material from the shipping cask). The NRC staff

1 assumed that shipping casks approved for transportation of spent fuel from an AP1000 reactor  
2 would provide equivalent mechanical and thermal protection of the spent-fuel cargo.

3 Accident frequencies are calculated in RADTRAN 5.6 using user-specified accident rates and  
4 conditional shipping-cask failure probabilities. State-specific accident rates were taken from  
5 Saricks and Tompkins (1999) and used in the RADTRAN 5.6 calculations. The state-specific  
6 accident rates were then adjusted to account for under-reporting, as described in  
7 Section 6.2.1.3. Conditional shipping-cask failure probabilities (i.e., the probability of cask  
8 failure as a function of the mechanical and thermal conditions applied in an accident) were  
9 taken from Sprung et al. (2000).

10 The RADTRAN 5.6 accident-risk calculations were performed using the radionuclide inventories  
11 given in Table 6-10. The resulting risk estimates were then multiplied by the assumed annual  
12 spent-fuel shipments to derive estimates of the annual accident risks associated with spent-fuel  
13 shipments from the VCSNS site and alternative sites to the proposed geologic repository at  
14 Yucca Mountain in Nevada. As was done for normal transport exposures, the NRC staff  
15 assumed that the number of shipments of spent fuel per year is equivalent to the annual  
16 discharge quantities.

17 For this assessment, release fractions for current-generation LWR fuel designs (Sprung et al.  
18 2000) were used to approximate the impacts of the Westinghouse AP1000 reactor spent-fuel  
19 shipments. This assumes that the fuel materials and containment systems (i.e., cladding, fuel  
20 coatings) behave similarly to current LWR fuel under applied mechanical and thermal  
21 conditions.

22 The NRC staff used RADTRAN 5.6 to calculate the population dose from the released  
23 radioactive material from four of five possible exposure pathways.<sup>(a)</sup> These pathways are as  
24 follows:

- 25 • external dose from exposure to the passing cloud of radioactive material (cloudshine)
- 26 • external dose from the radionuclides deposited on the ground by the passing plume  
27 (groundshine). The NRC staff's analysis included the radiation exposure from this pathway  
28 even though the area surrounding a potential accidental release would be evacuated and  
29 decontaminated, thus preventing long-term exposures from this pathway.
- 30 • internal dose from inhalation of airborne radioactive contaminants (inhalation)
- 31 • internal dose from resuspension of radioactive materials that were deposited on the ground  
32 (resuspension). The staff's analysis included the radiation exposures from this pathway

---

(a) Internal dose from ingestion of contaminated food was not considered because the staff assumed evacuation and subsequent interdiction of foodstuffs following a postulated transportation accident.

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1 even though evacuation and decontamination of the area surrounding a potential accidental  
2 release would prevent long-term exposures.

3 Table 6-11 presents the environmental consequences of transportation accidents when shipping  
4 spent fuel from the VCSNS site and alternative sites to the proposed geologic repository at  
5 Yucca Mountain, Nevada. The shipping distances and population-distribution information for  
6 the routes were the same as those used for the normal "incident-free" conditions (see  
7 Section 6.2.2.1). The results are normalized to the WASH-1238 reference reactor (880-MW(e)  
8 net electrical generation, 1100-MW(e) reactor operating at 80-percent capacity) to provide a  
9 common basis for comparison to the impacts listed in Table S-4. Note that the impacts for all  
10 site alternatives are less than the reference LWR impacts. Also, although there are slight  
11 differences in impacts among the alternative sites, none of the alternative sites would be clearly  
12 favored over the VCSNS site.

13 **Table 6-11.** Annual Spent-Fuel Transportation Accident Impacts for a Westinghouse AP1000  
14 Reactor at the VCSNS Site and Alternative Sites, Normalized to the Reference  
15 1100-MW(e) LWR Net Electrical Generation

	<b>Normalized Population Impacts, Person-rem/yr<sup>(a)</sup></b>
Reference LWR (WASH-1238)	$2.7 \times 10^{-5}$
VCSNS site <sup>(b)</sup>	$1.8 \times 10^{-5}$
CGS	$2.0 \times 10^{-5}$
Saluda	$1.7 \times 10^{-5}$
SR	$3.9 \times 10^{-5}$

(a) Multiply person-rem/yr times 0.01 to obtain person-Sv/yr.  
(b) The transportation impacts for the FA-1 site are not explicitly analyzed in this EIS. Shipping distances, population distributions, and transportation impacts are approximately the same as those for the VCSNS Site.  
LWR = light water reactor

16 Using the linear no-threshold dose-response relationship discussed in Section 6.2.1.1, the  
17 annual risk to the public from accidents during transportation of spent fuel from the VCSNS site  
18 and alternative sites to Yucca Mountain is lower than the value of 1754 person-rem that ICRP  
19 (2007) and NCRP (1995) suggest would most likely result in zero excess health effects. This  
20 risk is very small compared to the estimated  $2.1 \times 10^4$  person-rem that the same population  
21 along the route from the proposed VCSNS site to Yucca Mountain would incur annually from  
22 exposure to natural sources of radiation. Note that the estimated population dose to persons  
23 along the VCSNS-to-Yucca-Mountain route is different than the population dose calculated by  
24 the NRC staff for unirradiated fuel shipments in Section 6.2.1.1 because the route  
25 characteristics are different.

1 The NRC staff performed a confirmatory evaluation of SCE&G’s spent-fuel transportation  
 2 accident risk analysis. It was noted that SCE&G used a different, though valid, methodology for  
 3 the ER calculations. The primary difference was that SCE&G assumed aggregated route  
 4 parameters, whereas in this EIS the NRC staff used state-by-state shipping distances and  
 5 population densities. The staff concluded that SCE&G’s analysis was reasonable and  
 6 comprehensive and thus was considered to meet the intent of 10 CFR 51.52(b).

7 **6.2.2.3 Nonradiological Impact of Spent-Fuel Shipments**

8 The general approach used to calculate nonradiological impacts of spent-fuel shipments is the  
 9 same as that used for unirradiated fuel shipments. The main difference is that the spent-fuel  
 10 shipping route characteristics are better defined so the State-level accident statistics from  
 11 Saricks and Tompkins (1999) may be used. State-by-state shipping distances were obtained  
 12 from the TRAGIS output file and combined with the annual number of shipments and accident,  
 13 injury, and fatality rates by state from Saricks and Tompkins (1999) to calculate nonradiological  
 14 impacts. In addition, the accident, injury, and fatality rates from Saricks and Tompkins (1999)  
 15 were adjusted to account for under-reporting (see Section 6.2.1.3). The results are listed in  
 16 Table 6-12.

17 **Table 6-12.** Nonradiological Impacts of Transporting Spent Fuel from the VCSNS Site and  
 18 Alternative Sites to the Proposed Geologic Repository at Yucca Mountain,  
 19 Nevada, Normalized to the Reference LWR

Site	One-Way Shipping Distance, km	Nonradiological Impacts, per year		
		Accidents/yr	Injuries/yr	Fatalities/yr
VCSNS (preferred site) <sup>(a)</sup>	4096	$1.1 \times 10^{-1}$	$7.1 \times 10^{-2}$	$5.6 \times 10^{-3}$
CGS	4202	$1.2 \times 10^{-1}$	$7.4 \times 10^{-2}$	$5.9 \times 10^{-3}$
Saluda	4077	$1.1 \times 10^{-1}$	$7.0 \times 10^{-2}$	$5.5 \times 10^{-3}$
SR	4094	$1.3 \times 10^{-1}$	$8.0 \times 10^{-2}$	$5.7 \times 10^{-3}$

Note: The number of shipments of spent fuel assumed in the calculations is 46 shipments/yr after normalizing to the reference light water reactor.

(a) The transportation impacts for the FA-1 site are not explicitly analyzed in this EIS. Shipping distances, population distributions, and transportation impacts are approximately the same as those for the VCSNS Site.

20 **6.2.3 Transportation of Radioactive Waste Other Than Spent Fuel**

21 This section discusses the environmental effects of transporting radioactive waste other than  
 22 spent fuel from the VCSNS site and alternative sites. The environmental conditions listed in  
 23 10 CFR 51.52 that apply to shipments of radioactive waste are as follows:

- 24 • Radioactive waste (except spent fuel) would be packaged and in solid form.
- 25 • Radioactive waste (except spent fuel) would be shipped from the reactor by truck or railroad.
- 26 • The weight limitation of 73,000 lb per truck and 100 tons per cask per railcar would be met.

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- 1 • Traffic density would be less than the one truck shipment per day or three railcars per month  
2 condition.

3 Radioactive waste other than spent fuel from the Westinghouse AP1000 reactor is expected to  
4 be capable of being shipped in compliance with Federal or State weight restrictions. Table 6-13  
5 presents estimates of annual waste volumes and annual waste-shipment numbers for a  
6 Westinghouse AP1000 reactor normalized to the reference 1100-MW(e) LWR defined in  
7 WASH-1238 (AEC 1972). The expected annual radioactive waste volumes for the  
8 Westinghouse AP1000 reactor, except for spent fuel, was estimated at 1964 ft<sup>3</sup>/yr per unit, and  
9 the annual number of waste shipments was estimated at 21 shipments per year  
10 (SCE&G 2009a). The expected annual waste volume is less than that for the 1100-MW(e)  
11 reference reactor that was the basis for Table S-4. Therefore, the number of radioactive waste  
12 shipments for the Westinghouse AP1000 is smaller than the reference LWR. The NRC staff  
13 reviewed the radioactive waste generation and shipment data in the ER (SCE&G 2009a) and  
14 concluded that the information is consistent with current LWR operating experience. Therefore,  
15 the number of shipments of radioactive waste, other than spent fuel, to disposal facilities is  
16 expected to be smaller than the reference LWR in WASH-1238.

17 The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste for a  
18 Westinghouse AP1000 reactor located at the VCSNS site and alternative sites is less than the  
19 one-truck-shipment-per-day condition given in 10 CFR 51.52, Table S-4.

20 Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and waste under  
21 normal conditions are presented in Section 6.2.1.1.

22 Nonradiological impacts of radioactive waste shipments were calculated using the same general  
23 approach used for unirradiated and spent-fuel shipments. For this EIS, the shipping distance  
24 was assumed to be 500 mi one way (AEC 1972). Because the actual destination is uncertain,  
25 national median accident, injury, and fatality rates were used in the calculations (Saricks and  
26 Tompkins 1999). These rates were adjusted to account for under-reporting, as described in  
27 Section 6.2.1.3. The results are presented in Table 6-14. As shown, the calculated  
28 nonradiological impacts for transportation of radioactive waste other than spent fuel from the  
29 VCSNS site and alternative sites to waste disposal facilities are less than the impacts calculated  
30 for the reference LWR in WASH-1238.

1 **Table 6-13.** Summary of Radioactive Waste Shipments from the VCSNS Site and Alternative  
 2 Sites

Reactor Type	Waste Generation Information	Annual Waste Volume, m <sup>3</sup> /yr per Unit	Electrical Output, MW(e) per Unit	Normalized Rate, m <sup>3</sup> /1100-MW(e) Unit (880 MW(e) Net) <sup>(a)</sup>	Shipments/1100-MW(e) (880 MW(e) Net) Electrical Output <sup>(b)</sup>
Reference LWR (WASH-1238)	3800 ft <sup>3</sup> /yr per unit	108	1100	108	46 <sup>(b)</sup>
VCSNS and alternative sites Westinghouse AP1000 reactor (expected)	1964 ft <sup>3</sup> /yr per unit <sup>(c)</sup>	56	1107	48	21 <sup>(d)</sup>
VCSNS and alternative sites Westinghouse AP1000 reactor (maximum)	5717 ft <sup>3</sup> /yr per unit <sup>(c)</sup>	162	1107	138	60 <sup>(d)</sup>

Conversions: 1 m<sup>3</sup> = 35.31 ft<sup>3</sup>. Drum volume = 210 L (0.21 m<sup>3</sup>).

- (a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are 80 percent for the reference LWR (AEC 1972) and 93 percent for the Westinghouse AP1000 (SCE&G 2009a). Waste generation for the Westinghouse AP1000 is normalized to 880 MW(e) net electrical output (1100-MW(e) unit with an 80-percent capacity factor).
- (b) The number of shipments per 1100 MW(e) was calculated assuming the WASH-1238 average waste-shipment capacity of 2.34 m<sup>3</sup> (82.6 ft<sup>3</sup>) per shipment.
- (c) These values were taken from the ER (SCE&G 2009a) and are the same as the waste-generation estimates in the AP1000 Design Control Document (Westinghouse 2007).
- (d) This value was obtained by normalizing the SCE&G (2009a) estimate (15 shipments/yr) to the reference-LWR electrical generation output. If the WASH-1238 shipment capacity is used (2.34 m<sup>3</sup> per shipment) in lieu of the SCE&G (2009a) annual shipment estimate, the normalized shipments from the Westinghouse AP1000 would be about 53 shipments per year.

3 **Table 6-14.** Nonradiological Impacts of Radioactive Waste Shipments from the VCSNS Site

	Normalized Shipments per Year	One-Way Distance, km	Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	46	800	$3.4 \times 10^{-2}$	$1.7 \times 10^{-2}$	$1.1 \times 10^{-3}$
VCSNS Westinghouse AP1000 reactor (expected waste volume)	21	800	$1.6 \times 10^{-2}$	$7.8 \times 10^{-3}$	$4.9 \times 10^{-4}$

Note: The shipments and impacts have been normalized to the reference light water reactor (LWR); the expected waste volumes and shipments from the Westinghouse AP1000 (SCE&G 2009a) were used.

#### 1 **6.2.4 Conclusions**

2 The NRC staff conducted independent confirmatory analyses of potential impacts under normal  
3 and accident conditions of transporting fuel and wastes to and from a Westinghouse AP1000  
4 reactor proposed to be located at the VCSNS site and alternative sites. To make comparisons  
5 with Table S-4, the environmental impacts were adjusted (that is, normalized) to the  
6 environmental impacts associated with the reference LWR in WASH-1238 (AEC 1972) by  
7 multiplying the Westinghouse AP1000 impact estimates by the ratio of the total electric output  
8 for the reference reactor to the electric output of the proposed reactor.

9 Because of the conservative approaches and data used to calculate impacts, the actual  
10 environmental effects are not likely to exceed those calculated in this EIS. Thus, the NRC staff  
11 concludes that the environmental impacts of transportation of fuel and radioactive wastes to and  
12 from the VCSNS site and alternative sites would be SMALL, and would be consistent with the  
13 environmental impacts associated with transportation of materials, personnel, fuel, and  
14 radioactive wastes from current-generation reactors presented in Table S-4 of 10 CFR 51.52.

15 The NRC staff notes that on March 3, 2010, (DOE 2010), DOE submitted a motion to the Atomic  
16 Safety and Licensing Board to withdraw with prejudice its application for a permanent geologic  
17 repository at Yucca Mountain, Nevada. Regardless of the outcome of this motion, the NRC staff  
18 concludes that transportation impacts are roughly proportional to the distance from the reactor  
19 site to the repository site, in this case South Carolina to Nevada. The distance from the VCSNS  
20 site or any of the alternate sites to any new planned repository in the contiguous United States  
21 would be no more than double the distance from the VCSNS site to Yucca Mountain. Doubling  
22 the environmental impact estimates from the transportation of spent reactor fuel, as presented  
23 in this section, would provide a reasonable bounding estimate for the impacts for NEPA  
24 purposes. The NRC staff concludes that the environmental impacts of these doubled estimates  
25 would still be SMALL.

### 26 **6.3 Decommissioning Impacts**

27 At the end of the operating life of a power reactor, NRC regulations require that the facility  
28 undergo decommissioning. Decommissioning is the safe removal of a facility from service and  
29 the reduction of residual radioactivity to a level that permits termination of the NRC license. The  
30 regulations governing decommissioning of power reactors are found in 10 CFR 50.75 and  
31 10 CFR 50.82.

32 An applicant for a COL is required to certify that sufficient funds will be available for radiological  
33 decommissioning at the end of power-generation operations. As part of its COL application for  
34 the proposed Units 2 and 3 on the VCSNS site, SCE&G included a Decommissioning Funding  
35 Assurance Report (SCE&G 2008). SCE&G and Santee Cooper (the State-owned electric and



1 water utility, formally called the South Carolina Public Service Authority) would establish an  
2 external sinking-funds account to accumulate funds for decommissioning.

3 Environmental impacts from the activities associated with the decommissioning of any reactor  
4 before or at the end of an initial or renewed license are evaluated in the *Generic Environmental*  
5 *Impact Statement on Decommissioning of Nuclear Facilities: Supplement I, Regarding the*  
6 *Decommissioning of Nuclear Power Reactors* (GEIS-DECOM), NUREG-0586 Supplement 1  
7 (NRC 2002). Environmental impacts of the DECON, SAFSTOR, and ENTOMB  
8 decommissioning methods are evaluated in the GEIS-DECOM. A COL applicant is not required  
9 to identify a decommissioning method at the time of the COL application. The staff's evaluation  
10 of the environmental impacts of decommissioning presented in the GEIS-DECOM identifies a  
11 range of impacts for each environmental issue for a range of different reactor designs. The  
12 NRC staff concludes that the construction methods that would be used for the AP1000 are not  
13 sufficiently different from the construction methods used for the current plants to significantly  
14 affect the impacts evaluated in the GEIS-DECOM. Therefore, the NRC staff concludes that the  
15 impacts discussed in the GEIS-DECOM remain bounding for reactors deployed after 2002,  
16 including the AP1000.

17 The GEIS-DECOM does not specifically address the carbon footprint of decommissioning  
18 activities. However, it does list the decommissioning activities and states that the  
19 decommissioning workforce would be expected to be smaller than the operational workforce  
20 and that the decontamination and demolition activities could take up to 10 years to complete.  
21 Finally, it discusses SAFSTOR, in which decontamination and dismantlement are delayed for a  
22 number of years. Given this information, the NRC staff estimated the CO<sub>2</sub> footprint of  
23 decommissioning to be of the order of  $6.3 \times 10^4$  metric tons without SAFSTOR. This footprint is  
24 about equally split between decommissioning workforce transportation and equipment usage.  
25 The details of the NRC staff's estimate are presented in Appendix I. A 40-year SAFSTOR  
26 period would increase the footprint of decommissioning by about 40 percent. These CO<sub>2</sub>  
27 footprints are roughly three orders of magnitude lower than the CO<sub>2</sub> footprint presented in  
28 Section 6.1.3 for the uranium fuel cycle.

29 Therefore, the staff relies upon the bases established in the GEIS-DECOM, and concludes the  
30 following:

- 31 1. Doses to the public would be well below applicable regulatory standards, regardless of  
32 which decommissioning method considered in the GEIS-DECOM is used.
- 33 2. Occupational doses would be well below applicable regulatory standards during the license  
34 term.
- 35 3. The quantities of Class C or greater-than Class C wastes generated would be comparable  
36 to or smaller than the amounts of solid waste generated by reactors licensed before 2002.

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- 1 4. The air quality impacts of decommissioning are expected to be negligible at the end of the  
2 operating term.
  - 3 5. Measures are readily available to avoid potential significant water-quality impacts from  
4 erosion or spills. The liquid radioactive-waste system design includes features to limit  
5 release of radioactive material to the environment, such as pipe chases and tank collection  
6 basins. These features will minimize the amount of radioactive material in spills and leakage  
7 that would have to be addressed at decommissioning.
  - 8 6. The ecological impacts of decommissioning are expected to be negligible.
  - 9 7. The socioeconomic impacts would be short-term and could be offset by decreases in  
10 population and economic diversification.
- 11 On the basis of the GEIS-DECOM, and the evaluation of air quality impacts from greenhouse  
12 gas emissions above, the NRC staff concludes that, as long as the regulatory requirements on  
13 decommissioning activities to limit the impacts of decommissioning are met, the  
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## 15 **6.4 References**

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- 20 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, “Environmental  
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## 7.0 Cumulative Impacts

The National Environmental Policy Act of 1969, as amended (NEPA), requires Federal agencies to consider the cumulative impacts of proposals under its review. Cumulative impacts may result when the environmental effects associated with the proposed action are overlaid or added to temporary or permanent effects associated with past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. When evaluating the potential impacts of two new units at the Virgil C. Summer Nuclear Station (VCSNS) site proposed by South Carolina Electric and Gas (SCE&G) in its application for combined construction permits and operating licenses (COLs) (SCE&G 2008), U.S. Nuclear Regulatory Commission (NRC) staff and U.S. Army Corps of Engineers (USACE) staff considered potential cumulative impacts on resources that could be affected by the construction, preconstruction, and operation of two Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water reactors at the VCSNS site. Cumulative impacts result when the effects of an action are added to or interact with other past, present, and reasonably foreseeable future effects on the same resources. For the purposes of this analysis, past actions are those prior to the receipt of the COL application. Present actions are those related to resources from the time of the COL application until the start of NRC-authorized construction of the proposed new units. Future actions are those that are reasonably foreseeable through building and operating proposed VCSNS Units 2 and 3, including decommissioning. The geographic area over which past, present, and reasonably foreseeable future actions could contribute to cumulative impacts is dependent on the type of resource considered and is described below for each resource area. The review team considered, among other things, cumulative effects of proposed Units 2 and 3 with current operations at VCSNS Unit 1.

The approach for evaluating cumulative impacts in this environmental impact statement (EIS) is outlined in the following discussion. To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (CEQ) (Title 40 of the Code of Federal Regulations [CFR] 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, or LARGE – are defined 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.

## Cumulative Impacts

1 The impacts of the proposed action, as described in Chapters 4 and 5, are combined with other  
2 past, present, and reasonably foreseeable future actions near the VCSNS site that would affect  
3 the same resources affected by proposed VCSNS Units 2 and 3, regardless of what agency  
4 (Federal or non-Federal) or person undertakes such actions. These combined impacts are  
5 defined by CEQ as “cumulative” in 40 CFR 1508.7 and include individually minor but collectively  
6 significant actions taking place over a period of time. It is possible that an impact that may be  
7 SMALL by itself could result in a MODERATE or LARGE cumulative impact when considered in  
8 combination with the impacts of other actions on the affected resource. Likewise, if a resource  
9 is regionally declining or imperiled, even a SMALL individual impact could be important if it  
10 contributes to or accelerates the overall resource decline.

11 The description of the affected environment in Chapter 2 serves as the baseline for the  
12 cumulative impacts analysis, including the effects of past actions. The incremental impacts  
13 related to the construction activities requiring NRC authorization (10 CFR 50.10(a)) are  
14 described and characterized in Chapter 4 and those related to operations are described in  
15 Chapter 5. These impacts are summarized for each resource area in the sections that follow.  
16 The level of detail is commensurate with the significance of the impact for each resource area.

17 The specific resources and components that could be affected by the incremental effects of the  
18 proposed action and other actions in the same geographic area were assessed. This  
19 assessment includes the impacts of construction and operation of the proposed new units as  
20 described in Chapters 4 and 5; impacts of preconstruction activities as described in Chapter 4;  
21 impacts of fuel cycle, transportation, and decommissioning as described in Chapter 6; and  
22 impacts from past, present, and reasonably foreseeable Federal, non-Federal, and private  
23 actions that could affect the same resources affected by the proposed actions.

24 The review team visited the VCSNS site from March 8 through 13, 2009. The team then used  
25 the information provided in the Environmental Report, responses to Requests for Additional  
26 Information, information from other Federal and State agencies, and information gathered  
27 during the visits to the VCSNS site to evaluate the cumulative impacts of building and operating  
28 two new nuclear power plants at the site. To inform the cumulative analysis, the review team  
29 researched Environmental Protection Agency (EPA) databases for recent EISs, used an EPA  
30 database for permits for water discharges in the geographic area to identify water-use projects,  
31 and used the [www.recovery.gov](http://www.recovery.gov) website to identify projects in the geographic area funded by  
32 the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). Other actions and  
33 projects that were identified during this review and considered in the review team’s independent  
34 analysis of the potential cumulative effects are described in Table 7-1.



1 **Table 7-1.** Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered  
 2 in the Cumulative Analysis

Project Name	Summary of Project	Location	Status
<b>Energy Projects</b>			
VCSNS Unit 1	VCSNS Unit 1 consists of one 996-MW(e) nuclear power generating plant.	<1 mi north of proposed VCSNS Units 2 and 3	VCSNS Unit 1 is currently operational and is licensed to continue operations through August 6, 2042 <sup>(a)</sup>
Independent Spent Fuel Storage Installation	Dry spent-fuel storage	Same general location as VCSNS Units 2 and 3	Proposed <sup>(b)</sup>
Old Steam Generator Recycle Facility	Decommissioned steam generator storage	Same general location as VCSNS Unit 2 and 3	Operational <sup>(c)</sup>
Carolinas-Virginia Tube Reactor (CVTR)	Experimental pressurized tube heavy water nuclear power reactor	About 2 miles south of VCSNS Unit 1	Undergoing Decommissioning <sup>(d)</sup>
SCE&G Parr Hydroelectric Generating Station (Parr Hydroelectric Plant)	14-MW(e) hydroelectric plant	<1 mi south of VCSNS on Broad River	Operational <sup>(e)</sup>
SCE&G Fairfield Pumped Storage Facility (FPSF)	511.2-MW(e) hydroelectric plant. VCSNS Units 2 and 3 would use water supply from this facility	<2 mi northwest of VCSNS on Parr Reservoir (Broad River)	Operational <sup>(b)</sup>
SCE&G Parr Steam Plant	71-MW(e) natural gas electric generating plant	About 2 mi south of VCSNS	Operational
Lee Nuclear Station	Two 1199.5-MW(e) Westinghouse AP1000 pressurized water reactors	About 52 mi north	Proposed new nuclear plant. Operation would begin in 2021 <sup>(e)</sup>
Catawba Nuclear Station, Units 1 and 2	Two 1129-MW(e) Westinghouse reactors	About 54 mi north-northeast	Operational <sup>(f)</sup>
H.B. Robinson Steam Electric Plant, Unit 2	Nuclear power generating plant with one 710-MW(e) unit	About 66 mi east	Operational <sup>(g)</sup>
McGuire Nuclear Station, Units 1 and 2	Two 1100-MW(e) Westinghouse reactors	About 80 mi north-northeast	Operational <sup>(h)</sup>

3

## Cumulative Impacts

**Table 7-1. (contd)**

<b>Project Name</b>	<b>Summary of Project</b>	<b>Location</b>	<b>Status</b>
Vogtle Electric Generating Plant (VEGP)	Nuclear power generating plant with 2 units, VEGP 1 (1109 MW(e)) and VEGP 2 (1127 MW(e))	Approx 80 mi south-southwest	Operational <sup>(k)</sup>
VEGP Units 3 and 4	Nuclear power generating plant with two 1117-MW(e) Westinghouse AP1000 pressurized water reactors	Approx 80 mi south-southwest	Proposed. <sup>(j)</sup> Commercial operations are estimated to begin in 2016 for Unit 3 and 2017 for Unit 4.
Oconee Nuclear Station, Units 1, 2 and 3	Three 846-MW(e) Babcock and Wilcox reactors	About 96 mi west-northwest	Operational <sup>(b)</sup>
Buzzard Roost Combustion Turbine Station	196-MW oil/gas-fired peaking facility	Approx 35 mi west-southwest	Operational <sup>(k)</sup>
Buzzard's Roost Dam	15-MW hydroelectric facility	Approx 35 mi west-southwest	Operational <sup>(l)</sup>
Westinghouse Fuel Fabrication Plant in Columbia SC	Design and fabricate completed nuclear fuel assemblies and fuel-related products, such as top and bottom nozzles, control rods, and Zirconium Diboride and Erbium integral fuel burnable absorbers for pressurized water reactors and Vodo-Vodyanoi Energeticheskoy Reactors.	About 26 mi southwest	Operational <sup>(m)</sup>
Six Broad River Hydroelectric Projects	Hydroelectric facilities	5 upstream on the Broad River and 1 downstream on the Broad River	Operational <sup>(b)</sup>
<b>Mining Projects</b>			
Vulcan Materials Company/ Blair Quarry	Products include asphalt aggregate, base material, concrete, aggregate, and manufactured sand	Approximately 10 mi north of VCSNS	Operational <sup>(n)</sup>
<b>Transportation Projects</b>			
South Carolina Strategic Corridor System Plan	Strategic system of corridors forming the backbone of the state's transportation system.	State-wide	Planning document with no explicit schedules for projects, however, many strategic corridors coincide with routes which would/could be used for development at the VCSNS site <sup>(o)</sup>

Table 7-1. (contd)

Project Name	Summary of Project	Location	Status
<b>Parks and Aquaculture Facilities</b>			
Sumter National Forest	371,000-ac National Forest.	Located about 9 mi northwest of VCSNS boundary	Currently managed by U.S. Forest Service <sup>(p)</sup>
Parr Hydro Wildlife Management Area	4400-ac wildlife management area	Adjacent to VCSNS	Currently managed by the South Carolina Department of Natural Resources <sup>(b)</sup>
<b>Other Actions/Projects</b>			
City of Columbia	Municipal water withdrawals from the Broad River	About 26 mi southeast	Ongoing <sup>(b)</sup>
Various hospitals and industrial facilities that use radioactive materials	Medical isotopes	Within 50 mi	Operational in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens, Greenwood, and Camden
Cone Mills Carlisle Finishing Co.	Fabric finisher	About 22 mi. north of VCSNS on Broad River	Operational <sup>(q)</sup>
Chemtrade Performance Chemicals LLC	Industrial Inorganic Chemicals	About 23 mi north of VCSNS on Broad River	Operational <sup>(r)</sup>
Newberry County Water and Sewer Authority (NCW&SA)/Cannons Creek Waste Water Treatment Plant (WWTP)	Waste water treatment	About 8 mi west of VCSNS	Operational <sup>(s)</sup>
NCW&SA Broad River Wastewater Treatment Facility (WWTF) Phase 1	WWTF currently maintains a non-major National Pollutant Discharge Elimination System (NPDES) permit.	About 12 mi west of VCSNS	Operational <sup>(t)</sup>
SCE&G Combined Site Emergency Operations Facility	A new combined site emergency operations facility	10 mi from VCSNS	Proposed <sup>(b)</sup>
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroad; construction of water- and/or wastewater-treatment and distribution facilities and	Throughout region	Construction would occur in the future, as described in State and local land-use planning documents.

## Cumulative Impacts

**Table 7-1.** (contd)

Project Name	Summary of Project	Location	Status
	associated pipelines, as described in local land-use planning documents. There is a low-to-moderate potential for increase urbanization within the Broad River watershed in Newberry and Fairfield Counties, South Carolina. The highest potential for development would be associated with residential development around the reservoirs, the Towns of Prosperity and Pomaria, and the City of Newberry Sumter. National Forest would limit urbanization north of VCSNS.		
(a)	Source: NRC 2004		
(b)	Source: SCE&G 2009a		
(c)	Source: NRC GEIS (NRC 1996)		
(d)	Source: EPA 2009a		
(e)	Source: NRC 2009a		
(f)	Source: NRC 2009b		
(g)	Source: NRC 2009c		
(h)	Source: NRC 2009d		
(i)	Source: NRC 2009e		
(j)	Source: NRC 2009f		
(k)	Source: Duke 2009a		
(l)	Source: Greenwood County 2008		
(m)	Source: Westinghouse 2009		
(n)	Source: SCDHEC 2007b		
(o)	Source: SCDOT 2009		
(p)	Source: USFS 2004		
(q)	Source: EPA 2009b		
(r)	Source: EPA 2009c		
(s)	Source: EPA 2009d		
(t)	Source: EPA 2009e		

### 1 **7.1 Land Use**

2 The description of the affected environment in Section 2.2 serves as a baseline for the  
 3 cumulative impacts assessment in this resource area. As described in Section 4.1, the impacts  
 4 of NRC-authorized construction activities on land-use impacts would be SMALL, and no further  
 5 mitigation would be warranted. As described in Section 5.1 of this EIS, the review team  
 6 concludes that the impacts of operations on land use would also be SMALL, and no further  
 7 mitigation would be warranted.

8 The combined impacts from construction and preconstruction were described in Section 4.1 and  
 9 were determined to be MODERATE locally where new transmission-line corridors would be

1 developed and SMALL in all other areas. In addition to the impacts from construction,  
2 preconstruction, and operations, the cumulative analysis also considers other past, present, and  
3 reasonably foreseeable future actions that could affect land use. For this cumulative analysis,  
4 the geographic area of interest is considered to be the 50-mi region described in Section 2.2.3,  
5 plus any transmission-line corridors that extend beyond that range. Most but not all of the  
6 transmission-line corridor length falls within a 50-mi radius of the site. Although Fairfield County  
7 has adopted a zoning ordinance and developed a comprehensive plan specific to the county,  
8 land-use planning for transmission-line routing over wide areas must consider land-use plans of  
9 adjoining counties and other land-managing agencies, rather than considering one county in  
10 isolation. Further, in predominately rural settings such as that surrounding the VCSNS site,  
11 land-use changes occurring substantial distances away from a project site can substantially  
12 influence land-planning decisions close to the site. Roads and other public facilities and  
13 services in rural areas tend to serve people who are spread thinly but broadly over large  
14 portions of the landscape. Therefore, land-use changes can affect roads and other facilities at  
15 greater distances than similar changes in more densely populated areas.

16 The VCSNS site is located in a sparsely populated, largely rural area, with forests and small  
17 farms composing the dominant land use. This Piedmont terrain varies from gently rolling to hilly  
18 and is punctuated by relatively narrow stream valleys. Historically, most upland areas have  
19 been used for crop production, but presently they are used for silviculture. Jenkinsville and  
20 Peak are the closest communities. Monticello Reservoir was created by impounding Frees  
21 Creek as part of the Unit 1 development, and since then portions of the shoreline have  
22 experienced private residential and public recreational development. Several electric  
23 transmission lines, State routes, and interstate highways currently traverse the region.  
24 Industries and facilities that have historically affected the land use near VCSNS are described in  
25 Table 7-1. The proposed project would result in land conversions to residential areas, roads,  
26 and businesses to accommodate growth, new workers, and services related to the proposed  
27 nuclear facility. Other reasonably foreseeable projects in the area that could contribute to an  
28 increase in urbanization include potential residences along the Monticello Reservoir. This would  
29 result in a conversion of open areas, forests, and wetlands to residential areas. There are no  
30 specific plans to build new or widen existing roads in the area, other than those described for  
31 proposed VCSNS Units 2 and 3. The amount of land to be converted to residences, roads, or  
32 businesses would be minimal compared to the amount of land available in the area.

33 Because the other projects described in Table 7-1 do not include any reasonably foreseeable  
34 changes in types of land use within 50 mi of the VCSNS, other than the Monticello Reservoir  
35 shoreline development discussed above, there would not be any significant additional  
36 cumulative impacts on land use from those activities.

37 As described in Section 4.1, approximately 86 mi of entirely new transmission-line corridors  
38 would be built to support the VCSNS new units. In addition, approximately 88 mi of

## Cumulative Impacts

1 transmission lines serving the proposed reactors would be built within or along side of existing  
2 transmission-line rights-of-way. Because these transmission lines would be co-located with  
3 existing transmission-line corridors, they would not noticeably alter the land-use classification  
4 within the geographic area of interest. However, the 86 mi of new transmission-line corridors  
5 would noticeably alter the land-use classification acreage proportions within the geographic area  
6 of interest.

7 Cumulative land-use impacts within the geographic area of interest are expected to be  
8 manageable because the activities would be consistent with existing land-use plans and zoning.  
9 However, due to the potential reclassification of acreage caused by transmission-line  
10 development, especially for the 86 mi that would not be constructed within or adjacent to  
11 existing transmission-line rights-of-way, the review team concludes that the cumulative land-use  
12 impacts associated with the proposed Units 2 and 3, related transmission-line corridors, and  
13 other projects in the geographic area of interest would be MODERATE. The incremental  
14 impacts from NRC-authorized activities for proposed Units 2 and 3 would be SMALL, because  
15 impacts on land use, while noticeable at and in the vicinity of the site, would not noticeably alter  
16 the surrounding regional landscape.

## 17 **7.2 Water Use and Quality**

18 This section addresses the cumulative impacts of the proposed new units, the existing VCSNS  
19 units, and other past, present, and reasonably foreseeable future projects on water use and  
20 quality.

### 21 **7.2.1 Water-Use Impacts**

22 This section describes the cumulative water-use impacts from construction, preconstruction,  
23 and operation of proposed Units 2 and 3 and other past, present, and reasonably foreseeable  
24 projects.

#### 25 **7.2.1.1 Surface-Water-Use Impacts**

26 The description of the affected environment in Section 2.3 of this document serves as a  
27 baseline for surface-water use. As described in Section 4.2.2.1, the impacts from NRC-  
28 authorized construction on surface-water use would be SMALL, and no further mitigation would  
29 be warranted. As described in Section 5.2.2.1, the review team concludes that the impacts of  
30 operations on surface-water use would also be SMALL, and no further mitigation would be  
31 warranted.

32 The combined surface-water-use impacts from construction and preconstruction are described  
33 in Section 4.2.2.1 and were determined to be SMALL. In addition to the impacts from

1 construction, preconstruction, and operations, the cumulative analysis for surface-water use  
2 also considers other past, present, and reasonably foreseeable future actions that could  
3 potentially affect this resource. For the cumulative analysis of impacts of surface water, the  
4 geographic area of interest is considered to be the drainage basin of the Broad River upstream  
5 and downstream of the VCSNS site because other actions within this region could result in a  
6 cumulative impact. The Broad River has provided water for agricultural, industrial, and  
7 municipal use since colonial times. Dams have been installed on the river to provide flood  
8 control, increase the reliability of water supply to the region, and to provide power. Key actions  
9 that have current and reasonably foreseeable future potential impacts on surface-water supply  
10 in the Broad River basin include operation of VCSNS Unit 1, operation of the Fairfield Pumped  
11 Storage Facility (FPSF) that connects Monticello Reservoir with Parr Reservoir, the SCE&G  
12 Parr Hydroelectric Generating Station (or Plant), and the proposed William States Lee III  
13 Nuclear Station in Cherokee County, South Carolina (Lee Nuclear Station).

14 Peak water needs during construction and preconstruction, as described in Section 4.2.2.1, are  
15 estimated to be 420 gpm (approximately 1 cfs) (SCE&G 2009a). This represents less than 1  
16 percent of the 7Q10 (lowest flow for 7 consecutive days expected to occur once per decade)  
17 estimated for Broad River (SCE&G 2009a) and the impact of its use would not be noticeable.  
18 The surface-water-use impacts of construction, preconstruction, and operation are dominated  
19 by the higher demands that would occur under normal operation. The projected consumptive  
20 water use of proposed Units 2 and 3 is expected to be about 27,828 gpm (62 cfs) or 1 percent  
21 of the average river discharge of  $2.828 \times 10^6$  gpm (6300 cfs) near the site, as described in  
22 Section 5.2.2.1. This average river flow reflects upstream cumulative consumptive uses of  
23 current users including the consumptive use associated with VCSNS Unit 1. Increases in  
24 consumptive use of water in the Broad River drainage is anticipated in the future. For example,  
25 Duke Energy is proposing to build two nuclear reactors at the Lee Nuclear Station (Duke  
26 2009b). Duke has prepared an assessment of water availability and projected use for the Broad  
27 River to determine the availability of water to support expansions of Duke's generating capability  
28 (Duke 2007). Duke considered future agriculture and irrigation projects, power projections,  
29 public water supplies and wastewater projections, and future industrial use. Duke also  
30 considered future trends in water use such as water reuse, water conservation, and changes in  
31 regulations and the regional economy. The Duke study does not consider the impact of climate  
32 change. The study indicates that consumptive water use would increase in the Broad River  
33 drainage from the 241.5 cfs (0.33 acre-feet per year) in 2006 to 412.9 cfs (0.57 acre-feet per  
34 year) by 2070. Duke asserts in the document that the study will enable it to plan for water  
35 needs and develop water-storage facilities necessary to support the operation of its proposed  
36 facilities. Similarly, SCE&G asserts that the impact of consumptive use by VCSNS Units 1, 2,  
37 and 3 during low flows can be mitigated by using water from Monticello Reservoir. Because  
38 both the Lee Nuclear Station and VCSNS Units 1, 2, and 3 would rely on water from reservoirs  
39 during period of low flow, impacts would not likely noticeably alter surface-water resources in

## Cumulative Impacts

1 the Broad River. The impacts of other projects listed in Table 7-1 are considered in the analysis  
2 included in Sections 4.2 and 5.2 or would have little or no impact on surface-water use.

3 The review team is also aware of the potential climate changes that could affect the water  
4 resources available for cooling and the impacts of reactor operations on water resources for  
5 other users. A recent compilation of the state of the knowledge in this area (Karl et al. 2009)  
6 has been considered in the preparation of this EIS. Projected changes in the climate for the  
7 region during the life of proposed VCSNS Units 2 and 3 site include an increase in average  
8 temperature of 2 to 3°F and a decrease in precipitation in the winter, spring, and summer and a  
9 small increase in the fall (Karl et al. 2009, figures on pp. 28, 29, 31). Changes in climate during  
10 the life of proposed Units 2 and 3 could result in either an increase or decrease in the amount of  
11 runoff; the divergence in model projections for the southeastern United States precludes a  
12 definitive estimate (Karl et al. 2009, figures on p. 45). While the changes that are attributed to  
13 climate change in these studies are not insignificant, the review team did not identify anything  
14 that suggests the cumulative impacts would noticeably alter this resource.

15 The review team has examined the cumulative consumptive use of surface water from the  
16 operation of VCSNS Unit 1 and proposed Units 2 and 3 and other consumptive uses (existing or  
17 reasonably foreseeable user) and potential impacts from climate change. Although the  
18 cumulative effects on surface-water use may be detectable, they would not noticeably alter the  
19 resource. Based on its evaluation, the review team concludes that the cumulative impacts on  
20 surface-water use would be SMALL, and no mitigation would be warranted.

### 21 **7.2.1.2 Groundwater-Use Impacts**

22 The description of the affected environment in Section 2.3 of this document serves as a  
23 baseline for groundwater use. As described in Section 4.2.2.2, the impacts from NRC-  
24 authorized construction on groundwater use would be SMALL, and no further mitigation would  
25 be warranted. As described in Section 5.2.2.2, the review team concludes that the impacts of  
26 operations on groundwater use would also be SMALL, and no further mitigation would be  
27 warranted.

28 The combined groundwater-use impacts from construction and preconstruction are described in  
29 Section 4.2.2.2 and were determined to be SMALL. In addition to the impacts from  
30 construction, preconstruction, and operations, the cumulative analysis for groundwater use also  
31 considers other past, present, and reasonably foreseeable future actions that could potentially  
32 affect this resource. For the cumulative analysis of impacts on groundwater two geographic  
33 areas of interest have been identified – the VCSNS site and Fairfield County, South Carolina.  
34 The geographic area of interest affected by dewatering activities for construction and  
35 preconstruction activities is limited to the VCSNS site because local bodies of surface water  
36 along the project boundaries (Mayo Creek, Broad River, Parr Reservoir, and Monticello  
37 Reservoir) limit the influence of dewatering beyond those features. Fairfield County is



1 considered a region of interest for groundwater production because water from the Jenkinsville  
2 water-supply system would be used for construction and preconstruction of proposed Units 2  
3 and 3 until SCE&G completes the proposed water-treatment plant. The Jenkinsville water-  
4 supply system obtains a portion of its water from groundwater wells and is located in Fairfield  
5 County.

6 Impacts on groundwater use on the VCSNS site would be localized and temporary during both  
7 construction and preconstruction, as discussed in Section 4.2.2.2. As mentioned above, the  
8 groundwater withdrawals on the VCSNS site would not contribute to a cumulative impact offsite  
9 because local bodies of surface water along the project boundaries (Mayo Creek, Broad River,  
10 Parr Reservoir, and Monticello Reservoir) limit the influence of onsite withdrawals beyond those  
11 features.

12 Impacts on groundwater use in Fairfield County would be minimal. As described in Section 4.2,  
13 SCE&G has indicated that a portion of the water needed for construction and preconstruction  
14 would be supplied by the Jenkinsville Water District. SCE&G estimated that less than  
15 15,000 gpd would be required from this source to meet potable water needs during construction  
16 and preconstruction. Additional water would be supplied for the concrete batch plant. The  
17 Jenkinsville Water District obtains a portion of its water from groundwater wells but also has an  
18 excess capacity of 1 Mgd through its agreements with other nearby water districts (SCE&G  
19 2009a). As mentioned in Section 4.2.2.2 the excess capacity is from surface-water sources.

20 Groundwater supplies less than 10 percent of the water used for public water supplies in  
21 Fairfield County (SCDHEC 2007a). South Carolina requires that any user withdrawing more  
22 than 3 million gallons per month in any given month from surface water or groundwater report its  
23 withdrawal to the State. The 2006 water-use summary report for South Carolina reports no  
24 groundwater use for industrial, agricultural, or power generation for Fairfield County (SCDHEC  
25 2007a).

26 As discussed in Section 5.2.2.2, impacts on groundwater use during operations are anticipated  
27 to be localized because there is no plan to use groundwater or to discharge waste to  
28 groundwater during operations. No other projects listed in Table 7-1 would affect groundwater  
29 at the VCSNS site. As mentioned in Section 3.4.2.1, impacts on groundwater use in Fairfield  
30 County during operations are not anticipated because VCSNS would obtain all water for  
31 operations from Monticello Reservoir. Given that the potable water needed for Units 2 and 3  
32 represents less than 2 percent of the excess capacity available, the potable water demand on  
33 ground water resources would be temporary until the VCSNS water-treatment plant is  
34 completed, and no industrial, agricultural or power generation uses are identified for  
35 groundwater, the NRC staff concludes that the cumulative impact on groundwater use in  
36 Fairfield County would be minimal.

## Cumulative Impacts

1 The review team has examined the cumulative consumptive use of groundwater including the  
2 operation of Unit 1 and the proposed Units 2 and 3, and other consumptive uses (existing and  
3 reasonably foreseeable users). Based on its evaluation, the review team concludes that the  
4 cumulative impacts on groundwater use would be SMALL, and no mitigation would be  
5 warranted.

### 6 **7.2.2 Water-Quality Impacts**

7 This section describes cumulative water-quality impacts resulting from construction,  
8 preconstruction, and operation of the proposed VCSNS Units 2 and 3 and impacts from other  
9 past, present, and reasonably foreseeable projects.

#### 10 **7.2.2.1 Surface-Water-Quality Impacts**

11 The description of the affected environment in Section 2.3 serves as a baseline for this resource  
12 area. As described in Section 4.2.3.1, the impacts from NRC-authorized construction on  
13 surface-water quality would be SMALL, and no further mitigation would be warranted. As  
14 described in Section 5.2.3.1, the review team concludes that the impacts of operations on  
15 surface-water quality would also be SMALL, and no further mitigation would be warranted.

16 The combined surface-water-quality impacts from construction and preconstruction are  
17 described in Section 4.2.3.1 and were determined to be SMALL. In addition to the impacts from  
18 construction, preconstruction, and operations, the cumulative analysis for surface-water quality  
19 also considers other past, present, and reasonably foreseeable future actions that could  
20 potentially affect this resource. The geographic area of interest is the same as that described  
21 for surface-water use (Section 7.2.1.1).

22 The impacts from building and operating proposed Units 2 and 3 were determined to be  
23 minimal, and were evaluated using the current conditions in the Broad River. The current  
24 conditions include the impact of operations of the VCSNS Unit 1, the FPSF, and the Parr  
25 Hydroelectric Plant. The hydrological conditions described in Sections 4.2 and 5.2 also include  
26 the impact of the activities listed as currently operational in Table 7-1 that are distinct from the  
27 activities at the VCSNS site. Those activities include facilities with National Pollutant Discharge  
28 Elimination System (NPDES) permits to discharge water to the river and its tributaries, including  
29 the Newberry County Water and Sewer Authority (NCW&SA) Broad River Waste-Water  
30 Treatment Plant (WWTP) and NCW&SA Cannons Creek WWTP. The NCW&SA Broad River  
31 WWTP has an active NPDES permit for discharge of 34.7 gpm (0.078 cfs) to Cannons Creek,  
32 which ultimately flowed into Parr Reservoir up until the permit expired in September of 2007  
33 (EPA 2009e). Currently, only the NCW&SA Cannons Creek WWTP has a current NPDES  
34 permit (SC0048313) with a discharge of 65,972 gpm (147 cfs) to Cannons Creek (EPA 2009d).  
35 Discharge from this WWTP is monitored for compliance with NPDES permitting regulations.

1 The review team performed an independent assessment of the primary water-quality impacts on  
2 the Parr Reservoir and the Broad River in its analysis of the estimated blowdown discharge of  
3 Units 2 and 3 (see Section 5.3). The review team determined that both the thermal impacts and  
4 the impact of discharging solutes and solids concentrated through evaporation in the cooling  
5 towers would be minimal and localized to the zone defined by the thermal plume. Table 7-1  
6 identifies the proposed construction of two nuclear reactors at the Lee Nuclear Station. The  
7 review team anticipates that operation of this facility would result in a thermal discharge to the  
8 Broad River. However, given that it is located more than 50 mi upstream of the discharge for  
9 the proposed VCSNS Units 2 and 3, any thermal impact of the proposed Lee station would be  
10 undetectable by the time the water reaches Parr Reservoir. The impacts of other projects listed  
11 in Table 7-1 are either considered in the analysis included in Sections 4.2 and 5.2 or would have  
12 little or no impact on surface-water quality.

13 Although the cumulative effects on surface-water quality may be detectable, they would not  
14 noticeably alter the resource; therefore, the review team concludes that cumulative impacts of  
15 surface-water quality would be SMALL, and no further mitigation beyond that described in  
16 Chapters 4 and 5 would be warranted.

#### 17 **7.2.2.2 Groundwater-Quality Impacts**

18 The description of the affected environment in Section 2.3 of this document serves as a  
19 baseline for this resource area. The groundwater-quality impacts from NRC-authorized  
20 construction are described in Section 4.2.3.2 and were determined to be SMALL. As described  
21 in Section 5.2.3.2, the review team concludes that groundwater quality impacts from operation  
22 of the two proposed units would be SMALL.

23 The combined groundwater-quality impacts from construction and preconstruction are described  
24 in Section 4.2.3.2 and were determined to be SMALL. In addition to the impacts from  
25 construction, preconstruction, and operations, the cumulative analysis for groundwater quality  
26 also considers other past, present, and reasonably foreseeable future actions that could  
27 potentially impact this resource. The geographic area of interest is the same as that described  
28 for groundwater use (Section 7.2.1.2).

29 As discussed in Section 4.2.3.2, impacts on groundwater quality would be localized and  
30 temporary during construction. Impacts on groundwater quality during operations, as discussed  
31 in Section 5.2.3.2, are anticipated to be localized because there is no plan to use groundwater  
32 or to discharge waste to groundwater during operations. No other projects listed in Table 7-1  
33 would affect groundwater at the VCSNS site.

34 Although the cumulative effects on groundwater quality may be detectable, they would not  
35 noticeably alter the resource; therefore, the review team concludes that cumulative impacts of

## Cumulative Impacts

1 groundwater quality would be SMALL, and no further mitigation beyond that described in  
2 Chapters 4 and 5 would be warranted.

### 3 **7.3 Ecology**

4 This section addresses the cumulative impacts on terrestrial, wetlands, and aquatic ecological  
5 resources as a result of activities associated with the proposed new units at the proposed  
6 VCSNS site and past, present, and reasonably foreseeable future activities within the  
7 geographic area of interest of each resource.

#### 8 **7.3.1 Terrestrial Ecology and Wetlands**

9 The description of the affected environment in Chapter 2.4.1 provides the baseline for the  
10 cumulative impacts assessments for terrestrial ecological resources. As described in  
11 Section 4.3.1, the impacts from NRC-authorized construction on terrestrial and wetlands  
12 ecology would be SMALL, and no further mitigation would be warranted. As described in  
13 Section 5.3.1, the review team concludes that the impacts of operations on terrestrial and  
14 wetlands ecology would also be SMALL, and no further mitigation would be warranted.

15 The combined impacts from construction and preconstruction were described in Section 4.3.1  
16 and determined to be SMALL for the site and MODERATE for transmission-line corridors. In  
17 addition to the impacts from construction, preconstruction, and operations, the cumulative  
18 analysis also considers other past, present, and reasonably foreseeable future actions that  
19 could affect terrestrial resources. For the cumulative analysis of terrestrial ecology, the  
20 geographic area of interest is considered to be the 6-mi vicinity of the VCSNS site and the  
21 macro-corridors associated with the proposed transmission lines (as defined in Chapter 4). This  
22 area is expected to encompass the ecologically relevant landscape features and species  
23 potentially affected by proposed Units 2 and 3. Current projects within the geographic area of  
24 interest include operation of VCSNS Unit 1, the SCE&G Parr Hydroelectric Plant, the FPSF and  
25 urbanization. There are no other major current projects in the geographic area of interest that  
26 would contribute to cumulative impacts on terrestrial ecological resources. Reasonably  
27 foreseeable projects within the geographic area of interest that could affect terrestrial resources  
28 include continued regional commercial and residential development, such as new residences  
29 along Monticello Reservoir.

30 The geographic area of interest is located primarily in the South Carolina Southern Outer  
31 Piedmont ecoregion and portions occur within the Sandhills and Coastal Plain ecoregions.  
32 These ecoregions have been altered considerably since European settlement primarily due to  
33 farming, agriculture, and forestry (Godfrey 1980). During the time of early settlement, the  
34 forests were primarily a mixture of oaks, hickories, and pines (Kirkman et al. 2007). Currently,  
35 most forests in the geographic area of interest are dominated by planted and naturally

1 vegetated pine. The 6-mi geographic area of interest has also changed dramatically since the  
2 damming of the Broad River and of Frees Creek to create the Parr and Monticello reservoirs  
3 (SCE&G 2009a; FPC 1974; SCE&G 1977; see historical photos in Chapter 2 [Figure 2-13]).  
4 Prior to impoundment, the land currently inundated was primarily forest land, riparian land, and  
5 farmland (SCE&G 1977; FPC 1974). There also has been ongoing residential and commercial  
6 urbanization within the geographic area of interest.

7 The geographic area of interest includes open water and rural forested land with scattered small  
8 farms. The habitats and wildlife that would be disturbed are common in the region, and are not  
9 considered to be unique or critical for the survival of Federally listed threatened or endangered  
10 species or for the other important species identified in Section 2.4.1. In addition, the percentage  
11 of wetlands and riparian habitats that would be lost due to the preconstruction, construction, and  
12 operations of VCSNS Units 2 and 3 represents only a small fraction of the wetlands in the area.

### 13 **7.3.1.1 Site-Preparation and Site-Development Impacts**

14 The impacts on terrestrial habitats, wetlands, and important species from site preparation and  
15 development of the proposed VCSNS Units 2 and 3 and associated transmission lines are  
16 described in Section 4.3.1. Proposed future actions that have the potential to result in  
17 cumulative impacts on terrestrial resources would include regional urbanization that is expected  
18 to continue. The nearby Parr Hydro Wildlife Management Area, however, would continue to be  
19 managed for the benefit of wildlife, helping offset habitat losses in the future.

20 Activities from the projects mentioned above that could contribute to cumulative impacts for  
21 terrestrial ecological resources include land clearing and grading (temporary and permanent),  
22 filling and/or draining of wetlands, increased human presence, heavy equipment operation,  
23 traffic, noise, avian collisions, and fugitive dust. These activities would likely displace or destroy  
24 wildlife that inhabit affected areas. Some wildlife, including some individuals of important  
25 species, would perish or be displaced during land clearing for any of the above projects as a  
26 consequence of habitat loss, fragmentation, and competition for remaining resources. Less  
27 mobile animals, such as reptiles, amphibians, and small mammals, would be at greater risk of  
28 incurring mortality than more mobile animals, such as birds, many of which would be displaced  
29 to adjacent communities. Undisturbed land adjacent to areas of activity could provide habitat to  
30 support displaced wildlife, but increased competition for available space and resources could  
31 affect population levels. Wildlife would also be subjected to impacts from noise and traffic,  
32 and birds could be injured if they collide with tall structures. The impact on wildlife from each  
33 noise-generating activity is expected to be temporary and minor. The creation of new  
34 transmission-line corridors could be beneficial for some species, including those that inhabit  
35 early successional habitat or use forest edge environments, such as white-tailed deer  
36 (*Odocoileus virginianus*), bobwhite quail (*Colinus virginianus*), eastern meadowlark  
37 (*Sturnella magna*), and the gopher tortoise (*Gopherus polyphemus*). Birds of prey, such as red-

## Cumulative Impacts

1   tailed hawks (*Buteo jamaicensis*) would likely exploit newly created hunting grounds. Forested  
2   wetlands within the corridors would be converted to, and maintained in, a herbaceous or scrub-  
3   shrub condition that could provide improved foraging habitat for some waterfowl and wading  
4   birds. However, fragmentation of forests could adversely affect species that are dependent on  
5   large tracts of continuous forested habitat. Fragmentation would result in noticeable, but not  
6   destabilizing, impacts on continuously forested habitats.

### 7   **7.3.1.2   Operational Impacts**

8   As described in Section 5.3.1, potential operational impacts would include cooling-tower noise,  
9   salt drift from vapor plumes, and avian collisions with tall structures, and transmission-line  
10   operation. During the review of the VCSNS COL application, no other past, present, or  
11   reasonably foreseeable actions in the region were identified that would substantially affect  
12   terrestrial ecological resources that would be affected by the operation of the VCSNS Units 2  
13   and 3.

### 14   **7.3.1.3   Statement**

15   Cumulative impacts on terrestrial ecology and wetland resources from construction,  
16   preconstruction, and operation of the VCSNS and other past, present, and reasonably  
17   foreseeable projects are estimated based on the information provided by SCE&G and the  
18   review team's independent review. Due to the extent of habitat loss and fragmentation that  
19   would be caused by the proposed transmission-line development, especially where the  
20   transmission lines would be routed away from existing transmission-line rights-of-way, the  
21   review team concludes that cumulative impacts would be MODERATE. Such fragmentation  
22   would result in noticeable, but not destabilizing, impacts on species that are highly dependent  
23   on large tracts of continuous forest.

24   Construction of transmission lines does not require NRC authorization; therefore, the NRC staff  
25   concludes that the incremental impacts from NRC-authorized activities at the proposed VCSNS  
26   site would be SMALL and would not noticeably alter the ecology within the geographic area of  
27   interest. The incremental impacts associated with developing the proposed transmission lines,  
28   especially the 86 mi of transmission line not routed within or adjacent to existing transmission-  
29   line corridors, are the principal contributor to the MODERATE rating of cumulative impacts  
30   because the proposed new transmission lines could result in habitat fragmentation, which could  
31   affect species that are dependent on large tracts of continuous forested habitat.

### 32   **7.3.2   Aquatic Ecosystem Impacts**

33   The description of the affected environment in Section 2.4.2 serves as a baseline for the  
34   cumulative impacts assessment for aquatic ecological resources. As described in Section 4.3.2,  
35   the impacts of NRC-authorized construction on aquatic biota would be SMALL, and no further

1 mitigation would be warranted. As described in Section 5.3.2, the review team concludes that  
2 impacts of VCSNS Units 2 and 3 operations on aquatic resources inhabiting onsite waterbodies,  
3 Monticello Reservoir, and Broad River from Neal Shoals Dam to Parr Shoals Dam, and along  
4 the six new offsite transmission lines would be SMALL, and no further mitigation would be  
5 warranted.

6 The combined impacts from construction and preconstruction were described in Section 4.3.2  
7 and determined to be SMALL. In addition to the impacts from construction, preconstruction, and  
8 operations, the cumulative analysis also considers other past, present, and reasonably  
9 foreseeable actions that could affect aquatic ecology. For this analysis, the geographic area of  
10 interest is considered to be the drainage basin of the Broad River from Neal Shoals Dam  
11 downriver approximately 30 mi to the Parr Shoals Dam, Monticello Reservoir, and  
12 corresponding intermittent and seasonal streams on the VCSNS site, as the most likely to show  
13 the impact of water-use and water-quality criteria for aquatic biota. In addition, waterbodies  
14 crossed by the transmission-line corridors are considered within each macro-corridor as  
15 described for terrestrial resources in Section 4.3.1, and include the Santee River basin,  
16 Ashepoo, Combahee, Edisto (ACE) river basin, and Pee Dee River basins. Other actions listed  
17 in Table 7-1 within the geographic area of interest that have present and reasonably  
18 foreseeable future potential impacts on Monticello and Parr reservoirs include operation of  
19 VCSNS Unit 1, operation of the FPSF that connects Monticello Reservoir to Parr Reservoir, the  
20 NCW&SA Broad River WWTP, the NCW&SA Cannons Creek WWTP, and SCE&G's Parr  
21 Hydroelectric Plant located on the Broad River less than 1 mi southwest of proposed Units 2  
22 and 3. The evaluation of cumulative impacts from these actions on aquatic biota is described  
23 below.

24 Monticello Reservoir was formed in 1977 by impounding Frees Creek, a tributary to Parr  
25 Reservoir. Monticello Reservoir was designed to serve as a source of cooling water for VCSNS  
26 Unit 1, to receive thermal and chemical discharge from the VCSNS Unit 1, and to serve as the  
27 upper pool for the FPSF located on Parr Reservoir (SCE&G 2009a). Water elevations within  
28 Monticello Reservoir are maintained via operation of the FPSF, which pumps water between the  
29 Monticello and Parr reservoirs. The increased consumption of water from the Monticello  
30 Reservoir for cooling purposes for VCSNS Units 2 and 3 is expected to be about 1 percent of  
31 the average annual Broad River flow at Alston (SCE&G 2009a). Parr Reservoir was created in  
32 1914 by impounding a segment of the Broad River to provide a pool for the original Parr  
33 Hydroelectric Plant. In 1977, the size of Parr Reservoir increased to approximately 4400 ac  
34 when the height of the dam was increased to accommodate operation of the FPSF (SCE&G  
35 2009a).

36 Operation of proposed VCSNS Units 2 and 3 would increase the level of impingement and  
37 entrainment of aquatic biota in Monticello Reservoir and introduce discharge of effluent to Parr  
38 Reservoir. The Unit 1 intake structure impingement and entrainment estimates are discussed in

## Cumulative Impacts

1 Section 5.3.2. The new circulating-water system (CWS) proposed for VCSNS Units 2 and 3  
2 would operate at a reduced intake velocity (<0.5 fps versus 0.72 fps for VCSNS Unit 1), with  
3 water withdrawal rates varying between 81 cfs for normal operations and 131 cfs for maximum  
4 use operations. In addition, the new water-treatment plant (for plant service, potable,  
5 demineralized, and fire protection systems) would withdraw 2.2 cfs during normal operations  
6 and 6.7 cfs during maximum operations (SCE&G 2009a). Given that the impingement and  
7 entrainment rates for Unit 1 are based on a cooling-water withdrawal rate of 1190 cfs, the  
8 planned cooling-water withdrawal rate for VCSNS Units 2 and 3 should result in at least a  
9 ninefold less potential for impingement and entrainment when compared to Unit 1 impingement  
10 and entrainment rates, which were found to result in minimal impacts (NRC 2004). Organisms  
11 most vulnerable to impingement and entrainment (Section 5.3.2.1) at the VCSNS Unit 1 intake  
12 structure include taxa that are common and represent appreciable proportions of the standing  
13 stocks of fish in Monticello Reservoir (Christie and Stroud 1997). Further, many of these fish,  
14 such as gizzard shad (*Dorosoma cepedianum*) and bluegill (*Lepomis macrochirus*), are typically  
15 highly fecund and prolific spawners (Rohde et al. 2009).

16 Blowdown from proposed VCSNS Units 2 and 3 would enter the Parr Reservoir. Because the  
17 discharge structure for VCSNS Unit 1 is located on Monticello Reservoir, there would be no  
18 direct interaction between the thermal plume from Unit 1 and the plume associated with  
19 proposed Units 2 and 3. The proposed blowdown discharge to Parr Reservoir is not likely to  
20 noticeably affect the biota, water quality, or consumptive use of the Parr Hydroelectric Plant,  
21 and is described in more detail in Section 5.3.2.1. The proposed water-treatment plant  
22 associated with VCSNS Units 2 and 3 would discharge effluent into an existing Unit 1 discharge  
23 canal in Monticello Reservoir (SCE&G 2009a). Effluent from the water-treatment plant has the  
24 potential to affect aquatic biota in Monticello Reservoir; however, the impacts on aquatic biota  
25 are expected to be minimal because the discharge waste stream is quite small (from 0.1 to  
26 0.3 fps) and chemical constituents would be regulated by an NPDES permit.

27 Cumulative impacts on aquatic resources within Monticello and Parr reservoirs may also include  
28 activities or events that are distinct from the VCSNS site. Water quality may be affected by  
29 discharges from other plants or facilities that reach the Monticello and Parr reservoirs, such as  
30 wastewater treated discharge that enters Parr Reservoir through Cannons Creek with the  
31 current discharge point approximately 8 mi to the west of the VCSNS site. The NCW&SA Broad  
32 River WWTP had an active NPDES permit for discharge of 0.05 Mgd to Cannons Creek. This  
33 discharge ultimately flowed into Parr Reservoir until September of 2007, when the WWTP  
34 ceased operations (EPA 2009e). Currently only the NCW&SA Cannons Creek WWTP has a  
35 current NPDES permit (SC0048313) with a discharge of 0.95 Mgd to Cannons Creek (EPA  
36 2009d). Discharge from this operating WWTP is monitored for compliance with NPDES  
37 permitting regulations to make sure water-quality metrics do not exceed allowable levels. Given  
38 that current discharges do not exceed allowable levels, operations of the NCW&SA Cannons  
39 Creek WWTP has minor impacts on aquatic biota.



1 Another potential cumulative impact may come from the continued operation of the FPSF that  
2 maintains water elevation within Monticello Reservoir. SCDNR has active fish-stocking  
3 programs in the Broad River for smallmouth bass (*Micropterus dolomieu*) and robust redhorse  
4 (*Moxostoma robustum*), both of which were recently collected in Monticello Reservoir perhaps  
5 via FPSF intake operation from Parr Reservoir to Monticello Reservoir (SCDNR 2009).  
6 Section 7.2.1 concludes that the cumulative impacts on surface waters from operation of the  
7 FPSF would have little to no impact regarding water use. It is therefore anticipated that FPSF  
8 would not result in significant cumulative impacts on these species in addition to the already  
9 negligible impingement, entrainment, and discharge impacts.

10 Parr Shoals Dam is located approximately 1 mi from the proposed discharge location for  
11 VCSNS Units 2 and 3. The Parr Hydroelectric Plant at the Parr Shoals Dam generates up to  
12 15 MW through operation of six turbine units (SCE&G 2009a). A minimum daily average flow of  
13 800 cfs results in the transport of aquatic biota within the influence of the turbine intake systems  
14 downriver below Parr Shoals. The operation of the hydroelectric plant influences aquatic  
15 communities within Parr Reservoir by preventing any organisms that pass through the  
16 hydropower facility from returning upstream of the facility. In addition, the operation of the  
17 FPSF, which can produce over 511 MW of electricity, results in a daily average fluctuation of 4 ft  
18 in water elevation in Parr Reservoir as water is pumped from the Parr Reservoir into Monticello  
19 Reservoir and then flows back to Parr Reservoir through the hydroelectric turbines (NRC 2004).  
20 This daily pump-and-discharge operation may result in injury or mortality for some aquatic biota,  
21 thus contributing to the overall impact on aquatic populations. However, the overall impact is  
22 minor with no noticeable changes in local aquatic populations as a result of continuous  
23 operations.

24 No Federally listed threatened or endangered aquatic species are known to occur at the VCSNS  
25 site; however, six Federally protected aquatic species are known to occur within counties  
26 proposed for siting the six new transmission lines. Some of the aquatic taxa encountered during  
27 onsite aquatic inventories have been identified as State conservation priority species.  
28 Largemouth bass (*Micropterus salmoides*), sunfishes (*Lepomis spp.*), and catfish  
29 (*Ictalurus spp.*) are important recreational species in both Parr Reservoir and Monticello  
30 Reservoir.

31 The construction of six new transmission lines for Units 2 and 3 would have a minor effect on  
32 these and other aquatic species because best management practices (BMPs) would be  
33 employed during construction and environmentally responsible practices would be followed  
34 during transmission line maintenance activities once the lines are completed and energized.  
35 Although no impact on populations of threatened or endangered, State-listed, or recreationally  
36 important species is expected, there is the possibility that individuals of these important species  
37 may be taken.

## Cumulative Impacts

1 Anthropogenic activities such as residential or industrial development near the vicinity of the  
2 nuclear facility can present additional constraints on aquatic resources. Future activities may  
3 include shoreline development (i.e., removal of habitat), increased water needs, and increased  
4 discharge of effluents into the Broad River, Parr Reservoir, and/or Monticello Reservoir. There  
5 is a low-to-moderate potential for additional residential development within the geographic area  
6 of interest, and one new residential area is under construction along the Monticello Reservoir.  
7 In addition to direct anthropogenic activities, physical disturbance and climatic events may  
8 impose external stressors on aquatic communities. Aquatic ecosystem responses to these  
9 events are difficult to predict. At certain times of the year, VCSNS operation, other  
10 anthropogenic stressors, and climatic events could combine to adversely affect the aquatic  
11 populations of Parr and Monticello reservoirs. The level of impact resulting from these activities  
12 or events would depend on the intensity of the perturbation and the resiliency of the aquatic  
13 communities.

### 14 **7.3.2.1 Summary of Aquatic Ecology Impacts**

15 Cumulative impacts on aquatic ecology resources are estimated based on the information  
16 provided by SCE&G and the review team's independent review. Given the minimal levels of  
17 impingement and entrainment found at Units 1 and 2, the smaller likelihood for impingement  
18 and entrainment at Unit 3 compared to Units 1 and 2, and the high fecundity and prolific  
19 spawning habitats of many of the potentially affected fish species, impingement and entrainment  
20 from Units 1, 2, and 3 and other current and reasonably foreseeable projects would have minor  
21 impacts on aquatic resources. Cumulative impacts from thermal or chemical discharges are  
22 also expected to have minimal impacts on aquatic species because dischargers are operating  
23 within allowable levels that prevent water-quality degradation. The construction of six new  
24 transmission-line corridors for Units 2 and 3 would have a minor effect on Federally listed  
25 threatened or endangered species and other aquatic species because BMPs would be used  
26 during construction and environmentally responsible practices would be followed during  
27 transmission-line maintenance activities once the lines are completed and energized. Other  
28 direct and indirect anthropogenic stressors in the geographic area of interest, such as additional  
29 residential development and other changes in land use and global climate change, would  
30 cumulatively lead to some adverse effects on the aquatic communities, but they likely would be  
31 minor during the time period encompassing the building, operating, and decommissioning of  
32 proposed VCSNS Units 2 and 3. Therefore, the review team concludes that cumulative impacts  
33 on aquatic biota related to proposed VCSNS Units 2 and 3 and other past, present, and  
34 reasonably foreseeable projects would be SMALL.

## 1 **7.4 Socioeconomics and Environmental Justice**

2 The evaluation of cumulative impacts on socioeconomics and environmental justice is described  
3 in the following sections.

### 4 **7.4.1 Socioeconomics**

5 The description of the affected environment in Section 2.5 serves as a baseline for the  
6 cumulative impacts assessment in this resource area. As described in Section 4.4, the NRC  
7 staff concludes that any negative impacts of the NRC-authorized construction activities on all  
8 socioeconomics categories would be SMALL, with one exception. The NRC staff determined  
9 there would be a MODERATE and adverse traffic impact on Fairfield County in the vicinity of  
10 Jenkinsville for NRC-authorized construction. As described in Section 5.4, the review team  
11 concludes that all elements of socioeconomics would be SMALL and adverse, with the following  
12 exception. Operations would result in SMALL and beneficial tax revenue impacts in the region,  
13 and LARGE and beneficial impacts on Fairfield County.

14 The combined impacts from construction and preconstruction were described in Section 4.4 and  
15 determined to be SMALL and adverse, with one exception. The review team determined that  
16 traffic impacts in the vicinity of the site would be MODERATE and adverse. The cumulative  
17 analysis also considers past, present, and reasonably foreseeable future actions that could  
18 affect socioeconomics. For this cumulative analysis, the geographic area of interest is  
19 considered to be Fairfield, Lexington, Newberry, and Richard Counties, as that is where the  
20 review team expects the socioeconomic impacts to be the greatest. The geographic area of  
21 interest was modified as appropriate for specific impact analyses. For example, for some  
22 analyses the review team considered the entire 50-mi region surrounding the proposed VCSNS  
23 site, and for other analyses or specific taxation jurisdictions were considered. As the economic  
24 hub of the Central Midlands, the City of Columbia is the center of government and industry for a  
25 wide area in central South Carolina. Relatively recently, the Interstate-26 corridor has seen  
26 significant commercial and residential development in the areas of West Columbia and Irmo.  
27 The University of South Carolina and several regional medical facilities have attracted a well-  
28 educated workforce to this area. Fort Jackson, a large military installation in Columbia, is  
29 supported by nearly 4000 civilian employees.

30 The construction of Unit 1 provides context for what the potential cumulative impacts of building  
31 the new units would be. The NRC was completing its Final Environmental Statement (FES) for  
32 the Operating License (OL) for VCSNS Unit 1 just as final construction of that unit was winding  
33 down over the 1979–1981 period. As such, the OL FES provides a glimpse at the observed  
34 socioeconomic impacts from that construction project. At that time, the review team noted that  
35 the construction contractor commissioned a workforce survey to ascertain information such as  
36 the residence pattern of the construction workers. Of the approximately 2400 workers

## Cumulative Impacts

1 surveyed, 1913, or about 80 percent came from within the VCSNS region, and 927, or nearly  
2 50 percent came from either Lexington or Richland Counties (NRC 1981). The review team  
3 also observed that more than 70 percent of the workers came from the Central Midlands area,  
4 with the remainder coming from outside the region.

5 The impact analyses in Chapters 4 and 5 are cumulative by nature. Economic impacts  
6 associated with activities listed in Table 7-1 already have been considered as part of the  
7 socioeconomic baseline presented in Section 2.5. For example, the economic impacts of  
8 existing enterprises such as mining, other electrical utilities, etc., are part of the base used for  
9 establishing the Regional Input-Output Modeling System (RIMS) II multipliers. Regional  
10 planning efforts and associated demographic projections formed the basis for the review team's  
11 assessment of reasonably foreseeable future impacts. Thus, there are no cumulative impacts  
12 associated with building and operating VCSNS Units 2 and 3 beyond those already evaluated in  
13 Chapters 4 and 5.

14 The review team considered the impacts of the NRC-authorized activities plus past, present,  
15 and reasonably foreseeable future activities over the life of the two new units. Based on the  
16 above considerations, information provided by SCE&G, and the review team's independent  
17 review, the review team concludes that NRC-authorized construction of proposed VCSNS Units  
18 2 and 3 could make a temporary detectable adverse contribution to the cumulative effects  
19 associated with some socioeconomic issues. Adverse cumulative impacts would include  
20 physical impacts (workers and the local public, buildings, transportation, and visual aesthetics)  
21 and impacts on local infrastructures and community services (transportation; recreation;  
22 housing; water and wastewater facilities; police, fire, and medical services; social services; and  
23 schools).

24 The review team concludes there would be a LARGE and beneficial cumulative impact  
25 associated with tax revenues in Fairfield County. The incremental impact from NRC-authorized  
26 activities would be LARGE and beneficial. The review team also identified a MODERATE and  
27 adverse cumulative traffic impact in the Jenkinsville area that would be localized and temporary  
28 (limited to only "rush hour" traffic and the peak building activity period). The incremental impact  
29 from NRC-authorized activities would be MODERATE. The review team concludes that  
30 cumulative impacts on other socioeconomic impact categories would be SMALL and adverse.

### 31 **7.4.2 Environmental Justice**

32 The description of the affected environment in Section 2.6 serves as a baseline for the  
33 cumulative impacts assessment in this resource area. As described in Section 4.5, the NRC  
34 staff concludes that the NRC-authorized construction traffic-related activities may create  
35 disproportionate and adverse impacts on minority or low-income populations and, therefore, the  
36 environmental justice can be characterized as MODERATE for traffic impacts in the vicinity for

1 the building period. Because traffic is so much less for operations, the review team determined  
2 there would be no disproportionate and adverse impacts on minorities or low-income  
3 populations due to traffic-related activities during operations and, therefore, the impact would be  
4 SMALL. As described in Sections 4.5 and 5.5 for all other environmental justice impacts, the  
5 review team determined there would be no disproportionate or adverse impacts on minority or  
6 low-income populations, and therefore the impact would be SMALL.

7 The combined impacts from construction and preconstruction were described in Section 4.5 and  
8 determined to impose no disproportionate and adverse impacts on minority or low-income  
9 populations and, therefore the impact can be considered SMALL, with one exception. The  
10 review team determined traffic-related activities may create disproportionate and adverse  
11 impacts on minority or low-income populations and, therefore, the environmental justice impact  
12 would be MODERATE. The cumulative analysis also considers past, present, and reasonably  
13 foreseeable future actions that would cause environmental justice impacts on minority and low-  
14 income populations. For this cumulative analysis, the geographic area of interest is considered  
15 to be the entire 50-mi region surrounding the proposed VCSNS site.

16 From an environmental justice perspective, there is a potential for minority and low-income  
17 populations to be disproportionately affected by environmental impacts. Although Richland  
18 County and immediately adjacent counties are urban population centers, there are a number of  
19 farms within the region. Throughout the area of interest, the review team found low-income,  
20 African American, and aggregated minority populations that met the identification criteria  
21 established in Section 2.6.1 but did not identify any low-income populations that exceed the  
22 criteria in the vicinity of the VCSNS site. The impact analyses in Chapters 4 and 5 are  
23 cumulative by nature. Any environmental justice impacts associated with activities listed in  
24 Table 7-1 already have been considered as part of the environmental justice baseline presented  
25 in Sections 2.6 and 7.4.1. Thus, there are no environmental justice cumulative impacts  
26 associated with building and operating of VCSNS Units 2 and 3 beyond those already evaluated  
27 in Chapters 4 and 5.

28 Based on the above considerations, information provided by SCE&G, and the staff's  
29 independent review, the NRC staff concludes that NRC-authorized construction of proposed  
30 VCSNS Units 2 and 3 would not contribute additional environmental justice cumulative impacts  
31 beyond those described in Chapters 4 and 5. The impacts would include physical impacts  
32 (workers and the local public, noise, air quality, buildings, transportation, and visual aesthetics)  
33 and impacts on local infrastructures and community services (transportation; recreation;  
34 housing; water and wastewater facilities; police, fire, and medical services; social services; and  
35 schools). The NRC staff concludes that the environmental justice impacts of the NRC-  
36 authorized activities plus past, present, and reasonably foreseeable future activities over the life  
37 of the two new units depends on the impact category being considered. For example, the  
38 review team concludes there may be disproportionate and adverse cumulative impacts on

## Cumulative Impacts

1 minority and low-income populations from traffic during limited periods of time during the peak  
2 building period in the Jenkinsville area, and that those impacts could be considered  
3 MODERATE. The incremental impacts from NRC-authorized activities would be MODERATE.  
4 Impacts from building and operating Units 2 and 3 in combination with other projects described  
5 in Table 7-1 would have minimal disproportionate and adverse cumulative impacts on minority  
6 and low-income populations from all other environmental justice impact categories can be  
7 considered SMALL.

## 8 **7.5 Historic and Cultural Resources**

9 The description of the affected environment in Section 2.7 serves as a baseline for the  
10 cumulative impacts assessment in this resource area. As described in Section 4.6, impacts on  
11 cultural resources from NRC-authorized construction activities would be SMALL. As described  
12 in Section 5.6, the review team concludes that the impacts on cultural resources from  
13 operations are SMALL. Mitigative actions may be warranted only in the event of an  
14 unanticipated discovery during any ground-disturbing activities associated with construction or  
15 maintenance of the operating facility; these actions would be determined by SCE&G in  
16 consultation with the South Carolina State Historic Preservation Office (SHPO). To address the  
17 SHPO's request for a Programmatic Agreement, SCE&G and Santee Cooper have agreed to  
18 pursue a management agreement with the SHPO to formalize avoidance and protective  
19 measures listed above as well as any updates made to the Environmental Management Plan  
20 regarding cultural resources awareness training and inadvertent discovery procedures (SCE&G  
21 2009b).

22 The combined impacts from construction and preconstruction were described in Section 4.6 and  
23 determined to be MODERATE. If preconstruction activities associated with the transmission  
24 lines result in significant alterations to the cultural environment, then the impact could be greater.  
25 Chapter 2 defines the direct effects and viewshed Area of Potential Effect (APE) for cultural  
26 resources as the SCE&G property boundary, which is the geographic area of interest for this  
27 cumulative impacts assessment. The cumulative impacts assessment considers the eligibility of  
28 historical properties for listing on the National Register of Historic Places. Discussions with the  
29 SHPO provides information on cultural resources and potential impacts on cultural resources  
30 with respect to other past, present, and reasonably foreseeable future actions in the geographic  
31 area of interest.

32 Historically, several groups of American Indians lived in South Carolina, many of which became  
33 extinct or merged with other groups due to non-American Indian encroachment by Spanish,  
34 French, and British explorers and settlers by the mid-1700s. The largest groups were the  
35 Catawba and the Cherokee who likely used the Broad River region for resource gathering.  
36 Several Tribal groups and descendants of earlier groups are present today in South Carolina  
37 (descendants of the Cherokee, the Catawba, Pee Dee, Chicora, Edisto, Santee, and Chicora-

1 Waccamaw Tribes). In 1838, the Cherokee were forced to leave the eastern United States and  
2 resettle in Oklahoma. European settlement and colonization of South Carolina began in the  
3 early 1600s with more permanent settlement occurring along the Broad River in the early 1740s.  
4 Cotton production and plantations began flourishing during the 1800s, but were later affected by  
5 social and economic upheavals during the Civil War and later by the Great Depression of the  
6 1930s.

7 Table 7-1 identifies other past, present, and reasonably foreseeable projects and other actions  
8 considered in the cumulative analysis of the VCSNS site. Projects within the geographic area of  
9 interest that may have a potential cumulative impact on cultural resources include continued  
10 operation and decommissioning for VCSNS Unit 1 and future urbanization. Such projects could  
11 affect cultural resources if ground-disturbing activities occur that affect cultural resources. As  
12 described in Section 4.6, there are no significant cultural resources that would be adversely  
13 affected by building activities or operation of Units 2 and 3 because the four significant cultural  
14 resources located within the APE of the VCSNS site would be protected by SCE&G, pending a  
15 signed management agreement between SCE&G and the South Carolina SHPO.

16 Approximately 86 mi of new transmission line would be installed and approximately 88 mi of  
17 existing corridor would be widened to support the proposed new VCSNS units. As described in  
18 Sections 4.6 and 5.6, the incremental impacts from installation of transmission lines would be  
19 minimal if there are no significant alterations (either physical alteration or visual intrusion) to the  
20 cultural environment. If these activities result in significant alterations to the cultural  
21 environment, then the impact could be greater. For impacts greater than small, mitigation would  
22 occur as described in Section 4.6.

23 Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources  
24 is cumulative. Based on its evaluation, the review team concludes that the cumulative cultural  
25 resources impact from preconstruction, construction, operation and other projects would be  
26 MODERATE. However, if activities related to transmission lines and urbanization have the  
27 potential to affect cultural resources within the APEs. If these activities result in alterations to  
28 the cultural environment, then the impact could be greater. The review team further concludes  
29 that the incremental impacts associated with the NRC-authorized activities would be SMALL  
30 because no significant cultural resources would be affected by these activities. The incremental  
31 impacts associated with onsite preconstruction activities are the principal contributor to the  
32 MODERATE rating of cumulative impacts.

## 33 **7.6 Air Quality**

34 The description of the affected environment in Section 2.9 serves as a baseline for the  
35 cumulative impacts assessment in this resource area. As described in Section 4.7, the impacts  
36 of NRC-authorized construction on air quality would be SMALL, and no further mitigation would

## Cumulative Impacts

1 be warranted. As described in Section 5.7, the review team concludes that the impacts on air  
2 quality from operations would be SMALL, and no further mitigation would be warranted.

### 3 **7.6.1 Criteria Pollutants**

4 The combined impacts from construction and preconstruction were described in Section 4.7 and  
5 were determined to be SMALL. In addition to the impacts from construction, preconstruction,  
6 and operations, the cumulative analysis also considers other past, present, and reasonably  
7 foreseeable future actions that could contribute to cumulative impacts on air quality. The  
8 geographic area of interest defined for this evaluation is Fairfield County, South Carolina. The  
9 single county was selected because designations of attainment or nonattainment by the EPA  
10 are made on a county-by-county basis.

11 The VCSNS site is located in an area that is in attainment for all criteria pollutants for which  
12 National Ambient Air Quality Standards (NAAQSs) have been established (40 CFR 81.341).  
13 Emissions from building proposed Units 2 and 3 are expected to be temporary and limited in  
14 magnitude, as described in Section 4.7. During operations of proposed Units 2 and 3,  
15 emissions of water vapor and some salt drift would be associated with the operation of the  
16 mechanical draft cooling towers, as described in Section 5.7. Air emissions from operations  
17 would be primarily from cooling towers, diesel generators, and auxiliary power supplies. These  
18 systems would be permitted and operated in accordance with State and Federal regulatory  
19 requirements and emissions would be infrequent and negligible compared to other sources  
20 within the Columbia Intrastate Air Quality Control Region.

21 Other sources of permitted air emission sources within Fairfield County include the SCE&G  
22 VCSNS Unit 1 and the SCE&G Parr Steam Plant. Gaseous emissions from Unit 1 include sulfur  
23 oxides, carbon monoxide, hydrocarbons, and nitrogen oxides associated with the intermittent  
24 operation of diesel generators (NRC 2004). The SCE&G Parr Steam Plant is located  
25 approximately 2 mi south of the VCSNS and uses four natural gas turbines to generate  
26 electricity. Gaseous emissions from the Parr Steam Plant include sulfur oxides, carbon  
27 monoxide, hydrocarbons, and nitrogen oxides. This facility has a Part 70 Air Quality (Title V  
28 Operating) Permit (SCDHEC permit AIR-1000-0021), indicating that it could potentially emit  
29 more than 100 T/yr of any air pollutant. Both the SCE&G VCSNS Unit 1 and the SCE&G Parr  
30 Steam Plant are operating under regulated air quality permits. In addition, Fairfield County,  
31 South Carolina is in attainment, indicating that the total level of regulated pollutants within the  
32 county are within NAAQSs set by EPA.

33 Future development of the region around the VCSNS site could lead to increases in gaseous  
34 emissions related to transportation. Table 7-1 lists low-to-moderate potential for growth within  
35 Fairfield County.



1 Given the intermittent operation of the diesel generators at both the existing VCSNS Unit 1 and  
2 proposed Units 2 and 3, the current attainment status of Fairfield County, and the low-to-  
3 moderate potential for growth in the county, and limited gaseous emissions from other projects  
4 identified in Table 7-1, the review team concludes the cumulative impacts on air quality would  
5 be minimal, and mitigation would not be warranted.

## 6 **7.6.2 Greenhouse Gas Emissions**

7 As discussed in the state of the science report issued by the U.S. Global Change Research  
8 Program (GCRP), it is the "... production and use of energy that is the primary cause of global  
9 warming, and in turn, climate change will eventually affect our production and use of energy.  
10 The vast majority of U.S. greenhouse gas emissions, about 87 percent, come from energy  
11 production and use..." Approximately one-third of the greenhouse gas emissions are the result  
12 of generating electricity and heat (Karl et al. 2009). This assessment is focused on greenhouse  
13 gas emissions. Other elements of climate change are discussed in the EIS sections on  
14 hydrology and ecology.

15 Greenhouse gas emissions associated with building, operating, and decommissioning a nuclear  
16 power plant are addressed in Sections 4.7, 5.7.2, 6.1.3, and 6.3. The review team concludes  
17 that the atmospheric impacts of the emissions associated with each aspect of building,  
18 operating, and decommissioning a single plant are minimal. The review team also concludes  
19 that the impacts of the combined emissions for the full plant life cycle are minimal.

20 For the following reasons, it is difficult to evaluate cumulative impacts of a single or combination  
21 of greenhouse gas sources:

- 22 • The impact is global rather than local or regional.
- 23 • The impact is not particularly sensitive to location of the release point.
- 24 • The magnitudes of individual greenhouse gas sources related to human activity, no matter  
25 how large compared to other sources, are small when compared to the total mass of  
26 greenhouse gases in the atmosphere.
- 27 • The total number and variety of greenhouse gas sources is extremely large and the sources  
28 are located everywhere.

29 These points are illustrated by the following comparison of annual carbon dioxide emission rates  
30 (Table 7-2).

## Cumulative Impacts

1 **Table 7-2.** Comparison of Annual Carbon Dioxide Emission Rates

Source	Metric Tons per Year
Global Emissions	28,000,000,000 <sup>(a)</sup>
United States	6,000,000,000 <sup>(a)</sup>
1000-MW Nuclear Power Plant (including fuel cycle, 90-percent capacity factor)	400,000 <sup>(b)</sup>
1000-MW Nuclear Power Plant (operations only, 90-percent capacity factor)	5000 <sup>(b)</sup>
Average U.S. Passenger Vehicle	5 <sup>(c)</sup>

(a) EPA 2009f  
(b) Appendix J of this EIS  
(c) FHWA 2006

2 Evaluation of cumulative impacts of greenhouse gas emissions requires the use of a global  
3 climate model. The Karl et al. (2009) report referenced above provides a synthesis of the  
4 results of numerous climate modeling studies. The review team concludes that the cumulative  
5 impacts of greenhouse emissions around the world as presented in the report are the  
6 appropriate basis for its evaluation of cumulative impacts. Based on the impacts set forth in the  
7 Karl et al. (2009) report, the review team concludes that the national and worldwide cumulative  
8 impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team  
9 further concludes that the cumulative impacts would be noticeable but not destabilizing, with or  
10 without the greenhouse gas emission of the proposed project.

11 Consequently, the review team has determined an appropriate approach to addressing the  
12 cumulative impacts of greenhouse gases emissions, including carbon dioxide, is to recognize  
13 that the emissions contribute to climate change and that the carbon footprint is a relevant factor  
14 in evaluating energy alternatives. Section 9.2.5 contains a comparison of carbon footprints of  
15 the viable energy alternatives.

### 16 **7.6.3 Summary**

17 Cumulative impacts on air quality resources are estimated based on the information provided by  
18 SCE&G and the review team's independent evaluation. Other past, present, and reasonably  
19 foreseeable activities exist in the geographic areas of interest (local for criteria pollutants and  
20 global for greenhouse gas emissions) that could affect air quality resources. The cumulative  
21 impacts on criteria pollutants from emissions of effluents from the VCSNS site and other  
22 projects would be minimal. The national and worldwide cumulative impacts of greenhouse gas  
23 emissions are noticeable but not destabilizing. The review team concludes that the cumulative  
24 impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions  
25 from the VCSNS site. The review team concludes that cumulative impacts from other past,  
26 present, and reasonably foreseeable future actions on air quality resources in the geographic  
27 areas of interest would be SMALL to MODERATE. The incremental contribution of impacts on

1 air quality resources from building and operating proposed Units 2 and 3 would be SMALL. The  
2 incremental contribution of impacts on air quality resources from the NRC-authorized activities  
3 would also be SMALL.

## 4 **7.7 Nonradiological Health**

5 The description of the affected environmental in Section 2.10 serves as a baseline for the  
6 nonradiological health cumulative impact assessment. As described in Section 4.8, the impacts  
7 from NRC-authorized construction on nonradiological health would be SMALL, and no further  
8 mitigation would be warranted. As described in Section 5.8, the review team concludes that the  
9 impacts of operations on nonradiological health would also be SMALL, and no further mitigation  
10 would be warranted.

11 As described in Section 4.8, the combined nonradiological health impacts from construction and  
12 preconstruction would be SMALL, and no further mitigation would be warranted beyond what is  
13 described in SCE&G's ER. In addition to the impacts from construction, preconstruction, and  
14 operations, the cumulative analysis also considers other past, present, and reasonably  
15 foreseeable future actions that could contribute to cumulative impacts to nonradiological health  
16 (see Table 7-1). Based on the localized nature of nonradiological health impacts, the  
17 geographic area of interest for this cumulative impacts analysis includes projects within the  
18 10-km (6- mi) radius of the VCSNS site and the macro-corridors associated with the proposed  
19 transmission lines (as defined in Chapter 4). This area is expected to encompass areas where  
20 public and worker health could be influenced by the proposed project and associated  
21 transmission lines, in combination with any past, present, or reasonably foreseeable future  
22 actions.

23 Other than the continued operation of VCSNS Unit 1, there are no major current projects in the  
24 geographic area of interest that would contribute to the cumulative impacts for nonradiological  
25 health. Future non-major projects that would be expected to occur within the geographic area of  
26 interest include urbanization.

27 There are no existing or future projects that could contribute to cumulative nonradiological  
28 health impacts of occupational injuries. Existing and potential development of new transmission  
29 lines could increase nonradiological health impacts from exposure to acute electromagnetic  
30 fields (EMFs). However, as stated in Section 5.8.3, adherence to Federal criteria and State  
31 utility codes would create minimal cumulative nonradiological health impacts. With regard to  
32 chronic effects of EMFs, the scientific evidence on human health does not conclusively link  
33 extremely low frequency EMFs to adverse health impacts. Cumulative impacts from noise and  
34 vehicle emissions associated with current urbanization, current operations of VCSNS Unit 1,  
35 Parr Hydroelectric Station, FPSF, and Parr Steam Plant, along with further removed  
36 hydroelectric stations along the Broad River could occur. However, as discussed in

## Cumulative Impacts

1 Sections 4.8 and 5.8, the VCSNS Units 2 and 3 contribution to these impacts would be  
2 temporary and minimal, and existing facilities would likely comply with local, State, and Federal  
3 regulations governing noise and emissions. Section 7.10.1 discusses cumulative  
4 nonradiological health impacts related to additional traffic on the regional and local highway  
5 networks leading to and from the VCSNS site, and the review team determines that these  
6 impacts would be minimal.

7 The health impacts of operating the existing unit (Unit 1) and proposed two new units (Units 2  
8 and 3) at the VCSNS site were evaluated relative to the ambient temperature of Monticello  
9 Reservoir and Parr Reservoir and the potential propagation of thermophilic or other etiological  
10 microorganisms. The proposed William States Lee III Nuclear Station near Gaffney, South  
11 Carolina, also on the Broad River, is sufficiently remote from the Monticello and Parr reservoirs  
12 that thermal discharges to the Broad River would not interact with those from the existing and  
13 proposed units at VCSNS. The review team's independent evaluation indicated that because  
14 the thermal discharge from Unit 1 goes into Monticello Reservoir and proposed Units 2 and 3  
15 would discharge to Parr Reservoir, the addition of two proposed new units is not likely to  
16 increase populations of thermophilic or other etiological microorganisms in either reservoir.

17 Furthermore, the low incidence of waterborne diseases in the geographic area of interest  
18 indicates that the public uses these waters for recreation in a manner that minimizes their  
19 potential exposure to these organisms.

20 The review team is also aware of the potential climate changes that could affect human health;  
21 a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been  
22 considered in the preparation of this EIS. Projected changes in the climate for the region during  
23 the life of proposed VCSNS Units 2 and 3 include an increase in average temperature and a  
24 decrease in precipitation. This may result in an increase in water temperature and frequency of  
25 downpours, which may alter the presence of microorganisms and parasites. While the changes  
26 that are attributed to climate change in these studies are not inconsequential, the review team  
27 did not identify anything that would alter its conclusion regarding the presence of etiological  
28 agents or change the incidence of waterborne diseases.

29 Cumulative impacts on nonradiological health are based on information provided by SCE&G  
30 and the review team's independent evaluation of impacts resulting from proposed Units 2 and 3,  
31 along with a review of potential impacts from other past, present, and reasonably foreseeable  
32 projects and urbanization located in the geographic areas of interest. The review team  
33 concludes that cumulative impacts on public and worker nonradiological health would be  
34 SMALL, and that mitigation beyond what is discussed in Sections 4.8 and 5.8 would not be  
35 warranted. The review team acknowledges, however, that there is still uncertainty associated  
36 with chronic effects of EMFs.

## 1 **7.8 Radiological Impacts**

2 The description of the affected environment in Section 2.11 serves as a baseline for the  
3 cumulative impacts assessment in this resource area. As described in Section 4.9, the NRC  
4 staff concludes that the radiological impacts from NRC-authorized construction would be  
5 SMALL, and no further mitigation would be warranted. As described in Section 5.9, the NRC  
6 staff concludes that the radiological impacts from operations would be SMALL, and no further  
7 mitigation would be warranted.

8 The combined impacts from construction and preconstruction were described in Section 4.9 and  
9 were determined to be SMALL. In addition to the impacts from construction, preconstruction,  
10 and operations, the cumulative analysis also considers other past, present, and reasonably  
11 foreseeable future actions that could contribute to cumulative radiological impacts. For the  
12 purposes of this analysis, the geographic area of interest is the area within the 50-mi radius of  
13 the VCSNS site. Historically, the NRC has used the 50-mi radius as a standard bounding  
14 geographic area to evaluate population doses from routine releases from nuclear power plants.  
15 Located on the VCSNS site are the existing VCSNS Unit 1 reactor, the decommissioned  
16 Carolinas-Virginia Tube Reactor, and decommissioned steam generators at the steam-  
17 generator recycle-facility vault. SCE&G plans to construct an independent spent-fuel storage  
18 installation (ISFSI) on the VCSNS site. Offsite, but within the 50-mi radius area, are the  
19 Westinghouse nuclear fuel fabrication facility (south of Columbia, South Carolina) and hospitals  
20 using medical isotopes (in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens,  
21 Greenwood, and Camden, South Carolina).

22 As stated in Section 2.11, SCE&G has conducted a radiological environmental monitoring  
23 program (REMP) around the VCSNS site since 1982. The REMP measures radiation and  
24 radioactive materials from all sources, including the existing Unit 1 at the VCSNS site. In 2008,  
25 the REMP detected small concentrations of tritium at two locations, one in Monticello Reservoir  
26 very near Unit 1 and one in Parr Reservoir. All samples had maximum levels less than 5  
27 percent of the EPA drinking-water standard, which is 20,000 pCi/L for tritium.

28 As described in Section 4.9, the estimate of dose to construction workers during the building of  
29 proposed Units 2 and 3 is well within NRC annual exposure limits (i.e., 100 mrem per year),  
30 which are designed to protect the public health. For workers at Units 2 and 3, the estimate  
31 includes exposure from Unit 1, the steam generator recycle facility, and the proposed ISFSI.  
32 After Unit 2 begins operation, this estimate also includes exposure to workers at Unit 3 from  
33 operation of Unit 2. As described in Section 5.9, the public and occupational doses predicted  
34 from the proposed operation of two new units at the VCSNS site are well below regulatory limits  
35 and standards. In addition, the site-boundary dose to the maximally exposed individual (MEI)  
36 from existing Unit 1 and proposed Units 2 and 3 at the VCSNS site would be well within the  
37 regulatory standard in 40 CFR Part 190. The decommissioned tube reactor, the steam-

## Cumulative Impacts

1 generator recycle facility, and the planned ISFSI do not contribute significantly to the dose  
2 offsite. Also, based on results of the REMP and the estimates of doses to biota given in  
3 Chapter 5.9, the staff concludes that the cumulative radiological impact on biota would not be  
4 significant. The results of the REMP indicate that effluents and direct radiation from the distant  
5 nuclear fuel fabrication plant, area hospitals, and industrial facilities that use radioactive  
6 materials, do not contribute measurably to the cumulative dose.

7 Currently, there are no other nuclear facilities planned within 50 mi of the VCSNS site. The  
8 NRC, the U.S. Department of Energy, and the State of South Carolina would regulate or control  
9 any reasonably foreseeable future actions in the region that could contribute to cumulative  
10 radiological impacts.

11 Therefore, the NRC staff concludes that the cumulative radiological impacts of operating two  
12 new units, along with the existing unit at VCSNS and the influence of other man-made sources  
13 of radiation nearby would be SMALL.

## 14 **7.9 Postulated Accidents**

15 As described in Section 5.11.5, the staff concludes that the potential environmental impacts  
16 (risk) from a postulated accident from the operation of proposed VCSNS Units 2 and 3 would be  
17 SMALL. Section 5.11 considers both design basis accidents (DBAs) and severe accidents.

18 As described in Section 5.11, the staff concludes that the environmental consequences of DBAs  
19 at the VCSNS site would be SMALL for an AP1000 reactor. DBAs are addressed specifically to  
20 demonstrate that a reactor design is robust enough to meet NRC safety criteria. The  
21 consequences of DBAs are bounded by the consequences of severe accidents.

22 As described in Section 5.11.2, the NRC staff concludes that the severe-accident probability-  
23 weighted consequences (i.e., risks) of an AP1000 reactor at the VCSNS site are SMALL  
24 compared to risks to which the population is generally exposed, and no further mitigation would  
25 be warranted. The cumulative analysis considers risk from potential severe accidents at all  
26 other existing and proposed nuclear power plants that have the potential to increase risks at any  
27 location within 50 mi of proposed VCSNS Units 2 and 3. Existing reactors within the geographic  
28 area include VCSNS Unit 1, H.B. Robinson Unit 1, Oconee Units 1, 2, and 3, Catawba Units 1  
29 and 2, McGuire Units 1 and 2, and Vogtle Electric Generating Plant (VEGP) Units 1 and 2  
30 nuclear generating stations. Also, within the geographic area of interest, new reactors have  
31 been proposed for the existing Vogtle site and the new Lee site in South Carolina.

32 Tables 5-18 and 5-19 in Section 5.11.2.1 provide comparisons of estimated risk for the  
33 proposed AP1000 units at the VCSNS site and current-generation reactors. The estimated  
34 population dose risk for the proposed AP1000 units at the VCSNS site is well below the mean

1 and median value for current-generation reactors. In addition, estimates of average individual  
2 early fatality and latent cancer fatality risks are well below the Commission's<sup>(a)</sup> safety goals  
3 (51 FR 30028). For existing plants within the geographic area of interest, namely VCSNS Unit  
4 1, H.B. Robinson Unit 1, Oconee Units 1, 2, and 3, Catawba Units 1 and 2, McGuire Units 1 and  
5 2, and Vogtle Units 1 and 2 nuclear generating stations, the Commission has determined that  
6 the probability-weighted consequences of severe accidents are SMALL (10 CFR 51,  
7 Appendix B, Table B-1). Finally, according to the Lee Nuclear Station Environmental Report  
8 (Duke 2009b) and the Final Environmental Impact Statement for the Vogtle Early Site Permit  
9 (NRC 2008), the risks from these proposed reactors would also be well below risks for current-  
10 generation reactors and would meet the Commission's safety goals. The severe accident risk  
11 due to any particular nuclear power plant gets smaller as the distance from that plant increases.  
12 However, the combined risk at any location within 50 mi of the VCSNS site would be bounded  
13 by the sum of risks for all of these operating and proposed nuclear power plants. Even though  
14 there would be potentially several plants included in the combination, this combined risk would  
15 still be low. On this basis, the NRC staff concludes that the cumulative risks from severe  
16 accidents at any location within 50 mi of the VCSNS likely would be SMALL, and no further  
17 mitigation would be warranted.

## 18 **7.10 Fuel Cycle, Transportation, and Decommissioning**

19 The cumulative impacts related to the fuel cycle, transportation of radioactive materials (fuel and  
20 waste), and facility decommissioning for the proposed site are described below.

21 As described in Section 6.1, the NRC staff concludes that the environmental impacts of the fuel  
22 cycle due to operation of proposed Units 2 and 3 would be SMALL. Fuel-cycle impacts would  
23 occur not only at the VCSNS site but would also be scattered through other locations in the  
24 United States or, in the case of foreign-purchased uranium, in other countries as described in  
25 Section 6.1.

26 In addition to fuel-cycle impacts from proposed Units 2 and 3, this cumulative analysis also  
27 considers fuel-cycle impacts from existing Unit 1. There are no other nuclear power plants  
28 within 50 mi of the VCSNS site. The fuel-cycle impact of Unit 1 would be similar to that of  
29 proposed Unit 2 or Unit 3. In accordance with 10 CFR 51.51(a), the NRC staff considers the  
30 impacts to be acceptable for a 1000-MW(e) reference reactor. The impacts of producing and  
31 disposing of nuclear fuel include mining of the uranium ore, milling of the ore, conversion of the  
32 uranium oxide to uranium hexafluoride, enrichment of the uranium hexafluoride, fuel fabrication  
33 (where the uranium hexafluoride is converted into uranium oxide fuel pellets), and disposition of  
34 the spent fuel in a proposed Federal waste repository. As discussed in Section 6.1, advances in

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(a) The Commission is the body of up to five NRC commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.

## Cumulative Impacts

1 reactors since the development of Table S-3 in 10 CFR 51.51 reduce environmental impacts  
2 relative to the operating reference reactor. For example, a number of fuel-management  
3 improvements have been adopted by nuclear power plants to achieve higher performance and  
4 to reduce fuel and separative work (enrichment) requirements. The Westinghouse nuclear fuel  
5 fabrication facility near Columbia, South Carolina, is an impact of the fuel-cycle, and is implicitly  
6 included in the discussion in Section 6.1. In Section 6.1, the NRC staff multiplied the values in  
7 Table S-3 by a factor of three to scale the impacts up from the 1000-MW(e) LWR model to  
8 address the fuel-cycle impacts of proposed Units 2 and 3. Adding the fuel-cycle impacts from  
9 Unit 1 would increase the scaling to no more than a factor of four. Therefore, the staff considers  
10 the cumulative fuel-cycle impacts of operating the VCSNS site to be SMALL.

### 11 **7.10.1 Transportation**

12 The description of the affected environment in Section 2.5.2 serves as the baseline for the  
13 cumulative impacts assessment in this resource area. As described in Sections 4.8.3 and 5.8.6,  
14 the review team concludes that impacts of transporting personnel and nonradiological materials  
15 to and from the VCSNS site would be SMALL. In addition to impacts from preconstruction,  
16 construction, and operations, the cumulative analysis also considers other past, present, and  
17 reasonably foreseeable future actions that could contribute to cumulative transportation impacts.  
18 For this analysis, the geographic area of interest is the 50-mi region surrounding the  
19 VCSNS site.

20 Nonradiological transportation impacts are related to the additional traffic on the regional and  
21 local highway networks leading to and from the VCSNS site. Additional traffic would result from  
22 shipments of construction materials and movements of construction personnel to and from the  
23 sites. However, the additional traffic increases the risk of traffic accidents, injuries, and  
24 fatalities. A review of the projects listed in Table 7-1 indicates that other projects in the region  
25 could potentially increase nonradiological impacts. The most significant cumulative  
26 nonradiological impacts in the vicinity of the VCSNS site would result from major construction  
27 projects. However, there are no planned major construction projects in the region surrounding  
28 the VCSNS site. Operation of existing facilities could also result in cumulative nonradiological  
29 impacts if traffic to and from the VCSNS site will interact with traffic traveling to and from  
30 operating facilities in the region. For the VCSNS site, nearby operating facilities that could  
31 contribute to traffic hazards include the existing VCSNS Unit 1, Parr Hydroelectric Plant, FPSF,  
32 and the Blair Quarry facility. There are also a number of recreation projects, such as park  
33 improvements, identified in Table 7-1. These types of improvements are generally of much  
34 smaller scope and have much lower resource and personnel requirements than constructing a  
35 new nuclear power plant or highway, and are therefore less likely to result in a measurable  
36 addition to cumulative impacts. In this EIS, it was shown that the impacts of transporting  
37 construction material and personnel to and from the VCSNS site and alternative sites is a small  
38 fraction of the existing nonradiological accidents, injuries, and fatalities in the counties in which



1 the alternative sites are located. Mitigation measures designed to improve traffic flow at the  
2 VCSNS have been proposed by SCE&G (2009a). Based on this conclusion and the magnitude  
3 of nonradiological transportation impacts of nuclear power plant construction and operations  
4 relative to the other construction and operating activities listed above, the review team considers  
5 the cumulative nonradiological transportation impacts associated with constructing and  
6 operating the proposed new reactor at the VCSNS site to be minimal, and no further mitigation  
7 would be warranted.

8 As described in Section 6.2, the NRC staff concludes that impacts of transporting unirradiated  
9 fuel to the VCSNS site and irradiated fuel and radioactive waste from the VCSNS site would be  
10 SMALL. In addition to impacts from preconstruction, construction, and operations, the  
11 cumulative analysis also considers other past, present, and reasonably foreseeable future  
12 actions that could contribute to cumulative transportation impacts. For this analysis, the  
13 geographic area of interest is the 50-mi region surrounding the VCSNS site.

14 Historically, the radiological impacts on the public and environment associated with  
15 transportation of radioactive materials in the 50-mi region surrounding the VCSNS site are  
16 dominated by shipments of fuel and waste to and from the existing VCSNS Unit 1. The  
17 Westinghouse Fuel Fabrication Plant in Columbia, South Carolina, may also contribute to the  
18 cumulative radiological impacts of transportation due to sharing highway links with some  
19 VCSNS shipments. Radiological impacts of transporting radioactive materials would occur  
20 along the routes leading to and from the VCSNS site and would also be scattered throughout  
21 the United States. For all these historical, current, and potential future projects, the radiological  
22 transportation impacts are a small fraction of the impacts from natural background radiation.  
23 The impacts of transporting this fuel and radioactive waste to and from the VCSNS site would  
24 be consistent with the environmental impacts associated with transportation of fuel and  
25 radioactive wastes from current-generation reactors presented in Table S-4 of 10 CFR 51.52.  
26 In accordance with 10 CFR 51.52, the NRC staff considers the impacts to be acceptable for the  
27 1000-MW(e) reference reactor. Advances in reactors since the development of Table S-4 of  
28 10 CFR 51.52 will have the effect of reducing environmental impacts relative to the operating  
29 reference reactor. For example, fuel-management improvements have been adopted by  
30 nuclear power plants to achieve higher performance and to reduce fuel requirements. This  
31 leads to fewer unirradiated and spent-fuel shipments than for the 1000-MW(e) reference reactor  
32 in 10 CFR 51.52. In addition, advances in shipping cask designs to increase their capacities will  
33 result in fewer shipments of spent fuel to offsite storage or disposal facilities.

34 Therefore, the NRC staff considers the cumulative radiological and nonradiological  
35 transportation impacts of operating the proposed new reactors at the VCSNS site to be SMALL,  
36 and no further mitigation would be warranted.

## Cumulative Impacts

### 1 **7.10.2 Decommissioning**

2 As discussed in Section 6.3 of this EIS, the environmental impacts of decommissioning  
3 proposed Units 2 and 3 are expected to be SMALL.

4 In this cumulative analysis, the geographic area of interest is within a 50-mi radius of the  
5 VCSNS site. In addition to the proposed Units 2 and 3, the only other nuclear power plant  
6 within this area is the existing VCSNS Unit 1. The impacts of decommissioning nuclear power  
7 plants are bounded by the assessment in Supplement 1 to NUREG-0586, *Generic*  
8 *Environmental Impact Statement on Decommissioning of Nuclear Facilities*. In that document,  
9 the NRC found the impacts on radiation dose to workers and the public, waste management,  
10 water quality, air quality, ecological resources, and socioeconomics to be small (NRC 2002). In  
11 addition, in Section 6.3 the review team concluded that the impact of greenhouse gas emissions  
12 on air quality during decommissioning would be small. Therefore, the cumulative impacts for  
13 the VCSNS site would be SMALL, and further mitigation would not be warranted.

### 14 **7.11 Staff Conclusions**

15 The review team considered the potential cumulative impacts resulting from construction,  
16 preconstruction, and operation of two additional nuclear units at the VCSNS site together with  
17 past, present, and reasonably foreseeable future actions. The specific resources that could be  
18 affected by the incremental effects of the proposed action and the other actions listed in  
19 Table 7-1 in the same geographic area were assessed. This assessment included the impacts  
20 of construction and operations for the proposed new units as described in Chapters 4 and 5:  
21 impacts of preconstruction activities as described in Chapter 4; impacts of fuel cycle,  
22 transportation, and decommissioning described in Chapter 6; and impacts of past, present, and  
23 reasonably foreseeable Federal, non-Federal, and private actions that could affect the same  
24 resources affected by the proposed action.

25 Table 7-3 summarizes the cumulative impacts by resource area. The cumulative impacts for  
26 the majority of resource areas would be SMALL, although there could be MODERATE or  
27 LARGE impacts for some resources, as discussed below. For example, the cumulative impacts  
28 for land use and terrestrial ecology would be MODERATE, primarily due to new transmission  
29 lines. The incremental impact from NRC-authorized activities on land use would be SMALL  
30 because the effects to land use, and terrestrial ecology from constructing and operating Unit 2  
31 and 3 would be minimal and because construction of transmission lines does not require NRC  
32 authorization.

1 **Table 7-3.** Cumulative Impacts on Environmental Resources, Including the Impacts of  
 2 Proposed Units 2 and 3

Resource Category	Impact level
<b>Land-Use</b>	MODERATE
<b>Water-Related</b>	
Surface-Water Use	SMALL
Groundwater Use	SMALL
Surface-Water Quality	SMALL
Groundwater Quality	SMALL
<b>Ecology</b>	
Terrestrial Ecosystems	MODERATE
Aquatic Ecosystems	SMALL
<b>Socioeconomic</b>	
Physical Impacts	SMALL
Demography	SMALL
Economic Impacts on the Community	SMALL to LARGE (beneficial)
Infrastructure and Community Services	SMALL to MODERATE
Aesthetics and Recreation	SMALL
<b>Environmental Justice</b>	SMALL to MODERATE
Historic and Cultural Resources	MODERATE
Air Quality	SMALL to MODERATE
<b>Nonradiological Health</b>	SMALL
<b>Radiological Health</b>	SMALL
<b>Severe Accidents</b>	SMALL
<b>Fuel Cycle, Transportation, and Decommissioning</b>	SMALL

3 For socioeconomic, most categories would have SMALL impacts. However, the review team  
 4 concludes there would be a LARGE and beneficial cumulative impact associated with tax  
 5 revenues in Fairfield County. The incremental impact from NRC authorized activities would be  
 6 LARGE and beneficial. The review team also identified a MODERATE and adverse cumulative  
 7 traffic impact in the Jenkinsville area that would be localized and temporary (limited to only “rush  
 8 hour” traffic and the peak building activity period). The incremental impact from NRC authorized  
 9 activities would be MODERATE. Cumulative impacts to other socioeconomic impact categories  
 10 would be SMALL. For environmental justice, most categories would have SMALL impacts.  
 11 However, there may be disproportionate and adverse cumulative impacts to minority and low  
 12 income populations from traffic during limited periods of time during the peak building period in  
 13 the Jenkinsville area, and that those impacts could be considered MODERATE. The

## Cumulative Impacts

1 incremental impacts from NRC-authorized activities would be MODERATE. Cumulative impacts  
2 to other environmental justice impact categories would be SMALL.

3 There would be a MODERATE cumulative impact to cultural and historic resources, primarily  
4 due to preconstruction activities. The incremental impact from NRC-authorized activities would  
5 be SMALL.

6 For air quality, the cumulative impacts would be MODERATE primarily due to national and  
7 world-wide impacts of greenhouse gases emissions. The incremental impacts from NRC-  
8 authorized activities would be SMALL since such impacts would be minimal.

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## 8.0 Need for Power

Chapter 8 of the U.S. Nuclear Regulatory Commission's (NRC's) Environmental Standard Review Plan (ESRP) (NRC 2000) guides the staff's review and analysis of the need for power for a proposed nuclear power plant. The guidance states:

Affected states or regions continue to prepare need-for-power evaluations for proposed energy facilities. The NRC will review the evaluation for the proposed facility and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the State's or region's need-for-power evaluation is found acceptable, no additional independent review by NRC is needed, and the State's analysis can be the basis for ESRPs 8.2 through 8.4 (NRC 2000).

In a 2003 response to a petition for rulemaking, the NRC reviewed whether the need for power should be considered in NRC environmental impact statements (EISs) prepared in conjunction with applications that could result in new plant construction (68 FR 55905). The NRC concluded that "...need for power must be addressed in connection with new power plant construction so that the NRC may weigh the likely benefits (e.g., electrical power) against the environmental impacts of constructing and operating a nuclear power reactor." The NRC also stated in its response to the petition discussed above that (1) the NRC does not supplant the States, which have traditionally been responsible for assessing the need for power-generating facilities, for their economic feasibility, and for regulating rates and services; and (2) the NRC has acknowledged the primacy of State regulatory decisions regarding future energy options (68 FR 55905).

As identified in Section 1.3 of this EIS, the purpose and need for the project is to provide for additional baseload electric generating capacity. Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 would provide a combined net electrical output of approximately 2214 MW(e) of baseload electric generating capacity. Unit 2 is projected to enter commercial service in mid-2016, while Unit 3 is projected to enter commercial service in 2019. As a joint venture, SCE&G would be a 55-percent owner of VCSNS Units 2 and 3 and receive the commensurate power output, and Santee Cooper (the State-owned public utility, formally called the South Carolina Public Service Authority [SCPSA]) would own 45 percent of VCSNS Units 2 and 3 and receive the commensurate power output. The State of South Carolina frames the term "base load plant" by offering the following: "units or facility that is designed to be operated at a capacity factor exceeding seventy percent annually, has a gross initial generation capacity of 350 MW(e) or more, and is intended in whole or in part to serve retail customers of a utility of South Carolina" (South Carolina [SC] Code Ann. 58-33-220). The purpose of the proposed project is consistent with the definition as offered by the State.

## Need For Power

1 The proposed action is subject to the regulatory review and approval by the State of South  
2 Carolina through the Public Service Commission of South Carolina (PSCSC), as well as the  
3 Board of Directors of the SCPSA. Both the PSCSC and the Board of Directors of the SCPSA  
4 evaluated the proposed need for power. Finding that the State's evaluations and ensuing  
5 directions from these regulatory bodies conformed to the NRC's four criteria as previously  
6 discussed, the NRC staff relied on their analysis to provide the basis for its conclusion that there  
7 is a need for power from proposed VCSNS Units 2 and 3. Specific information regarding the  
8 application of the criteria is addressed in Section 8.4.

9 The following sections describe the need for baseload electric generating capacity. Section 8.1  
10 reviews the current power system, including geographic considerations, and describes the  
11 regional characteristics. Section 8.1 also reviews and discusses the State's regulatory guidance  
12 characterizing both the determination of the need for power and the approval of the proposed  
13 project through the PSCSC and SCPSA processes. Section 8.2 provides a review of pertinent  
14 details describing the demand for power, including an assessment of aspects that can impact  
15 the demand for power such as regional, State and Federal policies, energy efficiency and  
16 demand-side management, and econometric indicators. Section 8.3 is a discussion of power  
17 supply, including a review of past, present, and future generating capacity, power purchasing,  
18 and policies that may impact supply-side resources. Section 8.4 provides the staff's  
19 conclusions regarding the determination of the need for power as proposed by the applicant and  
20 verified by the PSCSC and SCPSA evaluation processes, and concludes with a description of  
21 how the need-for-power evaluation performed by the State of South Carolina meets the four  
22 required criteria provided by the NRC.

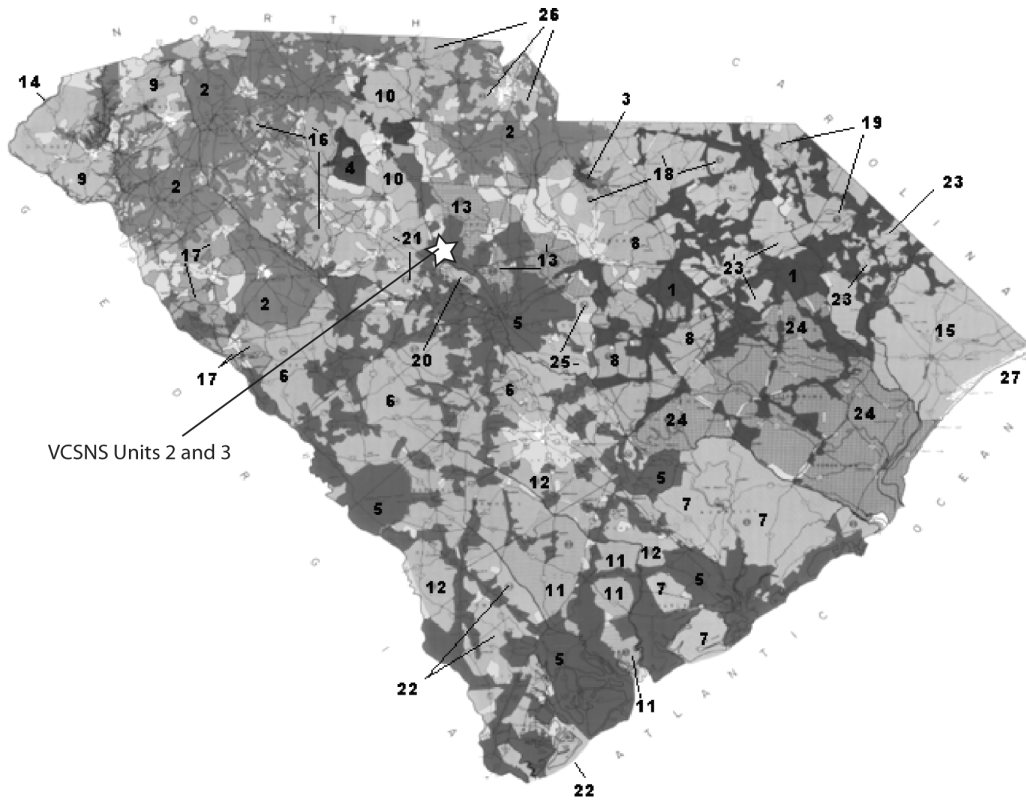
23 Where necessary, data and details may be supplemented by information from other resources  
24 such as State Energy Offices, regional reliability and power planning entities such as the  
25 Southeastern Electric Reliability Council (SERC), Energy Information Agency (EIA) estimates,  
26 and neighboring electric generating utilities.

## 27 **8.1 Description of the Power System**

28 The following sections describe the SCE&G and Santee Cooper relevant service areas, the  
29 regional reliability of the bulk power-supply system infrastructure related to the South Carolina  
30 power system, and the regulatory framework of the State of South Carolina under which the  
31 need for power has been evaluated and validated.

### 32 **8.1.1 SCE&G Relevant Service Area**

33 SCE&G is an investor-owned utility in the Southeast United States operating wholly within the  
34 State of South Carolina with a franchised service territory. The utility maintains a summer peak-  
35 generating capacity of approximately 5745 MW(e) including power purchases, and provides  
36 electrical service to approximately 640,000 customers in 24 counties across central and  
37 southern South Carolina (PSCSC 2008b) as shown in Figure 8-1.



Legend

- |   |  |
|---|--|
| 1 Progress Energy                       | 16 Laurens Electric Cooperative            |
| 2 Duke Power Company                    | 17 Little River Electric Cooperative       |
| 3 Heath Springs Light & Power           | 18 Lynches Electric Cooperative            |
| 4 Lockhart Power Company                | 19 Marlboro Electric Cooperative           |
| 5 South Carolina Electric & Gas Company | 20 Mid-Carolina Electric Cooperative       |
| 6 Aiken Electric Cooperative            | 21 Newberry Electric Cooperative           |
| 7 Berkeley Electric Cooperative         | 22 Palmetto Electric Cooperative           |
| 8 Black River Electric Cooperative      | 23 Pee Dee Electric Cooperative            |
| 9 Blue Ridge Electric Cooperative       | 24 Santee Electric Cooperative             |
| 10 Broad River Electric Cooperative     | 25 Tri-County Electric Cooperative         |
| 11 Coastal Electric Cooperative         | 26 York Electric Cooperative               |
| 12 Edisto Electric Cooperative          | Unassigned Area                            |
| 13 Fairfield Electric Cooperative       | 27 South Carolina Public Service Authority |
| 14 Haywood Electric Cooperative         | Municipally Owned Electric System          |
| 15 Horry Electric Cooperative           |  |

1

2

3 **Figure 8-1.** The Combined Service Territory of SCE&G and Santee Cooper (including State  
4 electric cooperatives) (SCG&E 2009a)

5 The major native load centers within SCE&G’s relevant service territory include municipal areas  
6 in South Carolina such as Columbia, Aiken, and the coastal regions up to and including the  
7 Charleston area. The territory includes portions of the quickly growing Interstate 95 and  
8 southern coastal corridors, with municipalities in that area continuing to show consistent growth  
9 in residential population and associated light commercial supporting industries.

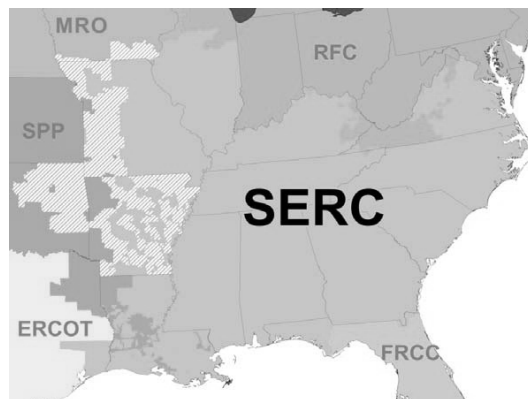
1 **8.1.2 Santee Cooper Relevant Service Area**

2 The SCPSA, operating as Santee Cooper, is a 100-percent State-owned electric and water  
3 utility, supplying electricity to more than 163,000 retail customers in Berkeley, Georgetown, and  
4 Horry Counties, as well as to 30 large industrial facilities, the cities of Bamberg and  
5 Georgetown, and the Charleston Air Force Base. Santee Cooper also generates the power  
6 distributed by the State's 20 electric cooperatives to more than 700,000 customers in all 46  
7 counties of South Carolina. Santee Cooper maintains a winter peak demand of approximately  
8 5850 MW(e).

9 Santee Cooper provides transmission and electrical services to a geographic area that is  
10 considerably larger than the franchised service territory of SCE&G. For the purposes of this  
11 EIS, the geographic boundary under consideration for the determination of the need for power is  
12 the SCE&G franchised service territory in addition to the retail and wholesale customer base of  
13 Santee Cooper as described above. The combined service territory of SCE&G and Santee  
14 Cooper (including State electric cooperatives) is illustrated in Figure 8-1.

15 **8.1.3 Regional Reliability**

16 SCE&G and Santee Cooper transmission systems operate entirely within the Virginia-Carolinas  
17 (VACAR) subregion of the SERC region, and are interconnected with both privately owned and  
18 State-owned utility systems. SERC serves as a regional entity with delegated authority from the  
19 North American Electric Reliability Corporation (NERC) for the purpose of proposing and  
20 enforcing reliability standards within the SERC region. SERC is a nonprofit corporation  
21 responsible for promoting and improving the reliability, adequacy, and critical infrastructure of  
22 the bulk power-supply systems in all or portions of 16 central and southeastern states. Owners,  
23 operators, and users of the bulk power-supply system in these states cover the SERC region,  
24 which, as shown in Figure 8-2, is an area of approximately 560,000 mi<sup>2</sup> (NERC 2008).



25  
26

**Figure 8-2.** The SERC Service Territory (NERC 2008)

1 As participants in the regional production and distribution of energy, SCE&G and Santee  
2 Cooper, in conjunction with other members of the VACAR subregion, develop current and future  
3 power-flow and stability models of the integrated transmission system to assess the reliability of  
4 the system and to ensure compliance with regional and Federal reliability standards. The  
5 models are routinely adjusted to accommodate variations in power-generation capacity,  
6 seasonal changes or regional impacts such as drought, and planning margins, and include both  
7 long-term and short-term reliability and power-flow assessments (SCE&G 2009b).

8 SCE&G and Santee Cooper's annual demand forecasts and electrical growth estimates are  
9 generally consistent with the most recent SERC forecasts. SCE&G stated for the PSCSC  
10 hearing record that it forecasted firm territorial demand growth of 1.7 percent per year for the  
11 next 15 years (PSCSC 2008b). Santee Cooper, through its Integrated Resource Plan (IRP), is  
12 forecasting average demand to increase 2 percent per year for the next 15 years (Santee  
13 Cooper 2008). This is consistent with the SERC forecast of approximately 2-percent annual  
14 growth for the next 10 years (NERC 2008) and the VACAR subregion of SERC forecast of  
15 approximately 1.9-percent annual growth for the next 10 years (NERC 2008).

16 Nonregulated (merchant) capacity exists in neighboring, balancing authority areas with direct  
17 interconnection to the SCE&G and Santee Cooper balancing authority areas. This capacity is  
18 primarily natural-gas-fired generation. Due to the unknown commitment status of this capacity,  
19 transmission access limitations, and physical transmission constraints, the reliable deliverability  
20 of this capacity cannot be guaranteed. Therefore, conclusions cannot be drawn regarding the  
21 purchase and distribution of merchant capacity within the service territory or in neighboring  
22 areas and the capacity can neither be considered nor modeled as a viable supply of baseload  
23 capacity. This premise is consistent with a review of nonregulated power capacity within the  
24 South Carolina service territories, which indicates a limited amount of total available capacity  
25 (EPA 2007).

#### 26 **8.1.4 South Carolina Regulatory Framework**

27 The proposed VCSNS Units 2 and 3 project was reviewed and evaluated by the PSCSC, which  
28 issued the final findings of fact, conclusions of law, and the Certificate of Environmental  
29 Compatibility and Public Convenience and Necessity (CPCN) giving legal authority to SCE&G to  
30 proceed with construction and operation of a two-unit nuclear power plant, after SCE&G met the  
31 State of South Carolina's statutory requirements for the commencement of the project. The  
32 authority granted by the PSCSC does not supersede the authority of the NRC to approve and  
33 authorize a COL. SCE&G was the sole applicant petitioning the PSCSC to grant the CPCN;  
34 however, SCE&G and the SCPSA (the latter operating as Santee Cooper) would be co-owners  
35 of the two-unit nuclear power plant and the power output. As such, both SCE&G and Santee  
36 Cooper have had to effectively demonstrate a need for power in their respective operating  
37 territories that is commensurate with the power output of the proposed project. They have done

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1 so through separate, yet analogous, proceedings, each of which is governed and controlled  
2 ultimately by the General Assembly of the State of South Carolina.

3 Broadly, the South Carolina General Assembly has numerous responsibilities directed toward  
4 the effective control and oversight of both public and private utilities operating within the State.  
5 The General Assembly directly contributes legislative membership and appoints public  
6 participants to the State Regulation of Public Utilities Review Committee. The committee is then  
7 tasked with evaluating and nominating leaders to each of the following entities (SC Code Ann.  
8 58-3 Article 5):

- 9 • PSCSC, which controls regulated utilities such as SCE&G
- 10 • SCPSA Board of Directors, which represents the State of South Carolina operating as  
11 Santee Cooper
- 12 • South Carolina Office of Regulatory Staff, which serves as a public interest advocate and  
13 provides independent overview of the PSCSC.

### 14 **8.1.4.1 SCE&G's Certificate of Public Convenience and Necessity**

15 A provision in South Carolina State law, the Utility Facility Siting and Environmental Protection  
16 Act, requires all persons desiring to construct major utility facilities to obtain a CPCN from the  
17 PSCSC prior to the commencement of any construction activities. This process is governed by  
18 Chapter 103, Article 3, Subarticle 1 of the South Carolina Code of Regulations and by Title 58,  
19 Chapter 33 of the South Carolina Code of Laws.

20 Pursuant to the Utility Facility Siting and Environmental Protection Act, the PSCSC may not  
21 grant a certificate for the construction, operation, and maintenance of a major utility facility,  
22 either as proposed or as modified, unless it shall find and determine the basis of the need for  
23 the facility; the nature of probable environmental impact; that the impact of the facility upon the  
24 environment is justified considering the alternatives; that the facilities serve in the interests of  
25 system economy and reliability; that there is reasonable conformance to applicable State and  
26 local laws and regulations; and that public convenience and necessity require the construction  
27 of the facility (PSCSC 2009). It is important to note that while the CPCN authorizes the  
28 construction of two units, the PSCSC does not have jurisdiction over Santee Cooper (PSCSC  
29 2009). Therefore, no ruling by the PSCSC through the CPCN evaluation is extended to the  
30 45 percent of the project that would be owned by Santee Cooper. However, as a joint owner in  
31 the proposed project, Santee Cooper's need for power is discussed in the following sections.

32 The PSCSC reviewed and evaluated SCE&G's petition for a determination of the need for  
33 power in the proceedings governing the Combined Application for the CPCN and Base Load  
34 Review Order (PSCSC 2008a) pursuant to provisions in South Carolina's Utility Facility Siting  
35 and Environmental Protection Act. Consistent with the preceding discussion, SCE&G submitted

1 the *Combined Application of South Carolina Electric and Gas Company for a Certificate of*  
2 *Environmental Compatibility and Public Convenience and Necessity and for a Base Load*  
3 *Review Order for the Construction and Operation of a Nuclear Facility in Jenkinsville, South*  
4 *Carolina*, to the PSCSC on May 30, 2008.

5 The final order provided by the PSCSC approving the combined application and CPCN was  
6 issued to SCE&G on March 2, 2009, granting SCE&G approval for the construction and  
7 operation of two Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000  
8 (AP1000) pressurized water reactors at the VCSNS site (PSCSC 2008b). The PSCSC further  
9 ruled that the impact of the proposed project would be justified based on the demonstrated need  
10 for additional baseload capacity (PSCSC 2008b). The CPCN application review proceedings  
11 provided full disclosure of expert and independent testimony provided by representative parties  
12 to the certification proceedings including the applicant, the South Carolina Office of Regulatory  
13 Staff, the Department of Health and Environmental Control, Department of Natural Resources,  
14 Department of Parks and Tourism, as well as public hearing and testimony.

15 Because the formal State process has been completed and the need for power has been  
16 demonstrated and documented by order of the PSCSC, the staff, in accordance with NUREG-  
17 1555 criteria, relies on the State's evaluation of the need for power for its own independent  
18 analysis of the applicant's determination of need.

#### 19 **8.1.4.2 South Carolina Public Service Authority (Santee Cooper)**

20 Santee Cooper is the State-owned public utility operating under direct authorization of the  
21 SCPSA Board of Directors to produce, distribute, and sell electric power in accordance with  
22 good business practices and the requirements of applicable licenses, laws, and regulations  
23 (SC Code Ann. 58-31-30(A) and 58-31-55(A)(3)(c)). Because Santee Cooper is a State-owned  
24 utility, the State prepares, or designates the preparation of, all analyses as required by statute  
25 such as IRPs and rate cases. The analyses are provided to the South Carolina State Energy  
26 Office for review and comment, and must be consistent with the processes imposed on  
27 regulated utilities by the PSCSC (SC Code Ann. 58-37-40). The resource plan, which includes  
28 a review of the load forecast, energy efficiency and conservation programs, and options to meet  
29 expected load growth and reserve requirements, is also submitted to the Board of Directors of  
30 the SCPSA. The Board of Directors authorizes auditing of the resource plan by both  
31 independent parties as well as affected parties, and upon final consideration provides final  
32 adoption of the plan through a formal SCPSA Board of Directors resolution (SCE&G 2009c).

33 The SCPSA Board of Directors adopted several board resolutions that provide a coordinated  
34 framework directly aligning Santee Cooper with the VCSNS Units 2 and 3 project. Individually,  
35 the resolutions address the following: (1) company-wide resource planning through IRPs that  
36 have been substantiated through independent audits; (2) the need for South Carolina to  
37 aggressively pursue goals toward expanding the deployment of power-generating resources

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1 that do not emit greenhouse gases, and improving energy efficiency and conservation; and  
2 (3) the need to provide the authority and mechanisms by which Santee Cooper as the State  
3 public utility may partner with SCE&G for the construction, operation, and rate-recovery of the  
4 proposed two-unit nuclear power plant at the VCSNS site located in Fairfield County.

5 In successive review and in support of the preceding discussion detailing Santee Cooper's  
6 ability to become a joint owner of a power plant in Fairfield County, the Board of Directors  
7 representing the State of South Carolina, fully adopted the following resolutions (SCE&G  
8 2009c):

- 9 • Mar. 27, 2006 (MB06-09): Adoption of the 2005/2006 Generation Resource Plan, which  
10 detailed the need for additional capacity as independently audited and corroborated by the  
11 R.W. Beck consulting company based on current data and acceptable forecasting methods.  
12 The resolution further authorized management to take actions deemed necessary or  
13 appropriate to obtain a construction and operating permit for an ownership share not to  
14 exceed 50 percent of a two-unit nuclear power plant at the VCSNS site.
- 15 • Oct. 20, 2006 (MB06-25): Santee Cooper management was authorized to continue to take  
16 actions necessary to design, permit, procure, construct, and install two nuclear units at the  
17 VCSNS site.
- 18 • Oct. 19, 2007 (MB07-14): The Board of Directors established a goal of generating  
19 40 percent of the gross electrical generation needs by non-greenhouse-gas-emitting  
20 resources, biomass fuels, energy efficiency, and conservation by 2020.
- 21 • Apr. 25, 2008 (MB08-06): Adoption of the 2008 Generation Resource Plan that reflected the  
22 necessary addition of new generating resources to meet projected load growth. The plan  
23 was independently audited and corroborated by the R.W. Beck consulting company, which  
24 concluded that the processes and assumptions were reasonable and accurate.  
25 Management was further authorized to take actions deemed necessary or appropriate to  
26 obtain a construction and operating permit for an ownership share not to exceed 50 percent  
27 of a two-unit nuclear power plant at the VCSNS site.
- 28 • May 22, 2008 (MB08-07): The resolution appointed SCE&G to act as the SCPSA's agent in  
29 connection with the execution and performance of the Engineer, Procure, Construct contract  
30 for the VCSNS Units 2 and 3 project. The resolution further authorized management to  
31 continue taking actions necessary to permit, design, procure, and install two nuclear units at  
32 the VCSNS site and allowed an expenditure of an additional sum of money through  
33 December 31, 2011.

34 With authority granted by the South Carolina General Assembly, the above resolutions  
35 constitute the State's evaluation and direct assessment of the need for power-generating  
36 facilities, their economic feasibility, and the regulation of rates and services. These resolutions,



1 as reviewed and approved by the SCPSA Board of Directors, established both precedence and  
2 further guidance for Santee Cooper's commitment to the VCSNS Units 2 and 3 project.

3 The following sections characterize the basis provided by the State via issuance of the CPCN.  
4 Further, because Santee Cooper is a participant in the project, the following review includes  
5 relevant sections and conclusions from its 2008 and 2009 IRP, as well as responses to  
6 Requests for Additional Information (RAIs) as issued by the NRC staff, which describes the  
7 need for power for Santee Cooper.

#### 8 **8.1.5 Description of the South Carolina Analytical Process**

9 In accordance with NUREG-1555, the staff reviewed the analytical process and need for power  
10 evaluation performed by the State of South Carolina. The staff found that this evaluation  
11 process met the four NRC criteria for being (1) systematic, (2) comprehensive, (3) subject to  
12 confirmation, and (4) responsive to forecasting uncertainty. The following details how the four  
13 NRC criteria were met.

14 **Systematic:** Regulatory provisions in South Carolina as previously described, state that on an  
15 annual basis SCE&G and Santee Cooper must provide the most up-to-date forecast and  
16 expected resource portfolio, respective of all known current conditions. SCE&G and Santee  
17 Cooper have a systematic and iterative process for load forecasting, which is updated and  
18 reviewed annually, as directed by the State either through the PSCSC or through the Board of  
19 Directors of the SCPSA. The load forecasts use utility industry best practices and  
20 methodological approaches to determine the utility's need for power and the most cost-effective  
21 strategies to meet its regulatory obligations. In the PSCSC hearings regarding the applicant's  
22 request for a CPCN the South Carolina Office of Regulatory Staff and other witnesses indicated  
23 that SCE&G's forecasts were reasonable for planning purposes, with the PSCSC finding that  
24 SCE&G had provided a reliable and appropriate basis for assessing the need for Units 2 and 3  
25 (PSCSC 2008b). The Board of Directors of the SCPSA approved the 2008 Santee Cooper  
26 Generation plan through Resolution MB-08-06 (April 25, 2008).

27 **Comprehensive:** The need for power as evaluated by the PSCSC and the Board of Directors  
28 of the SCPSA was found to be comprehensive. Peak and energy forecasts for both SCE&G  
29 and Santee Cooper incorporate key influencing factors, such as economic and demographic  
30 trends, weather, and implemented load-reduction programs such as new EE/DSM programs.  
31 Forecasts generated included each sector of the economy, and separate forecasts are  
32 developed to determine both short- and long-term demand. Power-supply forecasts include a  
33 comprehensive evaluation of present and planned generating capabilities as well as present  
34 and planned power purchases and sales in the service territory. All analyses are performed  
35 with forecasting and statistical modeling and methodological approaches appropriate for the  
36 power industry.

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1    **Subject to Confirmation:** The process, models, and estimations used in SCE&G's petition to  
2 the PSCSC for review and issuance of the CPCN are documented and subject to evidentiary  
3 review by the PSCSC, the South Carolina Office of Regulatory Staff, and the general public.  
4 The CPCN proceedings and relevant findings are all documented in the final order issued by the  
5 PSCSC (PSCSC 2008b). Santee Cooper's annual resource plan is independently verified  
6 through third-party review, and is subject to the State's approval through issuance of a  
7 resolution. The resolutions provide details specific to the presented annual resource plan such  
8 as interactions with relevant parties (Customer Advisory Council, SCPSA Executive Council,  
9 industrial customers, etc.); instructions for future actions including those related to permitting,  
10 additional capacity requirements and development; and other directives regarding the  
11 implementation of stated goals such as obtaining 40 percent of gross electrical generation from  
12 non-greenhouse-gas-emitting resources, renewable energy sources, and EE/DSM.

13    **Responsive to Forecasting Uncertainty:** SCE&G and Santee Cooper test the validity of their  
14 overall forecast by analyzing the impact of alternative load forecasts (high, medium, and low).  
15 In addition, uncertainty in the load forecast is quantified by evaluating the resource portfolios  
16 against variations in future sensitivities, such as fuel and construction costs, load forecasts,  
17 environmental laws and regulations, and risk. In doing so, SCE&G and Santee Cooper  
18 developed resource portfolios that quantify the long-term cost to customers under varying  
19 potential sensitivities, while understanding the fundamental strengths and weaknesses of  
20 various resource configurations. The PSCSC hearing record indicated that the forecast  
21 presented by SCE&G was comparatively analyzed against the previous 7 years as well as other  
22 utilities within the region and they were found to be not only accurate, but conservative as well  
23 (PSCSC 2008b). Santee Cooper's integrated resource plan (IRP) as developed by GDS  
24 Associates was independently verified by R.W. Beck, an independent consulting company  
25 specializing in the objective assessment of utility operations and management, who concluded  
26 that the assumptions and processes used were reasonable. Further, the generating plan,  
27 assumptions, and results were provided to affected parties for review, including the Central  
28 Electric Power Cooperative, Central Executive Committee, Customer Advisory Council,  
29 industrial customers, and the SCPSA Board of Directors. The final plan was adopted via  
30 SCPSA Board of Directors Resolution MB 08-06 (SCE&G 2009c).

## 31    **8.2 Power Demand**

32    In Section 8.2.1, the demand for power is discussed for SCE&G as described through the  
33 State's PSCSC process that culminated in the issuance of the CPCN. In Section 8.2.2, the  
34 demand for power is discussed for Santee Cooper as provided by its most recent IRP.

## 1 **8.2.1 SCE&G**

2 SCE&G is an investor-owned utility operating in South Carolina with a well-defined franchised  
3 service territory. As such, SCE&G is subject to the regulatory purview and jurisdiction of the  
4 PSCSC as granted by the General Assembly of the State of South Carolina, which charges the  
5 PSCSC with the broad supervision and regulation of the rates and services of every public utility  
6 in the State (SC Code Ann. 58-3-140).

### 7 **8.2.1.1 Factors Affecting Demand**

8 Pursuant to the Siting Act as previously described, SCE&G must provide for and justify the  
9 basis of need for the proposed facility (PSCSC 2008b). The following sections describe  
10 relevant information from the PSCSC proceedings regarding SCE&G's CPCN filing, and the  
11 basis for final issuance of the CPCN.

#### 12 ***Reliability of Load Forecasting and Margin***

13 The PSCSC reviewed the assertion that SCE&G energy forecasts incorporate extensive  
14 economic, population, and weather-based analysis, and that the forecasting accuracy compares  
15 favorably to actual growth rates on the SCE&G electrical system. Expert witnesses audited and  
16 corroborated the forecasting methodology and conclusions, and provided direct testimony  
17 supporting the forecasted growth in energy sales (1.3 percent per year) and growth in territorial  
18 peak demand (1.7 percent per year). It was also noted in the final order that current forecasts  
19 are 35 percent lower than historical growth rates for the prior 15-year period, and that the  
20 conservative nature of the assumptions would tend to understate the need for the proposed  
21 project rather than overstate the need. The South Carolina Office of Regulatory Staff expert  
22 witness also compared the SCE&G forecast to other utility forecasts and concluded that the  
23 forecast was consistent with others' forecasts within the region (PSCSC 2008b).

24 Testimony was provided during the PSCSC CPCN application hearing regarding reserve and  
25 capacity margin analysis that demonstrated the need for additional capacity within the time  
26 frame under consideration. SCE&G has established a minimum of 12-percent and a maximum  
27 of 18-percent reserve margin of the firm peak forecasted demand for planning purposes. This  
28 reserve margin was corroborated as being appropriate by the South Carolina Office of  
29 Regulatory Staff, and is included in the CPCN hearing record (PSCSC 2008b). The CPCN  
30 application hearings were based on the SCE&G 2008 IRP forecast, which showed reserve  
31 margin declining to 2 percent in 2016 (thought to represent the commercial operation of Unit 2)  
32 if no additional capacity was added prior to that time (PSCSC 2008b). This is below the  
33 accepted range of generating reserves, and would likely render the utility in breach of its service  
34 obligations to the reserve sharing group in which SCE&G participates.

1 ***Responsiveness to Forecast Uncertainty***

2 As an industry-accepted standard, SCE&G develops its forecast incorporating relevant variables  
3 as they pertain to its service territory. The forecasts are heavily data driven including but not  
4 limited to aspects of weather-related variability, such as heating degree days and cooling degree  
5 days; historic consumption; integration of new efficiency standards; and numerous others. The  
6 hearing record showed that as part of the audit of SCE&G's application filing, the forecasts  
7 offered were not only reasonable, but conservative as well (PSCSC 2008b).

8 The PSCSC reviewed the assertion that VCSNS Units 2 and 3 would likely not be needed when  
9 collective variations in supply and demand variables such as the implementation of new  
10 demand-side management and energy-efficiency programs, or adverse economic conditions are  
11 considered. Expert witness testimony was provided and the hearing record demonstrated that  
12 even if persistent adverse economic conditions significantly reduced SCE&G load capacity  
13 requirements in the future, VCSNS Units 2 and 3 would still be quite valuable (PSCSC 2008b).

14 Further testimony demonstrated that the most recent economic data were contained in the load  
15 forecast used to evaluate the combined application up to the time of the hearing, and that  
16 SCE&G regularly receives and updates load forecasts with data from national economic  
17 consulting firms (PSCSC 2008b). The data indicated that the impact of the current economic  
18 downturn on load forecasting, while potentially significant in the near term, would have only a  
19 minor impact on load forecasts in the 2016 and 2019 time frame (coinciding with commercial  
20 operation of VCSNS Units 2 and 3), and that the impacts did not change the forecasted need for  
21 VCSNS Units 2 and 3. The PSCSC concurred with the position that long-term decisions related  
22 to energy capacity should be based on the long-range needs of the system, and not on short-  
23 term considerations (PSCSC 2008b).

24 ***Demand-Side Management and Energy Efficiency***

25 SCE&G demand-side management (DSM) programs depend heavily on supply-side generation  
26 resources such as the Fairfield Pumped Storage Facility and Saluda Hydro to reduce peak  
27 demand. When combined with additional DSM resources, SCE&G maintains the capability to  
28 reduce demand by approximately 4 percent, which is well above industry standards for utilities  
29 in the region (PSCSC 2008b).

30 Based on the hearing record, the PSCSC found that SCE&G had accurately reflected DSM  
31 efforts and the proposed impacts of energy-efficiency measures in its resource planning, and  
32 that they were not a viable substitute for the baseload capacity that SCE&G was seeking in the  
33 application (PSCSC 2008b). The PSCSC further found that SCE&G had included substantial  
34 reductions in demand due to current and forecasted DSM contributions and that the resource  
35 plans provided room for increased DSM contributions even with the addition of VCSNS Units 2  
36 and 3 to the system (PSCSC 2008b).

1 The PSCSC considered expert testimony on the impact of current and projected energy-  
2 efficiency programs in the resource plan and determined, though accurate, SCE&G could have  
3 done more in general with its energy-efficiency programs in the past, particularly in regard to the  
4 expansion of residential energy-efficiency programs (PSCSC 2008b). In response to these  
5 specific concerns and previous feedback from PSCSC findings, SCE&G has performed a  
6 comprehensive study of potential new DSM programs. The suite of programs was submitted on  
7 June 30, 2009, for PSCSC review and approval and is currently undergoing the PSCSC and  
8 public vetting process (PSCSC 2009). The staff reviewed the information available regarding  
9 the nine proposed new DSM programs and determined that the targeted 131 MW(e) demand  
10 reduction expected by the end of the third year of implementation does not materially affect the  
11 need for power (PSCSC 2009). This is consistent with the PSCSC finding in the hearing record  
12 (PSCSC 2008b) that stated “DSM is a useful supplement to the generation capacity needed on  
13 SCE&G’s system. It is not a substitution for it.”

#### 14 **System Economy and Reliability**

15 The Utility Facility Siting and Environmental Protection Act requires that the proposed project  
16 “serve the interests of system economy and reliability” (SC Code Ann. 58-33-160 (1)(d)). The  
17 PSCSC heard expert witness testimony from SCE&G staff, the South Carolina Office of  
18 Regulatory Staff, and independent outside experts, and found that the projections and  
19 comparative analysis on which the selection of VCSNS Units 2 and 3 was based were  
20 reasonable and appropriate. The PSCSC further found that SCE&G properly concluded that the  
21 construction and operation of VCSNS Units 2 and 3 would provide the greatest and most  
22 dependable contribution to system economy of all reasonable competitive alternatives (PSCSC  
23 2008b).

24 The PSCSC assessed the ability of VCSNS Units 2 and 3 to provide reliable electricity to  
25 SCE&G customers. Although primarily limited to concerns regarding water availability and  
26 transmission planning, the PSCSC found that neither water supply nor transmission issues were  
27 likely to compromise the reliability of the plant to deliver power to SCE&G customers, and  
28 further found that the proposed location in Jenkinsville, South Carolina, provides a site that is  
29 appropriately located close to load centers in the central part of the State, thereby minimizing  
30 the impact on transmission issues (PSCSC 2008b).

31 SCE&G maintains a 12- to 18-percent reserve margin as discussed above. The reserve margin  
32 must also include SCE&G’s pro-rata share of approximately 200 MW(e) (SCE&G 2009b) as part  
33 of its VACAR Reserve Sharing Agreement.

#### 34 **8.2.2 Santee Cooper**

35 The following sections describe Santee Cooper’s demand for power based on the adopted  
36 resource plan of 2008. After independent review by outside consultants and affected parties,

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1 the 2008 resource plan was adopted by the full Board of Directors of the SCPSA via Resolution  
2 MB 08-06 (April 25, 2008). This Resolution constitutes the State of South Carolina's approval of  
3 the resource plan and the findings therein and provides the basis for the following analysis. As  
4 necessary, changes to that resource plan are reflected and noted by the most recent forecast in  
5 RAI Response NND-09-0320 (SCE&G 2009d).

### 6 **8.2.2.1 Factors Affecting Demand**

7 There are several contingencies currently impacting the future demand for power in the Santee  
8 Cooper service territory. Key among those that will affect the forecast estimates are the recent  
9 economic downturn, proposed Federal legislation that may increase the operating costs from  
10 fossil-fired generation, and the potential loss of a current power purchaser (SCE&G 2009d).  
11 These impacts are modeled using industry accepted standards and incorporated into the most  
12 current forecast to reflect the best known and currently available information.

### 13 ***Reliability in Load Forecasting***

14 The Santee Cooper service territory is somewhat unique in that it provides energy to three  
15 electric systems that have widely varying characteristics. Accordingly, Santee Cooper prepares  
16 separate forecasts for each area, and then combines them for a total territorial energy and peak  
17 demand prediction (SCE&G 2009d). The forecasts are independently updated and validated by  
18 GDS Associates, Inc. (Santee Cooper 2008); the forecast and generation plan is further  
19 evaluated by R.W. Beck as a condition of acceptance by the Board of Directors of the SCPSA.  
20 The 2008 IRP, which was reviewed and approved the Board of Directors of the SCPSA (MB  
21 08-06), projected energy growth at 1.8 percent.

22 In its 2009 IRP energy forecast, Santee Cooper indicates that energy sales are expected to  
23 grow at 1.6 percent for the next 15 years (SCE&G 2009d). The forecast includes future energy  
24 projections based on econometric modeling for weather, temperatures, non-weather-related  
25 components, and historical trends. The model also accounts for the potential loss of energy  
26 sales to the Central Electric Cooperative as indicated in RAI response NND-09-0320 (SCE&G  
27 2009d).

### 28 ***Energy Efficiency and Demand-Side Management***

29 Santee Cooper actively pursues cost-effective energy-efficiency and DSM (EE/DSM) programs.  
30 Formalized in 2007, the Santee Cooper Conservation and Renewable Energy Department has  
31 been tasked with developing and implementing new energy-efficiency and conservation  
32 programs, in addition to evaluating and acquiring renewable generating capacity to serve load.  
33 Discussion regarding Santee Cooper's effort to expand on renewable energy can be found in  
34 Section 8.3.2.

1 Currently, EE/DSM programs collectively account for almost 300 MW(e) of peak demand  
2 reduction and are effectively embedded in the system peak demand forecast (Santee Cooper  
3 2008). Santee Cooper also maintains an additional 300 MW of load-taking service, which is  
4 governed primarily through interruptible power rate structures.

5 To the extent that these programs are accurately reflected in the current and projected load  
6 forecasts, have been independently verified through third-party analysis, and have been judged  
7 to be acceptable projections based on known information through Board of Directors approval,  
8 the staff finds that the EE/DSM programs proposed by Santee Cooper reasonably reflect the  
9 utility's effort to reduce energy and peak demand in the service territory. However, these  
10 programs, though effective, do not represent a viable substitute for the baseload capacity that  
11 Santee Cooper would receive as a partner in the proposed project.

## 12 ***System Economy and Reliability***

13 Santee Cooper maintains a planning reserve margin from 10 to 13 percent to meet firm load  
14 requirements, and to assess the adequacy of its resources for long-term power planning. The  
15 total load-requiring reserve that Santee Cooper is responsible for does not include power  
16 requirements that are served by other resources, such as the power supplied by the  
17 Southeastern Power Administration (SEPA) (Santee Cooper 2008). Much like SCE&G, Santee  
18 Cooper is a participant in the VACAR reliability group, which requires maintenance of a pro-rata  
19 daily reserve margin. This additional capacity is factored into Santee Cooper's reserve-margin  
20 analysis and directly contributes to the minimum acceptable capacity that must be available to  
21 service peak load(s). If existing company generating resources are not able to service the peak  
22 power demand, firm capacity purchases of additional power must be used to meet the shortfall  
23 (SCE&G 2009d). Additional information regarding the reserve-margin analysis can be found in  
24 the Santee Cooper IRP (Santee Cooper 2008).

25 Purchase of long-term wholesale power in the region is challenging. The reasons for this  
26 include the lack of excess baseload capacity available, excessive costs when compared to self-  
27 build options, limited transmission paths that can effectively bring power into the service  
28 territory, and risk. An example of this is Santee Cooper's 2005 Request for Proposal for  
29 additional capacity that received no bids (SCE&G 2009d).

### 30 **8.2.3 Demand Forecast**

31 The following is a summary of the forecasted cumulative demand for the combined SCE&G and  
32 Santee Cooper service territories. Table 8-1 lists the 2022 forecasted demand. The forecasted  
33 cumulative demand is evaluated for 2022, which would represent 3 years of commercial  
34 operation of both proposed units. The analysis accounts for all known demand-side influencing  
35 resources as provided through utility IRPs, and from information contained in the CPCN

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1

**Table 8-1. 2022 Forecasted Demand**

	<b>IRP and CPCN-Related Forecasted Demand (MW(e))</b>
SCE&G Firm Peak Demand <sup>(a)</sup>	6076
SCE&G Reserve <sup>(b)</sup>	729
Santee Cooper Firm Peak Demand <sup>(c)</sup>	6796
Santee Cooper Reserve <sup>(d)</sup>	677
Final Electricity Demand for the Service Territory	14,278

IRP = Integrated Resource Plan; CPCN = Certificate of Environmental Compatibility and Public Convenience and Necessity  
(a) From SCE&G 2009b  
(b) 12-percent reserve margin  
(c) From SCE&G 2009d  
(d) 10-percent reserve margin

2 proceedings. The following analysis provides the projected demand for capacity and does not  
3 make assumptions regarding generating alternatives. The final demand and supply analysis is  
4 provided in Section 8.4.

5 Based on preceding information, the staff determined that the conclusions are acceptable as  
6 reviewed, verified, and approved by respective State regulatory bodies. Electricity demand for  
7 the combined utilities, including the minimum acceptable reserve margin, is forecast to be  
8 approximately 14,278 MW(e) in 2022.

### 9 **8.3 Power Supply**

10 This section discusses the expected supply of electricity in the relevant service area that would  
11 be available three years after full operation of both proposed units. In Section 8.3.1, the supply  
12 of power is discussed for SCE&G as described through the State's PSCSC process that  
13 culminated in the issuance of the CPCN. In Section 8.3.2, the supply of power is discussed for  
14 Santee Cooper as provided in its most recent IRP, and the revised forecast provided via RAI  
15 response NND-09-0320 (SCE&G 2009d).

#### 16 **8.3.1 SCE&G**

17 The reliable supply of power is inherent to SCE&G's legal obligations in South Carolina.  
18 Accordingly, the PSCSC annually reviews the proposed forecasts and/or annual updates in  
19 addition to supporting documentation that may materially affect forecasting accuracy and power-  
20 supply requirements. For the proposed project, which requires a full public vetting process, the



1 energy forecast and its distinct components were also subject to independent third-party review  
2 and testimony addressing the accuracy and completeness of the forecast.

3 In the comprehensive energy forecast submitted to the PSCSC as part of the proceedings that  
4 led to issuance of the CPCN, SCE&G factored in its full resource portfolio, including present and  
5 planned generating capabilities, present and planned purchases and sales of power, and the  
6 impact from EE/DSM programs.

### 7 **8.3.1.1 Present and Planned Generating Capacity**

8 By annually reviewing and adjusting capacity resources over a rolling 15-year planning period,  
9 SCE&G is able to account for new capacity, proposed unit retirements, capacity uprates and  
10 derates, policy drivers such as improved energy standards or Federal legislation regarding  
11 emissions, and their impact on the generating resource portfolio. In doing so, the forecasted  
12 variable (e.g., customer class) is modeled against multiple sensitivities of a broad range of  
13 possible indicators such as economic environment, weather, conservation, and price (SCE&G  
14 2009b). From this, multiple resource portfolios are generated and tested against cumulative  
15 capacity requirement projections and the likely combinations of forecast sensitivities. The  
16 resource portfolios do not specify preference or partiality for capacity type; rather, they provide a  
17 systematic analysis of a range of potential capacity resources necessary for the development of  
18 a balanced and cost-effective resource portfolio and include both purchased alternatives and  
19 self-build options.

20 As part of the PSCSC CPCN application hearing record, SCE&G indicated that it maintained  
21 5687 MW(e) of generating capacity broken out by capacity type as the following: coal-fired  
22 (2484), co-generation (90), natural-gas/oil fired combined cycle (1319), peaking combustion  
23 turbine (347), hydropower (227), pumped storage (576), and nuclear (644). SCE&G also has  
24 two long-term power purchase agreements that bring its total supply capacity to 5745 MW(e)  
25 (PSCSC 2008b). In servicing a 2007 peak power demand of 5248 MW(e), SCE&G's existing  
26 capacity provided for a 9-percent online reserve margin,<sup>(a)</sup> which is below its established reserve  
27 margin target of 12 percent as previously indicated. To meet its reserve margin target, SCE&G  
28 has been required to purchase short-term, off-system capacity to supplement and satisfy the  
29 growing demand for power.

### 30 **8.3.1.2 Need for Baseload Capacity**

31 The PSCSC heard testimony from SCE&G company witnesses regarding the need to add  
32 baseload capacity to the power-generation mix. The record shows that the last baseload  
33 capacity addition to the fleet was completed in 1996. From 1996 to the present, only peaking  
34 and intermediate capacity additions have been made to meet the 31-percent growth in demand

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(a)  $(\text{Capacity} - \text{Peak}) / \text{Peak}$

## Need For Power

1 over the same time period. By 2020, at the time when both Units 2 and 3 would be in  
2 commercial operation, the growth in energy demand is forecasted to have grown by 44 percent  
3 since 1996 (PSCSC 2008b).

4 Review of SCE&G current operating practices demonstrates the value of baseload “preferred”  
5 capacity. Baseload capacity currently represents approximately 56 percent of total capacity in  
6 the SCE&G system, while providing over 80 percent of the energy used by SCE&G customers  
7 (PSCSC 2008b). Without the capacity additions represented by the proposed operation of  
8 VCSNS Units 2 and 3, baseload capacity as a percentage of total capacity would shrink to  
9 45 percent by 2020, indicating a significantly higher reliance on intermediate duty cycle  
10 technologies (such as natural-gas-fired combined-cycle power plants) to make up the need for  
11 more energy. With the additional capacity of the proposed nuclear project, both fossil-fired  
12 technologies listed in Table 8-2 would likely experience lower demands for their capacity than  
13 are currently observed. The table outlines the potential impact the proposed project would have  
14 on baseload capacity resources and fuel diversity.

15 **Table 8-2.** Potential Impact the Proposed Project Would Have on Baseload Capacity  
16 Resources and Fuel Diversity

SCE&G	Percent of Capacity in Baseload	Total Capacity (MW(e))	Percent Capacity of Total		
			Coal	Nuclear	Gas
Current	56	5687	43	11	30
2020 w/Nuclear	63	6888	37	27	24
2020 w/o Nuclear <sup>(a)</sup>	45	6888	36	9.4	41

Sources: SCE&G 2009b and PSCSC 2008b

(a) Calculated using existing nuclear and coal capacity and forecasted capacity requirements for 2020.

17 The PSCSC hearing record further demonstrated that even with the addition of the baseload  
18 capacity resources as proposed in the project, at no time does SCE&G actually exceed its  
19 reserve planning target. In 2016, at the time Unit 2 is proposed to be in commercial operation,  
20 the reserve margin in that year would go from 2 percent (if no capacity additions are made in the  
21 interim), up to 13 percent. Likewise, in 2019, at the time Unit 3 is proposed to be in commercial  
22 operation, the reserve margin in that year would increase to 17 percent; this is still below the  
23 targeted maximum reserve margin of 18 percent (PSCSC 2008b).

### 24 8.3.1.3 Fuel Diversity

25 The PSCSC heard relevant testimony from the SCE&G resource planning experts, as well  
26 independent review and auditing from the South Carolina Office of Regulatory Staff  
27 demonstrating the appropriate selection and mix of power-generating resources that would  
28 function to minimize exposure to future fuel costs and environmental compliance costs. The  
29 assessed SCE&G generation plans provided analysis comparing the “base case” scenario (two

1 nuclear units) to combinations of various fossil-fired alternatives, such as coal-fired and natural-  
2 gas-fired plants either in simple cycle or combined cycle, including sensitivity analysis based on  
3 factors such as uranium pricing, lower gas prices, reduced reliability of aging fossil plants, and  
4 associated emissions considerations.

5 SCE&G is heavily dependent on fossil-fired capacity at 73 percent of existing resources. The  
6 utility's exposure to future variations in fuel costs, environmental compliance, and operational  
7 risks were qualitatively assessed against the strengths and weaknesses of the current power-  
8 generation fleet, and what the proposed generating alternatives might entail. The PSCSC  
9 CPCN application hearing record states that company leaders determined that the nuclear  
10 option would serve to strengthen SCE&G's aging baseload capacity portfolio, diversify the  
11 company's fuel mix, and reduce customer exposure to the risks and volatility of fossil fuel  
12 markets and supply (PSCSC 2008b). As discussed in Section 8.2.1, this was further validated  
13 by the PSCSC in its conclusion indicating that VCSNS Units 2 and 3 would provide the "greatest  
14 and most dependable contribution to system economy of all reasonably competitive  
15 alternatives" (PSCSC 2008b).

16 SCE&G company witnesses also confirmed the useful flexibility of adding VCSNS Units 2 and 3  
17 to the capacity supply mix by providing testimony addressing the potential benefit to reducing  
18 company reliance on an aging coal-fired fleet. Allowing older fossil-fired plants to be retired or  
19 used less intensively in the future could benefit the electrical system in terms of reliability,  
20 compliance, and fuel efficiency (PSCSC 2008b).

### 21 **8.3.2 Santee Cooper**

22 In developing the power-supply and capacity forecasts for its service territory, Santee Cooper  
23 factored in its present and planned generating capabilities, present and planned purchases and  
24 sales of power, distributed and self-generation power sources, and demand-side reduction. The  
25 power-supply analysis is bound by the description of Santee Cooper's current customer base,  
26 and any known proposals or conditions that may materially affect forecasting accuracy and  
27 power-supply requirements. An example of such is the recent decision by the SCPA to  
28 suspend all efforts to further permit and expand generating capacity at the Pee Dee site due to  
29 the potential loss of energy sales to the Central Electric Power Cooperative (SCE&G 2009d).

30 The reliable supply of power is inherent to Santee Cooper's legal obligation to the constituents  
31 of the State of South Carolina as reviewed in Section 8.2.2. Accordingly, the Board of Directors  
32 of the SCPA annually reviews the proposed forecasts through the IRP, and formally issues a  
33 resolution indicating both its approval of the IRP as well as ensuing instructions or  
34 authorizations regarding future directions such as the continued investment in the VCSNS Units  
35 2 and 3 project.

1 **8.3.2.1 Present and Planned Generating Capacity**

2 As a power generator, Santee Cooper is engaged in the operation of baseload, intermediate,  
3 and peaking duty cycle power plants. Santee Cooper owns and maintains a summer peak  
4 generating capacity of approximately 5672 MW(e). The capacity mix currently includes very  
5 high exposure to fossil-based generating resources, such as coal at 70 percent of all capacity,  
6 and gas-oil fired at 22 percent of all capacity (SCE&G 2009d). These fossil-based generating  
7 resources produce and supply approximately 81 percent of the energy required by Santee  
8 Cooper; the remainder being supplied by hydropower (1 percent), nuclear (9 percent), and  
9 power purchases (9 percent). Santee Cooper also indicates that approximately 70 percent of all  
10 its generation resources operate in baseload (SCE&G 2009d).

11 By annually reviewing and adjusting capacity resources over a rolling 20-year planning period,  
12 Santee Cooper is able to account for new capacity, unit retirements, capacity uprates and  
13 derates, policy drivers such as Renewable Energy Portfolio Standards and potential Federal  
14 greenhouse gas legislation, and their impact on the resource mix. From this, multiple resource  
15 portfolios are generated and tested against cumulative capacity requirement projections and  
16 combinations of forecast sensitivities. The resource portfolios do not specify preference or  
17 partiality for capacity type; rather, they provide a systematic analysis of a range of potential  
18 capacity resources necessary for the development of a balanced and cost-effective resource  
19 portfolio.

20 Santee Cooper is currently engaged in several activities that may provide additional capacity  
21 within the timeline of consideration. These activities include the potential development of fossil-  
22 fired capacity; integration of alternative or renewable based capacity; and upgrading,  
23 relicensing, or developing hydropower-based power plants. The activities are also modeled  
24 annually on a rolling 20-year planning horizon enabling the incorporation of the most recent and  
25 updated information, such as receiving the final ruling on the VCSNS CPCN or a sensitivity  
26 analysis regarding the cost and risk for potential capacity additions. Collectively, all of these  
27 activities are subject to the review and approval by applicable regulatory bodies such as the  
28 Board of Directors of the SCPSA and Federal Energy Regulatory Commission.

29 **8.3.2.2 Purchased Power**

30 Santee Cooper satisfies a portion of the resource portfolio by routinely purchasing intermediate  
31 and peaking power capacity through firm power purchase agreements. This practice has  
32 historically included contracted power purchase agreements from conventional non-utility  
33 (merchant) units, such as natural-gas-fired combustion turbines and combined cycle plants in  
34 addition to the known purchase and distribution of hydropower based power from SEPA and  
35 U.S. Army Corps of Engineers. In its 2008 IRP, Santee Cooper indicates that it currently has  
36 firm wholesale power purchase commitments for over 570 MW(e) from such facilities. Of this,  
37 approximately 28 percent represents mid-term firm power purchases expiring in 2014 that are

1 intended to provide adequate reserve margin; with the remainder representing long-term power  
2 purchases (Santee Cooper 2008). In deciding to add any new power resource, including  
3 purchased power, Santee Cooper evaluates and screens all viable supply-side options against  
4 the load forecast, assumptions of cost and risk, and the possible generation mix (Santee  
5 Cooper 2008).

### 6 **8.3.2.3 Renewable Resources**

7 Enabling legislation passed by the South Carolina General Assembly in 1934 chartered Santee  
8 Cooper with the development of renewable resources in the form of hydropower-based power  
9 generation. Hydropower continues to supply customers of Santee Cooper with clean energy.  
10 Although with limited developable resources, what was once the sole source of power  
11 generation, hydropower currently supplies only 2 percent of the summer-time peak generating  
12 capacity at 130 MW(e) (SCE&G 2009d). This still represents the single largest contribution to  
13 Santee Cooper's renewable energy portfolio.

14 Although renewable energy resources do not individually provide a significant amount of  
15 increased capacity, Santee Cooper continues to pursue developments in biomass, solar, and  
16 wind generation as the region and resources permit. Further, Santee Cooper indicates in long-  
17 term load forecasts (10 years) as reflected in the IRP, that renewable resources in combination  
18 are expected to supply up to 215 MW(e) during the timeline of consideration (Santee Cooper  
19 2008). One example includes the expansion of landfill-based methane gas collection and  
20 combustion, currently at 13 MW(e), which is expected to double by the end of 2010 (Santee  
21 Cooper 2008). In addition, Santee Cooper has partnered with universities and others to either  
22 expand on existing programs such as solar development, or to continue investigating  
23 alternatives such as coastal wind power (Santee Cooper 2008).

24 Additional information regarding specific renewable energy alternatives is discussed in  
25 Section 9.2.3.

### 26 **8.3.2.4 Need for Baseload Capacity**

27 As previously discussed, Santee Cooper operates 70 percent of its existing fleet of generating  
28 resources at baseload. As a percentage of available generating resources, this represents a  
29 significant commitment of resources, and is indicative of the utility's current need to develop  
30 additional baseload resources. This premise has been corroborated by several entities  
31 including the SERC's Reliability Review Subcommittee (RRS); the State of South Carolina  
32 through the State Regulation of Public Utilities Review Committee, and Board of Directors of the  
33 SCPSA.

## Need For Power

1 The SERC RRS reported in its 2009 Annual Report that while near-term<sup>(a)</sup> planning horizons  
2 appear to indicate sufficient capacity resources, adequate long-term<sup>(b)</sup> planning reserves would  
3 be dependent on future business decisions, including the use of uncommitted generation and  
4 construction of new baseload capacity (SERC 2009). The RRS also recognizes that based on  
5 the percentage of planned net capacity additions, utilities are preparing to meet long-term  
6 demand growth with a significant commitment to base-load generation rather than relying on  
7 natural-gas-fired generation or purchases (SERC 2009). As previously discussed in  
8 Section 8.1.3, there is both a shortage of available uncommitted capacity for Santee Cooper to  
9 pursue for long-term baseload capacity requirements, and the capacity that is available is  
10 largely natural-gas-fired generation. Typically, plants fueled by natural gas are used to supply  
11 intermediate generation (20–60 percent capacity factor), and peaking generation (20 percent  
12 capacity factor) (PURC 2009, Appendix B, Glossary). Accordingly, the staff finds that Santee  
13 Cooper’s commitment to the proposed project aligns its need for baseload capacity with a  
14 SERC RRS recognized baseload generating alternative. The staff considers additional  
15 generating alternatives, including natural gas-fired generation, in Section 9.2.

16 Additional language supporting the need for baseload capacity in the region is provided in the  
17 South Carolina State Regulation of Public Utilities Review Committee’s (PURC) Energy Policy  
18 Report, which is a comprehensive accounting of both the current and future energy  
19 requirements in the State of South Carolina. Although produced largely in the context of  
20 addressing pending Federal energy policies and establishing strategies for a course of action,  
21 the report, which was compiled by the Office of Regulatory Staff including a full public vetting,  
22 nonetheless recognized that South Carolina has a “growing baseload electric need” (PURC  
23 2009).

24 The SCPSA Board of Directors, representing the State of South Carolina, authorized the  
25 commitment of Santee Cooper to the proposed project via the Resolutions provided in  
26 Section 8.1.4.2. In doing so, the SCPSA Board of Directors sanctioned Santee Cooper’s pursuit  
27 of a generating resource that is used only to supply baseload power. Due to recognized need  
28 for baseload capacity within the region and the supporting documentation provided in the  
29 preceding discussion, the staff finds that it is reasonable to conclude that Santee Cooper’s  
30 pursuit of 45 percent of the capacity from the proposed project means the utility has a need to  
31 meet a significant percentage of its long-term demand for power by developing baseload  
32 generating capacity other than through natural-gas-fired generation or capacity purchases.

### 33 **8.3.3 Supply Forecast**

34 The following is a summary of the forecasted cumulative supply for the combined SCE&G and  
35 Santee Cooper service territories. The forecasted cumulative supply is evaluated for 2022,

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(a) Represented as years 2009 through 2013 (SERC 2009)

(b) Represented as years 2013 through 2018 (SERC 2009)

1 which would represent 3 years of commercial operation of both proposed units. The analysis  
 2 accounts for all known supply-side resources as provided through each respective utility's IRP,  
 3 with the exception of the capacity of the proposed project. By removing the capacity additions  
 4 of the proposed project, the staff is able to quantify the cumulative supply that is available to  
 5 service the expected demand for that power. The final demand and supply analysis is provided  
 6 in Section 8.4.

7 Table 8-3 provides the cumulative supply forecast for the combined service territories through  
 8 the summer of 2022.

9 **Table 8-3. Forecasted Cumulative Supply**

	<b>Forecasted Cumulative Supply (MW(e))</b>
SCE&G Cumulative Supply <sup>(a)</sup>	5660
Santee Cooper Cumulative Supply <sup>(b)</sup>	6398
Combined Cumulative Supply	12058
<small>(a) Generation minus the proposed 55 percent of VCSNS Units 2 and 3 (equal to 614 MW(e) X 2)</small>	
<small>(b) Generation minus the proposed 45 percent of VCSNS Units 2 and 3 (equal to 502 MW(e) X 2)</small>	

10 The staff determined based on the preceding information, that the conclusions are acceptable  
 11 as reviewed, verified, and approved by respective State regulatory bodies. Electricity supply for  
 12 the combined utilities, minus the cumulative supply of the proposed project, is forecast to be  
 13 approximately 12,058 MW(e) in 2022.

## 14 **8.4 Assessment of Need for Power and NRC Findings**

15 In its final order, the PSCSC provided a single determination of all aspects of the public interest  
 16 evaluation related to proposed VCSNS Units 2 and 3 stating that, "in this case, the record  
 17 demonstrates that VC Summer Units 2 and 3 represent capacity that is needed to supply  
 18 reasonably forecasted customer demands. In addition, the size, type, location, and technology  
 19 of the Units are the preferable means of doing so with the greatest economy and reliability and  
 20 with the least impact on the environment" (PSCSC 2008b). The PSCSC also commented  
 21 directly on the ability of the proposed project to insulate customers from the price volatility and  
 22 supply risk that are increasingly associated with fossil-fuel-fired generation. The PSCSC further  
 23 noted that alternative energy sources would likely provide useful supplemental energy for  
 24 SCE&G systems going forward, but that public convenience and necessity would not be  
 25 supported by forcing SCE&G customers to rely on the future availability and competitiveness of  
 26 these energy sources as a substitute for SCE&G constructing and operating additional baseload  
 27 capacity at this time (PSCSC 2008b). The staff's understanding of the PSCSC and SCPSA  
 28 Need for Power reviews is detailed in Section 8.1.5 above.

## Need For Power

1 **SCE&G:** The staff reviewed the information provided in PSCSC Docket 2008-196-E and  
 2 evaluated the assumptions and findings therein. The staff determined that SCE&G submitted a  
 3 combined application for a CPCN and for a Base Load Review Order to the PSCSC for the  
 4 design, construction, and operation of a two-unit nuclear power plant. The petition proceedings,  
 5 public hearings, and independent evaluation by the South Carolina Office of Regulatory Staff  
 6 confirmed for the record that SCE&G's determination of the need for power equal to 55 percent  
 7 of the power output of the two-unit plant followed conventional and appropriate practices,  
 8 including the thorough evaluation of methodologies and assumptions in forecasting, impacts of  
 9 energy-efficiency and DSM programs, and generation resource planning. The hearing record  
 10 further demonstrated that the need for additional baseload capacity was justified and that  
 11 proposed VCSNS Units 2 and 3 would serve the interests of system economy and reliability as  
 12 the most practicable means for the generation of electric power (PSCSC 2008b).

13 **Santee Cooper:** The staff reviewed the information found in the 2008 Santee Cooper IRP, the  
 14 2009 updated forecast as provided in RAI response NND-09-0320 (SCE&G 2009d), and  
 15 evaluated the assumptions and findings therein. The staff further determined that the State of  
 16 South Carolina appropriately accounted for current and future energy needs through the  
 17 submittal, independent auditing, and subsequent approval of Generation Resource Plans by the  
 18 SCPSA Board of Directors. The Board of Directors further authorized Santee Cooper  
 19 management to pursue an ownership share of 45 percent of the nuclear capacity additions  
 20 proposed for the VCSNS site, and determined that in consideration of factors set forth in South  
 21 Carolina Code 58-31-55(A)(3), adoption of the resolutions was in the best interest of the  
 22 SCPSA, and therefore, the State of South Carolina.

23 **Proposed Need for Power:** The final analysis of the combined power supply and demand  
 24 forecasts for SCE&G and Santee Cooper indicates that both utilities require an expansion of  
 25 generating capacity within the proposed timeline to maintain adequate generating capacity in  
 26 support of State, regional, and utility-level capacity requirements, including reserves. The  
 27 analysis is summarized in Table 8-4.

28 **Table 8-4.** Final Analysis of the Combined Power Supply and Demand Forecasts for SCE&G  
 29 and Santee Cooper

	<b>Cumulative Demand including Reserve Margin in 2022</b>	<b>Cumulative Supply in 2022 Without Units 2 and 3</b>	<b>Total New Capacity Required</b>
SCE&G <sup>(a)</sup>	6805	5660	1145
Santee Cooper <sup>(b)</sup>	7473	6398	1075
Combined	14,278	12,058	2220

(a) Analysis done using data supplied via SCE&G 2009b.  
 (b) Analysis done using data supplied via SCE&G (SCE&G 2009d).



1 In addition, the outcomes and accuracy of forecasting efforts are subject to confirmation by  
2 parties external to the utilities and State Utility Commissions, including SERC's RRS. The RRS  
3 conducts seasonal and annual reliability assessments of the SERC region by reviewing the data  
4 and studies submitted by SERC member systems. Load forecasting, as provided by the utilities  
5 within SERC, is a critical element of the process used to establish the reliability and capacity  
6 obligations within SERC; thus, the load forecast receives considerable scrutiny from the SERC  
7 RSS to make sure that it represents a reliable estimate of future peak loads and provides the  
8 basis upon which to evaluate future capacity requirements. The RSS annual report captures  
9 those forecasts and provides a documented assessment assuring that the SERC region is being  
10 planned in accordance with the NERC Reliability Standards and applicable SERC Supplements  
11 (SERC 2009). The historical predictive capability of SCE&G and Santee Cooper load forecasts  
12 compares favorably to the VACAR subregion analysis found in the annual report provided to  
13 SERC's Engineering Committee by the RRS (SERC 2009).

14 In aggregate, the rulings and resolutions constitute the State of South Carolina's application of  
15 statutory regulations to conclude that there is a justified need for power in the relevant service  
16 territory within the proposed timeline. In consideration of the State's evaluation and  
17 determination of the need for baseload capacity for both SCE&G and Santee Cooper, and in  
18 compliance with NUREG-1555 guidelines, the staff accepts as complete and adequate the  
19 need-for-power evaluation contained in the State's CPCN ruling as provided by the PSCSC, and  
20 in the resolutions provided by the SCPSA Board of Directors regarding the generation resource  
21 plans for Santee Cooper. Based on this analysis, the NRC staff concludes that there is a  
22 justified Need for Power in the region of interest.

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## Need For Power

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- 1 South Carolina Electric and Gas (SCE&G). 2009c. Letter from Ronald B. Clary (SCE&G,  
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3 May 5, 2009 in response to letters from S.A. Byrne dated March 27 2008 and Ronald B. Clary  
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## 9.0 Environmental Impacts of Alternatives

This chapter describes alternatives to the proposed U.S. Nuclear Regulatory (NRC) action for a combined construction permit and operating license (COL) and the U.S. Army Corps of Engineers' (USACE's) action for a Department of Army (DA) Individual Permit and discusses the environmental impacts of those alternatives. Section 9.1 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section 9.3 reviews the region of interest (ROI) evaluated in the site-selection process, the South Carolina Electric and Gas (SCE&G) site-selection process, details specific to each one of the respective alternative sites, and summarizes and compares the cumulative environmental impacts for the proposed and alternative sites. Section 9.4 examines plant design alternatives. Section 9.5 describes onsite alternatives to reduce impacts on wetlands on natural and cultural resources. Section 9.6 lists the references cited in this chapter.

The need to compare the proposed action with alternatives arises from the requirement in Section 102(2)(c)(iii) of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321) that environmental impact statements (EISs) include an analysis of alternatives to the proposed action. The U.S. Nuclear Regulatory Commission (NRC) implements this requirement through its regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51 and its Environmental Standard Review Plan (ESRP) (NRC 2000). The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality (CEQ) guidelines (40 CFR 1508.27) and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. The issues evaluated in this chapter are the same as those addressed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)<sup>(a)</sup> with the additional issue of environmental justice. Although NUREG-1437 was developed for license renewal, it provides useful information for the review reported here and is referenced throughout this chapter.

As part of the evaluation of permit applications subject to Section 404 of the Clean Water Act, the USACE is required by regulation to apply the criteria set forth in the U.S. Environmental Protection Agency's (EPA's) 404(b)(1) guidelines (40 CFR Part 230; hereafter 404 Guidelines). These guidelines establish criteria that must be met for the proposed activities to be permitted pursuant to Section 404, which governs disposal sites for dredged or fill material. Specifically, the 404 Guidelines state, in part, that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impacts on the aquatic ecosystem provided the alternative does not have other significant adverse consequences. An area not presently owned by the applicant that could reasonably be

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(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999a). Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

1 obtained, used, expanded, or managed to fulfill the basic purpose of the proposed activity may  
2 be considered if it is otherwise a practicable alternative.

### 3 **9.1 No-Action Alternative**

4 For purposes of an application for COLs, the no-action alternative refers to a scenario in which  
5 the NRC would deny the COLs requested by SCE&G. The USACE could also take no action, or  
6 deny the permit requests. Upon such a denial by NRC, the construction and operation of two  
7 new nuclear units at the VCSNS site in accordance with 10 CFR Part 52 would not occur and  
8 the predicted environmental impacts associated with the project would not occur.  
9 Preconstruction impacts associated with activities not within the definition of construction in  
10 10 CFR 50.10(a) and 51.4 may occur. The no-action alternative would result in the proposed  
11 facility not being built. If no other facility would be built or strategy implemented to take its  
12 place, the benefits of the additional electrical capacity and electricity generation to be provided  
13 by the project would not occur. If no additional conservation measures were enacted to  
14 decrease the amount of electrical capacity that would otherwise be required for power in the  
15 ROI, then the need for baseload power, discussed in Chapter 8, would not be met. Therefore,  
16 the purpose of and need for this project would not be satisfied if the no-action alternative was  
17 chosen and the need for power was not met by other means.

18 If other generating sources were built, either at another site or using a different energy source,  
19 the environmental impacts associated with these other sources would eventually occur. As  
20 discussed in Chapter 8, there is a demonstrated need for power and SCE&G and Santee  
21 Cooper (the State-owned electric and water utility formally called South Carolina Public Service  
22 Authority) have regulatory responsibilities in South Carolina to provide electrical service in their  
23 respective service territories. This needed power may be provided and supported through a  
24 number of alternatives that are discussed in Sections 9.2 and 9.3. Therefore, this section does  
25 not include a discussion of other energy alternatives (discussed in Section 9.2) and alternative  
26 sites (discussed in Section 9.3) that could meet the need for power.

### 27 **9.2 Energy Alternatives**

28 The purpose and need for the proposed NRC action (i.e., issuance of COLs) identified in  
29 Section 1.3.1 of this EIS is to provide for additional baseload electric generating capacity by  
30 2016 and 2019 within the service territories of SCE&G and Santee Cooper. This section  
31 examines the potential environmental impacts associated with alternatives to the construction  
32 and operation of a new baseload nuclear generating facility. Section 9.2.1 discusses energy  
33 alternatives that do not require new generating capacity, while Section 9.2.2 discusses energy  
34 alternatives that require new generating capacity. Other alternatives are discussed in  
35 Section 9.2.3. A combination of alternatives is discussed in Section 9.2.4. Section 9.2.5

## Environmental Impacts of Alternatives

1 compares the environmental impacts from new nuclear, coal-fired, and natural-gas-fired  
2 generating units, and a combination of alternatives at the VCSNS site.

3 For analysis of energy alternatives, the review team assumed a bounding target value of  
4 2214 MW(e) of electrical output, or the equivalent electrical capacity of the proposed VCSNS  
5 project. The review team also used this level of output in analyzing energy alternatives.

### 6 **9.2.1 Alternatives Not Requiring New Generating Capacity**

7 The following are three alternatives to the proposed action that do not require SCE&G to  
8 construct new generating capacity:

- 9 • Purchase the needed electric power from other suppliers.
- 10 • Extend the operating life of existing power plants or reactivate retired power plants.
- 11 • Implement conservation or demand-side management (DSM) programs.

12 These alternatives are reviewed in the following sections.

#### 13 **9.2.1.1 Purchased Power**

14 Power to replace the capacity of the proposed new nuclear units would have to be purchased  
15 from other generating resources, and likely would be one of those described in the *Generic*  
16 *Environmental Impact Statement for License Renewal of Nuclear Plants* (e.g., coal, natural gas,  
17 or nuclear) (NRC 1996). The environmental impacts of coal-fired and natural-gas-fired plants  
18 are discussed in Section 9.2.2. Under the purchased power alternative, the environmental  
19 impacts of power production would still occur but would likely be located elsewhere within the  
20 Southeastern Electric Reliability Council (SERC) region. However, the entire SERC region has  
21 been identified as a “Conditional Congestion Area” by the U.S. Department of Energy (DOE) in  
22 its 2006 (Aug) National Electric Transmission Congestion Study. This status means the  
23 movement of bulk power in the future has already been identified to be compromised unless the  
24 SERC region has a significant build-out of transmission capabilities in concert with the  
25 development of needed generation.

26 The option to purchase power implies that there is adequate generating capacity available for  
27 firm sales and transmission into or within the service territory. Although additional capacity may  
28 be available to serve native load from merchant power plants or other similar generators, the  
29 capacity from these plants is not considered to be useful in supplying baseload capacity. This  
30 premise was confirmed by Public Service Commission of South Carolina (PSCSC) Order 2007-  
31 626, which indicated that the risk to low-cost, reliable electricity increased in magnitude as  
32 mandatory Requests for Proposals (RFPs) were applied to peaking, intermediate, and baseload  
33 capacity requirements, and further concluded that testing the market via RFPs would only be  
34 mandatory for new peaking capacity needs (PSCSC 2007). In addition, under the Public Utility

1 Regulatory Policies Act (PURPA 1978), the electric utilities offer the purchase of electrical energy  
2 from qualifying facilities. Due to the limited number of PURPA-qualifying facilities in the area,  
3 and the limited total available capacity from these facilities, they do not represent a long-term  
4 solution for additional baseload capacity in the SCE&G and Santee Cooper service territory.

5 Both SCE&G and Santee Cooper are actively engaged in evaluating and negotiating firm  
6 power-purchase agreements for the time frame under consideration. Previous contracts have  
7 been established and are expected to fill intermediate and peaking duty cycles, and are not  
8 intended to be competitive with, or replace the need for, the additional baseload capacity. In the  
9 Certificate of Environmental Compatibility and Public Convenience and Necessity (CPCN) and  
10 Base Load Review Act proceedings, the PSCSC found that the capacity needs in the timeline  
11 under consideration would be most reliably and efficiently met through the addition of new  
12 baseload capacity to the system consistent with proposed VCSNS Units 2 and 3 (PSCSC  
13 2009a).

14 Based on the preceding discussion and information detailed in Section 8.3, the review team  
15 concludes that purchasing power is not a reasonable alternative to providing new additional  
16 baseload capacity commensurate with the proposed project.

#### 17 **9.2.1.2 Extending the Service Life of Existing Plants or Reactivating Retired Plants**

18 Nuclear power facilities are initially licensed by the NRC for a period of 40 years. An operating  
19 license can be renewed for up to 20 years, and NRC regulations permit additional license  
20 renewals. SCE&G and Santee Cooper jointly own and operate the VCSNS Unit 1 plant located  
21 in Jenkinsville, South Carolina. VCSNS Unit 1's license was renewed in April 2004, extending  
22 the operating license through 2042. The environmental impacts of continued operation of a  
23 nuclear power plant are significantly less than those of construction of a new plant. However,  
24 continued operation of an existing nuclear plant does not in and of itself provide additional  
25 generating capacity.

26 Currently, SCE&G and Santee Cooper do not indicate in their energy forecasts or Integrated  
27 Resource Plans (IRPs) that they have any retired plants that would be suitable for reactivation,  
28 nor does SCE&G have firm plans for retiring any of its generating units. The review team  
29 concludes that extending the service life of existing plants or reactivating retired plants is  
30 incapable of providing additional baseload capacity commensurate with the proposed project.  
31 Therefore, extending the service life of existing plants or reactivating retired plants is not a  
32 reasonable alternative to the proposed project.

#### 33 **9.2.1.3 Energy Conservation**

34 SCE&G offers conservation and DSM programs to its customers to reduce peak electricity  
35 demands and daily power consumption. As reviewed in Section 8.2.1, the PSCSC, through the



## Environmental Impacts of Alternatives

1 CPCN and Base Load Review Act process, fully evaluated existing energy-efficiency and DSM  
2 (EE/DSM) programs and their impact on capacity requirements. Collectively, the programs  
3 were found to be effective in reducing peaking and intermediate generation capacity  
4 requirements, but were not found to eliminate the need for baseload generation capacity that  
5 the proposed project would provide. Current energy forecasts and load growth projections  
6 incorporate these programs, and have been reported as part of both the IRP forecasting  
7 process and the CPCN process. SCE&G provided a comprehensive evaluation of potential new  
8 DSM programs to the PSCSC for review and approval, although no ruling has been provided to  
9 date (PSCSC 2009b). The review team based its analysis on the approved EE/DSM programs  
10 currently implemented; while the proposed new EE/DSM programs would reduce demand, they  
11 would not reduce demand to the point where the expected power from the proposed project  
12 would not be needed. Further information regarding SCE&G's EE/DSM programs can be found  
13 in Section 8.2.

14 In its 2008 IRP, Santee Cooper provided EE/DSM program-specific information and a planning  
15 forecast reflective of its current offerings (Santee Cooper 2008). Santee Cooper maintains a  
16 working group formed in 2007 (Conservation and Renewable Energy Department) that is tasked  
17 with developing and implementing new EE/DSM programs, in addition to obtaining renewable  
18 resources to serve load. The proposed programs undergo a vetting process similar to the  
19 PSCSC process. Santee Cooper is showing consistent growth in these programs in its out-year  
20 energy forecasts, ranging from 8 to 12 percent annual growth or approximately 300 MW(e) total  
21 over the time period ending in 2017, and a total peak-energy-shaving capacity of approximately  
22 7 to 8 percent (Santee Cooper 2008).

23 Collectively, the implemented EE/DSM programs have been an effective strategy for  
24 significantly reducing peak capacity requirements. However, as stated in Section 8.2, the  
25 review team concludes that energy conservation is not a viable substitute for the baseload  
26 capacity that SCE&G is seeking through the proposed project within the timeline of  
27 consideration. Therefore, EE/DSM programs are not a reasonable alternative to the proposed  
28 project.

### 29 **9.2.1.4 Conclusions**

30 Based on the preceding analysis, the review team concludes that the options of purchasing  
31 electric power from other suppliers, reactivating retired power plants, extending the operating  
32 life of existing power plants, and full implementation of EE/DSM programs are not reasonable  
33 alternatives to providing the baseload generation capacity necessary to meet the long-term  
34 requirements in the ROI.

## 1 **9.2.2 Alternatives Requiring New Generating Capacity**

2 This section discusses the environmental impacts of energy alternatives to the proposed action  
3 that would require the applicants to build new generating capacity. In keeping with the NRC  
4 staff's evaluation of alternatives to renewal of operating licenses, a reasonable set of energy  
5 alternatives to the construction and operation of one or more new nuclear units at the VCSNS  
6 site should be limited to analysis of discrete power-generation sources and those power-  
7 generation technologies that are technically reasonable and commercially viable (NRC 1996).  
8 The discussion in Section 9.2.2 is bounded by the individual power-generating alternatives that  
9 are considered reasonable and viable as baseload technologies. As described in Chapter 8.0,  
10 baseload designed power in the State of South Carolina is defined as being capable of  
11 operating at a capacity factor greater than 70 percent, and exceeding 350 MW(e) (SC Code  
12 Ann. 58-33-220). The current mix of power-generation options within the SERC is also an  
13 indicator of the feasible choices for power-generation technology; approximately 76 percent of  
14 the current fleet within the SERC region is fossil-fired generation (SERC 2009).

15 Each year, the Energy Information Administration (EIA), a component of the DOE, issues an  
16 annual energy outlook. In the *Annual Energy Outlook 2009* (DOE/EIA 2009), the EIA reference  
17 case projects that coal-fired capacity would account for approximately 18 percent of total electric  
18 generating capacity additions between 2006 and 2030. Coal-fired plants generally are used to  
19 meet baseload requirements. The EIA also projects that natural-gas-fired plants would account  
20 for approximately 53 percent of new capacity additions during this period. EIA projects that  
21 renewable energy sources would account for approximately 22 percent of new capacity  
22 additions during the period, and new nuclear plants would account for approximately 5 percent.  
23 The EIA projections include baseload, intermittent, and peaking units, and are based on the  
24 assumption that providers of new generating capacity would seek to minimize cost while  
25 meeting applicable environmental requirements (DOE/EIA 2009).

26 The discussion in Section 9.2.2 is limited to the individual alternatives that appear to the review  
27 team to be viable baseload generation sources: coal-fired and natural-gas combined-cycle-fired  
28 generation. The impacts discussed in Section 9.2.2 are estimates based on present  
29 technology. Section 9.2.3 addresses alternative generation technologies that have  
30 demonstrated commercial acceptance but may be limited in application, total capacity, or  
31 technical feasibility when based on the need to supply reliable, baseload capacity.

32 The review team assumed new generation capacity would be located at the VCSNS site for the  
33 coal-fired and natural-gas-fired alternatives. Either natural draft or mechanical draft cooling  
34 towers would be used for the coal-fired and natural-gas-fired alternatives. For the purpose of  
35 analysis, the electric power transmission lines from these alternatives were assumed to follow  
36 the same proposed corridors as the proposed baseload nuclear generating facility at the  
37 VCSNS site. These corridors would be developed consistent with the description provided in  
38 Section 3.3.

1 **9.2.2.1 Coal-Fired Power Generation**

2 For the coal-fired generation alternative, SCE&G assumed the operation of three pulverized  
3 coal-fired units, with a total net capacity of 2214 MW(e) at the VCSNS site (SCE&G 2009a).  
4 The associated emissions were determined based on factors contained in the EPA  
5 Clearinghouse for Inventories and Emissions Factors (EPA 1998). The emission estimates are  
6 based on “as fired” and controlled conditions using both combustion and post-combustion  
7 technologies to reduce criteria pollutants. The new coal-fired generation is assumed to have an  
8 operating life of 40 years.

9 The review team also considered integrated gasification combined cycle (IGCC) coal-fired  
10 plants as a baseload technology. IGCC is an emerging technology for generating electricity with  
11 coal that combines modern coal gasification technology with both gas turbine and steam turbine  
12 power generation. The technology is cleaner than conventional pulverized coal plants because  
13 major pollutants can be removed from the gas stream before combustion. The IGCC alternative  
14 also generates less solid waste than the pulverized coal-fired alternative. The largest solid  
15 waste stream produced by IGCC installations is slag, which is a black, glassy, sand-like material  
16 that is a potentially marketable byproduct. The other large-volume byproduct produced by  
17 IGCC plants is sulfur, which is extracted during the gasification process and can be marketed  
18 rather than placed in a landfill. IGCC units do not produce significant quantities of fly ash, and  
19 process wastes are often minimized through the use of water-reuse technologies, thereby  
20 reducing the total outflow. In spite of the preceding advantages, the review team concludes  
21 that, at present, IGCC is not a reasonable alternative to a 2000-MW(e) nuclear power-  
22 generation facility for the following reasons: (1) IGCC plants are more expensive than  
23 comparable pulverized coal plants (NETL 2007), (2) existing IGCC plants have considerably  
24 smaller capacity than the proposed 2000-MW(e) nuclear plant, (3) the system reliability of  
25 existing IGCC plants has been lower than conventional pulverized coal plants, and (4) a lack of  
26 overall plant performance warranties for IGCC plants has hindered commercial financing  
27 (NPCC 2005, Appendix I). For these reasons, IGCC plants are not considered further in this  
28 EIS.

29 The review team assumed that coal and limestone would be delivered to the site by train.  
30 SCE&G estimates that approximately 500 unit trains per year (each train consisting of 125 cars  
31 holding a 100 tons per car) would be needed to deliver coal and limestone to the coal-fired plant  
32 (SCE&G 2009a).

33 ***Air Quality***

34 The impacts on air quality from coal-fired generation would vary considerably from those of  
35 nuclear generation because of emissions of SO<sub>2</sub>, nitrogen oxides, carbon monoxide (CO),  
36 particulate matter (PM), volatile organic compounds, and hazardous air pollutants such as  
37 mercury and lead. SCE&G assumed a plant design that would minimize air emissions

1 through a combination of boiler and combustion technology as well as post-combustion  
2 pollutant removal (SCE&G 2009a).

3 Emissions from the coal-fired alternative such as SO<sub>2</sub> (sulfur oxides), nitrogen oxides (including  
4 NO and NO<sub>2</sub>), CO, and PM would be as follows (SCE&G 2009a):

- 5 • SO<sub>2</sub> = 7044 T/yr
- 6 • nitrogen oxides = 1495 T/yr
- 7 • CO = 1495 T/yr
- 8 • PM<sub>10</sub> (particulate matter with an aerodynamic diameter of 10 microns or less) = 67 T/yr
- 9 • PM<sub>2.5</sub> (particulate matter with an aerodynamic diameter 2.5 microns or less) = 0.17 T/yr.

10 Additionally, a coal-fired plant would have unregulated carbon dioxide emissions of  
11 approximately 16,500,000 T/yr that could contribute to global warming.

12 Coal and limestone (calcium carbonate) for the coal-fired plant would be delivered to the site by  
13 train. SCE&G estimated that the coal-fired facility would consume approximately 6.0 million  
14 tons per year of pulverized bituminous coal with an ash content of approximately 10 percent.  
15 Slaked lime or limestone, used in the flue-gas scrubbing process for control of sulfur dioxide  
16 (SO<sub>2</sub>) emissions, is made into slurry and injected into the hot effluent combustion gases to  
17 remove SO<sub>2</sub>. The limestone-based scrubbing solution reacts with SO<sub>2</sub> in the flue gas to form  
18 calcium sulfite or calcium sulfate, which precipitates and is removed from the process as sludge.  
19 SCE&G estimated that approximately 231,000 T/yr of limestone would be used for flue-gas  
20 desulfurization, generating approximately 275,000 T/yr of scrubber sludge that may be re-used  
21 in industries such as wall-board manufacturing (SCE&G 2009a).

22 The acid rain requirements of the Clean Air Act capped the nation's SO<sub>2</sub> emissions from power  
23 plants. SCE&G would need to obtain sufficient pollution credits either from a set-aside pool or  
24 purchases on the open market to cover annual emissions from the plant.

25 New coal-fired generation plants at the VCSNS site would likely need a Prevention of Significant  
26 Deterioration (PSD) Permit and an operating permit under the Clean Air Act Amendments of  
27 1990. In addition, the plants would need to comply with new source performance standards  
28 (NSPSs) for such plants in 40 CFR Part 60, Subpart Da. The standards establish emission  
29 limits for PM and opacity (40 CFR 60.42Da), SO<sub>2</sub> (40 CFR 60.43Da), nitrogen oxides  
30 (40 CFR 60.44Da), and mercury (40 CFR 60.45Da).

31 The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart  
32 P, including a specific requirement for review of any new major stationary source in an area  
33 designated as in attainment or unclassified for criteria pollutants under the Clean Air Act  
34 (40 CFR 51.307(a)). Criteria pollutants under the Clean Air Act are lead, ozone, particulates,  
35 CO, NO<sub>2</sub>, and SO<sub>2</sub>. Ambient air quality standards for criteria pollutants are in 40 CFR Part 50.

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1 The VCSNS site in Fairfield County, South Carolina, is currently in an area designated as in-  
2 attainment for all requirements.

3 Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing  
4 future and remedying existing impairment of visibility in mandatory Class I Federal areas when  
5 an impairment occurs because of air pollution resulting from human activities. In addition, EPA  
6 regulations provide that for each mandatory Class I Federal area located within a State, the  
7 State must establish goals that provide for reasonable progress toward achieving natural  
8 visibility conditions. The reasonable progress goals must provide for an improvement in visibility  
9 for the days on which visibility is most impaired over the period of the implementation plan and  
10 verify no degradation in visibility for the least visibility-impaired days over the same period  
11 (40 CFR 51.308(d)(1)). If a new coal-fired power-generation station were located close to a  
12 mandatory Class I area, additional air-pollution control requirements could be imposed. The  
13 Cape Romaine Wilderness is the only mandatory Class I Federal area within South Carolina.  
14 Several Class 1 Federal areas also are in neighboring North Carolina and Georgia. The closest  
15 area to the VCSNS site is the Cape Romaine Wilderness, which is approximately 130 mi to the  
16 southeast; remaining areas are farther than this distance, and no additional requirements would  
17 be expected based on proximity.

18 The fugitive dust emissions from construction activities would be mitigated using best  
19 management practices (BMPs), and such emissions would be temporary. The Generic  
20 Environmental Impact Statement (GEIS) for license renewal mentions global warming from  
21 unregulated carbon dioxide emissions and acid rain from sulfur oxides and nitrogen oxide  
22 emissions as a potential impact (NRC 1996). Adverse human health effects, such as cancer  
23 and emphysema, have been associated with the byproducts of coal combustion. Overall, the  
24 review team concludes that air quality impacts from coal-fired generation at the VCSNS site  
25 would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air  
26 quality.

### 27 ***Waste Management***

28 As the NRC has described in NUREG-1437 (NRC 1996) and verified during its preparation of  
29 operating license renewal supplemental EIS analyses since the publication of that document,  
30 coal combustion generates waste in the form of ash, and equipment for controlling air pollution  
31 generates additional solid wastes such as spent selective catalytic reduction (SCR) catalyst,  
32 and flue-gas scrubber sludge. SCE&G estimated that the coal-fired plants would generate  
33 582,000 T/yr of ash. Significant quantities of the fly ash may be recycled for use in commodity  
34 products such as concrete, thereby limiting the total landfill volume. The coal plant would also  
35 generate flue-gas scrubber sludge in the form of gypsum, which could also be dewatered and  
36 recycled for use in wall-board manufacturing.

1 In May 2000, the EPA issued a Notice of Regulatory Determination on Wastes from the  
2 Combustion of Fossil Fuels. The EPA concluded that national regulation is warranted under  
3 Subtitle D of the Resource Conservation and Recovery Act of 1976, as amended (RCRA) when  
4 coal combustion wastes are disposed of in landfills or surface impoundments, and that  
5 regulations under Subtitle D of RCRA (or modifications to existing regulations under the  
6 authority of the Surface Mining Control and Reclamation Act) are warranted when the wastes  
7 are used to fill surface impoundments or underground mines (65 FR 32214). As of November  
8 2009, EPA is continuing to study the appropriate form for regulation of coal combustion waste  
9 products.

10 Waste impacts on groundwater and surface water could extend beyond the operating life of the  
11 plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could  
12 noticeably affect land use and groundwater quality, but with appropriate management and  
13 monitoring, it would not destabilize any resources. After closure of the waste site and  
14 revegetation, the land could be available for other uses. Construction-related debris would be  
15 generated during plant construction activities, and would be disposed of in approved landfills.

16 For the reasons stated above, the review team concludes that the impacts from waste  
17 generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable  
18 but would not destabilize any important resources.

### 19 ***Human Health***

20 Coal-fired power generation introduces worker risks from coal and limestone mining, worker and  
21 public risk from coal and limestone transportation, worker and public risk from disposal of coal-  
22 combustion waste, and public risk from inhalation of stack emissions. In addition, the  
23 discharges of uranium and thorium from coal-fired plants can potentially produce radiological  
24 doses in excess of those arising from nuclear power-plant operations (Gabbard 1993).

25 The EPA and State agencies (65 FR 32214) base air emission standards and requirements on  
26 human health impacts. These agencies impose site-specific emission limits as needed to  
27 protect human health. Air emissions from a coal-fired power-generation plant located at the  
28 VCSNS site would be regulated by the South Carolina Department of Health and Environmental  
29 Control (SCDHEC). Given that the plant would have to comply with health-informed standards  
30 in the Clean Air Act (CAA) and other relevant air emissions regulations, the review team  
31 concludes that the human health impacts from the construction and operation of coal-fired  
32 generation at the VCSNS would be SMALL.

### 33 ***Other Impacts***

34 Approximately 357 ac of land would need to be permanently converted to industrial use for the  
35 powerblock, infrastructure and support facilities, ash and solids disposal, and coal and

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1 limestone storage and handling (SCE&G 2009a). This is very close to the estimated 320 ac of  
2 permanent land dedication (approximately 500 ac when also accounting for temporary laydown  
3 areas) needed for a nuclear facility (see Section 4.1). The land required for new transmission-  
4 line corridors would be similar to that reported in Section 4.1 for the transmission lines for the  
5 proposed nuclear facility. The land required for new transmission-line corridors would be similar  
6 to the proposed action. Land-use changes would affect the offsite coal-mining area that was  
7 supplying coal for the plant. In NUREG-1437, the NRC staff estimated that approximately  
8 22,000 ac would be needed for coal mining and waste disposal to supply a 1000-MW(e) coal-  
9 fire power plant over its operating life (NRC 1996), which would scale up to almost 49,000 ac for  
10 a 2214-MW(e) facility. This is almost five times the estimated 10,000 ac needed to supply fuel  
11 to the proposed nuclear plant. The nuclear estimate is based on an estimated need of 113 ac  
12 per year for a 1000-MW(e) nuclear plant, scaled to approximately 250 ac per year for a  
13 2214-MW(e) nuclear plant, multiplied by 40 years of operation. Commitment of 49,000 ac of  
14 land for coal mining would have a noticeable effect on the availability of land in most regions of  
15 the United States, but would not be expected to destabilize the availability of land in the typically  
16 rural locations used for mining. Based upon the amount of land affected, the review team  
17 concludes that land-use impacts would be MODERATE.

18 The impacts on water use and quality from constructing and operating a coal-fired plant at the  
19 VCSNS site would be comparable to the impacts associated with a new nuclear plant because  
20 both types of power plants rely on steam turbines to generate 100 percent of the power.  
21 Therefore, the review team assumes that the operation of coal-fired power plants located at the  
22 VCSNS site would be consistent with the proposed two-unit nuclear power plant. Plant  
23 discharges would consist mostly of cooling-tower blowdown, characterized primarily by an  
24 increased temperature and concentration of dissolved solids relative to the receiving waterbody  
25 and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams  
26 and sanitary wastewater may also be discharged. All discharges would be regulated by the  
27 South Carolina Department of Natural Resources (SCDNR) through a National Pollution  
28 Discharge Elimination System (NPDES) permit. Indirectly, water quality could be affected by  
29 acids and mercury from air emissions. The water would be consumed because of evaporation  
30 from the cooling towers. In NUREG-1437, the NRC staff determined that some erosion and  
31 sedimentation would likely occur during construction of new facilities (NRC 1996). Overall, the  
32 review team concludes that the water-use and water-quality impacts would be SMALL.

33 The coal-fired generation alternative would introduce ecological impacts from building and new  
34 incremental impacts from operations. The impacts could include wildlife habitat loss and  
35 fragmentation, reduced species productivity, and a local reduction in biological diversity. The  
36 impacts could occur at the proposed site and at the sites used for coal and limestone mining.  
37 Extraction of makeup water for cooling could have adverse impacts on aquatic resources.  
38 Cooling-tower drift would have minimal impacts on terrestrial ecology. Storage and disposal of  
39 fly ash could affect the aquatic environment. The impacts on threatened and endangered

1 species at the VCSNS site would be similar to the impacts from a new nuclear facility. Overall,  
2 the review team concludes that impacts on terrestrial ecology would likely be MODERATE  
3 primarily because of the potential impacts associated with the disposal of ash and the large land  
4 area affected by mining. The review team further concludes that the impacts on aquatic ecology  
5 would likely be SMALL and similar to the proposed action.

6 Adverse socioeconomic impacts would result from the average number of construction workers  
7 and the peak workforce of approximately 2000. However, socioeconomic impacts would be  
8 SMALL and consistent with the proposed project with the exception of the likely MODERATE  
9 impacts localized to the vicinity of the VCSNS due to traffic- and transportation-related issues.  
10 The plant would pay significant property taxes to Fairfield County, South Carolina and the  
11 review team concludes that these taxes would have a LARGE and beneficial impact on the  
12 county. Other socioeconomic impacts related to building and operation would be SMALL.

13 The coal-fired units would have emissions stacks that might be as much as 200 ft tall and would  
14 be visible offsite during daylight hours. The stacks and associated emissions would likely be  
15 visible in daylight hours for distances greater than 40 mi. Cooling towers and associated  
16 plumes also would have aesthetic impacts. Natural draft towers could be up to 600 ft high. The  
17 powerblock units and associated stacks and cooling towers would also be visible at night  
18 because of outside lighting. The Federal Aviation Administration (FAA) generally requires that  
19 all structures exceeding an overall height of 200 ft above ground level have markings and/or  
20 lighting so as not to impair aviation safety (FAA 2007). A mitigating factor is that the VCSNS  
21 site is currently a developed site located in a predominantly rural area. However, the site is  
22 near the towns of Jenkinsville and Pomaria, South Carolina, with several towns such as  
23 Newberry, Chapin, and Winnsboro located within 15 mi. The visual impacts of a new coal-fired  
24 plant could be further mitigated by landscaping and selection of building colors that are  
25 consistent with the environment. Visual impacts at night could be mitigated by reduced use of  
26 lighting, provided the lighting meets FAA requirements, and appropriate use of shielding.  
27 Transmission lines would have a larger aesthetic impact, but would be consistent with the  
28 proposed project. Overall, the review team concludes that the aesthetic impacts associated  
29 with new coal-fired power generation at the VCSNS site and around the transmission lines  
30 would be SMALL because of the amount of cover around the VCSNS site and along likely  
31 transmission-line corridors. Coal-fired power generation would introduce mechanical sources of  
32 noise that would be audible offsite. Sources contributing to the noise produced by plant  
33 operation are classified as continuous or intermittent. Continuous sources include the  
34 mechanical equipment associated with normal plant operations and mechanical draft cooling  
35 towers. Intermittent sources include the equipment related to coal handling, solid-waste  
36 disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers,  
37 and the commuting of plant employees. Noise levels from onsite building activities would be  
38 attenuated by distance and obstacles such as buildings, vegetation, and topography. Because  
39 the site is surrounded by forests and moderate topography, the review team concludes that



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1 noise emanating from the project site would be somewhat muffled to surrounding communities  
2 and the associated impact would not be significant. It is expected that noise levels experienced  
3 by sensitive noise receptors outside of the exclusion area boundary would rapidly attenuate to  
4 below 50 dBA (SCE&G 2009a). Noise impacts associated with railroad delivery of coal and  
5 lime/limestone would be most significant for residents living in close proximity to the facility and  
6 along the railroad route. While there is frequent train transport, and many people are likely to be  
7 within hearing distance of the rail line, the short duration of the noise reduces the impact.  
8 Therefore, the impact of noise on residents in close proximity to the facility and of the rail line  
9 are considered SMALL.

10 Historic and cultural resources impacts of locating a new coal-fired plant at the VCSNS site  
11 would be similar to the impacts of locating a new nuclear plant at the VCSNS site, as discussed  
12 in Sections 4.6 and 5.6. A cultural resources inventory would likely be needed for any onsite  
13 property that has not been previously surveyed. Other lands that are acquired to support the  
14 plant would also likely need an inventory of field cultural resources, identification and recording  
15 of existing historic and archaeological resources, and possible mitigation of the adverse effect  
16 from ground-disturbing actions. The studies would likely be needed for all areas of potential  
17 disturbance at the plant site, any offsite affected areas, such as mining and waste-disposal  
18 sites, and along associated corridors where new construction would occur, for example, roads  
19 and new transmission-line corridors. The review team concludes that the historic and cultural  
20 resource impacts at the VCSNS site would be MODERATE and consistent with the proposed  
21 project.

22 As discussed in Sections 4.5 and 5.5, at the VCSNS site there are no environmental pathways  
23 by which the identified minority or low-income populations in the 50-mi region would be likely to  
24 suffer disproportionate and adverse environmental impacts, with the exception of traffic-related  
25 adverse and disproportionate impacts on minority populations in the Jenkinsville area.  
26 Mitigation of the traffic-related impacts, such as a traffic-management plan, are discussed in  
27 Section 4.5. However, the review team finds that because the traffic-related impacts would be  
28 temporary and of short duration in nature, they would be noticeable but not destabilizing to the  
29 Jenkinsville community. Therefore, the review team concludes that the environmental justice  
30 impacts from building activities related to traffic would be MODERATE. Similar traffic-related  
31 impacts would occur during the building of a coal plant at the VCSNS site. Therefore, the  
32 review team concludes that the adverse impacts of building a coal-fired plant at the VCSNS site  
33 would be SMALL with the exception of the impact due to traffic which would be MODERATE.  
34 Other building and operation impacts would be SMALL. In most cases, the impacts would not  
35 be detectable or they would be so minor that they would neither destabilize nor noticeably alter  
36 any known attribute of the resource. Due to the minor nature of these impacts, mitigation  
37 beyond that discussed would not be warranted.

1 The building and operation impacts of coal-fired power generation at the VCSNS site are  
 2 summarized in Table 9-1.

3 **Table 9-1.** Summary of Environmental Impacts of Coal-Fired Power Generation – 2214 MW(e)

Impact Category	Impact	Comment
Land Use	MODERATE	Uses approximately 357 ac for powerblock; coal handling, storage, and transportation facilities; infrastructure facilities; waste disposal; and cooling-water facilities. An additional 49,000 ac of land would be used for mining activities over 40 years. Impacts would also be associated with transmission-line corridors.
Air Quality	MODERATE	SO <sub>2</sub> – 7044 T/yr Nitrogen oxides – 1495 T/yr CO – 1495 T/yr PM <sub>10</sub> – 67 T/yr PM <sub>2.5</sub> – 0.17 T/yr Small amounts of hazardous air pollutants
Water Use and Quality	SMALL	Impacts would be comparable to the impacts for new nuclear power units located at the VCSNS site.
Ecology	SMALL to MODERATE	Uses the undeveloped area of the existing VCSNS site. Potential habitat loss and fragmentation, reduced productivity and biological diversity, and impacts on terrestrial ecology from cooling-tower drift. Additional impacts are associated with the building and expansion of transmission-line corridors and mining
Waste Management	MODERATE	Total waste volume of combustion wastes including fly ash and flue gas scrubber sludge would exceed 1 million tons per year.
Historic and Cultural Resources	MODERATE	Impacts would be comparable to the impacts for new nuclear units located at the VCSNS site.
Human Health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Socioeconomic	LARGE Beneficial to MODERATE Adverse	Impacts would be comparable to the impacts for new nuclear units located at the VCSNS site. Large beneficial impacts derived from tax revenues. Moderate adverse due to localized traffic impacts.
Environmental Justice	MODERATE	Impacts would be comparable to the impacts for new nuclear units located at the VCSNS site. There are no environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to suffer disproportionate and adverse environmental or health impacts with the exception of traffic-related impacts within the vicinity of the VCSNS.

1 **9.2.2.2 Natural-Gas-Fired Power Generation**

2 For the natural gas alternative, SCE&G assumed operation of three natural-gas-fired plants with  
3 a closed-cycle cooling system and cooling towers located at the VCSNS site with a capacity of  
4 2214 MW(e) (SCE&G 2009a). The associated emissions were determined based on factors  
5 contained in the EPA Clearinghouse for Inventories and Emissions Factors (EPA 2000). The  
6 review team also assumed the construction and operation of transmission lines, as discussed in  
7 Section 3.3 of this EIS.

8 ***Air Quality***

9 Natural gas is a relatively clean-burning fuel. When compared with a coal-fired plant, natural-  
10 gas-fired plants release similar types of emissions such as nitrogen oxides, but in significantly  
11 lower quantities. Emission estimates are based on “as fired” and controlled conditions. A new  
12 natural-gas-fired power-generation plant would require a PSD Permit and a state-specific  
13 operating permit under the Clean Air Act. A new natural-gas-fired, combined-cycle plant would  
14 also be subject to the NSPSs specified in 40 CFR Part 60, Subparts Da and GG. These  
15 regulations establish emission limits for particulates, opacity, SO<sub>2</sub>, and nitrogen oxides.

16 The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51,  
17 Subpart P, including a specific requirement for review of any new major stationary source in  
18 areas designated as in attainment or unclassified under the Clean Air Act. As previously  
19 discussed, the VCSNS site is in an area designated as in attainment or unclassified for criteria  
20 pollutants (40 CFR 81.311).

21 Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing  
22 future impairment of visibility and remedying existing impairment in mandatory Class I Federal  
23 areas when impairment is from air pollution caused by human activities. In addition, EPA  
24 regulations provide that for each mandatory Class I Federal area located within a state, State  
25 regulatory agencies must establish goals that provide for reasonable progress toward achieving  
26 natural visibility conditions. The reasonable progress goals must provide for an improvement in  
27 visibility for the most impaired days over the period of the implementation plan and ensure no  
28 degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)).  
29 If a new natural-gas-fired power plant were located close to a mandatory Class I area, additional  
30 air-pollution control requirements could be imposed. As discussed previously, there are no  
31 mandatory Class I Federal areas within 130 mi of the VCSNS site.

32 Emissions from a natural-gas-fired plant equipped with appropriate combustion and post-  
33 combustion pollution-control technology would have approximately the following emissions  
34 (SCE&G 2009a):

- 35 • SO<sub>2</sub> – 34 T/yr

- 1 • nitrogen oxides – 558 T/yr
- 2 • CO – 116 T/yr
- 3 • PM<sub>10</sub> – 97 T/yr
- 4 • PM<sub>2.5</sub> – 97 T/yr.

5 A natural-gas-fired power plant would also have unregulated carbon dioxide emissions of  
6 approximately 5,630,000 T/yr.

7 The fugitive dust emissions from construction activities would be mitigated using BMPs, and  
8 such emissions would be temporary. Other construction and operation impacts, such as the  
9 development and use of material laydown areas and parking, would be minor.

10 The impacts of emissions from a natural-gas-fired power-generation plant would be clearly  
11 noticeable, but would not be sufficient to destabilize air resources. Overall, the review team  
12 concludes that air quality impacts resulting from construction and operation of new natural-gas-  
13 fired power generation at the VCSNS site would be SMALL to MODERATE.

#### 14 ***Waste Management***

15 In NUREG-1437, the NRC staff concluded that waste generation from natural-gas-fired  
16 technology would be minimal (NRC 1996). The only significant waste generated at a natural-  
17 gas-fired power plant would be spent SCR catalyst, which is used to control nitrogen oxide  
18 emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent  
19 SCR catalyst, waste generation at an operating natural-gas-fired plant would be largely limited  
20 to typical operations and maintenance waste. Minor construction-related debris would be  
21 generated during construction activities. Overall, the review team concludes that the waste  
22 impacts from natural-gas-fired power generation would be SMALL.

#### 23 ***Human Health***

24 In NUREG-1437, the NRC staff identified cancer and emphysema as potential health risks from  
25 natural-gas-fired plants (NRC 1996). The risks may be attributable to nitrogen oxide emissions  
26 that contribute to ozone formation, which in turn contributes to health risk. Air emissions from a  
27 natural-gas-fired power-generation plant located at the VCSNS site would be regulated by the  
28 SCDHEC. The human health effects are expected to be either undetectable or minor. Overall,  
29 the review team concludes that the impacts on human health from natural-gas-fired power  
30 generation would be SMALL.

#### 31 ***Other Impacts***

32 The natural-gas-fired generating plant would require approximately 87 ac for the powerblock  
33 and support facilities (for 2214 MW(e)). Construction of a natural-gas pipeline from the VCSNS

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1 site to the closest natural-gas distribution line would require approximately 318 ac. Thus, the  
2 total land-use commitment would be approximately 405 ac (SCE&G 2009a). This is very close  
3 to the estimated 320 ac of permanent land dedication (approximately 500 ac when also  
4 accounting for temporary laydown areas) needed for a nuclear facility (see Section 4.1).

5 For a new natural-gas-fired power plant, additional land may be required for natural-gas wells  
6 and collection stations. The additional land required is expected to be less than the 10,000 ac  
7 needed to support fuel cycle activities over a 40-year operational life of a nuclear plant. Due to  
8 the proximity of the VCSNS site to existing natural-gas infrastructure, minimal pipeline(s) would  
9 have to be constructed, and pipeline distances would be minimized. The land required for new  
10 transmission-line corridors would be similar to that reported in Section 4.1 for the transmission  
11 lines for the proposed nuclear facility. The impacts of new transmission-line corridors would  
12 have a noticeable but not destabilizing impact along the corridors, consistent with the impacts  
13 for building and operating two new nuclear units at the VCSNS site. Therefore, the review team  
14 concludes that the land-use impacts from new natural-gas-fired power generation at the VCSNS  
15 would be MODERATE. The impacts on water use and quality from constructing and operating a  
16 natural-gas-fired combined-cycle power plant at the VCSNS site would be similar to or less than  
17 the impacts associated with constructing and operating a new nuclear facility. Closed-cycle  
18 cooling with cooling towers is assumed. The impacts on water quality from sedimentation  
19 during construction of a natural-gas-fired plant were characterized in NUREG-1437 as SMALL  
20 (NRC 1996). NRC staff also noted in NUREG-1437 that the impacts on water quality from  
21 operations would be similar to, or less than, the impacts from other generating technologies.  
22 Overall, the review team concludes that impacts on water use and quality would be SMALL.

23 Siting of the natural-gas-fired plant would have ecological impacts. Some of the impact would  
24 occur in areas that were previously disturbed during construction of VCSNS Unit 1.  
25 Constructing a new underground gas pipeline to the site would cause temporary ecological  
26 impacts. Ecological impacts on the plant site and utility easements would not affect threatened  
27 and endangered species, although some wildlife habitat loss and fragmentation, reduced  
28 productivity, and a local reduction in biological diversity related to the expansion of  
29 transmission-line corridors would be likely. Withdrawal and discharge of makeup water for the  
30 cooling system could affect aquatic resources, and elevated total dissolved solids in cooling-  
31 tower drift could affect the terrestrial ecology. The review team concludes that impacts on  
32 terrestrial ecology would likely be MODERATE due to the impacts of the transmission-line  
33 corridors. The review team concludes that the impacts on aquatic ecology would likely be  
34 SMALL, similar to the proposed project, as described in Chapters 4 and 5.

35 Adverse socioeconomic impacts would result from the demands on housing and public services  
36 during construction, and the approximately 50 workers needed to operate the natural-gas-fired  
37 facility. Overall, the staff concludes that these impacts would be SMALL because of the  
38 proximity of the site to the surrounding population area and the relatively small number of

1 workers needed to construct and operate the plant in comparison to nuclear and coal-fired  
2 generation alternatives would cause the impacts to be minor. A review of workforce  
3 requirements for combined-cycle power plant construction suggests an average workforce of  
4 approximately 240 workers for a 550-MW(e) plant, with a peak of 350 workers (Palomar Energy  
5 2003). For the proposed project this would suggest an average peak workforce of  
6 approximately 1000 workers, or half of the suggested peak workforce for coal and nuclear plant  
7 construction. The plant would pay property taxes to Fairfield County, South Carolina. The  
8 review team concludes that the taxes would have a MODERATE and beneficial impact on the  
9 county, based on the smaller number of total workers required during construction and  
10 operation.

11 The heat-recovery steam generators, exhaust stacks (approximately 200 ft tall) and associated  
12 emissions, cooling towers and associated plumes from the cooling towers, and the gas pipeline  
13 compressors would be visible offsite during daylight hours. Noise and light from the plant would  
14 be detectable offsite. A mitigating factor is that the VCSNS site is currently a developed site  
15 located in a predominantly rural area. Transmission lines would have a larger aesthetic impact,  
16 but would be consistent with the proposed project. Overall, the review team concludes that the  
17 aesthetic impacts associated with new natural-gas-fired power generation at the VCSNS site  
18 and around the transmission lines would be SMALL, similar to the proposed project. Other  
19 construction and operation impacts would also be SMALL. In most cases, the impacts would  
20 not be detectable or they would be so minor that they would neither destabilize nor noticeably  
21 alter any known attribute of the resource.

22 As discussed in Sections 4.5 and 5.5, at the VCSNS site there are no environmental pathways  
23 by which the identified minority or low-income populations in the 50-mi region would be likely to  
24 suffer disproportionate and adverse environmental with the exception of traffic-related adverse  
25 and disproportionate impacts on minority populations in the Jenkinsville area. However, the  
26 review team believes that because the traffic-related impacts are temporary and of short  
27 duration in nature, they would be noticeable but not destabilizing to the Jenkinsville community.  
28 Therefore, the review team concludes that the environmental justice impacts from building  
29 activities related to traffic would be MODERATE. Similar traffic-related impacts would occur  
30 during the construction of a nuclear plant at the VCSNS site. Therefore, the review team  
31 concludes that the adverse impacts of building a gas-fired plant at the VCSNS site would be  
32 minor with the exception of the impact due to traffic, which would be MODERATE.

33 Historic and cultural resources impacts for a new natural-gas fired plant located at the VCSNS  
34 site would be similar to the impacts for a new nuclear plant as discussed in Sections 4.6 and  
35 5.6. A cultural resources inventory would likely be needed for any onsite property that has not  
36 been previously surveyed. Other lands that are acquired to support the plant would also likely  
37 need an inventory of field cultural resources, identification and recording of existing historic and  
38 archaeological resources, and possible mitigation of the adverse effect from ground-disturbing

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1 actions. The studies would likely be needed for all areas of potential disturbance at the plant  
2 site, any offsite affected areas, such as mining and waste-disposal sites, and along associated  
3 corridors where new construction would occur; for example, roads and new transmission-line  
4 corridors. The review team concludes that the historic and cultural resource impacts at the  
5 VCSNS would be MODERATE and consistent with the proposed project.

6 The impacts of natural-gas-fired power generation at the VCSNS site are summarized in  
7 Table 9-2.

### 8 **9.2.3 Other Alternatives**

9 This section discusses other energy alternatives, the review team's conclusions about the  
10 feasibility of each alternative, and the review team's basis for its conclusions. New nuclear units  
11 at the proposed site would provide baseload generation. Any feasible alternative to the new  
12 units would need to be capable of generating baseload power with high availability and capacity  
13 factors. In performing its initial evaluation in its Environmental Report (ER), SCE&G relied  
14 heavily on NUREG-1437, the NRC's *Generic Environmental Impact Statement for License  
15 Renewal of Nuclear Plants* (NRC 1996). The review team reviewed the information submitted  
16 by SCE&G, conducted an independent review, and finds that SCE&G's conclusion that these  
17 generation options are not reasonable alternatives to one or more new nuclear units is  
18 acceptable.

19 The review team has not assigned significance levels to the environmental impacts associated  
20 with the alternatives discussed in this section because, in general, the generation alternatives  
21 would have to be installed at a location other than the proposed site. Any attempt to assign  
22 significance levels would require the review team's speculation about the unknown site.

#### 23 **9.2.3.1 Oil-Fired Power Generation**

24 The EIA's reference case projects that oil-fired power plants would not account for any new  
25 electric power-generation capacity in the United States through the year 2030 (DOE/EIA 2009),  
26 although oil-firing in combustion turbines is often used to supplement natural-gas feed stock.  
27 Oil-fired generation is more expensive than nuclear, natural-gas-fired, or coal-fired generation  
28 options, and currently makes up only 1 percent of the existing capacity within the SERC region  
29 (SERC 2009). In addition, fluctuations in future oil prices are expected to make oil-fired  
30 generation increasingly more expensive. The high cost of oil has resulted in a decline in its use  
31 for electricity generation. In Section 8.3.11 of NUREG-1437, the staff estimated that  
32 construction of a 1000-MW(e) oil-fired plant would require about 120 ac of land (NRC 1996).  
33 Operation of an oil-fired power plant would have environmental impacts that would be similar to  
34 those of a comparably sized coal-fired plant (NRC 1996).

1 **Table 9-2.** Summary of Environmental Impacts of Natural-Gas-Fired Power Generation

<b>Impact Category</b>	<b>Impact</b>	<b>Comment</b>
Land Use	MODERATE	Approximately 230 ac would be needed for powerblock, cooling towers and support systems, and connection to a natural-gas pipeline. Additional land needed for gas pipelines, transmission-line corridors, and infrastructure would be required.
Air Quality	SMALL to MODERATE	SO <sub>2</sub> – 34 T/yr Nitrogen oxides – 558 T/yr CO – 116 T/yr PM <sub>10</sub> – 97 T/yr PM <sub>2.5</sub> – 97 T/yr
Water Use and Quality	SMALL	Impacts would be similar to or less than the impacts for a new nuclear power plant located at the site.
Ecology	SMALL to MODERATE	Uses the undeveloped area of the existing VCSNS site. Potential habitat loss and fragmentation, reduced productivity and biological diversity, and impacts on terrestrial ecology from cooling-tower drift. Additional impacts are associated with the construction and expansion of transmission-line corridors.
Waste Management	SMALL	The only significant waste would be from spent SCR catalyst used for control of nitrogen oxide emissions.
Socioeconomics	MODERATE Beneficial to SMALL Adverse	Construction and operations workforces would be relatively small compared to nuclear and coal plants. Addition to the property tax base, while smaller than for a nuclear or coal-fired plant, would still be noticeable. Construction-related impacts would be noticeable but minimized due to the smaller peak workforce. Operations-related impacts would be minor because of the small workforce involved. The plant and new transmission line would have aesthetic impacts.
Human Health	SMALL	Regulatory controls and oversight would be protective of human health.
Historic and Cultural Resources	MODERATE	Impacts would be comparable to the impacts for new nuclear units located at the VCSNS site.
Environmental Justice	MODERATE	There are no environmental pathways that would lead to disproportionate and adverse impacts on minority and low-income populations with the exception of traffic-related impacts within the vicinity of the VCSNS.



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1 For the preceding economic and environmental reasons, the review team concludes that an oil-  
2 fired power plant at or in the vicinity of the proposed VCSNS site would not be a reasonable  
3 alternative to construction of a 2214-MW(e) nuclear power-generation facility .

### 4 **9.2.3.2 Wind Power**

5 The VCSNS site is in a wind power Class 1 region with average wind speed lower than 5.6 m/s  
6 (DOE 2009c). Class 1 regions have the lowest potential for generation of wind energy and are  
7 considered unsuitable for the development of wind energy (DOE 2008a); however, the eastern  
8 coastal region of South Carolina is recognized as being capable of supporting intermittent utility-  
9 scale wind generation (DOE 2009c).

10 Newer wind turbines typically operate at approximately a 36-percent capacity factor  
11 (DOE 2009c), compared with 90 percent for a baseload plant such as a nuclear power station  
12 (NEI 2007). The largest operating wind farm has a more than 700-MW generating capacity  
13 (AWEA 2008a); however, the capacities of most installations or wind farms are under 200 MW.  
14 A utility-scale wind-generation plant would generally require about 60 ac/MW(e) of installed  
15 capacity, although much of this land could be used for other purposes (AWEA 2008b). Modern  
16 wind turbine designs are approaching 5 MW(e); however, it is likely that well over 800  
17 commonly deployed wind turbines would be required to produce the 2214 MW(e) of the  
18 proposed nuclear units. Because of the inherent variability of wind as a resource, the capacity  
19 from wind turbines may supply baseload power when or if coupled with energy-storage  
20 mechanisms or additional resources such as hydropower (NPCC 2005). This requires both the  
21 wind resource and the storage mechanism to be within reasonable proximity of each other, and  
22 of commensurate power output when used singly or in combination.

23 The coastal geographies containing adequate wind resources might support on-shore and off-  
24 shore-based wind turbines, both of which have considerable environmental and aesthetic  
25 challenges (SCE&G 2009a). Santee Cooper is actively pursuing the development of wind-  
26 generation resources as part of its renewable energy resource portfolio, including partnerships  
27 with the DOE, South Carolina Energy Office, and several universities. Although the utility has  
28 made no purchased-power commitments, Santee Cooper continues to investigate wind  
29 resources on coastal South Carolina, and remains engaged with the development of this  
30 potential resource (Santee Cooper 2008).

31 However, wind power is not capable of supplying baseload capacity of 2214 MW(e) due to the  
32 inherent variability of wind as a resource. Therefore, the review team concludes that a wind-  
33 energy facility would not be a reasonable alternative to the proposed project.

### 1   **9.2.3.3   Solar Power**

2   Solar technologies use energy and light from the sun to provide heating and cooling, light, hot  
3   water, and electricity for consumers. Solar-power technologies (both photovoltaic [PV] and  
4   solar-thermal) cannot currently compete with conventional nuclear and fossil-fueled  
5   technologies in grid-connected, utility-scale applications because of solar power's lower  
6   capacity factors and higher capital cost per kilowatt of capacity. In NUREG-1437, the NRC staff  
7   determined that the average capacity factor of PV cells is about 25 percent, and the capacity  
8   factor for solar thermal systems is about 25 to 40 percent (NRC 1996). As reviewed in  
9   Section 8.3.2, Santee Cooper is actively pursuing opportunities in solar power development as  
10   part of its committed expansion in renewable energy resources.

11   Because solar power cannot supply baseload power, the review team concludes that solar-  
12   power technologies would not be a reasonable alternative to proposed project.

### 13   **9.2.3.4   Hydropower**

14   South Carolina has an estimated 480 MW(e) of developable hydroelectric resources (Conner  
15   and Francfort 1997). As stated in Section 8.3.4 of NUREG-1437 for license renewal (NRC  
16   1996), the percentage of U.S. generating capacity supplied by hydropower is expected to  
17   decline because hydroelectric facilities have become difficult to site as a result of public  
18   concerns about flooding, destruction of natural habitat, and alteration of natural river courses.  
19   Most recently the EIA, in its *Annual Energy Outlook 2008* (DOE/EIA 2008), references expected  
20   stable electricity production only from existing hydropower resources through 2030. In  
21   NUREG-1437, the staff estimated that land requirements for hydroelectric power are  
22   approximately 1 million ac per 1000 MW(e) (NRC 1996).

23   Because there is an insufficient amount of undeveloped hydropower resource in South Carolina  
24   the review team concludes that hydropower is not a feasible alternative to the proposed project.

### 25   **9.2.3.5   Geothermal Energy**

26   Geothermal energy has an average capacity factor of 90 percent and can be used for baseload  
27   power where available. However, geothermal technology is not widely used as baseload power  
28   generation because of the limited geographic availability of the resource (NRC 1996).  
29   Geothermal plants are most likely to be sited in the western continental United States, Alaska,  
30   and Hawaii, where hydrothermal reservoirs are prevalent (DOE 2006). South Carolina does not  
31   have sufficient high-temperature geothermal resources that are suitable for electricity generation  
32   (DOE 2008e).

33   Therefore, the review team concludes that a geothermal energy facility at or in the vicinity of the  
34   proposed VCSNS site would not be a reasonable alternative to the proposed project.

1 **9.2.3.6 Wood Waste**

2 In NUREG-1437, the NRC staff determined that a wood-burning facility can provide baseload  
3 power and operate with an average annual capacity factor of around 70 to 80 percent and with  
4 20 to 25 percent efficiency (NRC 1996). SCE&G currently receives approximately 1 percent of  
5 its total energy from woody-biomass-fired facilities (SCE&G 2009b).

6 The fuels required are variable and site-specific. Wood-based biomass resources in South  
7 Carolina are significant, with an estimated 22 million tons of the resource available each year  
8 (SCE&G 2009a). However, significant impediments to the use of wood waste for the generation  
9 of electricity are the high cost of fuel delivery in addition to the quantity of acceptable fuel  
10 necessary. The larger wood-waste power plants are 40 to 50 MW(e) in size. Estimates in  
11 NUREG-1437 suggest that the overall level of construction impacts per megawatt of installed  
12 capacity would be approximately the same as that for a coal-fired plant, although facilities using  
13 wood waste for fuel would be built at a significantly smaller scale (NRC 1996). Similar to coal-  
14 fired plants, wood-waste plants require large areas for fuel storage and processing and involve  
15 similar types of combustion and combustion control equipment.

16 Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a  
17 baseload power plant, and the small total generating capacity per unit, the review team  
18 concludes that wood-waste-fired generating capacity would not be a reasonable alternative to  
19 the proposed project.

20 **9.2.3.7 Municipal Solid Waste**

21 Municipal solid-waste facilities incinerate waste and use the resultant heat to produce steam,  
22 hot water, or electricity. The combustion process can reduce the volume of waste by up to  
23 90 percent and the weight of the waste by up to 75 percent (EPA 2009d). Municipal waste  
24 combustion facilities use three basic types of technologies: mass burn, modular, and refuse-  
25 derived fuel (DOE/EIA 2001). Mass-burning technologies are most commonly used in the  
26 United States. This group of technologies processes raw municipal solid waste “as is,” with little  
27 or no sizing, shredding, or separation before combustion. In NUREG-1437, the NRC staff  
28 determined that the initial capital cost for municipal solid-waste plants is greater than for  
29 comparable steam-turbine technology at wood-waste facilities because of the need for  
30 specialized waste-separation and waste-handling equipment for municipal solid waste  
31 (NRC 1996). There are 89 waste-to-energy plants that are operating in the United States, with  
32 an average of approximately 30 MW(e) per plant (IWSA 2008).

33 One additional generating resource that uses municipal solid waste as a fuel derivative is the  
34 capture and combustion of landfill-based gas (LFG). Santee Cooper currently produces  
35 13 MW(e) from LFG, with plans to double that capacity by the end of 2010 (Santee Cooper  
36 2008).

1 Given the limited capacity of the plants and limited supply of LFG, the review team concludes  
2 that generating electricity from municipal solid waste or LFG is not be a reasonable alternative  
3 to the proposed project.

#### 4 **9.2.3.8 Other Biomass-Derived Fuels**

5 In addition to wood and municipal solid-waste fuel, several other biomass-derived fuels are  
6 available for fueling electric generators. These include but are not limited to animal-derived  
7 wastes, crop-based biomass, converting crops to a liquid fuel such as ethanol, and gasifying  
8 crops (including wood waste). However, in NUREG-1437, the NRC determined that none of  
9 these technologies has progressed to the point of being competitive on a large scale or of being  
10 reliable enough to replace a large baseload generating plant (NRC 1996).

11 The EIA estimates that biomass will be the largest source of renewable electricity generation  
12 among the nonhydropower renewable fuels through 2030 and that significant growth in  
13 dedicated biomass power-generation capacity is expected in regions with stringent Renewable  
14 Energy Portfolio Standards requirements and limited supplies of lower-cost resources such as  
15 wind (DOE/EIA 2008). As reviewed in Section 9.2.3.6, biomass resources are available in  
16 South Carolina in the form of woody residues, and they are expected to contribute to the overall  
17 production of energy and fuels in the future (South Carolina Energy Office 2007). Furthermore,  
18 South Carolina has created a biomass council through its South Carolina Energy Office to  
19 capitalize on increasing energy diversity and enhancing environmental quality for South  
20 Carolina (South Carolina Energy Office 2007).

21 Co-firing biomass with coal is possible when low-cost biomass resources are available.  
22 Co-firing is the most economic option for the near future to introduce new biomass power  
23 generation. These projects require small capital investments per unit of power-generation  
24 capacity. Co-firing systems range in size from 1 to 30 MW(e) of bio-power capacity (DOE  
25 2008d).

26 Construction of a biomass-fired plant would have an environmental impact that would be similar  
27 to that of a coal-fired plant, although facilities using wood waste and agricultural residues for fuel  
28 would be built on significantly smaller scales. Like coal-fired plants, biomass-fired plants require  
29 areas for fuel storage, processing, and waste (i.e., ash) disposal. In addition, operation of  
30 biomass-fired plants has environmental impacts, including potential impacts on the aquatic  
31 environment and air.

32 Given the limited capacity of the plants, the review team concludes that biomass-derived, or  
33 biomass co-fired fuels used singly or in combination with other fossil fuels do not offer a  
34 reasonable alternative to the proposed project.

1 **9.2.3.9 Fuel Cells**

2 Fuel cells work without combustion and its associated environmental side effects. Power is  
3 produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode,  
4 and then separating the two by an electrolyte. The only byproducts are heat, water, and carbon  
5 dioxide. Hydrogen is typically derived from hydrocarbon-based fuels, such as natural gas, by  
6 subjecting them to steam reforming or partial oxidation, through gasification of coal or biomass,  
7 or through the electrolysis of water.

8 Phosphoric-acid fuel cells are generally considered first-generation technology. During the past  
9 three decades, significant efforts have been made to develop more practical and affordable fuel  
10 cell designs for stationary power applications and the first-generation technologies have given  
11 way to membrane and solid-oxide-based fuel cells operating consistently at above 50-percent  
12 electrical efficiency (DOE 2008b). High-temperature, second-generation fuel cells have  
13 achieved increased fuel-to-electricity and thermal efficiencies, giving second-generation fuel-cell  
14 systems the ability to generate steam for cogeneration such as in distributed generation type  
15 combined heat and power applications.

16 Research in both stationary and transportation-based fuel cells is intended to provide continuing  
17 improvements of both materials and components as they relate to system cost and durability.  
18 Currently, the cost of fuel-cell power systems must be reduced before they can be competitive  
19 with conventional technologies (DOE 2008c). At the present time, fuel cells are not  
20 economically or technologically competitive with other alternatives for baseload electricity  
21 generation (NUREG-1437, Supplement 34). Because fuel cells have not been developed to the  
22 point where they are capable of supplying power consistent with the proposed projects purpose  
23 and need equal to 2214 MW(e), the review team concludes that fuel-cell-based electricity  
24 generation does not offer a reasonable alternative to the proposed project.

25 **9.2.4 Combinations of Alternatives**

26 Individual alternatives to the construction of one or more new nuclear units at the proposed site  
27 might not be sufficient on their own to generate SCE&G's target value of 2214 MW(e) of  
28 baseload capacity because of the small size of the resource, lack of cost-effective opportunities,  
29 or inability to generate baseload capacity. Nevertheless, it is conceivable that a combination of  
30 alternatives might be capable of meeting both the baseload and capacity targets of proposed  
31 VCSNS Units 2 and 3. There are many possible combinations of alternatives. It would not be  
32 reasonable to examine every possible combination of energy alternatives in an EIS. Doing so  
33 would be counter to CEQ's direction that an EIS should be analytic rather than encyclopedic,  
34 shall be kept concise, and shall be no longer than absolutely necessary to comply with NEPA  
35 and CEQ's regulations (40 CFR 1502.2(a), (c)). Given that the stated objective is for a  
36 baseload power generation facility, a fossil energy source, most likely coal or natural gas, would  
37 need to be a significant contributor to any reasonable alternative energy combination.

1 When examining the potential alternatives or combinations of alternatives, SCE&G indicated  
2 that the total generating capacity must be commensurate with the proposed 2214-MW(e)  
3 project. The selection of a combination of alternatives follows a reasonable set of capabilities  
4 determined to be within the proposed region, and supported by review and analysis of the  
5 programmatic goals of the applicant, technical maturity, and economics. Section 9.2.2.2  
6 assumes the construction of a 2214-MW(e) natural-gas-fired, combined-cycle generating unit at  
7 the proposed site using closed-cycle cooling with cooling towers. For a combined-alternatives  
8 option, the review team assessed the environmental impacts of an assumed combination of  
9 three 600-MW(e) natural-gas-fired, combined-cycle generating units at the proposed site using  
10 closed-cycle cooling with cooling towers, for a total of 1800 MW(e); 175 MW(e) from renewable  
11 energy resources such as biomass, solar, wind, and LFG; and 240 MW(e) from conservation  
12 and DSM programs for a total of 2215 MW(e). Based on the information presented in the  
13 preceding sections of this chapter, the review team believes that these contributions are  
14 reasonable and representative.

15 Natural-gas-fired generation was selected based on its lower environmental impact than a  
16 comparatively sized coal-fired unit(s). This type of power generation is capable of the load-  
17 following characteristics necessary when deployed in conjunction with renewable energy  
18 sources; this capability enables power production to continue when the renewable energy  
19 resource is unavailable. To review the potential impacts from a combination of alternatives, a  
20 reduction in environmental impacts can only be considered when the power generation from the  
21 fossil-fired facility is displaced by the renewable resource. The analysis assumes that the  
22 availability of the alternatives in any combination is similar to what would be required of the  
23 proposed project.

24 A summary of the environmental impacts associated with the construction and operation of this  
25 combination of alternatives is provided in Table 9-3. The combination of alternatives assumes  
26 siting of natural-gas-fired, combined-cycle units at the proposed site and siting of other  
27 generating units such as those using renewable resources in the general vicinity (within 100 mi)  
28 of the site. Similar to the proposed project, closed-cycle cooling with mechanical draft cooling  
29 towers is assumed for all thermal plants.

### 30 **9.2.5 Summary Comparison of Alternatives**

31 Table 9-4 contains a summary of the review team's environmental impact characterizations for  
32 constructing and operating new nuclear, coal-fired, and natural-gas-fired, combined-cycle  
33 generating units at the proposed site.

## Environmental Impacts of Alternatives

1 **Table 9-3.** Summary of Environmental Impacts of a Combination of Power Sources

Impact Category	Impact	Comment
Land Use	MODERATE	A natural-gas-fired plant would have land-use impacts for the powerblock, new transmission-line corridor, cooling towers and support systems, and connection to a natural-gas pipeline. Solar and biomass facilities and associated transmission lines may also have significant land-use impacts as previously discussed.
Air Quality	SMALL to MODERATE	Emissions from the natural-gas-fired plant would be approximately <sup>(a)</sup> SO <sub>2</sub> – 28 T/yr Nitrogen oxides – 458 T/yr CO – 95 T/yr PM <sub>10</sub> – 80 T/yr PM <sub>2.5</sub> – 80 T/yr Municipal solid-waste and biomass facilities would also have emissions associated with the combustion of gaseous or solid fuels.
Water Use and Quality	SMALL	Impacts would not be greater than the impacts associated with a new nuclear power plant located at the proposed site.
Ecology	SMALL to MODERATE	Some of the impacts would occur in areas that were previously disturbed during the construction of existing VCSNS Unit 1. Potential habitat loss and fragmentation and reduced productivity and biological diversity would likely be minimal in that area. Impacts on terrestrial ecology from cooling-tower drift could occur. Solar facilities take up large dedicated tracts of land that may displace existing biological populations and reduce diversity. Biomass production and collection may also result in reduced productivity and loss of habitat unless they are coordinated with existing harvesting practices or needs.
Waste Management	SMALL	The only significant waste would be from spent SCR catalyst used for control of nitrogen oxide emissions and ash and slag from biomass and municipal solid-waste sources.
Socioeconomics	MODERATE Beneficial to MODERATE Adverse	Construction and operations workforces would be relatively small. The addition to the property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts for some renewable sources would be noticeable. Impacts during operation would be minor because of the small workforce involved. The plant and new transmission line would have aesthetic impacts.
Human Health	SMALL	Regulatory controls and oversight would be protective of human health.
Historic and Cultural Resources	MODERATE	Impacts would be comparable to the impacts for new nuclear units located at the VCSNS site

1

**Table 9-3.** (contd)

<b>Impact Category</b>	<b>Impact</b>	<b>Comment</b>
Environmental Justice	MODERATE	There are no environmental pathways that would lead to disproportionate and adverse impacts on minority and low-income populations with the exception of traffic-related impacts within the vicinity of the VCSNS.
(a) Represented as a percentage of the natural-gas combined cycle analysis: 1800/2200 = 82 percent of the total emissions		
(b) SCR = selective catalytic reduction		

2  
3

**Table 9-4.** Summary of the Environmental Impacts of New Nuclear, Coal-Fired, Natural-Gas-Fired, and a Combination of Alternatives

<b>Impact Category</b>	<b>Nuclear<sup>(a)</sup></b>	<b>Coal</b>	<b>Natural Gas</b>	<b>Combination of Alternatives</b>
Land Use	MODERATE	MODERATE	MODERATE	MODERATE
Air Quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Ecology	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste Management	SMALL	MODERATE	SMALL	SMALL
Socioeconomics	LARGE Beneficial to MODERATE Adverse	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Adverse	MODERATE Beneficial to MODERATE Adverse
Human Health	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	MODERATE	MODERATE	MODERATE	MODERATE
Environmental Justice	MODERATE	MODERATE	MODERATE	MODERATE

(a) From Chapters 4 and 5.

4  
5  
6  
7  
8  
9

The distinguishing impacts are primarily related to emissions from the alternative generation sources (air quality). A nuclear plant has less impact on air quality than, coal, natural gas, or a combination of alternatives. The land-use impact for the coal-fired alternative is a function of the irretrievable commitment of land due to coal mining. For the combination of alternatives, in proposing a combination of renewable resources such as biomass and wind in addition to the natural-gas-fired capacity, it would be expected that the commitment of land would exceed the



## Environmental Impacts of Alternatives

1 natural-gas-fired capacity by itself. This may include further commitment of land for biomass  
2 production and harvesting, and the siting of renewable energy resources which would not be co-  
3 located on the VCSNS site.

4 For the energy-generation alternatives discussion, emissions are bound by a review of criteria  
5 pollutants and the total tons produced. Accordingly, the coal-fired alternative produces the  
6 highest level of criteria pollutants and total air emissions; in total tons, the highest percentage of  
7 emissions comes from the release of sulfur during the combustion process followed by nitrogen  
8 oxides and carbon monoxide also due to the combustion of coal with air (oxygen). These  
9 pollutants can also lead to the development of PM (particulate matter). The natural gas  
10 alternative produces the next highest level of emissions. With a reasonably clean fuel stream  
11 (methane), the primary pollutants are limited to nitrogen oxides and carbon monoxide. Natural  
12 gas, in combination with renewable resources is considered to be slightly less than the natural-  
13 gas-fired alternative assuming that when/if the alternative generating source was operable, the  
14 natural-gas-fired alternative would not be required to be operating.

15 Carbon dioxide (CO<sub>2</sub>) emissions for the proposed action and energy generation alternatives are  
16 discussed in Sections 5.7.2, 9.2.2.1, and 9.2.2.2. Table 9-5 summarizes the CO<sub>2</sub> emission  
17 estimates for a 40-year period for the alternatives considered by the review team to be viable for  
18 baseload power generation. These estimates are limited to the emissions from power  
19 generation and do not include CO<sub>2</sub> emissions for workforce transportation, construction, fuel-  
20 cycle, or decommissioning. Among the viable energy-generation alternatives, the CO<sub>2</sub>  
21 emissions for nuclear power are a small fraction of the emissions of the other viable energy-  
22 generation alternatives. Adding the transportation emissions for the nuclear plant workforce and  
23 fuel cycle emissions, would increase the emissions for plant operation over a 40-year period to  
24 about 53,000,000 MT. This number is still significantly lower than the emissions for any of the  
25 other alternatives.

26 **Table 9-5.** Comparison of Carbon Dioxide Emissions for Energy Alternatives

Generation Type	Years	CO <sub>2</sub> Emission (MT)
Nuclear Power <sup>(a)</sup>	40	382,000
Coal-Fired Generation <sup>(b)</sup>	40	600,000,000
Natural Gas-Fired Generation <sup>(c)</sup>	40	204,000,000
Combination of Alternatives <sup>(d)</sup>	40	166,000,000

(a) From Appendix J, value is for two units  
(b) From Section 9.2.2.1  
(c) From Section 9.2.2.2  
(d) From Section 9.2.4 (assuming only natural gas generation has significant CO<sub>2</sub> emissions)

1 Carbon dioxide emissions associated with generation alternatives such as wind power, solar  
2 power, and hydropower would be associated with workforce transportation, construction, and  
3 decommissioning of the facilities. Because these generation alternatives do not involve  
4 combustion, the review team considers the emissions to be minor and concludes that the  
5 emissions would have a minimal impact. Other energy-generation alternatives involving  
6 combustion of oil, wood waste, municipal solid waste, or biomass-derived fuels would have CO<sub>2</sub>  
7 emissions from combustion as well as from workforce transportation, plant construction, and  
8 plant decommissioning. It is likely that the CO<sub>2</sub> emissions from the combustion process for  
9 these alternatives would dominate the other CO<sub>2</sub> emissions associated with the generation  
10 alternative. It is also likely that the CO<sub>2</sub> emissions from these alternatives would be the same  
11 order of magnitude as the emissions for the fossil-fuel alternatives considered in Sections  
12 9.2.2.1 and 9.2.2.2. However, because these alternatives were determined by the review team  
13 not to meet the need for baseload power generation, the review team has not evaluated the  
14 CO<sub>2</sub> emissions quantitatively.

15 As discussed in Chapter 8 of this EIS, the review team has concluded that the need for the  
16 additional baseload power generation has been demonstrated. Also, as discussed earlier in this  
17 chapter, the review team concludes that the viable alternatives to the proposed action all would  
18 involve the use of fossil fuels (coal or natural gas) whether singly or in combination with other  
19 alternative energy resources. The review team concludes that the proposed action results in  
20 the lowest level of emissions of greenhouse gases among the viable alternatives.

21 The review team reviewed the available information on the environmental impacts of power-  
22 generation alternatives compared to the building and operation of new nuclear units at the  
23 VCSNS site. Based on this review, the review team concludes that, from an environmental  
24 perspective, none of the energy alternatives is environmentally preferable to building and  
25 operation of a new baseload nuclear power generation plant at the VCSNS site.

### 26 **9.3 Alternative Sites**

27 NRC EISs prepared in conjunction with a COL application must analyze alternatives to the  
28 proposed action (10 CFR 51.71(d)). NRC guidance (NRC 2000, the Environmental Standard  
29 Review Plan or ESRP) states that the ER, submitted in conjunction with an application for a  
30 COL, should include an evaluation of alternative sites to determine if any obviously superior  
31 alternative to the proposed site exists. NRC's site-selection process guidance calls for  
32 identification of an ROI followed by successive screening to candidate areas, potential sites,  
33 candidate sites, and the proposed site (NRC 2000, ESRP 9.3). This section includes a  
34 discussion of SCE&G's ROI for the proposed siting of a new nuclear power plant, and describes  
35 its alternative site-selection process. Because the project involves a partner, this section also  
36 includes a review of potential sites located within the Santee Cooper ROI that are located  
37 outside of the SCE&G ROI to confirm that in the selection of the VCSNS site, SCE&G did not

## Environmental Impacts of Alternatives

1 preclude any known alternative sites that may rank equal to or better than the VCSNS site. This  
2 is followed by the review team's description of the alternative sites selected, and discussion of  
3 the environmental impacts of locating a unit at each alternative site.

4 This section describes the SCE&G site-selection process, the review team's evaluation process,  
5 the alternative sites selected by SCE&G, and the review team's evaluation of the environmental  
6 impacts of locating two new nuclear generating units at each alternative site. The specific  
7 resources and components that could be affected by the incremental effects of the proposed  
8 action and other actions in the same geographic area were assessed. For the purposes of this  
9 alternative sites evaluation, impacts evaluated include NRC-authorized construction, operation,  
10 and other cumulative impacts including preconstruction activities. Sections 9.3.3 through 9.3.6  
11 provide a site-specific description of the environmental impacts at each alternative site based on  
12 issues such as land use, air quality, water resources, terrestrial and aquatic ecology,  
13 socioeconomics and environmental justice, and historic and cultural resources. Section 9.3.7  
14 contains tables of the staff's characterization of the impacts at the alternative sites and  
15 comparison with the proposed site to determine if there are any alternative sites that are  
16 environmentally preferable to the proposed site.

17 The review of alternative sites consists of a two-part sequential test (NRC 2000). The first part  
18 of the test determines whether any environmentally preferable sites are among the candidate  
19 sites. To determine if a site is environmentally preferable, the review team considers whether  
20 the applicant has (1) reasonably identified candidate sites, (2) evaluated the likely  
21 environmental impacts of construction and operation at these sites, and (3) used a logical  
22 means of comparing sites that led to the applicant's selection of the proposed site. Based on its  
23 own independent review, the review team then determines whether any of the alternative sites  
24 are environmentally preferable to the applicant's proposed site. If the review team determines  
25 that one or more alternative sites are environmentally preferable, then it would proceed with the  
26 second part of the test.

27 The second part of the test determines if an environmentally preferable alternative site is  
28 obviously superior to the proposed site. The review team must determine that (1) one or more  
29 important aspects, either singly or in combination, of an acceptable and available alternative site  
30 are obviously superior to the corresponding aspects of the applicant's proposed site, and (2) the  
31 alternative site does not have offsetting deficiencies in other important areas. Included in this  
32 part of the test is the consideration of estimated costs (i.e., environmental, economic, and time  
33 of building the proposed plant) at the proposed site and at the environmentally preferable site or  
34 sites (NRC 2000).

### 35 **9.3.1 SCE&G Alternative Site-Selection Process**

36 This section includes a discussion of the alternative site-selection processes used to evaluate  
37 the siting of the proposed two-unit nuclear power plant project. The site-selection and

1 comparison process focuses on strategically identifying and evaluating sites that represent an  
 2 acceptable range of alternatives for proposed VCSNS Units 2 and 3 within the stated ROI. This  
 3 section details the process deployed to strategically identify and screen the ROI in successive  
 4 steps until four alternative sites were determined and the final VCSNS site was selected.

5 Due to the joint ownership aspect of the proposed project, the following review includes  
 6 considerations from both the SCE&G and Santee Cooper siting evaluations. Section 9.3.1.1  
 7 outlines SCE&G's siting analysis while Section 9.3.1.2 outlines Santee Cooper's siting analysis.  
 8 It is noted that at the time the alternative siting analysis took place originally, Santee Cooper  
 9 was not yet a partner in the project, and therefore the alternative sites developed under the  
 10 Combined License Application (COLA) were generally limited to the SCE&G service territory, or  
 11 located within 15 mi of the franchised service territory to take advantage of land availability,  
 12 proximity to transmission lines and transportation facilities, and environmental factors (SCE&G  
 13 2009f). However, once joint ownership was established, SCE&G undertook an evaluation of the  
 14 Santee Cooper service territory to confirm that in the selection of the VCSNS site, SCE&G did  
 15 not overlook or preclude site(s) located within the Santee Cooper service territory that would  
 16 serve the power needs of both SCE&G and Santee Cooper.

17 One final consideration that is discussed in more detail in Section 8.2.2 is the following: while  
 18 there are no legal impediments to SCE&G siting a plant outside of its service territory, enabling  
 19 legislation provided by the South Carolina General Assembly limits Santee Cooper's  
 20 participation to existing or future nuclear generation units at or near Parr Shoals in Fairfield  
 21 County (SC Code Ann. § 58-33-200). Authorization for Santee Cooper to partner at another site  
 22 would require a change in statutory language. Therefore, the siting analysis performed by  
 23 Santee Cooper was done to confirm the findings of the SCE&G siting analysis, which proposed  
 24 the VCSNS as the preferred site, rather than to individually determine a proposed site for  
 25 Santee Cooper.

26 In successive steps, the process of site selection involves the screening of a group of sites  
 27 against applied criteria beginning with the ROI. The screening process proceeds through the  
 28 following steps successfully reducing the ROI to the candidate sites, and final proposed site:

- 29 • Region of Interest: Largest geographic area of consideration; for regulated utilities this is  
 30 considered to be the franchised service territory. Typically, the ROI is screened using  
 31 exclusionary type criteria to provide a targeted list of acceptable potential sites for further  
 32 analysis.
- 33 • Potential Sites: Discrete parcels of land found within the geographic area of consideration  
 34 that would support the facility as proposed. Potential sites are screened using suitability  
 35 criteria to provide an acceptable list of candidate sites. The screening data set is typically of  
 36 reconnaissance-level detail.

## Environmental Impacts of Alternatives

- 1 • Candidate Sites: Sites that are considered to be among the best sites in the given ROI that  
2 can reasonably be found for the siting and operation of a power plant. Candidate sites are  
3 typically evaluated through the application of a more refined set of suitability criteria where  
4 the quantifiable weighting and ranking process provides the mechanism through which the  
5 proposed site is chosen and evaluated against the other candidate sites.

6 The identification and validation of the final proposed site from the list of candidate sites is done  
7 on an issue-by-issue basis, which allows the applicant to identify the cost and environmental  
8 trade-offs associated with developing each one of the candidate sites. Review team visits to  
9 each of the candidate sites provides verification of the critical site-suitability criteria and provides  
10 a mechanism for deriving reasonable assurance that the proposed site has no unforeseen or  
11 fatal flaw that might result in licensing delays, increased costs, or environmental impacts outside  
12 of the identified scope.

13 NUREG-1555, Section 9.3 (III)(12) (NRC 2000) recognizes the potential value of including  
14 existing nuclear power plant sites that were “previously found acceptable on the basis of a  
15 National Environmental Policy Act (NEPA) review, or have [been] demonstrated to be  
16 environmentally acceptable on the basis of operating experience, or allocated to an applicant by  
17 a state government from a list of state approved power plant sites.”

18 Of the four candidate sites, VCSNS and the Savannah River Site met the preceding criteria of  
19 having been previously characterized and found acceptable after a NEPA review.

20 The State of South Carolina also lends considerable influence to the siting process, as can be  
21 found in the PSCSC language regarding implementation of the Utility Facility Siting and  
22 Environmental Protection Act (SC Code Ann. 58-33-160(c)). The statute requires that “the  
23 impact of the facility upon the environment must be justified, considering the state of available  
24 technology and the nature and economics of the various alternatives and other pertinent  
25 considerations.” Finally, the Base Load Review Act, “requires the [South Carolina Public  
26 Service] Commission to go beyond the public convenience and necessity findings required  
27 under the Siting Act and to conduct a full preconstruction prudency review of the proposed  
28 Units” (PSCSC 2009a). Prior to issuance of the CPCN, the South Carolina Office of Regulatory  
29 Staff independently audited and evaluated the SCE&G site-selection process, criteria used for  
30 evaluation, and the final decision to select the VCSNS site as the final proposed site. The  
31 PSCSC, in its Findings of Fact and Conclusions of Law, found that the record clearly supported  
32 the prudency and reasonableness of the selection of the Jenkinsville site (VCSNS) for VCSNS  
33 Units 2 and 3 (PSCSC 2009a).

### 34 **9.3.1.1 SCE&G Alternative Site-Selection Process**

35 SCE&G’s ROI is its legally obligated service area in addition to areas outside, but in close  
36 proximity to the ROI that were capable of supporting the proposed project (SCE&G 2009a).

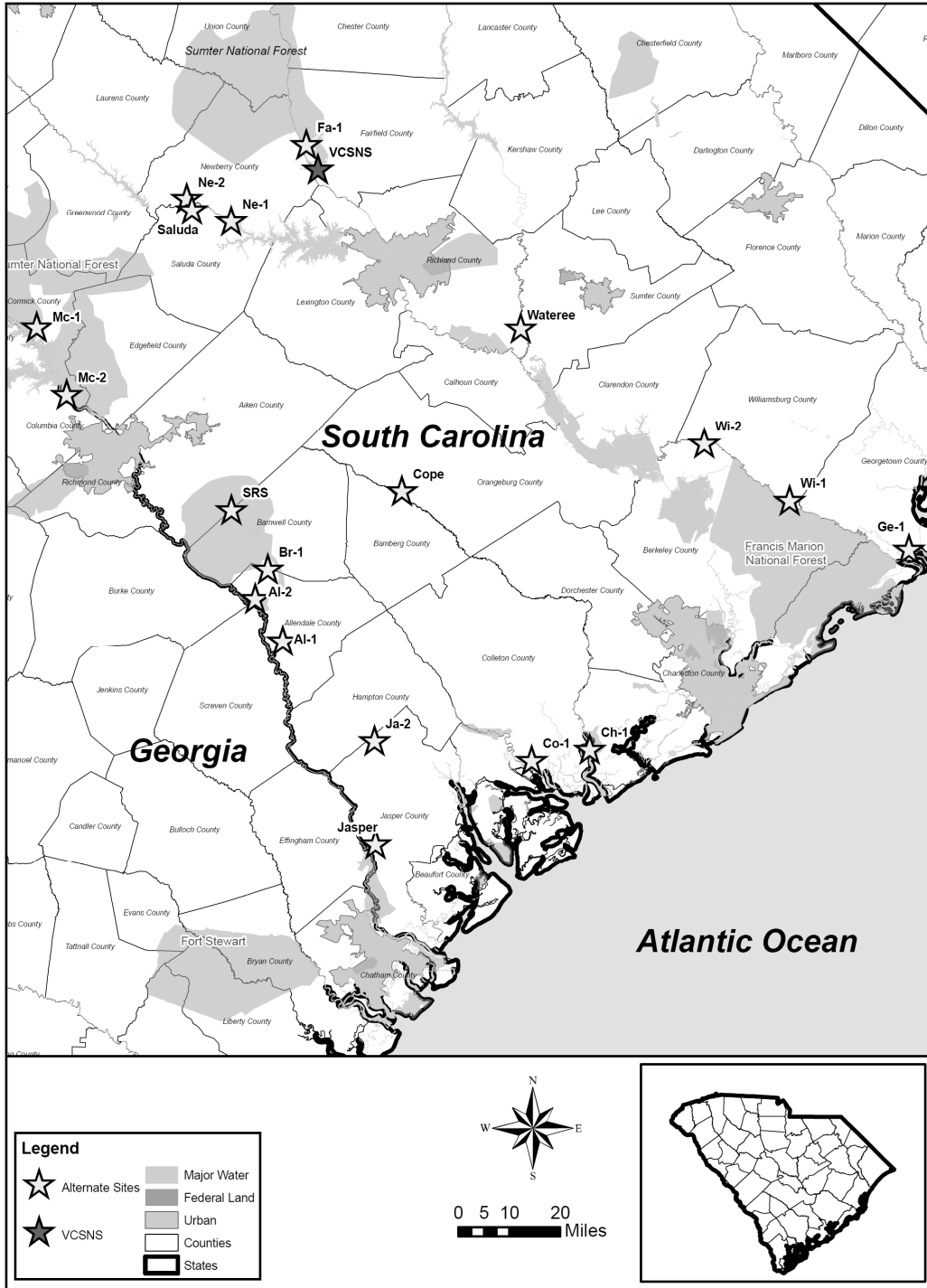
1 This enabled the characterization of areas outside of the franchised service area that  
2 maintained siting advantages such as the availability of land, proximity to transmission and  
3 transportation infrastructure, and environmental factors.

4 The designated ROI is consistent with the guidance in NUREG-1555 (NRC 2000, ESRP 9.3).  
5 The review team concludes that the ROI used in SCE&G's application is reasonable for  
6 consideration and analysis of candidate areas and sites. The review team also finds that  
7 SCE&G's basis for defining its ROI did not arbitrarily exclude desirable locations. Figure 9-1  
8 shows the geographic scope of the ROI analysis and the 20 potential sites that were evaluated  
9 through the site-selection process.

10 SCE&G considered three distinct evaluations in the final selection of the VCSNS site. The first  
11 siting study was the 1974 Dames and Moore study that screened the ROI and provided 18  
12 potential sites for evaluation (Dames and Moore 1974). Collectively, 18 sites were identified in  
13 the initial siting study for evaluation within the ROI: 15 of the sites were greenfield sites and 3  
14 were existing fossil-fired sites. The second siting study, the *South Carolina Electric & Gas*  
15 *(SCE&G) Nuclear Power Plant Siting Study, 2005*, was conducted in 2005 by McCallum-Turner  
16 who deployed the Electric Power Research Institute (EPRI) Siting Guide (EPRI 2002) to re-  
17 evaluate and update the earlier Dames and Moore study using the most current and available  
18 information (McCallum-Turner 2005a). In addition to the previous 18 sites under consideration,  
19 McCallum-Turner identified the Savannah River Site, an existing Federal nuclear site, and the  
20 existing (VCSNS) commercial site for inclusion in the analysis. The site-selection process used  
21 guidance provided in NUREG-1555 (NRC 2000) and the EPRI Siting Guide (EPRI 2002). A  
22 shortcoming of the second evaluation was simply that SCE&G brought forth only two sites for  
23 final characterization, which is inconsistent with NUREG-1555 guidelines which recommend  
24 three to five sites in addition to the proposed site (NRC 2000).

25 The third siting study, the *Nuclear Plant Site Selection Study Report* (Tetra Tech NUS, Inc.  
26 2009), was a compilation of the 1974 and 2005 siting studies. The study was conducted with  
27 the expressed intent of verifying that a reasonable suite of viable candidate sites was  
28 considered using a single methodology and set of criteria, and determining whether there were  
29 any obviously superior sites among the candidate sites for the siting and operation of two  
30 Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000 (AP1000)  
31 pressurized water reactors (Tetra Tech NUS, Inc. 2009). In screening the ROI, SCE&G used a  
32 dual process to confirm that potential sites were represented by both developed and  
33 undeveloped sites. The first process simply made sure that existing nuclear power plant  
34 locations, or other NEPA-characterized locations within the ROI, were included on the potential  
35 site list that would be subject to further analysis. In doing so, SCE&G included the VCSNS site  
36 and the Savannah River Site. The second process evaluated the ROI by applying refined  
37 screening criteria to areas that were found to be capable of supporting potential power plants,  
38 and were considered either "greenfield" (no development) or "brownfield" (existing power plant)  
39 sites.

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1  
2

**Figure 9-1. Potential Site Locations (Tetra Tech NUS, Inc. 2009)**

1 SCE&G provided key criteria for use as “bounding conditions” to aid in the identification and  
2 evaluation of sites for the 2005 McCallum-Turner siting study and the 2009 Tetra Tech NUS,  
3 Inc. evaluation. These factors included the following considerations (McCallum-Turner 2005b ):

- 4 • The sites and evaluations must be consistent with the applicant’s business plans and  
5 objectives (Unit 2 commercial by 2016, accurate reflection of need for power, etc).
- 6 • The site and siting evaluation must be consistent with NRC site suitability requirements  
7 (EPRI Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit  
8 Application dated March 2002 would be used).
- 9 • Compliance with NEPA – National Environmental Policy Act of 1969.

10 SCE&G’s process for screening the 20 potential sites followed a prescriptive methodology by  
11 applying exclusionary criteria appropriate to the geography in consideration and the technology  
12 involved with constructing and operating the proposed AP1000 nuclear power plant. SCE&G  
13 obtained data from publicly available resources such as the Environmental Systems Research  
14 Institute geographic information system database, U.S. Geological Survey (USGS), Federal  
15 Emergency Management Agency, as well as others, and evaluated and verified potential sites  
16 that could support the proposed nuclear power plant. In the selection and application of  
17 screening criteria, SCE&G aligned its 10 screening criteria with NUREG-1555 by focusing on  
18 the preservation of existing conditions and minimizing impacts at potential sites. Broadly,  
19 screening criteria fell into categories that enabled SCE&G to avoid carrying sites forward that  
20 demonstrated significant issues that precluded their use for a nuclear power plant, could cause  
21 significant impacts or degradation of local natural resources on the site, or posed significant  
22 impacts on surrounding terrestrial and aquatic ecosystems (SCE&G 2009a).

23 The 20 potential sites were quantitatively evaluated using the following exclusionary criteria:  
24 seismic, land use, hydrology, geotechnical, terrestrial ecology, aquatic ecology, and  
25 demographics. This reconnaissance-level approach evaluated potential sites by critical  
26 attributes and enabled the elimination of nine potential sites from more costly and in-depth  
27 analysis (Tetra Tech NUS, Inc. 2009). Through this process, SCE&G identified 11 candidate  
28 sites from the 20 potential sites that were carried forward for detailed investigation.

29 The remaining 11 candidate sites were evaluated against EPRI site criteria with both weighting  
30 and ranking factors applied to each of the following 10 criteria: cooling-water supply, flooding,  
31 population, hazardous land use, ecology, wetlands, railroad access, transmission access,  
32 geology/seismic, and land acquisition. Each criterion was then broken down into several  
33 respective sub-criteria to quantify the most meaningful set of measurements. For example,  
34 cooling-water supply was broken down into five categories, including the presence or absence  
35 of a lake or river, minimum flow measurement, average flow measurement, and distance to the  
36 water source. In this manner, each of the 11 candidate sites was subject to the application and  
37 analysis of 27 distinct sub-criteria (Tetra Tech NUS, Inc. 2009). The resulting weighting and



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1 ranking of candidate sites provided SCE&G with clear indications of acceptable alternative sites  
2 to carry forward for further analysis and auditing. Based on its site audit, the review team  
3 elected to carry one additional site forward, Fairfield 1 (FA-1) site, for full analysis because of its  
4 proximity in scoring to the next-highest ranking site.

5 Based on the guidance provided in NUREG-1555 (NRC 2000), the EPRI Siting Guide (EPRI  
6 2002), and in accordance with the site-selection process described by SCE&G, the applicant  
7 selected VCSNS as the proposed site and the three sites that maintained the highest composite  
8 scores were selected as alternative sites. The review team elected to include the FA-1 site as  
9 an alternative site based on its site audit. Of the four alternative sites, one site was a well-  
10 characterized existing nuclear facility; two sites were greenfield sites; and one site was a  
11 brownfield site. The four alternative sites presented for comparative evaluation included the  
12 following:

- 13 • FA-1, Fairfield County (greenfield), South Carolina
- 14 • Cope Generating Station site (brownfield), Orangeburg County, South Carolina
- 15 • Saluda site (greenfield), Saluda County, South Carolina
- 16 • Savannah River (SR) site (at the existing Federal Savannah River Site), Aiken County,  
17 South Carolina.

18 In analyzing each of the four alternative sites, SCE&G performed detailed evaluations  
19 considering environmental benefits, strategic business issues such as constructability and cost  
20 benefits, and additional non-tangible benefits. Specifically, SCE&G determined that there were  
21 advantages to co-locating new nuclear generating units with an existing power plant owned by  
22 SCE&G. The following potential advantages of co-location at the VCSNS site were identified in  
23 the application (SCE&G 2009a):

- 24 • environmental benefits
  - 25 – Extensive onsite conditions are known as a result of years of data collection. It is  
26 reasonable to assume that the impacts of additional units would be comparable to those  
27 of the operating unit.
  - 28 – Construction of new transmission-line corridors may be avoided if the existing  
29 transmission system can accommodate the increased power generation.
  - 30 – The site has already been characterized as mandated by NEPA and was the subject of  
31 extensive environmental screening during the original site-selection process.

- 1 • constructability and cost benefits
- 2 – Site physical criteria, including geologic and seismic, have been fully characterized.
- 3 – No additional land acquisitions would be necessary and the site could accommodate the
- 4 land requirements of the new units
- 5 – Construction, operation, and maintenance costs would be reduced because of existing
- 6 site infrastructure.
- 7 • other benefits
- 8 – The VCSNS site has nearby power markets. The VCSNS site personnel have relevant
- 9 nuclear experience.

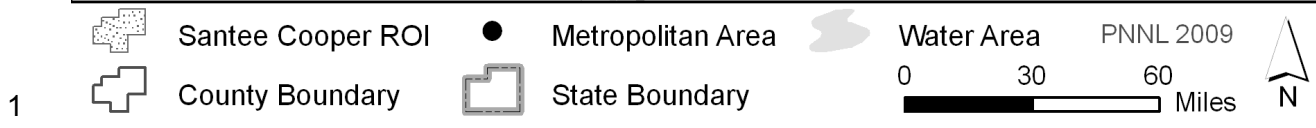
10 The review team considered only environmental matters in its determination of whether an  
 11 alternative site was environmentally preferable to the proposed site and did not consider non-  
 12 environmental issues, such as constructability and cost. The review team recognizes, however,  
 13 that in some cases environmental and cost factors are related. So, for example, a site that  
 14 requires longer transmission lines will have both higher environmental impacts and higher costs  
 15 related to those transmission lines.

16 **9.3.1.2 Santee Cooper Alternative Site-Selection Process**

17 The Santee Cooper ROI coincides with several regulated utilities and many of the electric  
 18 cooperatives within South Carolina. As such, SCE&G evaluated Santee Cooper’s ROI by  
 19 focusing on the 22 counties that lie in northern and northwestern South Carolina and are outside  
 20 of the SCE&G service territory. This region was not evaluated in the SCE&G siting analysis,  
 21 which focused only on the SCE&G service territory, and generally aligns with the service  
 22 territories of Duke Energy and Progress Energy. Figure 9-2 outlines the additional counties  
 23 reviewed by SCE&G (2009f).

24 Due to the interconnected transmission system that Santee Cooper maintains in supplying  
 25 power throughout the ROI, and the fact that the Santee Cooper system coincides with regulated  
 26 utilities operating in the same region, SCE&G reviewed and evaluated recent alternative site-  
 27 selection studies prepared by Duke Energy for the William States Lee III Nuclear Station (Duke  
 28 2009a) and Progress Energy for the Shearon Harris Nuclear Power Plant (PE 2008) specifically  
 29 for the South Carolina sites, as well as the siting analysis performed by MACTEC for Santee  
 30 Cooper’s coal-fired Pee Dee Generating Station (MACTEC 2006). Collectively, these site-  
 31 selection studies accounted for a reconnaissance-level review of over 20 potential sites, and a  
 32 detailed review of 9 sites located within South Carolina.

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**Figure 9-2.** Santee Cooper Region of Interest (SCE&G 2009f)

1 Because all nine sites were found to be viable sites based on previous siting studies, SCE&G's  
2 evaluation focused primarily on the application of reconnaissance-level criteria to determine if  
3 any one of the sites could rank equal to or better than the four alternative sites already identified  
4 in the VCSNS siting study. Of primary consideration, and with what might be expected when  
5 proposing to site a power plant outside of the franchised service territory or declared ROI, this  
6 included criteria such as the ability to own or control the property, distance to and impact on  
7 transmission corridor access, proximity to load centers, and critical site-development  
8 requirements such as improving water supply and availability. The criteria were consistent with  
9 those used in the SCE&G Site Selection Study Report (Tetra Tech NUS, Inc. 2009). In  
10 accordance with NUREG-1555 guidelines, which support the use of reconnaissance-level  
11 criteria to screen out potential sites from further evaluation, consideration of the Santee Cooper  
12 ROI did not "substantially improve" the environmental diversity of SCE&G's siting options  
13 (NUREG-1555 [NRC 2000]). Therefore, in the application of criteria, SCE&G did not carry  
14 forward any of the nine additional sites for in-depth comparative analysis, because they did not  
15 rank equal to or better than the proposed four alternative sites, nor did they improve the  
16 environmental diversity of SCE&G siting options.

17 Three sites evaluated in the Duke Energy service territory were Lee, Keowee, and Middleton  
18 Shoals. Each of the sites is currently owned by Duke Energy, and control of the property would  
19 be difficult to obtain. Furthermore, the distances to SCE&G high-voltage transmission lines runs  
20 from 45 to 85 mi requiring the development of transmission-line corridors, while distances to the  
21 major load centers is even farther, requiring extensive transmission system upgrades.  
22 Consistent with the siting analysis performed by Duke Energy, each of the sites would likely  
23 require site modifications such as the construction of a supplemental water reservoir (SCE&G  
24 2009f). As part of the alternative siting analysis and audit performed for the Lee site COLA, the  
25 NRC staff participated in onsite audits of each of the three Duke Energy sites under  
26 consideration (Lee, Keowee, and Middleton Shoals). Due to the preceding considerations, the  
27 review team found that the reconnaissance-level information evaluated for the alternative sites  
28 in the Lee COLA, in combination with the utility requirements for SCE&G and Santee Cooper,  
29 did not indicate that there was a site located within the Duke Energy service territory that would  
30 rank higher than the candidate sites in the SCE&G study.

31 Two sites evaluated in the Progress Energy Carolinas service territory included the existing H.B.  
32 Robinson Nuclear Plant site and a greenfield site located in Marion County. The Robinson site,  
33 as a Progress Energy-owned site, would require SCE&G and Santee Cooper to acquire rights to  
34 construct and operate on it; they would also have to acquire the Marion County site property as  
35 well. Similar to the issues discussed previously for candidate sites outside of the SCE&G service  
36 territory, the construction and operation of a power plant at either of these sites would require  
37 extensive development of transmission-line corridors and transmission system upgrades due to  
38 the distances to existing transmission infrastructure and load centers. At the Robinson site, water  
39 supply limits due to thermal restrictions on the lake may preclude the successful construction and

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1 operation of a two-unit nuclear power plant. Finally, the Marion site may require the construction  
2 of a cooling-water reservoir and has considerable wetland acreage onsite (SCE&G 2009f). As  
3 part of the alternative siting analysis and audit performed for the Harris site COLA, the NRC staff  
4 participated in onsite audits of each of the two Progress Energy Carolina sites under  
5 consideration (Robinson and Marion County). Due to the preceding considerations, the review  
6 team found that the ground-level information evaluated for the alternative sites in the Harris  
7 COLA, in combination with the utility requirements for SCE&G and Santee Cooper, did not  
8 indicate that there was a site located within the Progress Energy Carolinas service territory that  
9 would rank higher than the candidate sites in the SCE&G study.

10 Of the six sites evaluated in Santee Cooper's Pee Dee coal-fired power plant siting analysis,  
11 two of the sites were in close proximity to the AI-1 and Wateree sites identified by SCE&G in its  
12 site-selection process used for the VCSNS siting analysis. Because the two sites evaluated by  
13 Santee Cooper shared similar environmental characteristics with the sites identified in the  
14 SCE&G site-selection analysis and because there were no significant differences between the  
15 two comparable locations, the sites were not carried forward. SCE&G then reviewed the  
16 remaining four candidate sites, which included three sites located on the Great Pee Dee River  
17 (sites 7, 9, and 10), and one site located on Bull Creek (site 6). Site 7 was the preferred site for  
18 the Pee Dee coal-fired project and is the only site owned by either utility. Further, sites 7, 9, and  
19 10 would require the construction of a cooling-water reservoir to ensure adequate water supply  
20 in low flow periods. All four sites would require the development of approximately 65 mi of new  
21 transmission-line corridors to connect to the existing SCE&G transmission infrastructure, as well  
22 as significant transmission system upgrades to provide power to the major load centers located  
23 from 75 to 85 mi away (SCE&G 2009f).

24 Due to the preceding considerations, the review team found that the reconnaissance-level  
25 information evaluated by SCE&G for the alternative sites in the Pee Dee coal-fired project, in  
26 combination with the utility requirements for SCE&G and Santee Cooper, did not indicate that  
27 there was a site located within the Santee Cooper service territory that would rank higher than  
28 the candidate sites in the SCE&G study.

### 29 **9.3.1.3 Conclusions About the Alternative Site-Selection Process**

30 The review team evaluated the methodology used by SCE&G and concluded that the process  
31 for selecting and evaluating alternative sites, including the final proposed VCSNS site, was  
32 reasonable and consistent with the guidelines presented in NUREG-1555 and the EPRI Siting  
33 Guide.

34 The review team also evaluated the SCE&G analysis of the Santee Cooper service territory,  
35 including site-selection studies performed by Duke Energy, Progress Energy, and MACTEC for  
36 Santee Cooper's siting of the Pee Dee coal-fired project. Each of the site-selection studies  
37 individually followed a prescriptive process for the comparative evaluation of alternative sites,

1 and included the detailed analysis of nine sites located within the Santee Cooper service  
2 territory. The review team concluded that none of the sites identified in the Santee Cooper  
3 siting analysis would rank higher than the candidate sites identified in the SCE&G study based  
4 on critical siting criteria, such as the proximity to transmission access and load centers, the  
5 need for cooling-water reservoirs to ensure adequate water availability, and land availability.

6 Finally, the review team recognizes the siting precedence established by the State of South  
7 Carolina through the PSCSC process as part of the CPCN evaluation and findings (PSCSC  
8 2009a) and the through the South Carolina General Assembly (SC Code Ann. § 58-33-200) as  
9 part of the legislative language permitting Santee Cooper to participate with SCE&G in the  
10 construction and operation of a nuclear power plant at the Fairfield County site. This  
11 precedence is afforded “substantial weight” under NUREG-1555 guidelines, having undergone  
12 rigorous evaluation and extensive review (NRC 2000).

13 The review team found that the systematic alternative siting analysis demonstrated a logical  
14 selection process and application of screening and exclusionary siting criteria. The analysis  
15 enabled the evaluation of the likely environmental impacts associated with the respective sites,  
16 including the evaluation of suitability criteria; identified acceptable alternative sites; and clearly  
17 provided the mechanism for selection of the final proposed site. The review team evaluated the  
18 siting methodology used by SCE&G to select its ROI, potential sites, candidate sites, and  
19 alternative sites. Based on SCE&G’s description of its process and the review team’s  
20 evaluation of the criteria used, and as addressed in the analysis in the previous section, the  
21 review team determined that the process used to identify alternative sites was a logical  
22 approach and was therefore acceptable.

### 23 **9.3.2 NRC/USACE Alternative Site Evaluation**

24 The four alternative sites (FA-1, CGS, Saluda, and SR) are examined in detail in Sections 9.3.3  
25 through 9.3.6. The review team visited each of the four alternative sites as well as the proposed  
26 site in March 2009. Section 9.3.7 contains tables of the review team’s characterization of the  
27 cumulative impacts of the proposed action at the proposed and alternative sites.

28 Following the guidance promulgated in ESRP 9.3 (NRC 2000), the review team visited the four  
29 alternative sites and collected and analyzed reconnaissance-level information for each of the  
30 sites. The review team then used the information provided in the ER, RAI responses, and  
31 information from other Federal and State agencies, and information gathered during the visits to  
32 each alternative site to evaluate the cumulative impacts of building and operating two new  
33 nuclear power plants at those sites. The analysis therefore includes the impacts of NRC-  
34 authorized construction and operation as well as potential impacts associated with other actions  
35 affecting the same resources. Cumulative impacts occur when the effects of an action are  
36 added to or interact with other effects in a particular place and within a particular time; as a

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1 result, the cumulative impact assessment entails a more extensive and broader review of  
2 possible effects of the action beyond the site boundary.

3 The cumulative analysis for the impacts at the alternative sites was performed in the same  
4 manner as discussed in Chapter 7 for the proposed site except, as specified in ESRP 9.3 (NRC  
5 2000), the analysis was conducted at the reconnaissance level for the alternative sites. To  
6 inform the cumulative impacts analysis, the review team researched EPA databases for recent  
7 EISs within the state; used an EPA database for permits for water discharges in the geographic  
8 area to identify water-use projects; and used [www.recovery.gov](http://www.recovery.gov) to identify projects in the  
9 geographic area funded by the American Recovery and Reinvestment Act of 2009 (Public Law  
10 111-5). The review team developed tables of the major projects near each alternative site that  
11 were considered relevant in the cumulative analysis. The review team used the information to  
12 perform an independent evaluation of the direct and cumulative impacts of the proposed action  
13 at the alternative sites to determine if one or more of the alternative sites were environmentally  
14 preferable to the proposed site.

15 Included are past, present, and reasonably foreseeable Federal, non-Federal, and private  
16 actions that could have meaningful cumulative impacts with the proposed action. For the  
17 purposes of this analysis, the past is defined as the time period prior to receipt of the COL  
18 application. The present is defined as the time period from the receipt of the COL application  
19 until the beginning of activities associated with building proposed Units 2 and 3. The future is  
20 defined as the beginning of building activities (construction and preconstruction activities)  
21 associated with Units 2 and 3, through operation and eventual decommissioning.

22 The specific resources and components that could be affected by the incremental effects of the  
23 proposed action and other actions in the same geographic area were identified. The affected  
24 environment that serves as the baseline for the cumulative impacts analysis is described for  
25 each alternative site, and a qualitative discussion of the general effects of past actions is  
26 included. The geographic area over which past, present, and future actions could reasonably  
27 contribute to cumulative impacts is defined and is described in later sections for each resource  
28 area. The analysis for each resource area at each alternative site concludes with a cumulative  
29 impact finding (SMALL, MODERATE, or LARGE). For those cases in which the impact level to  
30 a resource was greater than SMALL, the review team also discussed whether building and  
31 operating the nuclear units would be a significant contributor to the cumulative impact. In the  
32 context of this evaluation, "significant" is defined as a contribution that is important in reaching  
33 that impact-level determination.

34 The cumulative impacts are summarized for each resource area in the sections that follow. The  
35 level of detail is commensurate with the significance of the impact for each resource area. The  
36 findings for each resource area at the VCSNS site and each alternative site are then compared  
37 in Table 9-31. The results of this comparison are used to determine if any of the alternative  
38 sites are environmentally preferable to the proposed site. If any alternative site is determined to

1 be environmentally preferable, the review team would evaluate whether that alternative site was  
2 obviously superior.

3 The impacts described in Chapter 6 of this EIS (e.g., nuclear fuel cycle; decommissioning)  
4 would not vary significantly from one site to another. This is true because all of the alternative  
5 sites and the proposed site are in low-population areas and because the review team assumes  
6 the same reactor design (therefore, the same fuel cycle technology, transportation methods,  
7 and decommissioning methods) for all of the sites. As such, these impacts would not  
8 differentiate between the sites and would not be useful in the determination of whether an  
9 alternative site is environmentally preferable to the proposed site. For this reason, these  
10 impacts are not discussed in the evaluation of the alternative sites.

### 11 **9.3.3 The FA-1 Site**

12 This section covers the review team's evaluation of the potential environmental impacts of siting  
13 a two-unit nuclear power plant at the FA-1 site located in Fairfield County, South Carolina. The  
14 following sections describe a cumulative impact assessment conducted for each major resource  
15 area. The specific resources and components that could be affected by the incremental effects  
16 of the proposed action if it were implemented at the FA-1 site and other actions in the same  
17 geographic area were considered. This assessment includes the impacts of NRC-authorized  
18 construction, operations, and preconstruction activities. Also included in the assessment are  
19 other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that  
20 could have meaningful cumulative impacts when considered together with the proposed action if  
21 implemented at the FA-1 site. Other actions and projects considered in this cumulative analysis  
22 are described in Table 9-6.

23 The FA-1 site is a privately owned, 6000-ac, undeveloped greenfield site located on the eastern  
24 bank of the Broad River approximately 2 mi north of the Parr Reservoir, and 1 mi to the west of  
25 Monticello Reservoir. Figure 9-3 shows the FA-1 alternative site region.

26 As an undeveloped greenfield site, FA-1 is primarily forested land composed of rolling hills and  
27 steep stream valleys, interspersed with limited amounts of open water and forested wetlands.  
28 The site also contains a limited number of residences primarily on the eastern boundary of the  
29 site. The site is bounded on the east by County Road 3, on the west by the Broad River, and on  
30 the north by State Highway 301 (SC-301). The Sumter National Forest lies to the immediate  
31 north of the site.

32 Locally, the area supports several small, rural, unincorporated communities located within 5 mi  
33 of the site. The site is located about 31 mi northwest of Columbia, South Carolina, and  
34 approximately 45 mi southwest of Rock Hill, South Carolina.



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1 **Table 9-6.** Past, Present, and Reasonably Foreseeable Projects and Other Actions  
 2 Considered in the FA-1 Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
VCSNS Unit 1	VCSNS Unit 1 consists of one 996-MW(e) nuclear power generating plant.	5.5 mi south-southwest of FA-1	VCSNS Unit 1 is currently operational and is licensed to continue operations through August 6, 2042 <sup>(a)</sup>
Carolinas-Virginia Tube Reactor (CVTR)	Experimental pressurized tube heavy water nuclear power reactor	About 7.5 mi south of FA-1	Undergoing Decommissioning <sup>(b)</sup>
Independent Spent Fuel Storage Installation	Dry spent-fuel storage	About 8 mi south of FA-1	Proposed <sup>(c)</sup>
Old Steam Generator Recycle Facility	Decommissioned steam generator storage	About 8 mi south of FA-1	Operational <sup>(c)</sup>
Lee Nuclear Station	Two Westinghouse AP1000 pressurized water reactors	About 47 mi upstream (north) on Broad River	Proposed new nuclear plant. Operation would begin in 2018-2021 <sup>(d)</sup>
Catawba Nuclear Station, Units 1 and 2	Two 1129-MW(e) Westinghouse reactors	About 50 mi north-northeast of FA-1	Operational <sup>(e)</sup>
H.B. Robinson Steam Electric Plant, Unit 2	Nuclear power generating plant with one 710-MW(e) unit	About 70 mi east of FA-1	Operational <sup>(f)</sup>
McGuire Nuclear Station, Units 1 and 2	Two 1100-MW(e) Westinghouse reactors	About 78 mi north-northeast of FA-1	Operational <sup>(g)</sup>
Vogtle Electric Generating Plant (VEGP)	Nuclear power generating plant with 2 units, VEGP 1 (1109 MW(e)) and VEGP 2 (1127 MW(e))	Approx 80 mi south-southwest of FA-1	Operational <sup>(h)</sup>
VEGP Units 3 and 4	Nuclear power generating plant with two Westinghouse AP 1000 pressurized water reactors	Approx 80 mi south-southwest of FA-1	Proposed <sup>(i)</sup>
Oconee Nuclear Station, Units 1, 2, and 3	Three 846-MW(e) Babcock and Wilcox reactors	About 92 mi west-northwest of FA-1	Operational <sup>(j)</sup>
SCE&G Parr Hydroelectric Plant	A 14-MW(e) hydroelectric plant	About 6.9 mi downstream on Broad River	Parr Hydro Plant is currently operational <sup>(k)</sup>
SCE&G Fairfield Pumped Storage Plant	A 511.2-MW(e) hydroelectric plant. VCSNS Units 2 and 3 would use water supply from this facility.	About 4.1 mi downstream on Parr Reservoir (Broad River)	The Fairfield Pumped Storage Plant is currently operational <sup>(c)</sup>
Buzzard Roost Combustion Turbine Station	A 196-MW oil/gas-fired peaking facility	Approx 35 mi west-southwest of FA-1	Operational <sup>(l)</sup>
Buzzard Roost Dam	A 15-MW hydroelectric facility	Approx 35 mi west-southwest of FA-1	Operational <sup>(m)</sup>

3

**Table 9-6.** (contd)

Project Name	Summary of Project	Location	Status
Westinghouse Fuel Fabrication Plant in Columbia, South Carolina	Design and fabricate completed nuclear fuel assemblies and fuel-related products, such as top and bottom nozzles, control rods, and zirconium diboride and erbia integral fuel burnable absorbers for pressurized water reactors and Vodo-Vodyanoi Energetichesky Reactors.	About 35 mi southwest of FA-1	Operational <sup>(n)</sup>
Six Broad River Hydroelectric Projects	Hydroelectric facilities	5 upstream of FA-1 on the Broad River and 1 downstream on the Broad River	Operational <sup>(c)</sup>
Transmission Lines	Various transmission lines currently exist throughout region and installation of additional lines would occur if new nuclear plants or other large energy projects are built. New transmission lines could require the following: widening of existing corridors, building new corridors, moving facilities within corridors, building new facilities within corridors.	Throughout region	Currently existing as well as the potential for additional transmission lines to be built.
Mining Projects			
Vulcan Materials Company/Blair Quarry	Products include asphalt aggregate, base material, concrete, aggregate, and manufactured sand.	About 5 mi north of FA-1	Operational <sup>(o)</sup>
Transportation Projects			
South Carolina Strategic Corridor System Plan	Strategic system of corridors forming the backbone of the State's transportation system.	State-wide	Planning document with no explicit schedules for projects, however, many strategic corridors coincide with routes which would/could be used for development at the FA-1 site <sup>(p)</sup>
Parks and Aquaculture Facilities			
Sumter National Forest	371,000-ac national forest.	About 3.5 mi northwest of FA-1 boundary	Currently managed by U.S. Forest Service <sup>(q)</sup>
Parr Hydro Wildlife	4400-ac wildlife management	About 5.4 mi south-	Currently managed by SC

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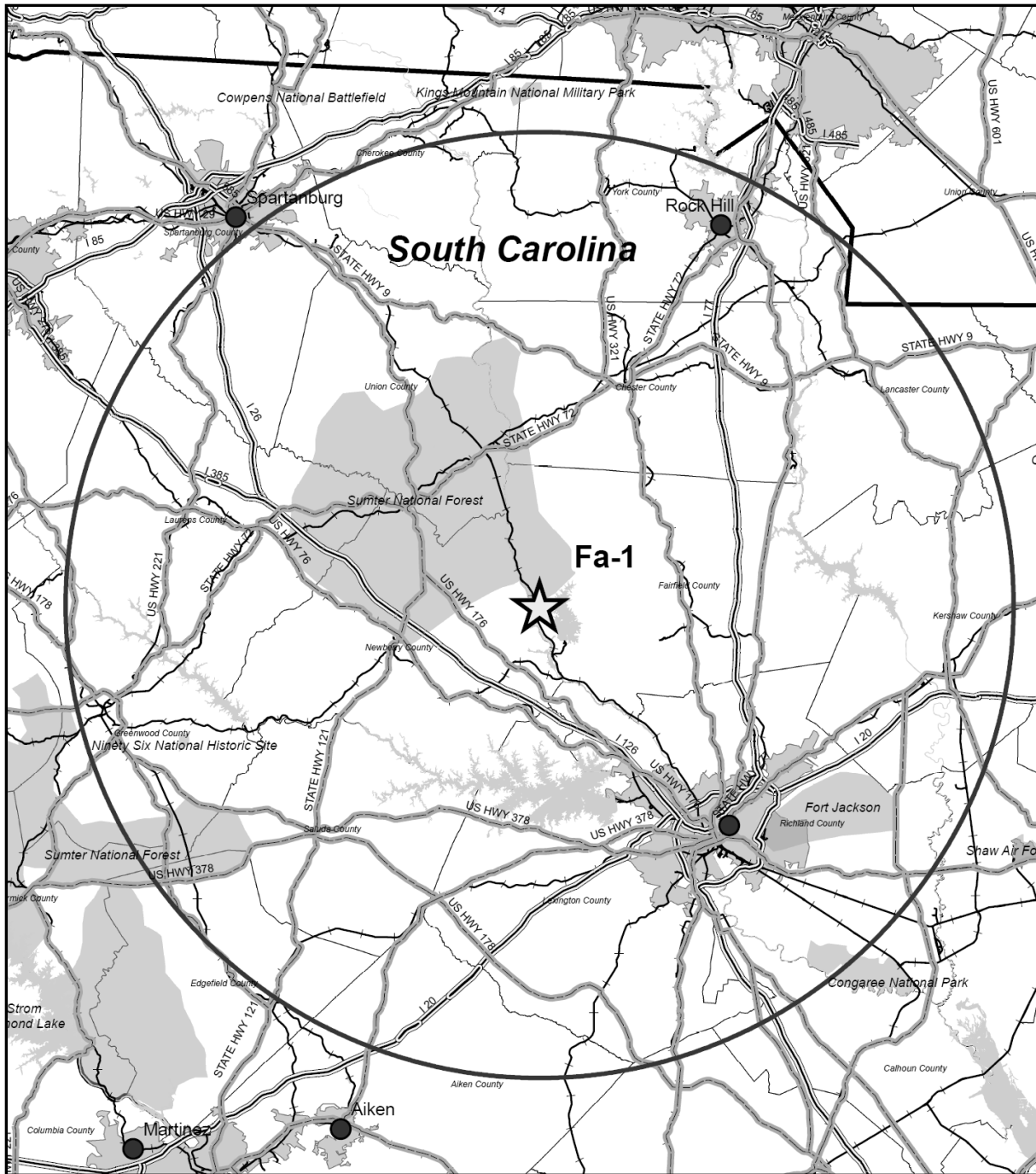
**Table 9-6.** (contd)

Project Name	Summary of Project	Location	Status
Management Area	area	southwest of FA-1	DNR <sup>(c)</sup>
Other parks, forests, and reserves	Several parks, recreation, and conservation areas are located within the 50-mi region. Examples of such areas include Lake Wateree, the Catawba River, Monticello and Parr reservoirs, Broad River, Lake Murray, Dreher Island State Park, Lake Greenwood, Riverbanks Zoo and Garden, Congaree National Park, Harbison State Forest, and Sesquicentennial State Park.	Throughout region	Currently managed by various local, State, and Federal agencies and organizations.
Other Actions/Projects			
City of Columbia	Municipal water withdrawals from the Broad River	About 30 mi southeast of FA-1	Ongoing <sup>(c)</sup>
Various hospitals	Medical isotopes	Within 50 mi of FA-1	Operational in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens, Greenwood, and Camden
Cone Mills Carlisle Finishing Co.	Fabric finisher	About 16.5 mi north of FA-1 on Broad River	Currently operational <sup>(r)</sup>
Chemtrade Performance Chemicals, LLC	Industrial inorganic chemicals	About 17.5 mi north of FA-1 on Broad River	Currently operational <sup>(s)</sup>
Newberry County Water & Sewer Authority (NCW&SA)/Cannons Creek Waste Water Treatment Plant (WWTP)	Wastewater treatment	About 8.3 mi southwest of FA-1	Currently operational <sup>(t)</sup>
NCW&SA Broad River Wastewater Treatment Facility (WWTF) Phase 1	WWTF currently maintains a non-major NPDES permit.	About 12 mi west of FA-1	Currently operational <sup>(u)</sup>
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroad; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use	Throughout region	Construction would occur in the future, as described in State and local land-use planning documents

**Table 9-6.** (contd)

Project Name	Summary of Project	Location	Status
	<p>planning documents. There is a low-to-moderate potential for increase urbanization within the Broad River watershed in Newberry and Fairfield Counties, South Carolina. The highest potential for development would be associated with residential development around the reservoirs, the Towns of Prosperity and Pomaria, and the City of Newberry Sumter National Forest would limit urbanization north of FA-1.</p>		
<p>(a) Source: NRC 2004                  (b) Source: NRC 1996                  (c) Source: SCE&amp;G 2009a                  (d) Source: NRC 2007                  (e) Source: NRC 2009a                  (f) Source: NRC 2009b                  (g) Source: NRC 2009c                  (h) Source: NRC 2009e                  (i) Source: NRC 2009f                  (j) Source: NRC 2009d                  (k) Source: EPA 2009g                  (l) Source: Duke 2009b                  (m) Source: Greenwood County 2008                  (n) Source: Westinghouse 2009                  (o) Source: SCDHEC 2009c                  (p) Source: SCDOT 2009                  (q) Source: USFS 2004                  (r) Source: EPA 2009c                  (s) Source: EPA 2009a                  (t) Source: EPA 2009h, k                  (u) Source: EPA 2009b</p>			

# Environmental Impacts of Alternatives



1  
2

Figure 9-3. FA-1 Alternative Site Region

### 1 9.3.3.1 Land Use and Transmission-Line Corridors

2 In addition to land-use impacts from building and operations at the FA-1 site, the cumulative  
3 analysis considers other past, present, and reasonably foreseeable future actions that could  
4 contribute to the cumulative land-use impacts, including other Federal and non-Federal projects  
5 and the projects listed in Table 9-6. For the analysis of land-use impacts at the FA-1 site, the  
6 geographic area of interest is considered to be the 50-mi region centered on the FA-1 site plus  
7 any transmission-line corridors that extend beyond that range. Most but not all of the  
8 transmission-line corridors' length does fall within a 50-mi radius of the site. Land-use planning  
9 for transmission-line routing over wide areas must consider land-use plans of adjoining counties  
10 and other land-managing agencies, rather than considering one county in isolation.  
11 Furthermore, in predominantly rural settings such as that surrounding the FA-1 site, land-use  
12 changes occurring substantial distances away from a project site can substantially influence  
13 land-use planning decisions close to the site. Roads and other public facilities and services in  
14 rural areas tend to serve people who are spread thinly but broadly over large portions of the  
15 landscape. Therefore, land-use changes can affect roads and other facilities at greater  
16 distances than similar changes in more densely populated areas. The FA-1 site presently is  
17 undeveloped and predominantly forested. It is located in a sparsely populated, largely rural  
18 area, with forests and small farms composing the dominant land use. Historically, most upland  
19 areas have been used for crop production, but presently are used for silviculture. Several  
20 electric transmission lines, State routes, and interstate highways currently traverse the region.  
21 The current comprehensive land-use plan for Fairfield County (V&A 1997) indicates that the FA-  
22 1 site is currently zoned as "Residential Conservation and Development" and links the area with  
23 the shoreline of both Monticello Reservoir and the Parr Reservoir, which also have this zoning.  
24 A change in zoning would be required to develop the FA-1 site because current zoning  
25 discourages nonresidential development from this area (V&A 1997)

26 Development of the proposed new units on the FA-1 site would convert existing land uses on  
27 about 400 ac of currently forested land to utility uses for the nuclear facility and associated  
28 structures and infrastructure. Similar to the VCSNS site, each AP1000 unit would require the  
29 addition of three 230-kV transmission lines, each of which would occupy a 100-ft-wide  
30 transmission-line corridor. Based on information provided by SCE&G, (SCE&G 2009d)  
31 describing dimensions of conceptual transmission-line corridors for the FA-1 site, approximately  
32 443 mi covering 5800 ac of land would be needed. The proposed routing would use existing  
33 corridors to the extent practicable, so that although the linear runs extend over 440 mi, relatively  
34 little of that distance would require entirely new corridor. The actual area of land disturbance,  
35 used for assessing impacts on terrestrial ecology and cultural resources, is therefore  
36 substantially lower than suggested by the overall land-use requirements. The review team  
37 concludes that the land-use impact of the transmission-line installation activities would be  
38 generally similar to those described for the VCSNS site in Section 4.1.2. SCE&G stated that all  
39 land clearing associated with nuclear facility and transmission-line development would be

## Environmental Impacts of Alternatives

1 conducted according to Federal, State, and local regulations, permit requirements, existing  
2 SCE&G and Santee Cooper procedures, good construction practices, and established BMPs  
3 (SCE&G 2009a).

4 Because the other projects described in Table 9-6 do not include any significant reasonably  
5 foreseeable changes in land-use types within 50 mi of the FA-1 site, there would not be any  
6 significant additional cumulative impacts on land use from those activities.

7 As described above, installation of new transmission-line corridors to support the new units  
8 could need as much as 5800 ac over 443 mi of length. If additional transmission lines are built  
9 from other energy projects, there would be a cumulative land-use impact from the additional  
10 amount of land converted to utility corridor use for transmission lines. Because transmission  
11 lines are often co-located and are relatively narrow, the review team expects that the cumulative  
12 impact would be consistent with the land-use plans and zoning regulations of the affected  
13 counties. Nonetheless, consistent with the review team's analysis in Sections 4.1 and 7.1,  
14 multiple new transmission-line corridors could noticeably alter the land-use classification  
15 acreage proportions, both within the vicinity of the FA-1 site and within the 50-mi region.

16 Cumulative land-use impacts within the region are expected to be manageable because the  
17 activities would be consistent with existing land-use plans, and the necessary zoning change is  
18 not expected to be difficult to obtain. However, due to potential impacts of transmission-line  
19 development crossing numerous individual properties, especially where the corridor will not fall  
20 within or parallel existing transmission-line corridors and reclassification of acreage within the  
21 region caused by transmission-line development, the review team concludes that the cumulative  
22 land-use impacts associated with the proposed project at the FA-1 site, related transmission-line  
23 corridor development, and other projects in the geographic area of interest would be  
24 MODERATE. Building and operating two new nuclear units at the FA-1 site would be a  
25 significant contributor to these impacts.

### 26 **9.3.3.2 Water Use and Quality**

27 The FA-1 site is a greenfield site located approximately 5 mi from the existing VCSNS site near  
28 the eastern bank of the Broad River (see Figure 9-3). The site hydrology, water use, and water  
29 quality are discussed in SCE&G (2009e) and this section of the draft EIS draws its information  
30 from that source. Given the FA-1 site's close proximity to the VCSNS site, SCE&G takes the  
31 same water-use approach and considers surface water to be the primary source of water for  
32 building and operations. In particular, SCE&G proposes using the same waterbodies for both  
33 withdrawal (Monticello Reservoir) and discharge (Parr Reservoir) as proposed for the VCSNS  
34 site. This approach results in impacts on water use, supply, and quality that are essentially  
35 identical to the impacts discussed in Sections 4.2, 5.2, and 7.2 for the VCSNS site.

1 The differences between the proposed action and the FA-1 alternative with respect to water use  
 2 and quality are (1) the alternative intake structure from Monticello Reservoir would be from the  
 3 northern shore rather than the proposed southern shore, (2) the alternative discharge structure  
 4 would be approximately 5 mi further upstream than the proposed discharge structure, and (3)  
 5 the alterations to the topography would differ between the alternative and proposed sites.  
 6 Although detailed analysis would be required to quantify the localized impact differences  
 7 between the sites for water use and quality in the Broad River or Monticello Reservoir, the  
 8 impacts that would be different are minor local impacts. There are no notable tributary flows to  
 9 the Broad River between the alternative and proposed discharge locations aside from the  
 10 SCE&G Fairfield Pumped Storage Facility (FPSF).

11 Similar to the discussion in Section 5.2.2.1, surface water at the site is available from the  
 12 Monticello Reservoir as supplied by the Broad River through the FPSF. Representative  
 13 historical flow data for water is available for Broad River near Alston, South Carolina (USGS  
 14 2008a) (see Table 2-5). Table 9-7 lists the reduction in flow for the Broad River that would  
 15 occur as a result of being the sole water source for the operation of two units at this site. This  
 16 table also includes the assessed impact levels. Because withdrawal of surface water to meet  
 17 the needs of the proposed units would create a reduction of less than 5 percent of the mean  
 18 annual flow, the associated water-use impact is assessed to be minimal.

19 **Table 9-7.** Broad River Reduction in Flow and Assessed Impact Levels

<b>Broad River Flow Condition</b>	<b>River Flow Rate (cfs)</b>	<b>Normal Consumptive Use (cfs)</b>	<b>Percent Flow Reduction</b>	<b>Impact Level</b>
Annual Mean Flow	6300	62	1.0	Minimal
Lowest Annual Flow	2150	62	2.9	Minimal

20 Because all the water needed to support the building and operation of two new units at FA-1  
 21 would come from Monticello Reservoir, groundwater-use impacts would be restricted to aquifer  
 22 dewatering during the building phase. Because this assessment is similar to the one found in  
 23 Section 4.2.2.2, in that (1) the underlying aquifers demonstrate generally low permeability and  
 24 (2) excavation dewatering is likely to be temporary and of limited volume, the impact is  
 25 considered minimal.

26 Building and operational activities that could affect surface-water quality include hydrologic  
 27 alterations (e.g., creek or stream drainages or realignment), and water-treatment plant and  
 28 cooling-tower blowdown discharges. As discussed in Section 4.2.3.1, the development of a  
 29 stormwater pollution prevention plan with its call for implementation of BMPs would minimize  
 30 water-quality impacts. As discussed in Section 5.2.3.1, the requirements of a NPDES-permitted  
 31 outfall would ensure the protection of water quality through compliance with the Clean Water  
 32 Act. Given the implementation of BMPs and the need for a SCDHEC-issued NPDES permit, the  
 33 impact on surface-water quality is assessed to be minimal. The impacts of the building and  
 34 operation of two new units at FA-1 on groundwater quality may occur due to leaching of spilled



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1 pollutants and effluents into the subsurface. However, based on experience with other similar  
2 facilities, the staff concludes that, with the implementation of BMPs, the impacts on groundwater  
3 quality from building and operating two new nuclear units at the FA-1 site would likely be  
4 minimal.

### 5 ***Cumulative Impacts***

6 In addition to water-use and water-quality impacts from building and operations activities,  
7 cumulative impacts analysis considers other past, present, and reasonably foreseeable future  
8 actions that affect the same environmental resources. For the cumulative analysis of impacts  
9 on surface water, the geographic area of interest for the FA-1 site is considered to be the  
10 drainage basin of the Broad River upstream and downstream of the site because this is the  
11 resource that would be affected by the proposed project. Key actions that have past, present,  
12 and future potential impacts on surface-water supply and surface-water quality in the Broad  
13 River basin include operation of VCSNS Unit 1, operation of the FPSF that connects Monticello  
14 Reservoir with Parr Reservoir, the Newberry County Water and Sewer Authority (NCW&SA),  
15 Broad River Wastewater Treatment Plant (WWTP), the NCW&SA Cannons Creek WWTP, and  
16 the SCE&G Parr Hydroelectric Generating Station (or Plant). These are the same as those  
17 identified as having potential impacts on surface-water supply and surface-water quality in the  
18 Broad River with the proposed action, which are described in Section 7.2.

19 Increases in consumptive use of water in the Broad River drainage are anticipated in the future  
20 and discussed in Section 7.2.1. This earlier discussion notes that Duke Energy is proposing to  
21 build two nuclear reactors at the William States Lee III Nuclear Station in Cherokee County,  
22 South Carolina (Duke 2009b). Duke has prepared an assessment of water availability and  
23 projected use for Broad River to determine the availability of water to support expansions of  
24 Duke's generating capability (Duke 2007). Duke considered future agriculture and irrigation  
25 projects, power projections, public water supplies and wastewater projections, and future  
26 industrial use. Duke also considered future trends in water use such as water reuse, water  
27 conservation, and changes in regulations and the regional economy. The Duke study does not  
28 consider the impact of climate change. The study states that consumptive water use would  
29 increase in the Broad River drainage from the 241.5 cfs in 2006 to 412.9 cfs by 2070. Duke  
30 asserts that the study will enable it to plan for water needs and develop water-storage facilities  
31 necessary to support the operation of its proposed facilities. Similarly, SCE&G asserts that the  
32 impact of consumptive use by VCSNS Units 1, 2, and 3 during low flows can be mitigated by  
33 using water from Monticello Reservoir.

34 As discussed in Section 7.2, the review team is aware of the potential climate changes that  
35 could affect the water resources available for cooling and the impacts of reactor operations on  
36 water resources for other users. Because the alternative sites are in the same region, the  
37 impact of climate change may be similar for all them.

1 The surface-water-use impacts of building and operating two nuclear power plants at FA-1 are  
2 dominated by the increased demands that would occur under normal operation relative to the  
3 no-action option for this site. The projected consumptive water use of proposed units is  
4 expected to be about 62 cfs or about 1 percent of the average river discharge just downstream  
5 of Parr Reservoir. Consequently, the review team concludes that the cumulative impacts of  
6 surface-water use would be SMALL.

7 As discussed in Section 7.2.1, groundwater supplies less than 10 percent of the water used for  
8 public supplies in Fairfield County (SCDHEC 2007) and no industrial, agricultural, or power  
9 generation uses are identified for groundwater in Fairfield County. Because groundwater-use  
10 impacts are limited to the temporary aquifer dewatering during the building phase, the review  
11 team concludes that the cumulative impacts of groundwater use would be SMALL. Water-  
12 quality information presented above for the impacts of building and operating two new units at  
13 the FA-1 alternative site would also apply to evaluation of cumulative impacts. As mentioned  
14 above, a SCDHEC-issued NPDES permit would be required to operate the two new nuclear  
15 units at this site. Effluent discharge through an NPDES-permitted outfall would ensure that the  
16 discharges complied with the Clean Water Act. Such permits are designed to ensure the  
17 protection of water quality. The staff also concludes that with the implementation of BMPs, the  
18 impacts on groundwater quality from building and operating two new nuclear units at the FA-1  
19 site would likely be minimal. Of the projects listed in Table 7-1, only the SCE&G FPSP lies  
20 between the alternative and proposed discharge structures. There are no notable cumulative  
21 impacts anticipated with FPSP and FA-1. Given these factors, the review team concludes the  
22 cumulative impact on surface-water and groundwater quality would be SMALL.

### 23 **9.3.3.3 Terrestrial and Wetland Resources**

#### 24 ***Site Description***

25 The following analysis includes impacts from building activities and operations on terrestrial  
26 ecology resources. The analysis also considers past, present, and reasonably foreseeable  
27 future actions that affect the terrestrial ecological resources, including other Federal and non-  
28 Federal projects and the projects listed in Table 9-6. For the analysis of terrestrial ecological  
29 impacts at the FA-1 site, the geographic area of interest is considered to be a 6 mi-wide area  
30 centered on the FA-1 site, plus the associated transmission-line corridors. The 6-mi radius is  
31 expected to encompass the ecologically relevant landscape features and species. Because  
32 both sites are located in western Fairfield County and the transmission-line corridors for both  
33 projects traverse the same general landscape, the FA-1 area of interest substantially overlaps  
34 the VCSNS region described in Section 2.2.3.

35 The FA-1 site is surrounded by a mosaic of forests and farmland, typical of the Piedmont  
36 physiographic province. This province begins in the southernmost portion of New York State and  
37 stretches in a southwestward direction to approximately mid-Alabama (Godfrey 1980). The

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1 Piedmont has been heavily farmed and cultivated, which altered the pre-settlement landscape  
2 considerably (Kirkman et al. 2007). The FA-1 site and vicinity is primarily a human-altered  
3 landscape that has changed dramatically since the damming of the Broad River and Frees  
4 Creek, which created Parr and Monticello reservoirs, respectively. The FA-1 site and associated  
5 transmission-line corridors consist of forests, wetlands, open water, and residential areas. The  
6 landscape is predominately rural and habitats are typical of the Southern Outer Piedmont  
7 ecoregion, consisting of planted and naturally vegetated pine, mixed pine-hardwood, and  
8 hardwood forests. Common canopy species include white oak (*Quercus alba*), southern red oak  
9 (*Quercus falcata*), black oak (*Quercus velutina*), mockernut (*Carya alba*), and pignut (*Carya*  
10 *glabra*) hickories, intermixed with some loblolly pine (*Pinus taeda*) and shortleaf pine (*Pinus*  
11 *echinata*). Beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), tulip poplar  
12 (*Liriodendron tulipifera*), and red maple (*Acer rubrum*) are found on more mesic sites (Griffith et  
13 al. 2002).

14 The associated proposed transmission-line corridors begin in the Southern Outer Piedmont  
15 ecoregion and cross the Sandhills into the Coastal Plain ecoregion (see Section 2.4.1.2).  
16 Vegetation community types in the Sandhills ecoregion include grassland and early successional  
17 habitats, Sandhills pine woodland, seepage slopes, ponds and depressions, blackwater stream  
18 systems, and river bottoms (SCDNR 2005). The sandy soils create a xeric environment that  
19 supports a distinctive type of vegetation dominated by longleaf pines (*Pinus palustris*) and turkey  
20 oaks (*Quercus laevis*). The Coastal Plain, the largest ecoregion in South Carolina, includes  
21 bottomland hardwood forest consisting of bottomland oaks, red maple, sweetgum, green ash  
22 (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformis*), and cypress-gum swamps  
23 dominated by water tupelo (*Nyssa aquatica*), swamp tupelo (*Nyssa biflora*), bald cypress  
24 (*Taxodium distichum*), and pond cypress (*Taxodium ascendens*) (Griffith et al. 2002).

25 Common wildlife associated with the Southern Outer Piedmont ecoregion that may occur on the  
26 FA-1 site and associated transmission-line corridors includes white-tailed deer (*Odocoileus*  
27 *virginianus*), eastern cottontail (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*),  
28 opossum (*Didelphis virginiana*), and raccoon (*Procyon lotor*). Various bird, reptile, and  
29 amphibian species also reside on the FA-1 site and associated proposed transmission-line  
30 corridors (Tetra Tech NUS, Inc. 2009; SCDNR 2005).

31 The bald eagle (*Haliaeetus leucocephalus*), which is delisted from the Endangered Species Act  
32 but still protected under the Bald and Golden Eagle Protection Act, occurs in Fairfield and  
33 Newberry Counties. One Federally listed species is known to occur in Newberry County – the  
34 endangered wood stork (*Mycteria americana*). The proposed transmission-line corridors would  
35 cross Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington,  
36 Newberry, Orangeburg, Richland, and Saluda Counties to connect to the proposed St. George  
37 substation in Colleton County (FP&S 2008). Table 9-8 lists all Federally and State-listed  
38 species that occur on the FA-1 site and in the vicinity, as well as in the counties crossed by the

1 proposed transmission-line corridors. SCE&G has stated that on-the-ground field surveys  
 2 would be conducted prior to commencement of ground-disturbing activities on the site or  
 3 transmission-line corridors (SCE&G 2009a).

4 **Table 9-8.** Federally and State-Listed Species That May Occur on the FA-1 Alternative Site,  
 5 Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	SE	Aiken, Bamberg, Colleton, Dorchester, Orangeburg, Richland
<b>Birds</b>			
<i>Charadrius melodus</i>	Piping plover	FT/ST	Colleton
<i>Charadrius wilsonia</i>	Wilson's plover	ST	Colleton
<i>Elanoides forficatus</i>	American swallow-tailed kite	SE	Dorchester
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA/SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Saluda
<i>Mycteria americana</i>	Wood stork	FE/SE	Aiken, Bamberg, Calhoun, Colleton, Dorchester, Lexington, Newberry, Richland
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Lexington, Orangeburg, Richland, Saluda
<i>Sterna antillarum</i>	Least tern	ST	Colleton
<b>Reptiles</b>			
<i>Clemmys guttata</i>	Spotted turtle	ST	Aiken, Bamberg, Colleton
<i>Gopherus polyphemus</i>	Gopher tortoise	SE	Aiken, Colleton, Dorchester
<b>Amphibians</b>			
<i>Ambystoma cingulatum</i>	Flatwoods salamander	FT/SE	Orangeburg
<i>Hyla andersonii</i>	Pine barrens treefrog	ST	Richland
<i>Plethodon websteri</i>	Webster's salamander	SE	Saluda
<i>Pseudobranchius striatus</i>	Dwarf siren	ST	Orangeburg
<i>Rana capito</i>	Gopher frog	SE	Aiken, Dorchester
<b>Vascular Plants</b>			
<i>Amphianthus pusillus</i>	Pool sprite	FT/ST	Lancaster, Saluda

1

**Table 9-8.** (contd)

<b>Scientific Name</b>	<b>Common Name</b>	<b>Legal Status</b>	<b>County</b>
<i>Echinacea laevigata</i>	Smooth coneflower	FE/SE	Aiken, Lancaster, Lexington, Richland
<i>Helianthus schweinitzii</i>	Schweinitz’s sunflower	FE/SE	Lancaster, Lexington
<i>Isoetes melanospora</i>	Black-spored quillwort	FE/SE	Lancaster
<i>Lindera melissifolia</i>	Pondberry	FE/SE	Dorchester
<i>Lysimachia asperulifolia</i>	Rough-leaved loosestrife	FE/SE	Richland
<i>Oxypolis canbyi</i>	Canby’s dropwort	FE/SE	Bamberg, Colleton, Dorchester, Orangeburg, Richland
<i>Ptilimnium nodosum</i>	Harperella	FE/SE	Aiken, Saluda
<i>Trillium reliquum</i>	Relict trillium	FE/SE	Aiken

Sources: SCDNR 2006a; FWS 2008 Southeast Region County Lists  
 BGEPA = Bald and Golden Eagle Protection Act; FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered; ST = State listed as threatened

**2 Building Impacts**

3 To accommodate the building of two nuclear units on the FA-1 site, SCE&G would need to clear  
 4 approximately 400 ac of natural habitat for the nuclear facility and associated structures and  
 5 infrastructure. Based on a preliminary site layout of the tabletop footprint provided by SCE&G,  
 6 approximately 3.1 ac of the 50.3 ac of wetlands present on the 1141.1-ac site would be affected  
 7 during building activities for the two proposed units (SCE&G 2010a). SCE&G states that the  
 8 nuclear facility would be sited to avoid wetlands whenever possible and potential impacts on  
 9 wetlands near building zones would be minimized through the use of established BMPs  
 10 (SCE&G 2009a).

11 Each AP1000 unit would require the addition of three 230-kV transmission lines, which would  
 12 each occupy a 100-ft-wide transmission-line corridor. The total length and acreage of new  
 13 transmission-line corridor required (collectively) that would affect terrestrial ecological resources  
 14 would be approximately 227 mi and 2492 ac, which is a portion of the 443 mi and 5793 ac  
 15 required (SCE&G 2009c, d). Acreages were determined by calculating the total number of miles  
 16 and acres of clearing required for right-of-way widening and/or building activities (SCE&G  
 17 2009c, d). SCE&G and Santee Cooper would both have a portion of the new transmission lines  
 18 and details are provided in Table 9-9 and Table 9-10 (SCE&G 2009c, d). SCE&G stated that all  
 19 land clearing associated with nuclear facility and transmission-line creation would be conducted  
 20 according to Federal, State, and local regulations, permit requirements, existing SCE&G and  
 21 Santee Cooper procedures, good construction practices, and established BMPs  
 22 (SCE&G 2009a).

1 **Table 9-9.** SCE&G Transmission-Line Information for the FA-1 Alternative Site

<b>Transmission-Line Segment</b>	<b>Length of Corridor (mi)</b>	<b>Acres of Corridor</b>	<b>Acres of Forested Wetlands</b>	<b>Acres of Nonforested Wetlands</b>	<b>Acres of Open Water</b>	<b>Linear Feet of Streams</b>
Fairfield-St. George	137	1535	214	41	19	22,428
Fairfield-Lake Murray	24	64	1	--	2	1787
Fairfield-VCSNS	6	186	2	--	6	3712
Fairfield-Killian	39	452	21	--	1	8148
<b>Total</b>	<b>206</b>	<b>2237</b>	<b>238</b>	<b>41</b>	<b>28</b>	<b>36,075</b>

Source: SCE&G 2009c, d

NOTE: Acreages were determined by calculating the total number of miles and acres of clearing required for right-of-way widening and/or building activities.

2 **Table 9-10.** Santee Cooper Transmission-Line Information for the FA-1 Alternative Site

<b>Wetlands Estimate</b>	<b>New Corridor (21 mi, 255 ac)</b>		<b>Existing Corridor (217 mi, 3302 ac)</b>		<b>Total Corridor (3557 ac)</b>	
	<b>Acres</b>	<b>Percent of Corridors</b>	<b>Acres</b>	<b>Percent of Corridors</b>	<b>Acres</b>	<b>Percent of Corridors</b>
Hydric Soils	20	8	1134	34	1154	32
National Wetlands Inventory Wetlands	14	5	244	7	258	7

Source: SCE&G 2009c, d

NOTE: Acreages were determined by calculating the total number of miles and acres of clearing required for right-of-way widening and/or building activities.

3 Past actions in the geographic area of interest that have influenced terrestrial resources include  
 4 the development and operation of VCSNS Unit 1, located approximately 5.5 mi south-southwest  
 5 of the FA-1 site. The building of Unit 1 required the creation of Monticello Reservoir by  
 6 damming Frees Creek. This reservoir flooded approximately 6800 ac of terrestrial habitat  
 7 (SCE&G 2009a). The development of the SCE&G Parr Hydroelectric Generating Station (or  
 8 Plant), located approximately 6.9 mi downstream on the Broad River, dammed the Broad River  
 9 and created Parr Reservoir. This reservoir flooded approximately 4400 ac of terrestrial habitat.  
 10 The Vulcan Materials Company/Blair Quarry, approximately 5 mi north of the FA-1 site and the  
 11 FPSF, approximately 4.1 mi downstream on the Broad River, also contributed to the loss of  
 12 terrestrial habitat. There are no major current projects in the geographic area of interest that  
 13 would cumulatively affect terrestrial ecological resources in a similar way.

14 Proposed future actions that would affect terrestrial resources in a similar way to development  
 15 at the FA-1 site include the proposed SCE&G Combined Site Emergency Operations Facility,  
 16 which is expected to be sited as close as 5 mi from the proposed FA-1 alternative site.

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1 Transmission-line creation and/or upgrading throughout the designated geographic region of  
2 interest and future urbanization would also be expected to occur. There are, however, several  
3 areas within the geographic region of interest that would continue to be managed for the benefit  
4 of wildlife, including (but not limited to) Sumter National Forest and Parr Hydro Wildlife  
5 Management Area.

6 Impacts on wildlife habitat from building two nuclear units and supporting facilities would be  
7 unavoidable. Activities that would affect wildlife include land clearing and grading (temporary  
8 and permanent), filling and or draining of wetlands, increased human presence, heavy  
9 equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would  
10 likely displace or destroy wildlife that inhabits the development areas. Some wildlife, including  
11 important species, would perish or be displaced during land clearing for any of the above  
12 projects as a consequence of habitat loss, fragmentation, and competition for remaining  
13 resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be  
14 at greater risk of incurring mortality than more mobile animals, such as birds, many of which  
15 would be displaced to adjacent communities. Undisturbed land adjacent to the project could  
16 provide habitat to support displaced wildlife, but increased competition for available space and  
17 resources could affect population levels.

18 Wildlife would also be subjected to impacts from noise and traffic, and birds could be injured if  
19 they collide with tall structures. The impact on wildlife from noise is expected to be temporary  
20 and minor. The creation of new transmission-line corridors could be beneficial for some  
21 species, including those that inhabit early successional habitat or use edge environments, such  
22 as white-tailed deer, northern bobwhite quail (*Colinus virginianus*), eastern meadowlark  
23 (*Sturnella magna*), and the gopher tortoise (*Gopherus polyphemus*). Birds of prey, such as red-  
24 tailed hawks (*Buteo jamaicensis*) would likely exploit newly created hunting grounds. Forested  
25 wetlands within the corridors would be converted to and maintained in a herbaceous or scrub-  
26 shrub condition that could provide improved foraging habitat for some waterfowl and wading  
27 birds. However, fragmentation of forests could adversely affect species that are dependent on  
28 large tracts of continuous forested habitat.

29 The review team concludes that the impacts on terrestrial resources from building two new  
30 nuclear units and associated transmission lines at the FA-1 site would be noticeable, but not  
31 destabilizing.

### 32 **Operational Impacts**

33 Impacts on terrestrial ecological resources from operation of two new nuclear units at the FA-1  
34 site are primarily attributable to the operation of cooling towers and transmission lines.

35 Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be  
36 evaluated in detail in the absence of information about the type (mechanical or natural draft),

1 number, and specific location of cooling towers at each alternative site. Similarly, bird collisions  
2 with cooling towers cannot be evaluated in the absence of information about the type  
3 (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of  
4 cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing  
5 power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance  
6 for nuclear power plants in general, including those with various numbers and types of cooling  
7 towers. On this basis, the review team concludes, for the purpose of comparing the alternative  
8 sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from  
9 operation of new nuclear units would be minor.

10 For mechanical draft cooling towers, the anticipated noise level from cooling-tower operation is  
11 anticipated to be 55 dBA at 1000 ft (SCE&G 2009a). This noise level is well below the 80 to 85  
12 dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980).  
13 Thus, noise from operating cooling towers at the FA-1 site would not be likely to disturb wildlife  
14 beyond 1000 ft from the source. Consequently, the review team concludes that the impacts of  
15 cooling-tower noise on wildlife would be minimal.

16 The impacts associated with transmission-line operation consist of bird collisions with  
17 transmission lines and the effects of electromagnetic fields (EMFs) on flora and fauna. The  
18 impacts associated with transmission-line corridor maintenance activities include alteration of  
19 habitat due to cutting and herbicide application, in floodplains and wetlands as well as uplands.

20 Transmission lines and associated structures pose a potential avian collision hazard. Bird  
21 collisions with transmission lines are recognized as being of minor significance at operating  
22 nuclear power plants, including transmission-line corridors with variable numbers of power lines  
23 (NRC 1996). Although additional transmission lines would be required for new nuclear units at  
24 the alternative sites, increases in bird collisions would be minor and these would not be  
25 expected to cause a measurable reduction in local bird populations. Consequently, the  
26 incremental number of bird collisions posed by the addition of new transmission lines for new  
27 nuclear units would be negligible.

28 EMFs are unlike other agents (e.g., toxic chemicals and ionizing radiation) that have an adverse  
29 impact in that dramatic acute effects cannot be demonstrated and long-term effects, if they  
30 exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did  
31 not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). The  
32 impacts of EMFs on terrestrial flora and fauna are recognized as being of small significance at  
33 operating nuclear power plants, including transmission systems with variable numbers of power  
34 lines (NRC 1996). Therefore, the incremental EMF impact posed by addition of new  
35 transmission lines for new nuclear units would be negligible.

36 Existing roads providing access to the existing transmission-line corridors at the alternative sites  
37 would likely be sufficient for use in any expanded corridors; however, new roads would be



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1 required during the building of new transmission-line corridors. Management activities (cutting  
2 and herbicide application) related to transmission-line corridors and related impacts on  
3 floodplains and wetlands in transmission-line corridors are recognized as being of minor  
4 significance at operating nuclear power plants, including those with transmission-line corridors  
5 of variable widths (NRC 1996). The review team assumes that the same methods of building  
6 and vegetation management of corridors currently used by SCE&G and Santee Cooper would  
7 be used in the establishment and maintenance of the new corridors. Consequently, the  
8 incremental effects of the maintenance of transmission-line corridors and associated impacts on  
9 floodplains and wetlands posed by expanding existing corridors or the addition of a new  
10 transmission-line corridor for new nuclear units would be negligible.

11 No past, present, or future actions in the geographic area of interest were identified that would  
12 significantly affect terrestrial habitat and wildlife, including important species in ways similar to  
13 those associated with the operation of two new units at the FA-1 site.

14 The review team concludes that the impacts on terrestrial resources from operating two new  
15 nuclear units and associated transmission lines at the FA-1 site would be minimal.

### 16 **9.3.3.4 Summary Statement**

17 Impacts on terrestrial ecology resources are estimated based on the information provided by  
18 SCE&G and the review team's independent review. There are past, present and future  
19 activities in the geographic area of interest that could affect terrestrial ecology in ways similar to  
20 the building of two nuclear units at the FA-1 site (Table 9-6). The FA-1 site and some of the  
21 associated transmission-line corridors are natural habitats that would be substantially altered by  
22 development and maintenance activities, noticeably affecting the level and movement of  
23 terrestrial wildlife populations in the area of interest. Other anticipated development projects  
24 would further alter wildlife habitats and migration patterns in the surrounding landscape. The  
25 review team therefore concludes that the cumulative impacts on baseline conditions for  
26 terrestrial ecological resources would be MODERATE. The contribution to the impacts from  
27 building and operating the proposed units would not, however, likely result in destabilization of  
28 terrestrial resources or populations. Building and operating two new nuclear units at the FA-1  
29 site would be a significant contributor to the MODERATE impact.

### 30 **9.3.3.5 Aquatic Resources**

31 The following impact analysis includes impacts from building activities and operations on  
32 aquatic ecology resources. The FA-1 site is a greenfield site located approximately 5 mi from  
33 the existing VCSNS on the eastern bank of the Broad River. As described by SCE&G (2009e),  
34 the Monticello Reservoir would be used to supply makeup water at the FA-1 alternative site, and  
35 the blowdown line would be located near the upper extent of Parr Reservoir in the Broad River.  
36 The geographic area of interest is considered to be same as for VCSNS as described in Section

1 7.3.2 and includes the drainage basin of the Broad River from Neal Shoals Dam downriver  
2 approximately 30 mi to the Parr Shoals Dam, Monticello Reservoir and corresponding  
3 intermittent and seasonal streams on the VCSNS site, and waterbodies crossed by the  
4 transmission-line corridors within the macro-corridor, as described for terrestrial resources in  
5 Section 4.3.1. This geographic region of interest considers primarily the Broad River  
6 impoundment as the region to be the most likely to show impacts on water quality relative to the  
7 water-quality criteria for aquatic biota.

8 Historically, the Parr Reservoir was created in 1914 by installing a 2000-ft-long dam across the  
9 Broad River at Parr Shoals (Figure 2-3) SCE&G (2009a). Before 1977, the surface area of the  
10 reservoir was 1850 ac. In 1977, the reservoir level was raised 9 ft, which increased the surface  
11 area to approximately 4400 ac. Parr Reservoir is approximately 7 mi long and has an average  
12 water depth of 15 ft (SCE&G 2009a). Because of the operation of the FPSF, hydrologic  
13 patterns in the Parr Reservoir are variable. Generally, water from the Monticello Reservoir is  
14 released through the FPSF into Parr Reservoir throughout the day and early evening to provide  
15 hydroelectric power at the Parr Shoals Dam, resulting in a net southward flow in Parr Reservoir.  
16 During the night, when electrical demand is lower, water from the Parr Reservoir is pumped  
17 upward into the Monticello Reservoir, reversing the flow to the north in Parr Reservoir (SCE&G  
18 2009a).

19 Flow conditions and the 4-day retention time of water in Parr Reservoir generally promote high  
20 dissolved-oxygen levels and turbid conditions SCE&G (2009a). According to SCDHEC (2007),  
21 water conditions are not optimal for supporting aquatic life at the two SCDHEC water-quality  
22 monitoring stations on Parr Reservoir, located near the FPSF and near Parr Shoals Dam,  
23 respectively. The total phosphorus concentrations upstream of the site above the  
24 intake/discharge canal for the FPSF were found to exceed the standards for supporting aquatic  
25 life uses (SCDHEC 2007). At the downstream station near Parr Shoals Dam, elevated copper  
26 concentrations were deemed to exceed the aquatic life criterion; therefore, conditions are not  
27 optimal for supporting aquatic life at this site. There are no fish-consumption advisories in Parr  
28 Reservoir (SCDHEC 2007).

### 29 ***Monticello Reservoir***

30 The Monticello Reservoir was formed by damming Frees Creek, a small tributary of the Broad  
31 River that flowed into Parr Reservoir approximately 1 mi upstream of Parr Shoals Dam (SCE&G  
32 2009a). The reservoir is hydraulically connected to Parr Reservoir via the FPSF, and it serves  
33 both as an upper pool for the FPSF and as a cooling pond for VCSNS Unit 1 (Figure 2-1). To  
34 the northeast, the reservoir contains a subimpoundment (Figure 2-3), which is a 300-ac area  
35 owned by SCE&G and co-managed by SCE&G and SCDNR (SCE&G 2009a; SCDNR 2002).  
36 The subimpoundment fishery is managed differently from the main reservoir in that SCDNR  
37 regulates lower allowable catch limits, restricts fishing effort to 2 days per week, and limits boat  
38 operations to electric motors (SCDNR 2002). The Monticello Reservoir, excluding the

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1 subimpoundment, is approximately 6 mi long with a total surface area of 6500 ac. The average  
2 water depth is 59 ft and the maximum depth is 126 ft (SCE&G 2009a).

3 Between 2000 and 2004, SCDHEC evaluated the water quality within the Broad River basin to  
4 assess the overall health and conditions of aquatic areas throughout the basin. As part of this  
5 assessment, SCDHEC monitored four stations in Monticello Reservoir (Figure 2-12). The  
6 closest station to the proposed FA-1 site, Station B-328, yielded water-quality parameters (e.g.,  
7 dissolved oxygen, pH, toxins, turbidity, nutrients) that met the compliance criteria and standards  
8 for supporting aquatic life. Throughout the 5-year monitoring period, Station B-328 yielded  
9 indications of improving conditions via a reduction in 5-day biochemical oxygen demand,  
10 turbidity, fecal coliform, and total nitrogen and phosphorus concentrations (SCDHEC 2007).  
11 Based on analysis of fish tissue, there are no fish consumption advisories on Monticello  
12 Reservoir (SCDNR 2009c).

13 A comprehensive list of aquatic species present in Parr and Monticello reservoirs for proposed  
14 VCSNS Units 2 and 3 has been established in Section 2.4.2.3 of this EIS. Due to the close  
15 proximity of the FA-1 alternative site to the existing VCSNS site, the community composition of  
16 aquatic biota associated with the FA-1 site is likely similar to the existing VCSNS site.

### 17 **Recreationally Important Species**

18 The identification of species deemed to be recreationally important was derived from published  
19 creel surveys (Christie and Stroud 1998, 1999) and game fish outlined in the SCDNR freshwater  
20 fishing rules and regulations document (SCDNR 2009e). Section 2.4.2.3 provides a detailed  
21 description of some of these species and their life histories associated with Monticello  
22 Reservoir.

23 In South Carolina, largemouth bass (*Micropterus salmoides*) are among the most sought-after  
24 sport fish (Bulak and Crane 2009). While largemouth bass occur within waters near the VCSNS  
25 site and accounted for 15 to 19 percent of the fishing effort in Monticello Reservoir during the  
26 late 1990s, SCDNR creel surveys indicate that fishing effort in Monticello Reservoir was  
27 primarily directed at channel catfish (*Ictalurus punctatus*) and blue catfish (*I. furcatus*) (Christie  
28 and Stroud 1998, 1999). Data pertaining to fishing efforts do not exist for Parr Reservoir;  
29 however, efforts purportedly target catfish species in this reservoir as well (Hayes 1999).

### 30 **Invasive Species**

31 Of the list of invasive species considered to be a management concern within South Carolina,  
32 two plant species, two fish species, and one mollusk species are known to occur in the Parr and  
33 Monticello reservoirs and are listed in Table 9-11.

1 **Table 9-11.** Aquatic Invasive Species Documented to Occur in the Vicinity of the FA-1  
 2 Alternative Site

<b>Common Name</b>	<b>Scientific Name</b>	<b>Type</b>	<b>Invasive Attributes</b>	<b>Occurrence at the VCSNS Site</b>
Alligatorweed	<i>Alternanthera philoxeroides</i>	Freshwater plant	Aggressive, rapidly colonizing plant, impacts flow and uptake of water	Parr Reservoir
Water primrose	<i>Ludwigia uruguayensis</i>	Freshwater plant	Rhizomatous, chokes shorelines, affects water use and access, decreases flow, clogs water-intake structures	Parr Reservoir
Blue catfish	<i>Ictalurus furcatus</i>	Freshwater fish	Can tolerate a range of environmental conditions, piscivorous, competes for prey resources with native catfish	Parr Reservoir, Monticello Reservoir
White perch	<i>Morone americana</i>	Freshwater fish	Competes with recreationally important fish such as white bass and crappie	Parr Reservoir, Monticello Reservoir
Asian clam	<i>Corbicula fluminea</i>	Freshwater clam	Competes with native mollusks for food and space, alters substrate conditions, high densities clog water-intake structures	Parr Reservoir

Sources: SCDNR 2008; SCE&G 2009a  
 Survey efforts included multiple methodologies and spanned multiple spatial and temporal scales.

3 **Critical Habitats**

4 No critical habitat has been designated by the U.S. Fish and Wildlife Service (FWS) in the  
 5 vicinity of the FA-1 site. However, critical habitat for the Carolina heelsplitter (*Lasmigona*  
 6 *decorata*) is present in waterbodies proposed for transmission-line crossing in Chester and  
 7 Lancaster Counties.

8 **Federally and State-Listed Species**

9 There are no known occurrences of threatened or endangered species at the FA-1 alternative  
 10 site. However, activities to create new transmission-line corridors could potentially affect  
 11 Federally and State-listed freshwater species and would require appropriate Federally or State-  
 12 mandated mitigation. The proposed transmission-line corridors would cross Aiken, Bamberg,  
 13 Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg,  
 14 Richland, and Saluda Counties to connect to the proposed St. George substation in Colleton  
 15 Country (FP&S 2008). Table 9-12 lists all Federally and State-listed species that occur on the  
 16 FA-1 site and in the vicinity, as well as in the counties crossed by the proposed transmission-

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1 **Table 9-12.** Federally and State-Listed Aquatic Species that May Occur on the FA-1  
 2 Alternative Site, Including the Vicinity and Associated Transmission-Line  
 3 Corridors

Scientific Name	Common Name	Status	County
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead sea turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT	Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	Colleton
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE	Colleton
<b>Fish</b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	FE/SE	Aiken, Calhoun, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
<i>Etheostoma collis</i>	Carolina darter	ST	Richland
<b>Mollusks</b>			
<i>Lasmigona decorata</i>	Carolina heelsplitter	FE/SE	Chester, Fairfield, Lancaster, Richland, Newberry, Saluda, Lexington

Sources: FP&S 2008; MACTEC 2008; FWS 2008; SCDNR 2006a  
 FE = Federally Endangered, SE = State Endangered, FT = Federally Threatened, ST = State Threatened

4 line corridors. Santee Cooper has stated that on-the-ground field surveys would be conducted  
 5 prior to commencement of ground-disturbing activities on the site or within transmission-line  
 6 corridors (MACTEC 2008).

7 There are four Federally listed species of sea turtles in South Carolina. The loggerhead sea  
 8 turtle (*Caretta caretta*) and the green sea turtle (*Chelonia mydas*) are listed as threatened  
 9 whereas the leatherback sea turtle (*Dermochelys coriacea*) and Kemp's ridley sea turtle  
 10 (*Lepidochelys kempii*) are listed as endangered (FWS 2008). The loggerhead sea turtle is also  
 11 listed as a State threatened species for Colleton County (SCDNR 2006a). The siting of the  
 12 FA-1-Varnville transmission line is projected to run to the west of Interstate Highway 95 (I-95),  
 13 which is well over 50 mi from the coastline, and does not cross any marine habitats (SCE&G  
 14 2009d). Therefore, although the four species of sea turtles occur in Colleton County, no  
 15 activities associated with transmission lines for the FA-1 site would affect these species.

16 The shortnose sturgeon (*Acipenser brevirostrum*) is a State and Federal endangered species  
 17 (FWS 2008). The shortnose sturgeon has not been reported to occur in the vicinity of the FA-1  
 18 site, but the routing of transmission-line corridors for this alternative site is proposed to occur  
 19 within eight South Carolina counties that are associated with the occurrence of shortnose  
 20 sturgeon: Aiken, Calhoun, Colleton, Dorchester, Hampton, Lexington, Orangeburg, and  
 21 Richland Counties. The shortnose sturgeon was initially listed as a Federally endangered  
 22 species in 1967 and is designated as a species of highest conservation priority by SCDNR  
 23 (McCord 2006; NMFS 1998). This amphidromous species uses freshwater, estuarine, and  
 24 marine habitats to complete its life cycle (Rohde et al. 2009; McCord 2006; NMFS 1998). In  
 25 South Carolina, populations of shortnose sturgeon exist in the Ashepoo, Combahee, and Edisto  
 26 rivers (flowing to St. Helena Sound); the Pee Dee, Waccamaw, and Black rivers (flowing to

1 Winyah Bay); and the Savannah, Cooper, and Santee rivers. There is also a small landlocked  
2 population of shortnose sturgeon in the Santee-Cooper Lake system (Collins et al. 2003).

3 In freshwater habitats, shortnose sturgeon are associated with soft bottom substrates in deep  
4 water. Spawning occurs in freshwaters characterized by low-to-moderate velocities and over  
5 substrates that include clay, sand, gravel, and woody debris (Rohde et al. 2009; McCord 2006).  
6 Eggs are adhesive and survival is reportedly dependent on water having little turbidity (McCord  
7 2006).

8 The Carolina darter (*Etheostoma collis*), a Federal species of concern, is listed as a State  
9 threatened species for Richland County (SCDNR 2009). While there are reported accounts  
10 pertaining to the distribution of the Carolina darter within the Piedmont ecoregion, the overall  
11 abundance of this species is unknown (Hayes and Bettinger 2006).

12 The Carolina heelsplitter is a Federally listed aquatic species (FWS 2008). It is unknown  
13 whether the Carolina heelsplitter occurs in the vicinity of the proposed alternative site.  
14 However, there are six known populations of the Carolina heelsplitter within the state defined by  
15 geographic location: (1) Savannah River tributaries in Edgefield and McCormick Counties,  
16 (2) Cuffeytown Creek in Greenwood and McCormick Counties, (3) Lynches River and Flat  
17 Creek in Chesterfield, Kershaw, and Lancaster Counties, (4) Gills Creek in Lancaster County,  
18 (5) Fishing Creek in Chester County, and (6) Bull Run Creek in Chester County (SCDNR 2006b;  
19 67 FR 44502).

20 Designated critical habitat includes 103.2 km of streams and rivers in South Carolina that occur  
21 in conjunction with the known populations. The lateral boundaries of the critical habitats for the  
22 Carolina heelsplitter are denoted by the ordinary high-water mark along channel edges (67 FR  
23 44502). Designated critical habitats for the Carolina heelsplitter do not occur in the vicinity of  
24 the FA-1 site and the species has never been found in the Parr and Monticello reservoirs.  
25 However, the routing of transmission-line corridors for the FA-1 Units is proposed to occur within  
26 Chester and Lancaster Counties; both counties contain critical habitat for the Carolina  
27 heelsplitter.

## 28 **Building Impacts**

29 Building impacts at the FA-1 alternative site would include a new intake structure located on the  
30 north end of Monticello Reservoir and a new discharge structure in Parr Reservoir on the Broad  
31 River. In addition, activities that include land clearing associated with new infrastructure (roads,  
32 site footprint) and upgrading existing features (rail lines) would affect approximately 5344 linear  
33 feet of a total of approximately 32,463 linear feet of onsite streams by increasing the number of  
34 stream crossings, or by filling streams and removing riparian corridors to accommodate site  
35 infrastructure (SCE&G 2010a). Building activities would also affect 1.4 ac of a total of 133.8 ac  
36 of open water present on the proposed FA-1 site (SCE&G 2010a). Building impacts would likely

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1 include impacts on water quality stemming from direct (e.g., dredging, shoreline excavation) and  
2 indirect sources (e.g., stormwater runoff, sedimentation). Impacts from building activities in and  
3 near water resources would be minimized through the use of established BMPs (SCE&G  
4 2009a).

5 New transmission lines and corridors are a necessary component of the proposed FA-1  
6 alternative site. According to SCE&G (2009e), a new transmission-line corridor would extend  
7 4.5 mi from the FA-1 site to the existing VCSNS substation and encompass a 100-ft-wide area.  
8 The remaining transmission-line corridors associated with the FA-1 site would follow the routes  
9 discussed for VCSNS in Section 2.2.2 of this EIS, to include corridors maintained by both  
10 SCE&G and Santee Cooper. For SCE&G lines, approximately 36,075 linear feet of streams  
11 and 28 ac of open water are located within the new transmission-line rights-of-way (Table 9-9)  
12 (SCE&G 2009d). The Santee Cooper transmission-line corridors associated with the FA-1 site  
13 would include an estimated seven stream crossings, three of which would be State Navigable  
14 Waters (SCE&G 2009d). SCE&G stated that all land clearing associated with transmission-line  
15 creation would be conducted according to Federal State, and local regulations, permit  
16 requirements, existing SCE&G and Santee Cooper procedures, good construction practices,  
17 and established BMPs (SCE&G 2009a).

18 Cumulative impacts that could result from the building of two new units at the FA-1 site would be  
19 similar to those discussed in Section 7.3.2 of this EIS because the affected waterbodies are the  
20 same. Impacts on aquatic biota are expected to be localized and short-term. Past actions in  
21 the geographic area of interest that have similarly affected aquatic resources include the  
22 building of VCSNS Unit 1, construction of the FPSF that connects Monticello Reservoir with Parr  
23 Reservoir, and the creation of Parr Reservoir to provide a pool for the original Parr Hydroelectric  
24 Plant located on the Broad River approximately 7 mi southwest of proposed FA-1 alternative  
25 site. Proposed future actions that would affect aquatic resources in a similar way to  
26 development at the FA-1 alternative site would include transmission-line creation and/or  
27 upgrading throughout the designated geographic region of interest, and future urbanization  
28 would also be expected to occur.

### 29 ***Operational Impacts***

30 Aquatic impacts associated with operation of the FA-1 alternative site would be associated  
31 primarily with intake-related impingement and entrainment losses of aquatic biota within the  
32 Monticello Reservoir, water-quality impacts on Parr Reservoir stemming from the discharge line,  
33 and stormwater drainage impacts. Specifications associated with the intake structure would  
34 include a closed-cycle cooling system designed to meet the EPA's 316(b) Phase I requirements  
35 for new facilities (66 FR 65256). The maximum through-screen velocity at the cooling-water  
36 intake would be limited to 0.5 fps or less and the intake would not be located near critical habitat.  
37 Thus, if the proposed units were located at the FA-1 site, the anticipated impacts on aquatic  
38 communities from impingement and entrainment within Monticello Reservoir would be minor.

1 Operational impacts associated with water quality and discharge cannot be precisely  
2 determined without additional detailed analysis. However, based on the review team's  
3 experience with other facilities such as the VCSNS Unit 1, the review team concludes that, with  
4 proper design, the impacts on aquatic resources from operation of two new nuclear units at the  
5 FA-1 site would be minimal.

6 The review team also concludes that operational impacts on aquatic biota from maintenance of  
7 the transmission-line corridors would also be minimal assuming that appropriate BMPs are  
8 used.

9 Cumulative impacts that could result from the operation of two new units at the FA-1 site would  
10 be similar to those discussed in Section 7.3.2 for VCSNS Units 2 and 3. Past, present, or future  
11 actions in the geographic area of interest that would affect aquatic ecological resources include  
12 aquatic biota impacts from the operation of VCSNS Unit 1, operation of the FPSF that connects  
13 Monticello Reservoir to Parr Reservoir, water quality from the NCW&SA Broad River WWTP  
14 and the NCW&SA Cannons Creek WWTP, and the SCE&G's Parr Hydroelectric Plant.  
15 Anthropogenic activities such as residential or industrial development near the vicinity of the  
16 nuclear facility may also contribute to cumulative impacts.

#### 17 ***Summary Statement***

18 Impacts on aquatic ecology resources are estimated based on the information provided by  
19 SCE&G, the State of South Carolina, and the review team's independent review. There are  
20 past and future activities in the geographic area of interest that could affect aquatic ecology  
21 resources in ways similar to the building and operation of two units at the FA-1 site. The  
22 existence of Parr and Monticello reservoirs that would be used by the FA-1 site for cooling  
23 eliminates much of the potential impact associated with water development needed for closed-  
24 cycle cooling for a new site. Due to the close proximity of the FA-1 site to VCSNS and the  
25 potential reliance of both sites on Monticello and Parr reservoirs for cooling, many of the  
26 potential impacts on aquatic resources in the two reservoirs would be the same. Proper siting of  
27 associated transmission lines, avoiding habitat for protected species, minimizing interactions  
28 with waterbodies and watercourses along the transmission-line corridors, and using BMPs  
29 during corridor preparation and tower placement would minimize impacts related to the  
30 transmission system. Based on the information provided by SCE&G, the State of South  
31 Carolina, and the review team's independent evaluation, the review team concludes that the  
32 cumulative impacts of building and operating two new reactors on the FA-1 site combined with  
33 other past, present, and future activities on most aquatic resources in the Broad River drainage  
34 would be SMALL.



1 **9.3.3.6 Socioeconomics**

2 For the analysis of socioeconomic impacts at the FA-1 site, the geographic area of interest is  
3 considered to be the 50-mi region centered on the FA-1 site with special consideration of  
4 Fairfield, Lexington, Newberry, and Richland Counties, because that is where the review team  
5 expects socioeconomic impacts would be the greatest. In evaluating the socioeconomic  
6 impacts of site development and operation at the FA-1 site near Dawkins in Fairfield County, the  
7 review team undertook a reconnaissance survey of the region using readily obtainable data  
8 from the ER, the alternative site audit, and Federal, State, and local government agencies. The  
9 analysis also considers other past, present, and reasonably foreseeable future actions that  
10 could affect the same environmental resources, including other Federal and non-Federal  
11 projects and the projects listed in Table 9-6. Impacts from both building and station operation  
12 are discussed.

13 ***Physical Impacts***

14 Many of the physical impacts of building and operation would be similar regardless of the site.  
15 Building activities can cause temporary and localized physical impacts such as noise, odor,  
16 vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public  
17 roadways, railways, and waterways would be necessary to transport materials and equipment.  
18 Offsite areas that would support building activities (e.g., borrow pits, quarries, and disposal  
19 sites) would be expected to already be permitted and operational.

20 Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and  
21 visual intrusions (the latter are discussed under aesthetics and recreation). New units would  
22 produce noise from the operation of pumps, cooling towers, transformers, turbines, generators,  
23 and switchyard equipment. Traffic at the site also would be a source of noise. The review team  
24 assumed that the same standard noise protection and abatement procedures proposed for the  
25 VCSNS site would be used to control noise coming from the FA-1 site. This practice also would  
26 be expected to apply to all alternative sites. Commuter traffic would be controlled by speed  
27 limits. Good road conditions and appropriate speed limits would minimize the noise level  
28 generated by the workforce commuting to the alternative site.

29 The new units at the FA-1 site would likely have standby diesel generators and auxiliary power  
30 systems. Permits obtained for these generators would ensure that air emissions comply with  
31 applicable regulations. In addition, the generators would be operated on a limited, short-term  
32 basis. During normal plant operation, new units would not use a significant quantity of  
33 chemicals that could generate odors that exceed odor threshold values. Good access roads  
34 and appropriate speed limits would minimize the dust generated by the commuting workforce.  
35 Based on the information provided by SCE&G and the review team's independent evaluation,  
36 the review team concludes that the physical impacts of building and operating Units 1 and 2 at  
37 the FA-1 site would be minimal.

## 1 **Demography**

2 The FA-1 site is located in Fairfield County in South Carolina, approximately 31 air mi northwest  
3 of the closest economic center, Columbia, South Carolina (2007 population 124,818). Due to  
4 the close proximity of FA-1 site to the VCSNS site, the review team assumed the in-migrating  
5 project workforce would be similarly distributed. Because 95 percent of the VCSNS workforce  
6 live in one of four counties – Fairfield (2007 population 23,333), Lexington (2007 population  
7 243,270), Newberry (2007 population 37,633), and Richland (2007 population 357,734) – these  
8 counties compose the economic impact area and are the focus of the following analysis (see  
9 Table 2-23).

10 Currently, 36.8 percent of the VCSNS workforce is located in Lexington County, 18.9 percent in  
11 Newberry County, 34.7 percent in Richland County, and 9.5 percent in Fairfield County. The in-  
12 migrating population would be expected to reside within this four-county area in the same  
13 pattern as the VCSNS workforce. At peak project employment, SCE&G would expect the onsite  
14 workforce to be 3600. Based on the close proximity of the FA-1 site to the VCSNS site, the  
15 review team used similar labor force assumptions and estimated that 50 percent of the  
16 workforce associated with site development (1800) would migrate to the four-county economic  
17 impact area with their families. Using South Carolina's average household size of 2.53, this  
18 would bring the total in-migrating population to 4554. Considering that the estimate of the in-  
19 migrating population would be less than 1 percent of the 2007 population estimates for the  
20 economic impact area, the regional and local demographic impacts of building the proposed two  
21 new units at the FA-1 site are expected to be minimal. Once the facility is operational, the  
22 workforce would include 930 operations and support workers. The review team expects that as  
23 much as 50 percent of these workers would migrate to the economic impact area. The review  
24 team expects the demographic impacts would be similar to those estimated for the VCSNS site,  
25 based on the close proximity of the FA-1 site. Based on the information provided by SCE&G  
26 and the review team's independent evaluation, the review team concludes that the demographic  
27 impacts of building and operating two new nuclear units at the FA-1 site would be minimal.

## 28 **Taxes and Economy**

29 If the proposed nuclear facility were located at the FA-1 site, taxes and fee-in-lieu-of-taxes  
30 agreements would be similar to those estimated to occur at the VCSNS site. Corporate and  
31 personal income taxes along with sales and use taxes would be collected during both building  
32 and operations; however property taxes would not be paid until operations begin. Once  
33 operations begin, SCE&G likely would have entered into a fee-in-lieu-of-taxes agreement with  
34 Fairfield County. Based on the agreement SCE&G has with the County in regard to VCSNS,  
35 which has an assessment ratio of 4 percent and a special revenue credit of 20 percent of the  
36 fee-in-lieu-of-taxes payments during the first 20 years, SCE&G estimates VCSNS annual  
37 payments to be between \$13.7 million and \$31.6 million over 40 years of the license period.  
38 The review team does not expect significant growth in the Fairfield County tax base between

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1 now and the start of operations that could otherwise diminish the scale of the tax impact on  
2 county revenue. The contribution to the total property tax revenue for Fairfield County would  
3 increase by 150 percent to an amount that is more in each year than the current overall total  
4 property tax revenue of the county. Therefore, the review team concludes that property tax  
5 revenue impacts would be substantial and beneficial for Fairfield County.

6 The four-county economic impact area had 324,230 people in the labor force in 2008 with an  
7 unemployment rate of 5.9 percent, just under the State average of 6.9 percent. Fairfield and  
8 Newberry Counties have the smallest economies with a predominantly manufacturing base  
9 while Lexington and Richland Counties have larger service-based economies. The wages and  
10 salaries of the project workforce would have a multiplier effect that could result in increases in  
11 business activity, particularly in the retail and service sectors.

12 SCE&G acquired Regional Input-Output Model System (RIMS) II economic multiplier values  
13 specific to this economic impact area from the U.S. Bureau of Economic Analysis (BEA 2006).  
14 Using the RIMS multiplier of 2.04 (for utility construction industries), the influx of 1800  
15 construction jobs would create 1872 indirect jobs in the economic impact area. This would have  
16 a positive impact on the business community and could provide (1) opportunities for new  
17 businesses to get started and (2) increased job opportunities for local residents. Once the new  
18 units are operational, approximately 930 new operations and support jobs would be added to  
19 the local economy. Using the RIMS multiplier of 3.13 (for utility operations industries), an influx  
20 of 930 operations and support jobs would create 1981 indirect and induced jobs for a total of  
21 2911 jobs supported within the four-county economic impact area (see Section 5.4.3.1). The  
22 new jobs would constitute a minor beneficial impact on the four-county economic impact area.  
23 Based on the information provided by SCE&G and the review team's independent evaluation,  
24 the review team concludes that the economic and tax base impacts of building and operating  
25 two new nuclear units at the FA-1 site would be minor in the four-county area, but would be  
26 substantial in Fairfield County.

### 27 ***Transportation and Housing***

28 A new access road would be constructed to access the FA-1 site. The plant entrance road  
29 would be accessed from SR-34 via Pearson Road and Dawkins Road. SC-34 is an east-west  
30 paved two-lane highway with a 2008 annual average daily traffic (AADT) count of 1600 vehicles  
31 between the Fairfield County line and SC-215, the closest segment measured by SCDOT  
32 (SCDOT 2009). SC-34 connects with SC-215 to the east and I-26 and US-176 to the west. A  
33 rail spur from the existing Norfolk Southern railroad would be constructed adjacent to the site.  
34 Based on the analysis in Section 4.5, an additional 1800 cars could be on the road at shift  
35 change. Also, project deliveries of 100 trucks per day are expected (SCE&G 2009a). Because  
36 access to the FA-1 site would be provided using two-lane county roads through the Dawkins  
37 area, the review team estimates traffic volumes during the project would likely represent a 50- to  
38 125-percent increase or more above baseline AADT levels of affected roadways, based on

1 analysis of the VCSNS site (see Section 4.4.4.1). The review team concludes that these  
2 impacts would be significant and would likely be especially acute during periods of shift change.  
3 These impacts would be further exacerbated by truck traffic and site delivery traffic that have no  
4 other route options available. The review team expects these impacts would be of short  
5 duration and temporary, and would be substantially mitigated by traffic management planning by  
6 SCE&G, but they would be noticeable in the local vicinity. Operation impacts would be  
7 significantly lower than the building phase impacts of traffic due to the much smaller workforce  
8 and because roads likely would have been improved during the building phase.

9 Approximately 1800 construction workers are predicted to migrate into the region during peak  
10 project employment. Approximately 400 operations workers could migrate into the region by the  
11 time the facility becomes operational. Construction workers may choose to buy housing, rent,  
12 use mobile homes, or stay in a hotel/motel, while operations workers would likely choose to buy  
13 a house. According to the 2000 U.S. Census there were 246,119 housing units in the four-  
14 county economic impact area, of which 7738 in Lexington County, 2779 in Newberry County,  
15 9692 in Richland County, and 1416 in Fairfield County were vacant, for a total of 21,625 vacant  
16 units (SCE&G 2009a). The review team expects that the in-migrating workforce could be  
17 absorbed fairly easily by the region and the impacts would likely be minimal during both building  
18 and operation. Based on the information provided by SCE&G and the review team's  
19 independent evaluation, the review team concludes that transportation and housing impacts of  
20 building and operating two new nuclear units at the FA-1 site would be minor across the four-  
21 county area, and would be noticeable in Fairfield County, though not destabilizing.

## 22 ***Public Services and Education***

23 In-migrating construction workers and plant operations workers would likely affect local  
24 municipal water, wastewater treatment facilities, and other public services in the region. These  
25 impacts would likely be in proportion with the demographic impacts experienced in the region,  
26 unless these resources have excess capacity or are particularly strained during building, which  
27 would decrease or increase the impact, respectively. The in-migrating workers represent a  
28 small portion of the total population of Fairfield County and likely would not have a noticeable  
29 impact on their public services. During operations the impact on public services would likely be  
30 minimal.

31 Within the four-county area there are 162 public schools serving almost 111,000 students, with  
32 an average student-to-teacher ratio of 13.3 to 1, as discussed in Section 2.5.2.7. The total  
33 number of students in the public school systems surrounding the FA-1 site has grown over the  
34 past decade as the population of the region as a whole has grown. The largest public school  
35 districts in the area plan to construct new schools prior to the start of major site-development  
36 activities. The number of in-migrating workers and their families is not likely to be significant  
37 and would be dispersed across the four-county area in roughly the proportion of the current  
38 operations workforce for VCSNS Unit 1 (see Table 4-5). Based on review team visits to the

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1 region and consultations with local officials, the review team expects that project-related  
2 students that would enter the local school systems would not noticeably alter current growth  
3 projections. During operation, this impact on schools would be significantly less due to the  
4 lower number of in-migrating students. Based on the information provided by SCE&G and the  
5 review team's independent evaluation, the review team concludes that the public services and  
6 education impacts of building and operating two new nuclear units at the FA-1 site would be  
7 minor.

### 8 ***Aesthetics and Recreation***

9 The four-county economic impact area is a defined tourism region called Capital City/Lake  
10 Murray Country. The region includes Congaree National Monument, parts of Sumter National  
11 Forest, and several large State Recreation Areas (see Table 2-26). Near the FA-1 site are  
12 several trails and State heritage preserves that offer wildlife viewing, hunting, camping, boating,  
13 fishing, and other recreational activities. The site nearly borders the Sumter National Forest.  
14 No recreation would take place on the FA-1 site during the project or over the life of the plant  
15 (SCE&G 2009a).

16 Most development would occur near the center of the property and wouldn't be visible from afar  
17 except from elevated areas. The intake and outfall structures on the Broad River would be  
18 visible. During certain weather conditions, cooling-tower plumes may also be visible. The  
19 review team concludes that the visual impact of a nuclear facility on this site would have a minor  
20 impact on the aesthetics and recreational resources in the area. The impacts would be similar  
21 to those at the VCSNS site. Based on the information provided by SCE&G and the review  
22 team's independent evaluation, the review team concludes that public aesthetics and recreation  
23 impacts of building and operating two new nuclear units at the FA-1 site would be minimal.

### 24 ***Summary of Project-Related Socioeconomic Impacts***

25 Physical impacts on workers and the general public include impacts on existing buildings,  
26 transportation, aesthetics, noise levels, and air quality. Social and economic impacts span  
27 issues of demographics, economy, taxes, infrastructure, and community services. In summary,  
28 on the basis of information provided by SCE&G and the review team's independent evaluation,  
29 the review team concludes that the impacts of building and operating a new nuclear plant at the  
30 FA-1 site on socioeconomics would be minimal and adverse for most of the region but could be  
31 noticeable but not destabilizing for Fairfield County in terms of transportation impacts during the  
32 building phase. During operation, these impacts are expected to be minimal. Impacts on  
33 aesthetics are expected to be minor. The impacts on the Fairfield County tax base during  
34 operations likely would be substantial and beneficial; however only minor beneficial impacts  
35 would result in the rest of the region.

## 1 ***Cumulative Impacts***

2 The projects identified in Table 9-6, particularly the future urbanization of the Columbia  
3 metropolitan area, have contributed or would contribute to the demographics, economic climate,  
4 and community infrastructure of the region and generally result in increased urbanization and  
5 industrialization. Because the projects within the review area identified in Table 9-6 would be  
6 consistent with applicable land-use plans and control policies, the review team considers the  
7 cumulative socioeconomic impacts from the projects to be manageable.

8 For the analysis of socioeconomic impacts at the FA-1 site, the geographic area of interest is  
9 considered to be the 50-mi region centered on the FA-1 site, with special consideration of  
10 Fairfield, Lexington, Newberry, and Richland Counties, because that is where the review team  
11 expects socioeconomic impacts to be the greatest.

12 The FA-1 site is located in a rural area of western Fairfield County. The site itself is near the  
13 Monticello Reservoir, which is surrounded by wetlands and pine forest, with sparse residential  
14 development. The site is near metropolitan Columbia, the Richland County Seat and capital of  
15 South Carolina. However, Fairfield County is much more rural than Richland County, and is  
16 governed from the County Seat of Winnsboro. As the economic hub of the Central Midlands,  
17 the City of Columbia is the center of government and industry for a wide area in central South  
18 Carolina. Relatively recently, the I-26 corridor has seen significant commercial and residential  
19 development in the areas of West Columbia and Irmo. The University of South Carolina and  
20 several regional medical facilities have attracted a well-educated workforce to this area. Fort  
21 Jackson, a large military installation in Columbia, is supported by nearly 4000 civilian  
22 employees.

23 The construction of VCSNS Unit 1 provides additional context for what the potential cumulative  
24 impacts of building the new units at the FA-1 site would be. The NRC was completing its Final  
25 Environmental Statement (FES) for the Operating License (OL) for VCSNS Unit 1 just as final  
26 construction of that unit was winding down over the 1979–1981 period. As such, the OL FES  
27 provides a glimpse at the observed socioeconomic impacts from that construction project. At  
28 that time the review team noted that the construction contractor commissioned a workforce  
29 survey to ascertain information such as the residence pattern of the construction workers. Of  
30 the approximately 2400 workers surveyed, 1913, or about 80 percent came from within the  
31 VCSNS region, and 927, or nearly 50 percent came from either Lexington or Richland Counties  
32 (NRC 1981). The review team also observed that more than 70 percent of the workers came  
33 from the Central Midlands area, with the remainder coming from outside the region.

34 In addition to assessing the marginal socioeconomic impacts from the building and operations of  
35 two additional nuclear units on the FA-1 site, the cumulative impact is also considered. The  
36 cumulative impact analysis considers other past, present, and reasonably foreseeable future  
37 actions that could contribute to the cumulative socioeconomic impacts on a given region,

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1 including other Federal and non-Federal projects and the projects listed in Table 9-6. The  
2 projects identified in Table 9-6 have contributed or would contribute to the demographics,  
3 economic climate, and community infrastructure of the region and generally result in increased  
4 urbanization and industrialization. However, many impacts such as those on housing or public  
5 services are able to adjust over time, particularly with increased tax revenues. Furthermore,  
6 State and county plans along with modeled demographic projections include forecasts of future  
7 development and population increases. Because the other projects described in Table 9-6 do  
8 not include any significant reasonably foreseeable changes in socioeconomic impacts within 50  
9 mi of the FA-1 site, the review team determined there would not be any significant additional  
10 cumulative socioeconomic impacts in the region from those activities. Any economic impacts  
11 associated with activities listed in Table 9-6 would have been considered as part of the  
12 socioeconomic baseline.

13 The review team concludes that the socioeconomic impacts of the building and operation of a  
14 new two-unit nuclear plant at the FA-1 site would be SMALL and adverse across most of the  
15 region but could be MODERATE and adverse for Fairfield County in terms of transportation  
16 impacts during the building phase. The cumulative impacts on the Fairfield County tax base  
17 during plant building and operation likely would be beneficial and LARGE. Building and  
18 operating a new plant at the FA-1 site would make a significant incremental contribution to both  
19 adverse and beneficial impact levels.

### 20 **9.3.3.7 Environmental Justice**

21 In addition to impacts from building and operations, the review team considered other past,  
22 present, and reasonably foreseeable future actions that could contribute to disproportionate and  
23 adverse impacts on minority and low-income populations at the FA-1 site, including other  
24 Federal and non-Federal projects and the projects listed in Table 9-6. For this analysis, the  
25 geographic area of interest is considered to be the 50-mi region centered on the FA-1 site.  
26 Because both sites are located in western Fairfield County, the FA-1 region substantially  
27 overlaps the VCSNS region described in Section 2.2.3.

28 The FA-1 site is located in a rural area of western Fairfield County. The site itself is near the  
29 Monticello Reservoir, which is surrounded by wetlands and pine forest, with sparse residential  
30 development. The site is near metropolitan Columbia, the Richland County Seat and capital of  
31 South Carolina. However, Fairfield County is much more rural than Richland County and is  
32 governed from the County Seat of Winnsboro. The immediate vicinity of the FA-1 site was  
33 affected substantially by the VCSNS Unit 1 construction and the creation of Monticello Reservoir  
34 as part of the FPSF project as land was acquired and cleared for development.

35 From an environmental justice perspective, the review team determined there is a potential for  
36 minority populations to be disproportionately and adversely affected by environmental impacts.  
37 Although Richland County and immediately adjacent counties are urban population centers,

1 there are a number of farms within the region. The review team found low-income, African  
2 American, and aggregated minority populations that exceed the percentage criteria established  
3 in Section 2.6.1 for further consideration in an environmental justice analyses. Several of these  
4 populations are clustered in the vicinity of the FA-1 site (see Figure 9-4 and Figure 9-5).

5 Because the other projects described in Table 9-6 do not include any significant reasonably  
6 foreseeable changes in socioeconomic impacts within 50 mi of the FA-1 site, the review team  
7 concluded there would not be any significant additional cumulative environmental justice  
8 impacts in the region from those activities. Any economic impacts associated with activities  
9 listed in Table 9-6 already have been considered as part of the socioeconomic baseline  
10 presented in Section 2.5. For example, the economic impacts of existing enterprises such as  
11 mining, other electrical utilities, etc., are part of the base used for establishing the RIMS II  
12 multipliers. Regional planning efforts and associated demographic projections formed the basis  
13 for the review team's assessment of reasonably foreseeable future impacts.

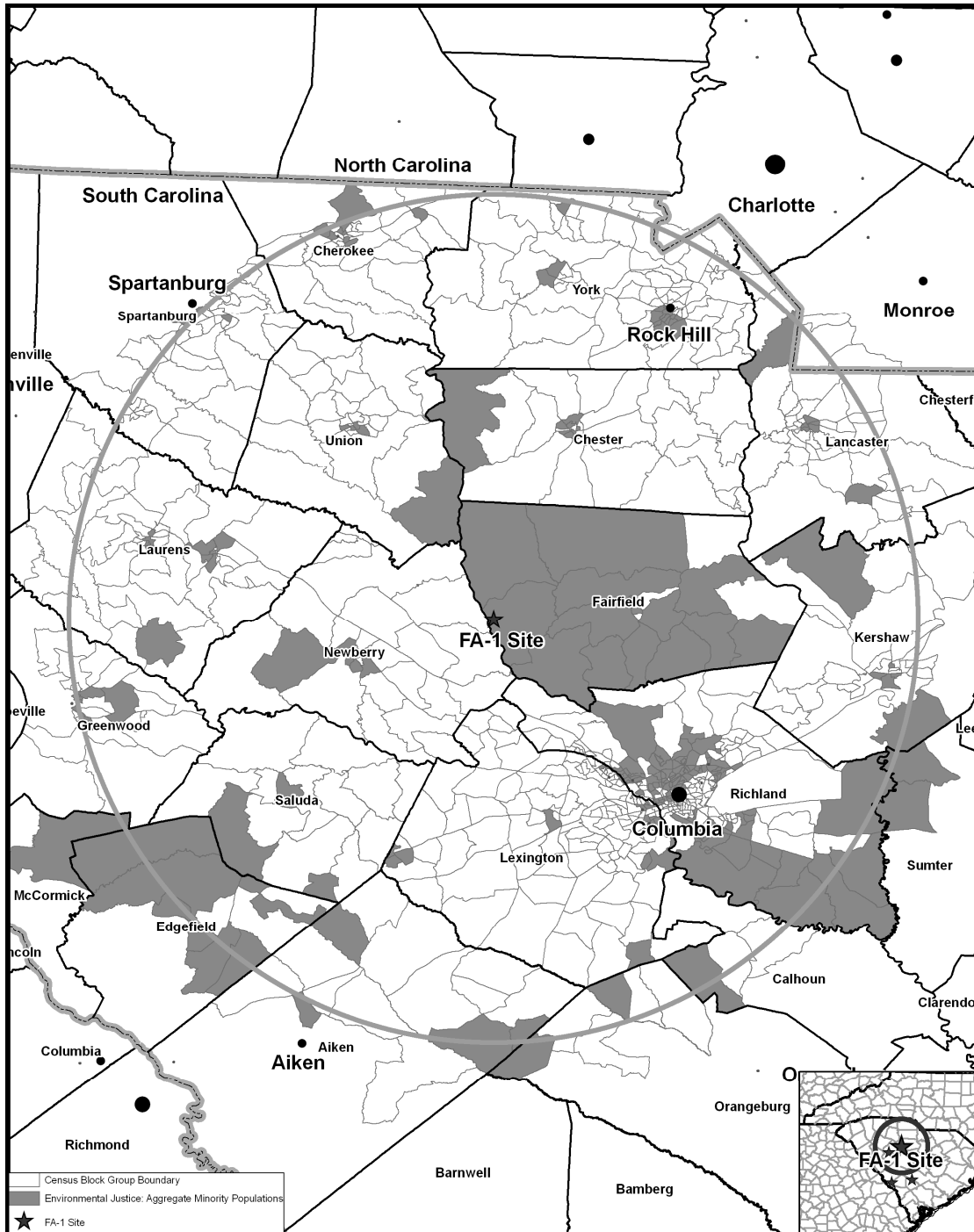
14 Because of the proximity of the FA-1 site to the proposed VCSNS site, the review team relied  
15 upon its analysis and conclusions for the proposed site (Sections 4.5 and 5.5 of this EIS) in  
16 determining the hypothetical impacts of construction at the FA-1 site. The review team based  
17 its environmental justice determinations on the methodology discussed in Section 2.6.1,  
18 including a closer look at potential areas of interest using a series of health and physical  
19 considerations. As found for the VCSNS site, the review team determined the only  
20 consideration that required greater scrutiny at the FA-1 site was related to the characteristics of  
21 the natural or physical environment – roads and traffic. Under the limitations of a  
22 reconnaissance-level analysis, the review team found no other health or physical consideration  
23 and no unique characteristics or practices that could lead to a disproportionately high and  
24 adverse impact on any minority or low-income community within the FA-1 region.

25 Because access to the FA-1 site would be provided using two-lane roads through the Dawkins  
26 community, the review team estimates traffic volumes during building activities are likely to  
27 represent a 50- to 125-percent increase or more above baseline AADT levels of affected  
28 roadways, based on analysis of the VCSNS site (see Section 4.4.4.1). The review team  
29 concludes that these impacts would be significant and would likely be especially acute during  
30 periods of shift change. These impacts would be further exacerbated by truck traffic and site  
31 delivery traffic that have no other route options available. The review team expects these  
32 impacts would be of short duration and temporary. Because the review team concluded  
33 disproportionate impacts from project activities on minority populations would occur in an area  
34 with an environmental justice population of interest, environmental justice impacts also would be  
35 noticeable, but would be of short duration and temporary.

36

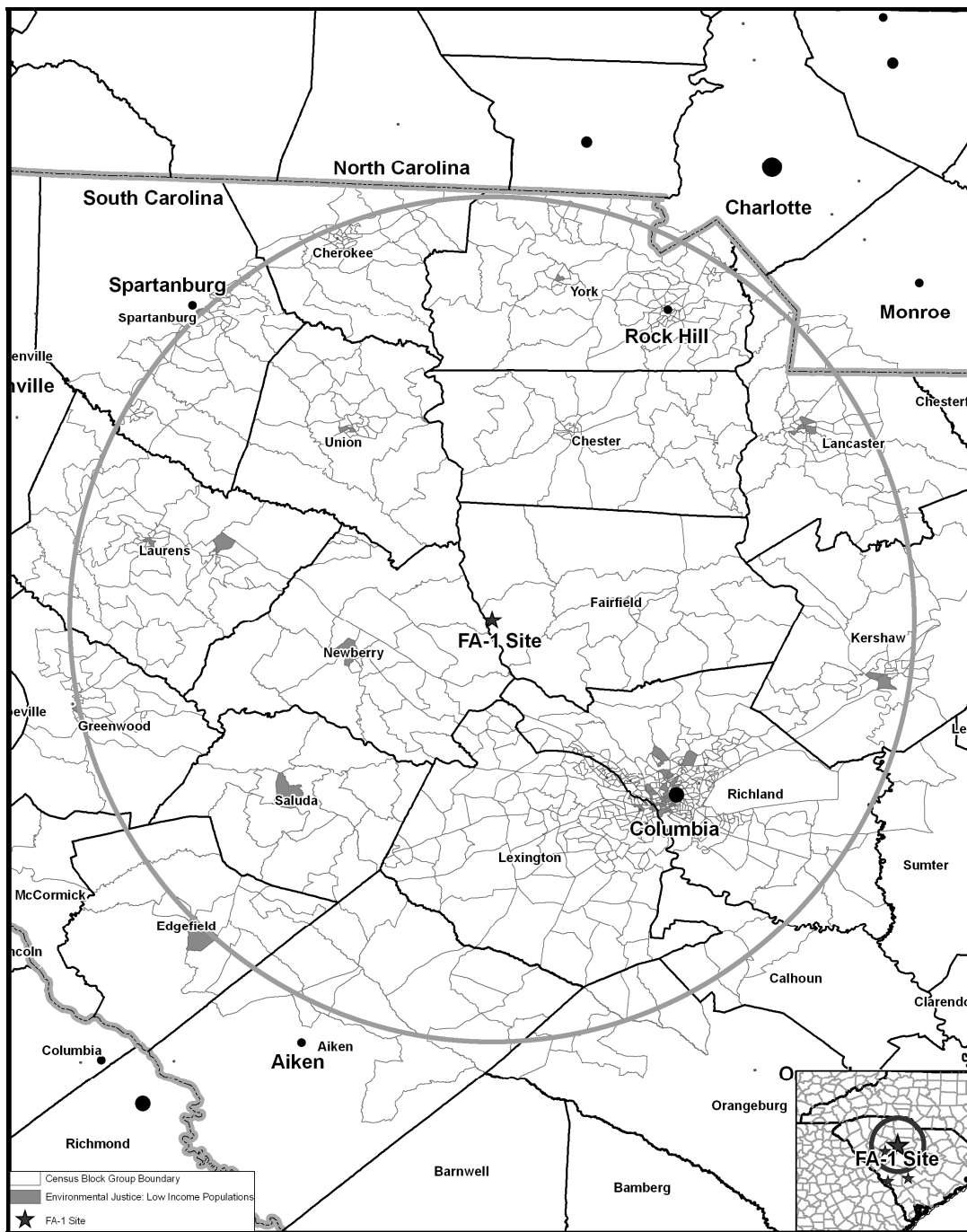


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**Figure 9-4.** Aggregate Minority Populations in Block Groups that Meet the Environmental Justice Selection Criteria at the FA-1 Site



1  
 2 **Figure 9-5.** Low-Income Populations in Block Groups that Meet the Environmental Justice  
 3 Selection Criteria at the FA-1 Site

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1 Based on the above considerations, information provided by SCE&G, visits to the site, and the  
2 review team's independent review, the review team concludes that when viewed in the context  
3 of the wider region, locating the proposed action at the FA-1 site would not contribute additional  
4 cumulative impacts beyond impacts described in Chapters 4 and 5 for the VCSNS site. The  
5 review team did not identify any other environmental pathways by which disproportionate and  
6 adverse impacts could affect minority or low-income populations or communities. The review  
7 team concludes that disproportionate and adverse impacts, which may be noticeable locally, do  
8 not create pathways to increase expected cumulative impacts on minority and low-income  
9 populations in the region. Based on its evaluation, the review team concludes that cumulative  
10 environmental justice impacts associated with building and operating two new nuclear units at  
11 the FA-1 site would be SMALL, with the exception of a limited MODERATE disproportionate and  
12 adverse impact from traffic during peak project employment. Building two new nuclear units at  
13 the FA-1 site would be a significant contributor to these impacts.

### 14 **9.3.3.8 Historic and Cultural Resources**

15 The following cumulative impact analysis includes building and operating two new nuclear  
16 generating units at the FA-1 site. The analysis also considers other past, present, and  
17 reasonably foreseeable future actions that could affect cultural resources, including other  
18 Federal and non-Federal projects and the projects listed in Table 9-6. For the analysis of  
19 cultural impacts at the FA-1 site, the geographic area of interest is considered to be the Area of  
20 Potential Effect (APE) that would be defined for this proposed undertaking. This includes the  
21 physical APE, defined as the area directly affected by the site-development and operation  
22 activities at the site and transmission lines, and the visual APE. The visual APE is defined as  
23 an additional 1-mi radius around the physical APE as a reasonable assumption for defining a  
24 maximum distance from which the structures can be seen.

25 Reconnaissance activities in a cultural resource review have particular meaning. For example,  
26 these activities include preliminary field investigations to confirm the presence or absence of  
27 cultural resources. However, in developing its EISs, the review team relies upon  
28 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-  
29 level information is data that are readily available from agencies and other public sources. It  
30 can also include information obtained through visits to the site area. To identify the historic and  
31 cultural resources at the FA-1 site the following information was used:

- 32 • SCE&G ER (SCE&G 2009a) – including the National Park Services National Register  
33 Information
- 34 • NRC Alternative Sites Visit, March 2009 (NRC 2010).

35 The FA-1 site is a greenfield site that is forested and primarily undeveloped. Historically, the  
36 site and vicinity were largely undisturbed and likely contained intact archaeological sites  
37 associated with the past 10,000 years of human settlement. Over time, the FA-1 site has been

1 disturbed by forestry practices (SCE&G 2009e). The physical and visual APEs for a proposed  
2 plant at the FA-1 site do not appear to have any historic properties located within the area likely  
3 to be affected by building or operating new plants. No archaeological and/or architectural  
4 surveys have been conducted at the FA-1 site.

5 Two significant cultural resources are known to be located within 2 mi of the FA-1 site (SCE&G  
6 2009e). These two sites are the McMeekin Rock Shelter and the Blair Mound, both of which are  
7 listed in the National Register of Historic Places (NRHP or the National Register) (SCE&G  
8 2009e). The project has the potential to affect resources through visual impacts from buildings  
9 and transmission lines. Impacts on these resources may occur as a result of significant  
10 alterations to the visual landscape within the geographic area of interest.

11 To accommodate the building of two nuclear units on the FA-1 site, SCE&G would need to clear  
12 approximately 400 ac of undeveloped land for the nuclear facility and associated structures and  
13 infrastructure. The proposed facility footprint would lie within a 400-ac parcel within a 6000-ac  
14 facility boundary (Tetra Tech NUS, Inc. 2009). SCE&G has stated that as part of the site-  
15 selection process known cultural resource locations would be considered as avoidance areas  
16 (SCE&G 2009i, j). SCE&G has also stated that if the proposed project was sited at the FA-1  
17 site, identification of cultural resources would be accomplished through cultural resource  
18 surveys. The results would be used in the site-planning process to avoid cultural resource  
19 impacts. If significant cultural resources were identified by these surveys, SCE&G would also  
20 develop protective measures similar to what they have in place for the VCSNS site. In addition,  
21 inadvertent discovery procedures would be developed if cultural resources were discovered  
22 during site-development activities (SCE&G 2009i).

23 Each AP1000 unit would require the addition of three 230-kV transmission lines, which would  
24 each occupy a 100-ft-wide transmission-line corridor. The total length and acreage of new  
25 transmission-line corridor required (collectively) would be approximately 227 mi and 2492 ac.  
26 SCE&G and Santee Cooper would both have a portion of the new transmission lines and details  
27 are provided in Table 9-9 and Table 9-10 (SCE&G 2009c, d). If the proposed project was sited  
28 at the FA-1 site, the staff assumes SCE&G would conduct its transmission-line-related cultural  
29 resource activities similar to what they have committed to do for the VCSNS site, as described  
30 in Section 4.6.

31 Past actions in the geographic area of interest that have similarly affected cultural and historic  
32 resources include forestry practices at the FA-1 site and any road development and logging  
33 activities associated with those practices. No current or planned projects were identified in  
34 Table 9-6 that may contribute to cumulative impacts on historic and cultural resources in the  
35 geographic area of interest. Activities associated with building two nuclear units and supporting  
36 facilities that can potentially directly affect cultural and historic resources include land-clearing,  
37 excavation, and grading activities. Given SCE&G's site-planning process and no known cultural

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1 resources at the FA-1 site based on reconnaissance-level information, the impacts on cultural  
2 resources due to site-development activities would be negligible.

3 In addition, visual impacts from transmission lines may result in significant alterations to the  
4 visual landscape within the geographic area of interest. Given that there are no known cultural  
5 resources where the historic setting and character of the resources are important, the visual  
6 impacts would be negligible. The staff assumes that SCE&G and Santee Cooper would  
7 develop a management agreement in consultation with the State Historic Preservation Officer  
8 (SHPO) similar to the one that would be developed for VCSNS.

9 Impacts on cultural and historic resources from operation of two new nuclear units at the FA-1  
10 site include those associated with the operation of new units and maintenance of  
11 transmission lines. The review team assumes that the same procedures currently used by  
12 SCE&G and Santee Cooper would be used for onsite and offsite maintenance activities.  
13 Consequently, the incremental effects of the maintenance of transmission-line corridors and  
14 operations of the two new units and associated impacts on cultural resources would be  
15 negligible in the physical and visual APEs.

16 Table 9-6 identifies projects within the geographic area of interest and includes transmission  
17 lines; transportation improvements described in the South Carolina Strategic Corridor System  
18 Plan (SCDOT 2009); other parks, forests, and reserves; and future urbanization. These  
19 projects could affect historic and cultural resources in a manner similar to those associated with  
20 the operation of two new units.

21 Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources  
22 is cumulative. Based on the information provided by the applicant and the review team's  
23 independent evaluation, the review team concludes that the cumulative impacts from building  
24 and operating two new nuclear generating units on the FA-1 site would be SMALL. This impact-  
25 level determination reflects no known cultural resources that could be affected; however, if the  
26 FA-1 site was to be developed, then cultural resource surveys may reveal important historic  
27 properties that could result in greater cumulative impacts.

### 28 **9.3.3.9 Air Quality**

29 Because FA-1 is located only 5.5 mi from the VCSNS site, the air quality impacts of building and  
30 operating a nuclear facility at the FA-1 site would be similar to the air quality impacts at the  
31 VCSNS site. As described in Sections 4.7 and 5.7, the review team determined that the  
32 impacts of building and operating two new nuclear units on air quality at the VCSNS site would  
33 be SMALL. Therefore, the impacts of building and operating two new nuclear units on air  
34 quality at the FA-1 site would be minimal.

1 The FA-1 site is located in the Columbia Intrastate Air Quality Control Region, which is  
2 designated as being unclassified or in attainment with the National Ambient Air Quality  
3 Standards (NAAQSs) (40 CFR 81.108). The resource area defined for this evaluation is  
4 Fairfield County, South Carolina. A single county was selected because designations of  
5 attainment or non-attainment are made on a county-by-county basis. As listed in Table 9-6,  
6 sources of gaseous emissions in Fairfield County include the VCSNS Unit 1 and the SCE&G  
7 Parr Steam Plant. Gaseous emissions from Unit 1 include sulfur oxides, carbon monoxide,  
8 hydrocarbons, and nitrogen oxides associated with the intermittent operation of diesel  
9 generators (NRC 2004). The SCE&G Parr Steam Plant is located approximately 2 mi south of  
10 the VCSNS site and uses four natural-gas turbines to generate electricity. Gaseous emissions  
11 from the Parr Steam Plant include sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen  
12 oxides. Future development of the region around the VCSNS site could lead to increases in  
13 gaseous emissions related to transportation. Table 7-1 lists low-to-moderate potential for  
14 growth within Fairfield County. Given the intermittent operation of the diesel generators at both  
15 the existing Unit 1 and proposed Units 2 and 3, the low-to-moderate potential for growth in the  
16 county, and given the area is currently in attainment, the review team concludes the cumulative  
17 impacts, including the impacts from building and operating two new units on air quality, would  
18 be SMALL for criteria pollutants.

19 Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6. As  
20 pointed out in Chapter 7, the impacts of the emissions are independent of emission location.  
21 Consequently, the discussions in the previous chapters and in Section 9.2.5 are applicable to  
22 two AP1000 reactors located at the FA-1 site. The impacts of greenhouse gas emissions at the  
23 FA-1 site considered in isolation would be minor, and the cumulative impact of greenhouse gas  
24 emissions would also be MODERATE, primarily due to national and world-wide impacts of  
25 emissions of greenhouse gases. Building and operating two new nuclear units at the FA-1 site  
26 would not be a significant contributor to the MODERATE impact.

#### 27 **9.3.3.10 Nonradiological Health Impacts**

28 The following analysis considers nonradiological health impacts from building activities and  
29 operations. The analysis also includes past, present, and reasonably foreseeable future actions  
30 that impact the nonradiological health, including other Federal and non-Federal projects and the  
31 projects listed in Table 9-6. For the analysis of nonradiological health impacts at the FA-1 site,  
32 the geographic area of interest is considered to be the 6-mi area centered on the FA-1 site and  
33 the associated transmission-line corridors. The 6-mi radius is expected to encompass all  
34 nonradiological health impacts. Because the FA-1 site is located in close proximity to the  
35 VCSNS site, the geographic areas of interest overlap each other somewhat and are  
36 substantially the same in terms of characteristics. The VCSNS site vicinity (6-mi radius) is  
37 described in detail in Chapter 2.

## Environmental Impacts of Alternatives

### 1 ***Building Impacts***

2 Nonradiological health impacts from building two new nuclear units on construction workers and  
3 members of the public at the FA-1 alternative site would be similar to those evaluated in  
4 Section 4.8. They include occupational injuries, noise, vehicle exhaust, and dust. Applicable  
5 Federal and State regulations on air quality and noise would be complied with during the site-  
6 preparation and building phase. The FA-1 site is located in a rural area and building impacts  
7 would likely be negligible on the surrounding populations that are classified as medium- and  
8 low-population areas.

9 Past actions in the geographic area of interest that have similarly affected nonradiological health  
10 include the development and operation of the VCSNS Unit 1, located approximately 5.5 mi  
11 south-southwest of the FA-1 site; the development of the SCE&G Parr Hydroelectric Plant,  
12 located approximately 6.9 mi downstream on the Broad River; the Vulcan Materials  
13 Company/Blair Quarry, approximately 5 mi north of the FA-1 site; and the FPSF, approximately  
14 4.1 mi downstream on the Broad River. There are no major current projects in the geographic  
15 area of interest that would have a cumulative impact on nonradiological health in a similar way.

16 Proposed future actions that would affect nonradiological health in a similar way to development  
17 at the FA-1 site would include the proposed SCE&G Combined Site Emergency Operations  
18 Facility that may be located as close as 5 mi from the proposed FA-1 alternative site.  
19 Transmission-line creation and/or upgrading throughout the designated geographic region of  
20 interest and future urbanization would also be expected to occur. The review team concludes  
21 that the cumulative impacts on nonradiological health from building two new nuclear units and  
22 associated transmission lines at the FA-1 site would be minimal.

### 23 ***Operational Impacts***

24 Occupational health impacts on operational employees would include those associated with the  
25 operation of cooling towers and transmission lines and they are fully described in Section 5.8.  
26 Based on the configuration of the proposed new units at the FA-1 site (closed-cycle, wet cooling  
27 system with mechanical draft cooling towers), etiological agents would not likely increase the  
28 incidence of waterborne diseases in the vicinity of the site. Impacts on workers health from  
29 occupational injuries, noise, and electric fields would be similar. Noise and electric fields would  
30 be monitored and controlled in accordance with applicable Occupational Safety and Health  
31 Administration (OSHA) regulations.

32 No past, present, or future actions in the geographic area of interest were identified that would  
33 significantly affect nonradiological health in ways similar to those associated with the operation  
34 of two new units at the FA-1 site. The review team therefore concludes that the impacts on  
35 nonradiological health from operating two new nuclear units and associated transmission lines  
36 at the FA-1 site would be minimal.

## 1 **Summary Statement**

2 Impacts on nonradiological health from building and operation of two new units at the FA-1 site  
3 are estimated based in the information provided by SCE&G and the review team's independent  
4 evaluation. The review team concludes that nonradiological health impacts on construction  
5 workers and the public resulting from the building of two new nuclear units and associated  
6 transmission lines at the FA-1 site would be minimal. The review team also expects that the  
7 occupational health impacts on the operations employees and the public of two new nuclear  
8 units at the FA-1 site would be minimal. Finally, the review team concludes that cumulative  
9 impacts from related past, present, and future actions in the geographic area of interest to  
10 nonradiological health would be SMALL.

### 11 **9.3.3.11 Radiological Impacts of Normal Operations**

12 The following impact analysis includes radiological impacts on the public and workers from  
13 building activities and operations for two nuclear units at the FA-1 alternative site. The analysis  
14 also considers other past, present, and reasonably foreseeable future actions that affect  
15 radiological health, including other Federal and non-Federal projects and the projects listed in  
16 Table 9-6. As described in Section 9.3.3, the FA-1 site is a greenfield site; there are currently  
17 no nuclear facilities on the site. The geographic area of interest is the area within a 50-mi radius  
18 of the FA-1 site. Facilities potentially affecting radiological health within this geographic area of  
19 interest are the existing VCSNS Unit 1, the proposed independent spent fuel storage (ISFSI)  
20 facility at the VCSNS Unit 1, the proposed Lee Units 1 and 2, and the Westinghouse Fuel  
21 Fabrication Plant outside of Columbia, South Carolina. In addition, there are likely to be  
22 hospitals and industrial facilities within 50 mi of the FA-1 site that use radioactive material.

23 The radiological impacts of building and operating the proposed two AP1000 plants at the FA-1  
24 site include doses from direct radiation and liquid and gaseous radioactive effluents. These  
25 pathways would result in low doses to people and biota offsite that would be well below  
26 regulatory limits. The impacts are expected to be similar to those at the VCSNS site.

27 The radiological impacts of the VCSNS Unit 1 include doses from direct radiation and liquid and  
28 gaseous radioactive effluents. These pathways would result in low doses to people and biota  
29 offsite that would be well below regulatory limits as demonstrated by the ongoing radiological  
30 environmental monitoring program conducted around VCSNS Unit 1. In addition, the ongoing  
31 radiological environmental monitoring program conducted around VCSNS Unit 1 indicates that  
32 there are no significant cumulative radiological impacts from operation of the Westinghouse  
33 Fuel Fabrication Plant. The proposed ISFSI would produce negligible direct radiation offsite as  
34 discussed in Section 4.9.1. The ER submitted to the NRC as part of the application for the  
35 proposed plants at the Lee site indicates that operation of the proposed Lee reactors would  
36 result in radiological impacts from direct radiation and liquid and gaseous radioactive effluents.  
37 The Lee ER indicates that these pathways would result in low doses to people and biota offsite



## Environmental Impacts of Alternatives

1 that would be well below regulatory limits (Duke 2009b). The NRC staff concludes that the dose  
2 from direct radiation and effluents from hospitals and industrial facilities that use radioactive  
3 material would be an insignificant contribution to the cumulative impact around the FA-1 site.  
4 This conclusion is based on data from the radiological environmental monitoring programs  
5 conducted around currently operating nuclear power plants. Based on the information provided  
6 by SCE&G and the NRC staff's independent analysis, the NRC staff concludes that the  
7 cumulative radiological impacts from building and operating the two proposed AP1000 plants  
8 and other existing and planned projects and actions in the geographic area of interest around  
9 the FA-1 site would be SMALL.

### 10 **9.3.3.12 Postulated Accident Impacts**

11 The following impact analysis includes radiological impacts from postulated accidents from  
12 operations for two nuclear units at the FA-1 alternative site. The analysis also considers other  
13 past, present, and reasonably foreseeable future actions that affect radiological health from  
14 postulated accidents, including other Federal and non-Federal projects and the projects listed in  
15 Table 9-6. As described in Section 9.3.3, the FA-1 site is a greenfield site; there currently are  
16 no nuclear facilities on the site. The geographic area of interest considers all existing and  
17 proposed nuclear power plants that have the potential to increase the probability-weighted  
18 consequences (i.e., risks) from a severe accident at any location within 50 mi of the FA-1  
19 alternative site. Existing facilities potentially affecting radiological accident risk within this  
20 geographic area of interest are the existing VCSNS Unit 1; H.B. Robinson Unit 1; Oconee Units  
21 1, 2, and 3; Catawba Units 1 and 2; McGuire Units 1 and 2; and Vogtle Units 1 and 2. Other  
22 proposed reactors within this geographic area of interest include two AP1000 reactors at the  
23 Lee Nuclear Station and two AP1000 reactors at the Vogtle site. The Westinghouse Fuel  
24 Fabrication Plant outside of Columbia, South Carolina, is also within the geographic area of  
25 interest.

26 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences  
27 of design basis accidents (DBAs) at the VCSNS site would be minimal for AP1000 reactors.  
28 DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet  
29 NRC safety criteria. The AP1000 design is independent of site conditions and the meteorology  
30 of the FA-1 and VCSNS sites are similar; therefore, the NRC staff concludes that the  
31 environmental consequences of DBAs at the FA-1 site would be minimal. Because the  
32 meteorology, population distribution, and land use for the FA-1 alternative site are expected to  
33 be similar to the proposed VCSNS site, risks from a severe accident for an AP1000 reactor  
34 located at the FA-1 alternative site are expected to be similar to those analyzed for the  
35 proposed VCSNS site. These risks for the proposed VCSNS site are presented in Tables 5-17  
36 and 5-19 and are well below the median value for current-generation reactors. In addition, as  
37 discussed in Section 5.11.1, estimates of average individual early fatality and latent cancer

1 fatality risks are well below the Commission's<sup>(a)</sup> safety goals (51 FR 30028). For existing plants  
2 within the geographic area of interest (VCSNS Unit 1; H.B. Robinson Unit 1; Oconee Unit 1, 2,  
3 and 3; Catawba Units 1 and 2; McGuire Units 1 and 2; and Vogtle Units 1 and 2), the  
4 Commission has determined that the probability-weighted consequences of severe accidents  
5 are small (10 CFR Part 51, Appendix B, Table B-1). Finally, according to the Lee Nuclear  
6 Station Environmental Report (Duke 2009a) and the EIS for the Vogtle Early Site Permit (ESP)  
7 (NRC 2008a), the risks from these proposed sites are also well below current-generation  
8 reactors and meet the Commission's safety goals. There is no irradiated fuel at the  
9 Westinghouse Fuel Fabrication Plant, and the plant is designed to prevent inadvertent  
10 criticalities; therefore, the additional risk is not significant in the evaluation of the cumulative  
11 severe accident risk for a nuclear power plant at the FA-1 site. On this basis, the NRC staff  
12 concludes that the cumulative risks from severe accidents at any location within 50 mi of the FA-  
13 1 alternative site would be SMALL.

#### 14 **9.3.4 The Cope Generating Station Site**

15 This section covers the review team's evaluation of the potential environmental impacts of siting  
16 a two-unit nuclear power plant at the 6000-ac Cope Generating Station (CGS) site located in  
17 Orangeburg County, South Carolina, 1.5 mi southwest of the town of Cope. The following  
18 sections describe a cumulative impact assessment conducted for each major resource area.  
19 The specific resources and components that could be affected by the incremental effects of the  
20 proposed action if it were implemented at the CGS site and other actions in the same  
21 geographic area were considered. This assessment includes the impacts of NRC-authorized  
22 construction, operations, and preconstruction activities. Also included in the assessment are  
23 other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that  
24 could have meaningful cumulative impacts when considered together with the proposed action if  
25 implemented at the CGS site. Other actions and projects considered in this cumulative analysis  
26 are described in Table 9-13.

27 The CGS is located in a predominantly rural area. The undeveloped sections on the site consist  
28 primarily of mixed pine and hardwood stands, wetland mixed hardwood forest, and cypress-gum  
29 swamplands. Wetlands are predominantly located along the floodplain of the Edisto River  
30 (South Fork), which crosses the SCE&G property 1 mi south of the CGS. A conservation  
31 easement granted to the Congaree Land Trust encompasses and protects 400 ac of wetlands  
32 located along the Edisto River at the site. Figure 9-6 shows the CGS alternative site region.

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(a) The Commission is the body of up to five NRC commissioners that formulates policies, develops regulations governing nuclear reactor and nuclear material safety, issues orders to licensees, and adjudicates legal matters.

## Environmental Impacts of Alternatives

1 **Table 9-13.** Past, Present, and Reasonably Foreseeable Projects and Other Actions  
 2 Considered in the Cope Generating Station Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
Cope Generating Station	A 430-MW(e) coal-fired electrical generating plant	In same general location	Operational <sup>(a)</sup>
VCSNS Unit 1	VCSNS Unit 1 consists of one 996-MW(e) nuclear power generating plant.	About 65 mi north of Cope	Operational <sup>(b)</sup>
Vogtle Electric Generating Plant (VEGP)	Nuclear power generating plant with 2 units, VEGP 1 (1109 MW(e)) and VEGP 2 (1127 MW(e))	Within 50 mi of Cope	Operational <sup>(c)</sup>
VEGP Units 3 and 4	Nuclear power generating plant with two Westinghouse AP1000 pressurized water reactors	About 45 mi west-southwest of Cope	Proposed <sup>(d)</sup>
H.B. Robinson Steam Electric Plant, Unit 2	Nuclear power generating plant with one 710-MW(e) unit	About 90 mi northeast of Cope	Operational <sup>(e)</sup>
Westinghouse Fuel Fabrication Plant in Columbia, South Carolina	Design and fabricate completed nuclear fuel assemblies and fuel-related products	About 40 mi north of Cope	Operational <sup>(f)</sup>
Savannah River Site Mixed Oxide (MOX) Fuel Fabrication facility	Nuclear fuel fabrication	About 40 mi west of Cope	Construction of the MOX facility began in August 2007; operation is expected to begin in 2016 <sup>(g)</sup>
Other Actions/Projects:			
U.S. Department of Energy Savannah River Site	Research and industrial complex	About 40 mi west of Cope	Operational <sup>(h)</sup>
Barnwell Low-Level Radioactive Waste Disposal Facility	Low-level radioactive waste disposal	About 25 mi west of Cope	Operational <sup>(i)</sup>
Charleston Naval Weapons Station	Radiological materials	About 65 mi east-southeast of Cope	Operational <sup>(j)</sup>
Various hospitals	Medical isotopes	Within 50 mi of Cope	Operational in Orangeburg, Berkeley, Calhoun, Bamberg, Dorchester, Barnwell, Allendale, Richland and Lexington Counties.
Kaiser Agricultural Chemicals	Chemical facility	About 1 mi east-northeast of Cope	Listed on the EPA Facility Registry System

3

Table 9-13. (contd)

Project Name	Summary of Project	Location	Status
Rockland-Bamberg Industries	Fabric coating mill	About 5 mi south-southwest of Cope	Operational <sup>(k)</sup>
Town of Norway	Sewage Treatment System Discharge	About 8 mi northwest of Cope	Operational <sup>(l)</sup>
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroad; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region.	Construction would occur in the future, as described in State and local land-use planning documents

(a) Source: SCE&G 2009g

(b) Source: NRC 2004

(c) Source: NRC 2009e

(d) Source: NRC 2009f

(e) Source: NRC 2009b

(f) Source: Westinghouse 2009

(g) Source: DOE 2009a

(h) Source: DOE 2009b

(i) Source: South Carolina Energy Office 2009

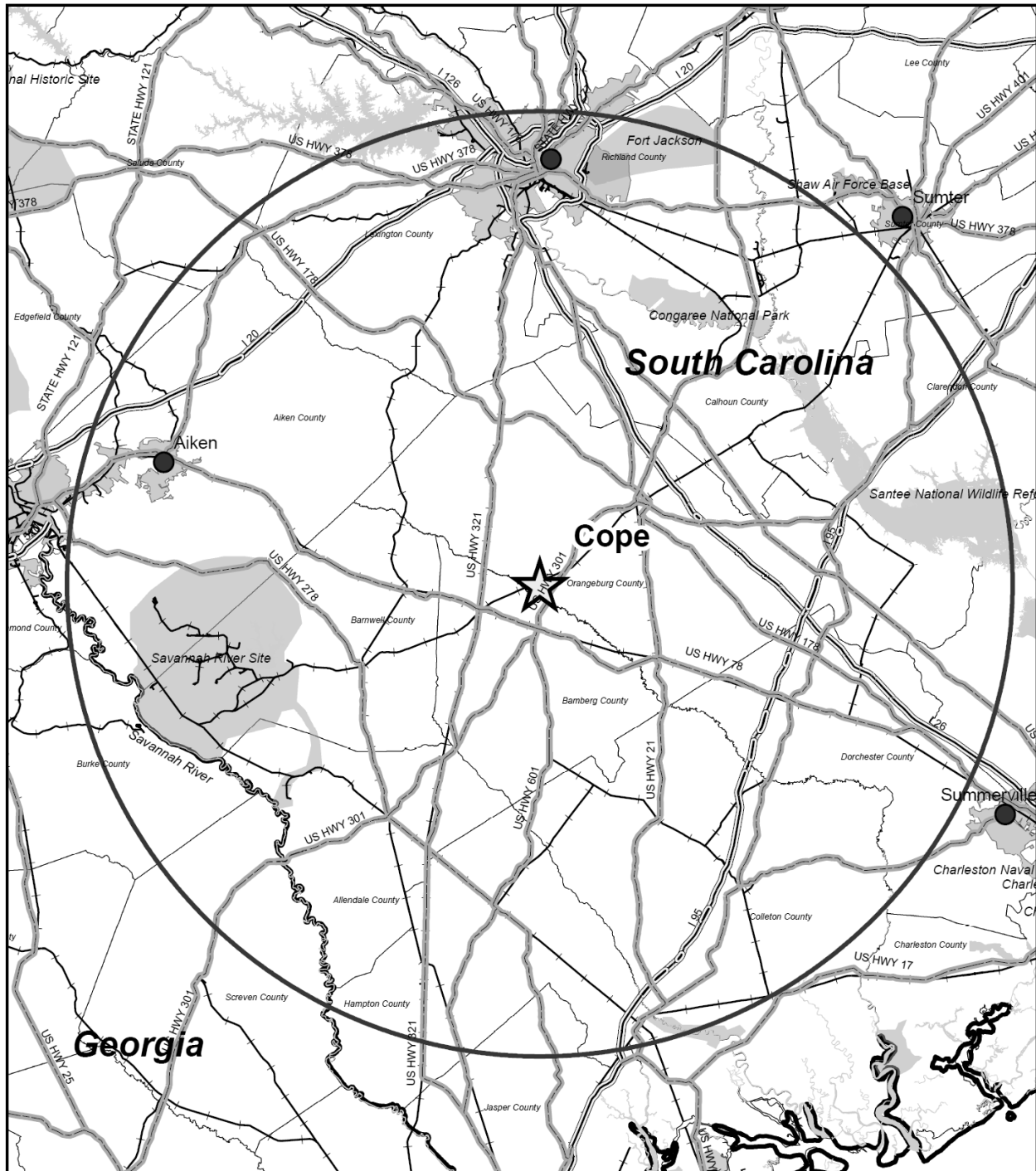
(j) Source: SCE&G 2009a

(k) Source: EPA 2009e

(l) Source: EPA 2009f

- 1 The CGS, and an adjacent greenfield site, were originally identified in a 1974 siting evaluation  
2 for facilities development. The current CGS site has an existing 430-MW(e) coal-fired plant that  
3 has been in commercial operation since 1996. As a currently operational power plant, existing  
4 infrastructure includes rail access, transmission and distribution systems, and developed water  
5 resources. The power plant and associated support facilities are located on approximately  
6 550 ac. The primary source of cooling water for the CGS is pumped groundwater, with  
7 supplemental water supply provided through withdrawal of excess flow from the Edisto River.  
8 No additional land would need to be acquired for an expansion of generating capacity at the site  
9 (SCE&G 2009a).

Environmental Impacts of Alternatives



1  
2

Figure 9-6. The CGS Alternative Site Region

#### 1 **9.3.4.1 Land Use and Transmission-Line Corridors**

2 In addition to land-use impacts from building and operations, the cumulative analysis for the  
3 CGS site considers other past, present, and reasonably foreseeable future actions that could  
4 contribute to the cumulative land-use impacts, including other Federal and non-Federal projects  
5 and the projects listed in Table 9-13. For the analysis of land-use impacts at the CGS site, the  
6 geographic area of interest is considered to be the 50-mi region centered on the CGS site, plus  
7 any transmission-line corridors that extend beyond that range. Most but not all of the  
8 transmission-line corridor length falls within a 50-mi radius of the site. Land-use planning for  
9 transmission-line routing over wide areas must consider land-use plans of adjoining counties  
10 and other land-managing agencies, rather than considering one county in isolation.  
11 Furthermore, in predominantly rural settings such as that surrounding the CGS site, land-use  
12 changes occurring substantial distances away from a project site can substantially influence  
13 land-use planning decisions close to the site.

14 Roads and other public facilities and services in rural areas tend to serve people who are  
15 spread thinly but broadly over large portions of the landscape. Therefore land-use changes can  
16 affect roads and other facilities at greater distances than similar changes in more densely  
17 populated areas

18 The CGS site is located in a sparsely populated, largely rural area, with forests and small farms  
19 composing the dominant land use. Historically, the area has been used for crop production, and  
20 agriculture and silviculture are the dominant land uses in the vicinity. Several electric  
21 transmission lines, State routes, and interstate highways currently traverse the region. Because  
22 the site already hosts a power station, the review team believes location of nuclear units there  
23 would not be inconsistent with existing zoning.

24 Development of the proposed new units on the CGS site would convert existing land uses on  
25 about 400 ac of currently forested land to utility uses for the nuclear facility and associated  
26 structures and infrastructure. Similar to the VCSNS site, each AP1000 unit would require the  
27 addition of three 230-kV transmission lines, each of which would occupy a 100-ft-wide  
28 transmission-line corridor. Based on information provided by SCE&G (2009d) describing  
29 dimensions of conceptual transmission-line corridors for the CGS site, approximately 162 mi  
30 covering about 1179 ac of land would be affected. The review team concludes that the land-use  
31 impacts of the transmission-line installation activities would be generally similar to those  
32 described for the VCSNS site in Section 4.1.2. SCE&G stated that all land clearing associated  
33 with nuclear facility and transmission-line development would be conducted according to  
34 Federal, State, and local regulations, permit requirements, existing SCE&G and Santee Cooper  
35 procedures, good construction practices, and established BMPs (SCE&G 2009a).

36 Because the other projects described in Table 9-13 do not include any reasonably foreseeable  
37 changes in land-use types within 50 mi of the CGS site, there would not be any significant  
38 additional cumulative impacts on land use from those activities.

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1 As described above, installation of new transmission-line corridors to support the new units  
2 have the potential to affect as much as 1179 ac over 162 mi of length. If additional transmission  
3 lines are built from other energy projects, there would be a cumulative land-use impact from the  
4 additional amount of land converted to utility corridor use for transmission lines. Because  
5 transmission lines are often co-located and are relatively narrow, the review team expects that  
6 the cumulative impact would be consistent with the land-use plans and zoning regulations of the  
7 affected counties. Nonetheless, consistent with previous discussions, multiple new  
8 transmission-line corridors could noticeably alter the land-use classification acreage proportions,  
9 both within the vicinity of the CGS and within the 50-mi region.

10 Cumulative land-use impacts within the region are expected to be manageable because the  
11 activities would be consistent with existing land-use plans and zoning. However, due to the  
12 potential reclassification of acreage within the region caused by the transmission-line  
13 development, the review team concludes that the cumulative land-use impacts associated with  
14 the proposed project at the CGS site, related transmission-line corridor development, and other  
15 projects in the geographic area of interest would be MODERATE. Considering the land needs  
16 noted above, building and operating two new nuclear units at the CGS site would be a  
17 significant contributor to these impacts.

### 18 **9.3.4.2 Water Use and Quality**

19 The CGS site hydrology, water use, and water quality are discussed in ER Section 9.3.3.2  
20 (SCE&G 2009a); this section draws from information presented in the ER. Additional material  
21 for this alternative site is available in the Nuclear Plant Site Selection Study Report (Tetra Tech  
22 NUS, Inc. 2009). SCE&G currently uses groundwater as the primary source of water for  
23 operations and surface water as a backup source for the existing CGS. Groundwater is  
24 currently withdrawn on the site from the Middendorf aquifer and the Black Creek aquifer to  
25 support operation of the 430-MW(e) coal-fired plant onsite. These aquifers have high  
26 transmissivities and local well yields exceed 1000 gpm (2.2 cfs) (SCE&G 2009a). Two  
27 additional units at the CGS site would require an additional 83 cfs of total water withdrawal  
28 resulting in a 62-cfs consumptive loss through evaporation in the cooling towers and a 21-cfs  
29 return to the Edisto River as blowdown. Reliance solely on groundwater to meet station water  
30 demand would require an additional 28 groundwater wells, which would likely draw down the  
31 aquifer and result in interference with other local wells. Conversely, using the surface water  
32 from the adjacent South Fork Edisto River as the sole water source to support two new units at  
33 the site would exceed the 5-percent withdrawal limit of the river's annual mean flow required by  
34 EPA's Phase I regulations in 40 CFR 125.84(b)(3)(i). While the CGS site hydrology poses  
35 some challenges to supporting the building and operation of two new units, these challenges  
36 could be met by using both groundwater and surface water in combination with other water-  
37 saving mitigation strategies, such as hybrid or dry cooling towers, or the construction of a  
38 cooling-water storage reservoir. Specific water consumption and mitigation strategies could  
39 include 5-percent consumptive use from the South Fork Edisto River, makeup groundwater

1 withdrawn at a sustainable level, and the use of dry cooling towers and/or hybrid cooling towers  
 2 to make up for any cooling-water shortfalls.

3 Representative historical flow data for water years 1991–2008 is available for the South Fork  
 4 Edisto River near Cope, South Carolina (USGS 2008b). The average flow is slightly lower than  
 5 what is reported in the ER for this station due to the difference in periods covered. Table 9-14  
 6 lists the South Fork Edisto River reduction in flow that would occur if 5 percent of the annual mean  
 7 flow of the river was relied on as a partial water source for the operation of two units at this site.

8 **Table 9-14.** South Fork Edisto River Reduction in Flow and Assessed Impact Levels

<b>South Fork Edisto River Flow Condition</b>	<b>River Flow Rate (cfs)</b>	<b>Withdrawal Rate (cfs)</b>	<b>Percent River Flow Reduction</b>
Annual Mean Flow	678	34	5
Lowest Annual Flow	304	34	11.2

9 Withdrawal of water from the South Fork Edisto River would be limited to 5 percent of the mean  
 10 annual flow. Withdrawal of enough groundwater to meet the needs of the proposed units would  
 11 likely create significant drawdowns at other local wells and might be difficult to sustain. Water-  
 12 use impacts would likely require some mitigation, such as the use of dry cooling towers or  
 13 hybrid cooling towers, or the construction of a cooling-water storage reservoir to supplement  
 14 water requirements during certain times of the year.

15 SCE&G does not describe its proposed method for disposing of cooling-tower blowdown, but  
 16 indicates that a SCDHEC-issued NPDES permit would be required to operate the nuclear  
 17 project at this site. Effluent discharge through an NPDES-permitted outfall would ensure that  
 18 the discharges complied with the Clean Water Act. Such permits are designed to ensure the  
 19 protection of water quality, and therefore the impact on water quality from station blowdown to  
 20 the Edisto River is assessed to be minimal.

21 Impacts of building and operation of the proposed units on groundwater quality may occur due to  
 22 leaching of spilled pollutants and effluents. However, based on the review team’s experience  
 23 with other facilities, the review team concludes that, with the implementation of BMPs, the  
 24 impacts on groundwater quality from building and operating two new nuclear units at the CGS  
 25 site would likely be minimal.

26 **Cumulative Impacts**

27 In addition to water-use and water-quality impacts from building and operations activities,  
 28 cumulative analysis considers past, present, and reasonably foreseeable future actions that  
 29 affect the same environmental resources. For the cumulative analysis of impacts on surface  
 30 water, the geographic area of interest for the CGS site is considered to be the drainage basin of



## Environmental Impacts of Alternatives

1 the South Fork Edisto River upstream and downstream of the site, because this is the resource  
2 that would be affected by the proposed project. Key actions that have past, present, and future  
3 potential impacts on water supply and water quality in the South Fork Edisto River basin include  
4 the building and operation of the existing coal-fired plant at CGS, the sewage-treatment plant  
5 discharge for the town of Norway, and industrial activities in the South Fork Edisto River basin.  
6 For the cumulative analysis of impacts on groundwater, the geographic area of interest for the  
7 CGS site is considered to be the areas of the Middendorf and Black Creek aquifers up-gradient  
8 and down-gradient of the site.

9 The surface-water-use impacts of building and operating two nuclear power plants at this site  
10 are dominated by the water demands associated with station operation. The projected surface-  
11 water withdrawal for the proposed units is expected to be no more than 34 cfs or a maximum of  
12 5 percent of the average river discharge of 678 cfs near the site, and therefore the surface-  
13 water-use impacts are assessed to be SMALL.

14 Increases in consumptive use of water in the South Fork Edisto River drainage is anticipated in  
15 the future. The impacts of other projects listed in Table 9-13 within this resource's geographic  
16 area of interest are considered in the analysis included above or would have little or no impact  
17 on surface-water use.

18 Impacts on groundwater use would be localized and temporary during building. Potential  
19 impacts on groundwater use during operations are anticipated to be significant because the two  
20 additional units on the CGS site would rely on groundwater to meet a significant portion of its  
21 water-supply needs. Because withdrawal of enough groundwater to meet the needs of the  
22 proposed units would adversely affect other local wells by noticeably drawing down the  
23 groundwater levels over time, water-use impacts are assessed to be MODERATE. Using both  
24 surface water and groundwater may require some mitigation such as the use of dry cooling  
25 towers, hybrid cooling towers, or the construction of a cooling-water reservoir. Building and  
26 operating two new nuclear units at the CGS site would be a significant contributor to the  
27 MODERATE impact. As discussed in Section 7.2, the review team is aware of the potential  
28 climate changes that could affect the water resources available for cooling and the impacts of  
29 reactor operations on water resources for other users. The impact of climate change would be  
30 similar for all the alternative sites.

31 Point and non-point sources have affected the water quality of the South Fork Edisto River  
32 upstream and downstream of the CGS site, including the impact of operating the CGS, the  
33 sewage-treatment plant discharge for the town of Norway, and industrial activities in the South  
34 Fork Edisto River valley. Water-quality information presented above for the impacts of building  
35 and operating two new units at the CGS would also apply to evaluation of cumulative impacts.  
36 The impacts of other projects listed in Table 9-13 are either considered in the analysis included  
37 above or would have little or no impact on surface-water quality. As mentioned above, a  
38 SCDHEC-issued NPDES permit would be required to operate the nuclear project at this site

1 including disposing of cooling-tower blowdown. Effluent discharge through an NPDES-  
2 permitted outfall would ensure that the discharges complied with the Clean Water Act. Such  
3 permits are designed to ensure the protection of water quality. The review team also concludes  
4 that with the implementation of BMPs, the impacts on groundwater quality from building and  
5 operating two new nuclear units at the CGS site would likely be minimal, and therefore  
6 concludes that the cumulative impact on surface and groundwater quality would be SMALL.

### 7 **9.3.4.3 Terrestrial and Wetland Resources**

#### 8 ***Site Description***

9 The following impact analysis includes impacts from building activities and operations on  
10 terrestrial ecology resources. The analysis also considers past, present, and reasonably  
11 foreseeable future actions that affect the terrestrial ecological resources, including other Federal  
12 and non-Federal projects and the projects listed in Table 9-13. For the analysis of terrestrial  
13 ecological impacts at the CGS site, the geographic area of interest is considered to be the 6-mi  
14 region centered on the CGS site, plus the associated transmission-line corridors. This 6-mile  
15 radius is expected to encompass the ecologically relevant landscape features and species.

16 The CGS site encompasses approximately 1143 ac and would be in the same general location  
17 as the existing CGS 430-MW(e) coal-fired electrical generating plant (SCE&G 2009a). Habitats  
18 present on the proposed CGS site and associated transmission-line corridors are typical of  
19 those found in the Middle Atlantic Coastal Plain ecoregion. The southern floodplain forests  
20 include bottomland hardwood forest (bottomland oaks, red maple, sweetgum, green ash,  
21 bitternut hickory) and cypress-gum swamp (water tupelo, swamp tupelo, bald cypress, and pond  
22 cypress ) (Griffith et al. 2002). Understory vegetation in the cypress-gum swamp community is  
23 sparse; however, a variety of wildlife species use this habitat, from amphibians to mammals.  
24 The CGS site includes primarily cypress-gum swamp, wetland mixed hardwoods, planted pine,  
25 and old fields (SCE&G 2009a).

26 Common wildlife species present on the CGS project site (and in the vicinity) include many  
27 game species: white-tailed deer, eastern cottontail, gray squirrel, opossum, and raccoon, wild  
28 turkey (*Meleagris gallpavo*), northern bobwhite quail, mourning dove (*Zenaida macroura*), red  
29 fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), wood duck (*Aix sponsa*), mink  
30 (*Mustela vison*), otter (*Lontra canadensis*), and beaver (*Castor canadensis*) (SCE&G 2009a).

31 SCE&G has not conducted any on-the-ground studies to determine whether threatened or  
32 endangered species occur on the proposed CGS project site; however, four Federally listed  
33 species are known to occur in Orangeburg and Bamberg Counties. These species include the  
34 delisted bald eagle (still protected by the Bald and Golden Eagle Protection Act), and  
35

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1 endangered species such as the red-cockaded woodpecker (*Picoides borealis*), the wood stork,  
 2 the threatened flatwoods salamander (*Ambystoma cingulatum*), and one vascular plant, the  
 3 Canby's dropwort (*Oxypolis canbyi*).

4 In addition to the Federally listed species, the State of South Carolina has several listed species  
 5 known to occur in the counties of the proposed site and vicinity, including those crossed by  
 6 transmission lines. They include one mammal, two birds, two reptiles, and two amphibians (see  
 7 Table 9-15 below), including endangered species such as Rafinesque's big-eared bat  
 8 (*Corynorhinus rafinesquii*), the gopher tortoise, and the gopher frog (*Rana capito*) and State  
 9 threatened species such as Wilson's plover (*Charadrius wilsonia*), least tern (*Sterna antillarum*),  
 10 spotted turtle (*Clemmys guttata*), and the dwarf siren (*Pseudobranchius striatus*).

11 **Table 9-15.** Federally and State-Listed Species that May Occur on the CGS Alternative Site,  
 12 Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	SE	Bamberg, Colleton, Orangeburg
<b>Birds</b>			
<i>Charadrius melodus</i>	Piping plover	FT/ST	Colleton
<i>Charadrius wilsonia</i>	Wilson's plover	ST	Colleton
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA/SE	Bamberg, Colleton, Orangeburg
<i>Mycteria americana</i>	Wood stork	FE/SE	Bamberg, Colleton
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	Bamberg, Colleton, Orangeburg
<i>Sterna antillarum</i>	Least tern	ST	Colleton
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT/ST	Colleton
<i>Clemmys guttata</i>	Spotted turtle	ST	Bamberg, Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE/SE	Colleton
<i>Gopherus polyphemus</i>	Gopher tortoise	SE	Colleton
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE/SE	Colleton
<b>Amphibians</b>			
<i>Ambystoma cingulatum</i>	Flatwoods salamander	FT/SE	Orangeburg
<i>Rana capito</i>	Gopher frog	SE	Orangeburg
<i>Pseudobranchius striatus</i>	Dwarf siren	ST	Orangeburg
<b>Vascular Plants</b>			
<i>Oxypolis canbyi</i>	Canby's dropwort	FE/SE	Bamberg, Colleton, Orangeburg

Source: SCDNR 2006a; FWS 2008 Southeast Region County Lists

BGEPA = Bald and Golden Eagle Protection Act; FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered; ST = State listed as threatened

1 Although four species of sea turtle occur in Colleton County, none would be found in the upland  
 2 areas where the transmission-line corridors would be located. SCE&G has stated that on-the-  
 3 ground field surveys would be conducted prior to commencement of any ground-disturbing  
 4 activities on the site or transmission-line corridors as part of the permitting process (SCE&G  
 5 2009a).

6 **Building Impacts**

7 Although estimates of acreage of disturbance to habitat types were not given, SCE&G stated  
 8 that the proposed project could be designed and sited to fit into previously disturbed land within  
 9 the existing CGS site boundary (SCE&G 2009a). Based on a preliminary site layout of the  
 10 tabletop footprint provided by SCE&G, approximately 15.9 ac of the 425.2 ac of wetlands  
 11 present on the 1143.3-ac site would be affected during building activities for the two proposed  
 12 units (SCE&G 2010a). SCE&G states that the nuclear facility would be sited to avoid wetlands  
 13 whenever possible and potential impacts on wetlands near building zones would be minimized  
 14 through the use of established BMPs (SCE&G 2009a).

15 Each AP1000 unit would require the addition of three 230-kV transmission lines, which would  
 16 each occupy a 100-ft-wide transmission-line corridor. The total length and acreage of new  
 17 transmission-line corridor required (collectively) that would affect terrestrial ecological resources  
 18 would be approximately 162 mi and 1179 ac . SCE&G and Santee Cooper would both have a  
 19 portion of the new transmission lines and details are provided in Table 9-16 and Table 9-17  
 20 below (SCE&G 2009c, d).

21 One of the transmission lines would be in the Coastal Zone region of South Carolina, which  
 22 would require review and certification under the South Carolina Coastal Zone Management Act.  
 23 Due to the routing in the coastal zone and the amount of wetlands present within the proposed  
 24 corridors, new lines could incur substantial wetland impacts. SCE&G stated that all land  
 25 clearing associated with transmission-line development would be conducted according to  
 26 Federal, State, and local regulations, permit requirements, existing SCE&G and Santee Cooper  
 27 procedures, and established BMPs (SCE&G 2009a).

28 **Table 9-16.** SCE&G Transmission-Line Information for the CGS Alternative Site

Transmission-Line Segment	Length of Corridor (mi)	Acreage of Corridor	Acreage of Forested Wetlands	Acreage of Nonforested Wetlands	Acreage of Open Water	Linear Feet of Streams
Cope-Orangeburg	22	32	0.3	1	--	288
Cope-St. George	34	345	103	42	0.4	4075
Total	56	377	104	43	0.4	4363

Source: SCE&G 2009c, d

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1 **Table 9-17.** Santee Cooper Transmission-Line Information for the CGS Alternative Site

Wetlands Estimate	New Corridor (106 mi, 802 ac)		Existing Corridor (0 ac)		Total Corridor (802 ac)	
	Acres	Percent of Corridors	Acres	Percent of Corridors	Acres	Percent of Corridors
Hydric Soils	471	59	0	NA	471	59
NWI Wetlands	138	17	0	NA	138	17

NA = Not applicable; NWI = National Wetlands Inventory

Source: SCE&G 2009c, d

2 Past actions in the geographic area of interest that have similarly affected terrestrial resources  
 3 include the development and operation of the CGS, located in the same general location as the  
 4 CGS site. The building of the existing CGS facilities resulted in the clearing of approximately  
 5 550 ac of terrestrial resources to accommodate the power plant and associated buildings. The  
 6 Kaiser Agricultural Chemical Company, located less than 1 mi east-northeast of the CGS site,  
 7 also contributed to the loss of terrestrial habitat in the region. There are no major current  
 8 projects in the geographic area of interest that would have a cumulative impact on terrestrial  
 9 ecological resources in a similar way.

10 Proposed future actions that would affect terrestrial resources in a similar way to development  
 11 at the CGS site would include transmission-line development and/or upgrading throughout the  
 12 designated geographic region of interest, and future urbanization would also be expected to  
 13 occur.

14 Impacts from building two nuclear units and supporting facilities on wildlife habitat would be  
 15 unavoidable, and activities that would affect wildlife include land clearing and grading  
 16 (temporary and permanent), filling and or draining of wetlands, increased human presence,  
 17 heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities  
 18 would likely displace or destroy wildlife that inhabits the development areas. Some wildlife,  
 19 including some individuals of important species, would perish or be displaced during land  
 20 clearing for any of the above projects as a consequence of habitat loss, fragmentation, and  
 21 competition for remaining resources. Less mobile animals, such as reptiles, amphibians, and  
 22 small mammals, would be at greater risk of incurring mortality than more mobile animals, such  
 23 as birds, many of which would be displaced to adjacent communities. Undisturbed land  
 24 adjacent to the project could provide habitat to support displaced wildlife, but increased  
 25 competition for available space and resources could affect population levels. Wildlife would also  
 26 be subjected to impacts from noise and traffic, and birds could be injured if they collide with tall  
 27 structures. The impact on wildlife from noise is expected to be temporary and minor. The  
 28 creation of new transmission-line corridors could be beneficial for some species, including those  
 29 that inhabit early successional habitat or use edge environments, such as white-tailed deer,

1 northern bobwhite quail, eastern meadowlark, and the gopher tortoise. Birds of prey, such as  
2 red-tailed hawks, would likely exploit newly created hunting grounds. Forested wetlands within  
3 the corridors would be converted to and maintained in a herbaceous or scrub-shrub condition  
4 that could provide improved foraging habitat for some waterfowl and wading birds. However,  
5 fragmentation of forests could adversely affect species that are dependent on large tracts of  
6 continuous forested habitat.

7 Based on the information provided by SCE&G and the review team's independent review, the  
8 review team concludes that the impacts on terrestrial ecological resources from the building of  
9 two new nuclear units at the CGS site could be minimal. Because of the uncertainty about the  
10 possible routing of new transmission-line corridors, the review team concludes that the  
11 terrestrial resource impacts associated with the building of new transmission lines for the CGS  
12 site could be noticeable, although not ecologically destabilizing.

### 13 ***Operational Impacts***

14 Impacts on terrestrial ecological resources from the operation of two new nuclear units at the  
15 CGS site primarily include those associated with cooling towers and transmission lines. Impacts  
16 resulting from the operation of cooling towers and transmission lines are discussed in detail in  
17 Section 9.3.3.3 and would apply to the CGS site.

18 No other past, present, or future actions in the geographic area of interest were identified that  
19 would significantly affect terrestrial habitat and wildlife, including important species, in ways  
20 similar to those associated with the operation of two new units and the associated transmission  
21 lines at the CGS site. The review team concludes that the impacts of operating two new units  
22 and associated transmission lines at the CGS site on terrestrial resources and wetlands would  
23 be minimal.

### 24 **9.3.4.4 Summary Statement**

25 Impacts on terrestrial ecology resources are estimated based on the information provided by  
26 SCE&G and the review team's independent review. Past and future activities in the geographic  
27 area of interest could affect wildlife and wildlife habitat in ways similar to the building of two units  
28 at the CGS site. Although much of the land disturbance would occur within existing developed  
29 areas on the CGS site, other affected areas on the site as well as some of the associated  
30 transmission-line corridors are natural habitats that would be substantially altered by  
31 development and maintenance activities, noticeably affecting the level and movement of  
32 terrestrial wildlife populations in the area of interest. Other anticipated development projects  
33 would further alter wildlife habitats and migration patterns in the surrounding landscape. The  
34 review team concludes that cumulative impacts on baseline conditions for terrestrial resources  
35

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1 would be noticeable in the regional ecosystem and hence MODERATE. Building and operating  
2 two new nuclear units at the CGS site would be a significant contributor to the MODERATE  
3 impact.

### 4 **9.3.4.5 Aquatic Resources**

5 The following impact analysis includes impacts from building activities and operations on  
6 aquatic ecology resources. The CGS alternative site is located between Roberts Swamp and  
7 Snake Swamp (Sam Branch), which drain into the South Fork Edisto River watershed  
8 (SCDHEC 2004a; SCE&G 2009a), which falls within Orangeburg, Barnwell, and Bamberg  
9 Counties. This 164,149-ac watershed lies within the Upper and Lower Coastal Plain ecoregions  
10 of South Carolina (SCDHEC 2004a). Within the South Fork Edisto River watershed (Hydrologic  
11 Unit Code [HUC] 03050204-050), 18.7 percent of the area is classified as forested wetland  
12 swamps. Water and nonforested wetland marshes make up less than 1 percent of the land  
13 cover in this watershed (SCDHEC 2004a). The geographic area of interest is the South Fork  
14 Edisto River watershed because this region is the most likely to show impacts on water quality  
15 relative to the water-quality criteria for aquatic biota affected by CGS site activities.

16 Historically, water-quality conditions within the South Fork Edisto River region have been and  
17 still are influenced by natural conditions and land-use practices. With no impoundments, the  
18 Edisto River is one of the longest blackwater rivers in the United States (SCDHEC 2005). A  
19 blackwater system is characterized by water-quality conditions that are characterized by  
20 naturally low pH and dissolved oxygen concentrations (SCDHEC 2004a). Near the vicinity of  
21 the proposed CGS alternative site, the upstream and downstream SCDHEC monitoring stations  
22 meet the water-quality criteria optimal for supporting aquatic life and have no restrictions for  
23 recreational use. However, a trend in increasing fecal coliform concentrations has been noted  
24 (SCDHEC 2004a), and elevated mercury concentrations within the watershed have resulted in a  
25 fish-consumption advisory. The SCDHEC (2009a) advises no consumption of bowfin (*Amia*  
26 *calva*), chain pickerel (*Esox niger*), and largemouth bass, and suggests limited consumption of  
27 redear sunfish (*Lepomis microlophus*) and redbreast sunfish (*L. auritus*) from the South Fork  
28 Edisto River.

### 29 ***Recreationally Important Species***

30 The South Fork Edisto River is a known fishing area with largemouth bass, flat bullhead  
31 (*Ameiurus platycephalus*), and channel catfish being the most sought-after sport fish on the river  
32 (Angler Guide 2009). Catfish species are prized recreationally for consumption, and while adult  
33 catch sizes are modest (30–60 cm), channel catfish have been caught in excess of 1 m in  
34 length (Rohde and Parnell 1994).

1 **Invasive Species**

2 No invasive or nuisance species have been specifically identified within the South Fork Edisto  
3 River near the proposed CGS site.

4 **Critical Habitats**

5 No critical habitat has been designated by the FWS in the vicinity of the CGS site.

6 **Federally and State-Listed Species**

7 Federal and State-listed threatened and endangered species that may occur near the CGS site  
8 or in counties sited for transmission-line corridor development are listed in Table 9-18.

9 **Table 9-18.** Federally and State-Listed Aquatic Species that May Occur on the CGS  
10 Alternative Site, Including the Vicinity and Associated Transmission-Line  
11 Corridors

Scientific Name	Common Name	Status	County
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead sea turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT	Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	Colleton
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE	Colleton
<b>Fish</b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	FE/SE	Colleton, Dorchester, Orangeburg
Sources: FP&S 2008; MACTEC 2008; FWS 2008; SCDNR 2006a FE = Federally Endangered, SE = State Endangered, FT = Federally Threatened, ST = State Threatened			

12 There are four Federally listed species of sea turtles in South Carolina. The loggerhead and  
13 green sea turtles are listed as threatened, whereas the leatherback and Kemp's ridley sea  
14 turtles are listed as endangered (FWS 2008). The loggerhead sea turtle is also listed as a State  
15 threatened species for Colleton County (SCDNR 2006a). The siting of the Cope-Varnville  
16 transmission line is projected to run to the west of I-95, which is well over 50 mi from the  
17 coastline, and does not cross any marine habitats (MACTEC 2009). Therefore, although the  
18 four species of sea turtles occur in Colleton County, no activities associated with transmission  
19 lines for the CGS site would affect these species.

20 The shortnose sturgeon is the only Federally listed aquatic species known to occur in  
21 Orangeburg County. The shortnose sturgeon is a State and Federal endangered species (FWS  
22 2008). It is unknown whether the shortnose sturgeon occurs in the immediate vicinity of the  
23 proposed alternative site; however, populations are known to reside downstream in the Edisto  
24 River. It is unknown whether shortnose sturgeon migrate up the South Fork Edisto River, and



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1 no reliable records are available to document this species for this sub-basin. The shortnose  
2 sturgeon was initially listed as a Federally endangered species in 1967 and is designated as a  
3 species of highest conservation priority by SCDNR (McCord 2006; NMFS 1998). This  
4 amphidromous species uses freshwater, estuarine, and marine habitats to complete its life cycle  
5 (Rohde et al. 2009; McCord 2006; NMFS 1998).

6 In South Carolina, populations of shortnose sturgeon exist in the Ashepoo, Combahee, and  
7 Edisto rivers (flowing to St. Helena Sound); the Pee Dee, Waccamaw, and Black rivers (flowing  
8 to Winyah Bay); and the Savannah, Cooper, and Santee rivers. There is also a small  
9 landlocked population of shortnose sturgeon in the Santee-Cooper Lake system (Collins et al.  
10 2003).

11 In freshwater habitats, shortnose sturgeon are associated with soft bottom substrates in deep  
12 water. Spawning occurs in fresh waters characterized by low-to-moderate velocities and over  
13 substrates that include clay, sand, gravel, and woody debris (Rohde et al. 2009; McCord 2006).  
14 Eggs are adhesive and survival is reportedly dependent on water having little turbidity (McCord  
15 2006).

### 16 ***Building Impacts***

17 The proposed alternative site would be located within the existing footprint of the CGS, adjacent  
18 to the coal-fired facility. SCE&G (2009a) has indicated that the makeup water for the cooling  
19 system would be derived from groundwater sources, but may also include water from the South  
20 Fork Edisto River. The CGS alternative site requires additional intake and discharge structures  
21 that are discrete from the existing structures associated with the CGS and installation activities  
22 may impose temporary, localized impacts on aquatic biota in the South Fork Edisto River.  
23 Impacts on water quality would stem from direct (e.g., dredging, shoreline excavation) and  
24 indirect sources (e.g., stormwater runoff, sedimentation). Building associated with new  
25 infrastructure (e.g., roads, site footprint) and upgrading existing features (e.g., railroad lines)  
26 would affect approximately 432 linear feet out of a total of approximately 16,041 linear feet of  
27 onsite streams; however, there would be no impacts on the approximately 9.8 ac of open water  
28 on the site (SCE&G 2010a).

29 Because the CGS alternative site footprint would likely occupy previously disturbed land  
30 adjacent to the existing coal facility, impacts on aquatic biota in nearby streams or ponds would  
31 likely be minimized during building activities. However, site-specific information pertaining to  
32 aquatic habitat and/or important aquatic biota is unavailable. Based on the absence of  
33 occurrence information, building in the vicinity of the intake and discharge structures may result  
34 in impacts on important species, but impacts are likely to be temporary and largely mitigated by  
35 the use of appropriate water-quality BMPs.

1 If the new units were located at the CGS alternative site, the addition of up to six 230-kV  
2 transmission lines would be required. Installation of the new transmission lines may include  
3 upgrading existing transmission-line corridors, or the development of new transmission-line  
4 corridors. One transmission line would fall within the jurisdiction of the South Carolina Coastal  
5 Zone Management Act, thus requiring additional review and certification. Transmission-line  
6 corridors would be maintained by both SCE&G and Santee Cooper. For SCE&G lines,  
7 approximately 4363 linear feet of streams and 0.4 ac of open water are located within the new  
8 transmission-line rights-of-way (Table 9-16) (SCE&G 2009d). The Santee Cooper transmission-  
9 line corridors associated with the CGS site would include an estimated 72 stream crossings,  
10 4 of which would be State Navigable Waters crossings, such as the South Fork Edisto River,  
11 and the Salkehatchie River (SCE&G 2009d). SCE&G stated that all land clearing associated  
12 with transmission-line creation would be conducted according to Federal, State, and local  
13 regulations, permit requirements, existing SCE&G and Santee Cooper procedures, good  
14 construction practices, and established BMPs (SCE&G 2009a).

15 Past actions in the geographic area of interest that have affected aquatic resources, including  
16 important species, in ways similar to those associated with the building of two new units at the  
17 CGS alternative site include the construction of the existing CGS coal-fired plant, located  
18 adjacent to the CGS alternative site. Proposed future actions that would affect aquatic  
19 resources in a similar way to development at the CGS alternative site would include  
20 transmission-line creation and/or upgrading throughout the designated geographic area of  
21 interest, and future urbanization would also be expected to occur.

## 22 ***Operational Impacts***

23 Operational impacts expected to occur at the CGS alternative site would be dependent on site-  
24 specific characteristics that include plant specifications (e.g., water sources, discharge design)  
25 as well as the occurrence of important aquatic biota. Impacts on aquatic biota within the South  
26 Fork Edisto River as a result of intake-related impingement and entrainment losses would  
27 depend on the final source of makeup water. If groundwater were to be used as the source of  
28 cooling-water makeup, impingement and entrainment would be nonexistent. However, if water  
29 were to be withdrawn from the river using conventional technology, there would be impingement  
30 and entrainment losses to aquatic biota. Several intake/discharge configurations are designed  
31 to minimize impacts on aquatic biota. SCE&G has stated that “[t]he design of the intake  
32 structure would comply with the requirements of Section 316(b) [Phase I regulations] of the  
33 Clean Water Act, thereby reducing the potential impacts of entrainment and impingement to  
34 sensitive species.” Nevertheless, there is still the potential for noticeable impacts on aquatic  
35 resources due to water withdrawal for cooling-system makeup water from the South Fork Edisto  
36 River as described in Section 9.3.4.2; it is dependent upon the degree to which the South Fork  
37 Edisto River would be used as a cooling-water source.

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1 Operational impacts associated with water quality and discharge cannot be precisely  
2 determined without additional detailed analysis. However, based on the review team's  
3 experience with other facilities, the review team concludes that, with proper design, the thermal  
4 and chemical impacts on aquatic resources from operation of two new nuclear units at the CGS  
5 site would likely be minimal except during periods of low flow or drought conditions when  
6 impacts on aquatic biota from discharge of station blowdown to the river could be noticeable.

7 The review team also concludes that operational impacts on aquatic biota from maintenance of  
8 the transmission-line corridors would be minimal assuming that appropriate BMPs are used.

9 Cumulative impacts that could result from the operation of two new units at the CGS site would  
10 include intake-related impingement and entrainment losses and chemical and thermal discharge  
11 from station blowdown. Past, present, or future actions in the geographic area of interest that  
12 would affect aquatic ecological resources include aquatic biota impacts from the operation of a  
13 sewage-treatment plant for the town of Norway, South Carolina, located approximately 7.6 mi to  
14 the northwest of the CGS alternative site, which discharges into the Willow Swamp area of the  
15 South Fork Edisto River, and the CGS coal-fired plant, located immediately adjacent to the  
16 proposed CGS site, which discharges into the South Fork Edisto River. Both plants are  
17 compliant with NPDES permitting for discharges (SCE&G 2009a). Thermal and chemical  
18 discharges from the proposed nuclear units, when combined with the effluents from the existing  
19 coal-fired plant, may create significant NPDES challenges because the portion of the Edisto  
20 River adjacent to the site is relatively narrow, with low river velocities. Detailed information  
21 necessary to address these unknowns is not available, nor is site-specific information regarding  
22 the presence of important aquatic biota. Anthropogenic activities such as residential or  
23 industrial development near the vicinity of the nuclear facility may also contribute to cumulative  
24 impacts.

### 25 ***Summary Statement***

26 Impacts on aquatic ecology resources are estimated based on the information provided by  
27 SCE&G, the State of South Carolina, and the review team's independent review. There are  
28 past and future activities in the geographic area of interest that could affect aquatic ecology  
29 resources in ways similar to the building and operation of two units at the CGS site. Overall, the  
30 cumulative impact of building and operating two new units at the CGS site is expected to be  
31 SMALL to MODERATE. Effects on aquatic biota may be SMALL if habitat for protected species  
32 is avoided through proper siting; BMPs are used during building, both at the site and along the  
33 new transmission lines; and groundwater is used for part of the station cooling water. However,  
34 if siting of buildings or ancillary services and transmission-line corridor routing is unable to avoid  
35 waterbodies with known populations of protected species, there may be noticeable effects on  
36 populations of these important organisms. In addition, due to the relatively low flow rates in the  
37 South Fork Edisto River, the use of river water for station cooling could adversely affect aquatic  
38 biota due to intake-related impingement and/or entrainment losses, as well as from station

1 blowdown effects, particularly during periods of drought. Therefore, it is possible that aquatic  
2 biota may be noticeably altered due to the building and operating of two additional units at the  
3 CGS, thereby resulting in a MODERATE impact. Building and operating two new nuclear units  
4 at the CGS would be a significant contributor to the MODERATE impact.

#### 5 **9.3.4.6 Socioeconomics**

6 For the analysis of socioeconomic impacts at the CGS site, the geographic area of interest is  
7 considered to be the 50-mi region centered on the CGS site with special consideration of  
8 Orangeburg, Bamberg, Lexington, Colleton, Aiken, and Barnwell Counties, because that is  
9 where the review team expects socioeconomic impacts to be the greatest. In evaluating the  
10 socioeconomic impacts of project development and operation at the CGS site in Orangeburg  
11 County, just north of the town of Bamberg, South Carolina, the review team undertook a  
12 reconnaissance survey of the region using readily obtainable data from the ER, the alternative  
13 site audit, and Federal, State, and local government agencies. The analysis also considers  
14 other past, present, and reasonably foreseeable future actions that affect the same  
15 environmental resources, including other Federal and non-Federal projects and the projects  
16 listed in Table 9-13. Impacts from both building and station operation are discussed.

#### 17 ***Physical Impacts***

18 Many of the physical impacts of building and operation would be similar regardless of the site.  
19 Building activities can cause temporary and localized physical impacts such as noise, odor,  
20 vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public  
21 roadways, railways, and waterways would be necessary to transport construction materials and  
22 equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and  
23 disposal sites) would be expected to be already permitted and operational.

24 Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and  
25 visual intrusions (the latter are discussed under aesthetics and recreation). New units would  
26 produce noise from the operation of pumps, cooling towers, transformers, turbines, generators,  
27 and switchyard equipment. Traffic at the site also would be a source of noise. The review team  
28 assumed that the same standard noise protection and abatement procedures used for the  
29 VCSNS site would be used to control noise coming from the CGS site. This practice also would  
30 be expected to apply to all alternative sites. Commuter traffic would be controlled by speed  
31 limits. Good road conditions and appropriate speed limits would minimize the noise level  
32 generated by the workforce commuting to the alternative site.

33 The new units at the CGS site would likely have standby diesel generators and auxiliary power  
34 systems. Permits obtained for these generators would ensure that air emissions comply with  
35 applicable regulations. In addition, the generators would be operated on a limited, short-term  
36 basis. During normal plant operation, new units would not use a significant quantity of

## Environmental Impacts of Alternatives

1 chemicals that could generate odors that exceed odor threshold values. Good access roads  
2 and appropriate speed limits would minimize the dust generated by the commuting workforce.  
3 Based on the information provided by SCE&G and the review team's independent evaluation,  
4 the review team concludes that the physical impacts of building and operating two new nuclear  
5 units at the CGS site would be minimal.

### 6 ***Demography***

7 The CGS is located in Orangeburg County, South Carolina, approximately 35 air mi from  
8 Columbia, South Carolina (2007 population 124,818), the closest major economic center. The  
9 2007 population of Orangeburg County is 89,952, Bamberg County is 15,452, Lexington County  
10 is 243,270, Colleton County is 38,903, Aiken County is 152,307, and Barnwell County is 22,975  
11 for a total population of 562,859 for the six counties (see Table 2-24).

12 Ninety percent of the current CGS workforce resides in Orangeburg, Bamberg, Lexington,  
13 Colleton, Aiken, and Barnwell Counties. The review team expects the in-migrating population  
14 would reside within this six-county area in about the same pattern as the existing CGS  
15 workforce. However, because of the proximity of the town of Bamberg to the site, the review  
16 team expects Bamberg County would receive a noticeable influx of workers (SCE&G 2009a).  
17 Therefore, these six counties compose the economic impact area and are the focus of the  
18 following analysis. Because of the rural nature of the two sites and the fact that the CGS site  
19 also hosts an existing power plant, development of the proposed new units on the CGS site  
20 would have similar socioeconomic impacts in most respects to adding two new units to the  
21 VCSNS site. Building the new units would require 3600 workers at the peak of the project. The  
22 review team believes that because the economic impact area includes portions of two larger  
23 metropolitan areas (Aiken and Columbia), migration patterns would be similar to those expected  
24 at the VCSNS site. About 50 percent or 1800 would migrate to the economic impact area in  
25 rough proportion to the current operating workforce of the CGS. As the building period winds  
26 down, the operations staff would be hired, eventually reaching a workforce of 930. The  
27 demographic impacts of the project are expected to be minor, with the exception of Bamberg  
28 County, where the impact likely would be noticeable. Based on review team assumptions for  
29 the VCSNS site and similarity of the economic impact areas, the review team expects that  
30 50 percent of the operations workforce or 465 employees would migrate to the region. The  
31 review team expects the demographic impact during operations to be minimal.

### 32 ***Taxes and Economy***

33 If the proposed nuclear facility were located at the CGS, taxes and fee-in-lieu-of-taxes  
34 agreements would be governed by South Carolina law. Corporate and personal income taxes  
35 along with sales and use taxes would be collected during both building and operation, but  
36 property taxes would not be paid until operations begin. Once operations begin, SCE&G would  
37 have likely entered into a fee-in-lieu-of-taxes agreement with the State as it has with the VCSNS

1 site. Based on the agreement SCE&G has with the State in regard to VCSNS, which has an  
2 assessment ratio of 4 percent and a special revenue credit of 20 percent of the fee-in-lieu-of-  
3 taxes payments during the first 20 years, SCE&G estimates VCSNS annual payments to be  
4 between \$13.7 million and \$31.6 million over 40 years of the license period. If SCE&G entered  
5 into a similar agreement for the CGS site, the tax payments would increase Orangeburg County  
6 property tax revenues (currently \$86.5 million (SCBCB 2007) by 16 to 37 percent. The total fee-  
7 in-lieu-of-taxes payments to Orangeburg County are expected to be substantial and beneficial  
8 during operations.

9 Aiken, Bamberg, Colleton, and Lexington Counties have service-based economies while the  
10 Barnwell and Orangeburg County economies are dominated by manufacturing (SCE&G 2009a).  
11 Aiken and Lexington Counties have the largest economies followed by Orangeburg and  
12 Barnwell Counties, and the smallest economies are in Bamberg and Colleton Counties. The  
13 wages and salaries of the workforce would have a multiplier effect that could result in increases  
14 in business activity, particularly in the retail and service sectors.

15 SCE&G acquired RIMS II economic multiplier values specific to this economic impact area from  
16 the U.S. Bureau of Economic Analysis (BEA 2006; SCG&E 2009a), which permit detailed  
17 examination of potential economic impacts with individual multipliers attributable to construction  
18 activities and plant operations activities. Using the RIMS multiplier of 1.34, the 3600  
19 construction jobs would create 1224 indirect jobs in the economic impact area, for a total of  
20 4824 jobs supported by the project. Because the review team assumes 50 percent of the  
21 project workforce would migrate to the region, the approximate net employment effect of the  
22 project would be 2412 new jobs spread over the six counties. This would have a beneficial but  
23 temporary impact on the business community and could provide (1) opportunities for new  
24 businesses to get started and (2) increased job opportunities for local residents. Once the new  
25 units are operational, approximately 930 new operations jobs would be added to the local  
26 economy. Using a multiplier of 1.70 jobs, the 930 operations and support jobs would create 651  
27 indirect jobs in the economic impact area, for a total of 1581 jobs supported by plant operations.  
28 Because the review team assumes 50 percent of the workforce would migrate to the region, the  
29 approximate net employment effect of operations would be 790 new jobs spread over the six  
30 counties. The new jobs from project-related activities would constitute a minor beneficial impact  
31 on the six-county economic impact area, but these impacts would be noticeable in Orangeburg  
32 and Bamberg Counties. Based on the information provided by SCE&G and the review team's  
33 independent evaluation, the review team concludes that the combination of economic and tax  
34 base impacts of building and operating two new nuclear units at the CGS site would be minor in  
35 the six-county area, but would be substantial in Orangeburg County and noticeable in Bamberg  
36 County.

1 ***Transportation and Housing***

2 The CGS is accessed by US-301/601, SC-193, and the plant entrance road. US-301/601 is a  
3 four-lane divided highway that runs north-south through Orangeburg and Bamberg Counties.  
4 SC-193 is a paved two-lane road that has been upgraded between the plant entrance and  
5 US-301/601 to accommodate existing plant traffic. The 2005 AADT count for US-301/601 was  
6 7800 south of the site and 7600 north of the site. The second nuclear facility access route is via  
7 SC-332, SC-1144, and the plant entrance road. SC-332 is a paved two-lane east-west route  
8 north of the site with an AADT count of 500 vehicles. Based on the analysis in Section 4.5, an  
9 additional 1800 cars could be on the road at shift change. Also, project-related deliveries of  
10 100 trucks per day are expected (SCE&G 2009a). Access to the site would be from one of  
11 three approaches depending on worker residence. Several routes link the various cities and  
12 towns in the economic impact area with the CGS site. The review team expects that although  
13 the peak workforce represents significant vehicle traffic, the availability of multiple access routes  
14 would help disperse site-related traffic, and impacts would be less noticeable than at the  
15 VCSNS site. Because the review team expects these impacts would be of short duration and  
16 temporary, and would be substantially mitigated by traffic management planning by SCE&G, the  
17 review team concludes traffic-related impacts would be minor.

18 Approximately 1800 construction workers could migrate into the region during peak project  
19 employment. Approximately 465 operations workers could migrate into the region by the time  
20 the facility becomes operational. Construction workers may choose to buy housing, rent, use  
21 mobile homes, or stay in a hotel/motel, while operations workers would likely choose to buy a  
22 house. According to the 2000 U.S. Census, there were 227,719 housing units in the six-county  
23 economic impact area, of which 6400 in Aiken County, 1007 in Bamberg County, 1170 in  
24 Barnwell County, 3659 in Colleton County, 7738 in Lexington County, and 5186 in Orangeburg  
25 County were vacant, for a total of 25,160 vacant units (SCE&G 2009a). Based on the  
26 information provided by SCE&G and the review team's independent evaluation, the review team  
27 concludes that transportation and housing impacts of building and operating two new nuclear  
28 units at the CGS site would be minimal across the six-county area and the wider region.

29 ***Public Services and Education***

30 In-migrating construction workers and plant operations workers would likely affect local  
31 municipal water, wastewater treatment facilities, and other public services in the region. These  
32 impacts would likely be in proportion with the demographic impacts experienced in the region,  
33 unless these resources have excess capacity or are particularly strained during building, which  
34 would decrease or increase the impact, respectively. The in-migrating workers represent a  
35 small portion of the total population of Orangeburg County and likely would not have a  
36 noticeable impact on their public services. During operations the impact on public services  
37 would likely be minimal.

1 SCE&G reports in its ER (SCE&G 2009a) that during the 2004–2005 school year, Aiken County  
2 had 40 preschool through 12th grade (PK-12) schools, Bamberg County had 7 schools,  
3 Barnwell County had 11 schools, Colleton County had 12 schools, Lexington County had 66  
4 schools, and Orangeburg County had 30 schools. Total enrollment for Aiken, Bamberg,  
5 Barnwell, Colleton, Lexington and Orangeburg Counties for the 2004–2005 school year was  
6 25,299, 2744, 4721, 6592, 51,276, and 15,449, respectively. A maximum of 938 students are  
7 expected to migrate into the four-county economic impact area during peak project employment  
8 and this number would decline to 484 during operations. This would increase the student  
9 population during peak project employment in Aiken County by 0.3 percent, Bamberg County by  
10 7.9 percent, Barnwell County by 1.3 percent, Colleton County by 0.2 percent, Lexington County  
11 by 0.2 percent, and Orangeburg County by 2.4 percent. During operations, the student body  
12 population increase in Aiken, Bamberg, Barnwell, Colleton, Lexington, and Orangeburg  
13 Counties would be 0.2 percent, 4.1 percent, 0.8 percent, 0.7 percent, 0.1 percent, and  
14 1.3 percent, respectively (SCE&G 2009a). Building and operating a nuclear facility on the CGS  
15 site would have a minor impact on education, with the exception of a more noticeable impact on  
16 Bamberg County during peak project employment. Based on the information provided by  
17 SCE&G and the review team’s independent evaluation, the review team concludes that public  
18 services and education impacts of building and operating two new nuclear units at the CGS site  
19 would be minor, except for a noticeable impact on education services in Bamberg County during  
20 peak project employment.

### 21 ***Aesthetics and Recreation***

22 No recreational facilities exist within the site boundary. There are nine State parks and one  
23 national recreational area (Congaree National Park) within 50 mi of the plant. With the  
24 exception of the South Fork Edisto River, there are no national and State recreational areas  
25 within 6 mi of the site. The North and South Fork Edisto rivers merge 10 mi from the site to form  
26 the Edisto River. These three rivers provide numerous recreational activities such as fishing,  
27 hunting, boating, and nature study.

28 The visual aesthetics of the site have already been altered by the existing coal-fired unit. The  
29 upper portions of the stacks are visible from most of the surrounding area, while other existing  
30 facilities are visible from nearby roads and from the South Fork Edisto River. The proposed  
31 project would be visible from some offsite locations and the cooling towers would be visible  
32 during operations. Project activities would increase the noise level at the site, but given the  
33 rural nature in the vicinity of the proposed site, this would likely not have a significant impact.  
34 The CGS site is already connected to the electric grid with existing transmission lines traversing  
35 mostly agricultural land, and the addition of new lines would not add significantly to the existing  
36 visual impact. Based on the information provided by SCE&G and the review team’s  
37 independent evaluation, the review team concludes that public aesthetics and recreation  
38 impacts of building and operating two new nuclear units at the CGS site would be minimal.



1 **Summary of Socioeconomics**

2 Physical impacts on workers and the general public include impacts on existing buildings,  
3 transportation, aesthetics, noise levels, and air quality. Social and economic impacts span  
4 issues of demographics, economy, taxes, infrastructure, and community services. In summary,  
5 on the basis of information provided by SCE&G and the review team's independent evaluation,  
6 the review team concludes that the impacts of building and operating a new nuclear plant at the  
7 CGS site on socioeconomics would be minimal and adverse for most of the region but could be  
8 noticeable, but not destabilizing, for Bamberg County in terms of education system impacts  
9 during peak project employment. Noticeable demographic impacts may be possible in  
10 Orangeburg and Bamberg Counties during the building phase, depending on worker settlement  
11 patterns. During operations, these impacts are expected to be minimal. Impacts on aesthetics  
12 are expected to be minor. The impacts on the Orangeburg County tax base during operations  
13 likely will be substantial and beneficial; however only minor beneficial impacts would result in  
14 the rest of the region. The new jobs from project-related activities would constitute a minor  
15 beneficial impact on the six-county economic impact area, but these impacts would be  
16 noticeable in Orangeburg and Bamberg Counties.

17 **Cumulative Impacts**

18 The projects identified in Table 9-13, particularly the future urbanization of the Columbia, South  
19 Carolina, and Augusta, Georgia, metropolitan areas, have contributed or would contribute to the  
20 demographics, economic climate, and community infrastructure of the region and generally  
21 result in increased urbanization and industrialization. Because the projects within the review  
22 area identified in Table 9-13 would be consistent with applicable land-use plans and control  
23 policies, the review team considers the cumulative socioeconomic impacts from the projects to  
24 be manageable.

25 For the analysis of socioeconomic impacts at the CGS site, the geographic area of interest is  
26 considered to be the 50-mi region centered on the CGS site, with special consideration of  
27 Orangeburg, Bamberg, Lexington, Colleton, Aiken, and Barnwell Counties, because that is  
28 where the review team expects socioeconomic impacts to be the greatest.

29 The CGS site is located in a rural area of southern Orangeburg County. The site currently hosts  
30 a 430-MW(e) coal-fired power station that is surrounded by wetlands and pine forest, with  
31 residential and agricultural development in the vicinity. The site is about 4.5 mi north of  
32 Bamberg (2007 population 3463), the Bamberg County Seat and about 13.5 mi southwest of  
33 Orangeburg (2007 population 12,756), the Orangeburg County Seat. The 50-mi region includes  
34 Columbia and Aiken, South Carolina, two larger urban areas. The economy of the region has  
35 been and continues to be largely agriculture-based. Most of the current CGS workforce  
36 (90 percent) lives in Orangeburg, Bamberg, Lexington, Colleton, Aiken, and Barnwell Counties  
37 (SCE&G 2009a). The review team believes these six counties make up the economic impact

1 area. The review team expects the project workforce would be distributed within the economic  
2 impact area in approximately the same proportion as the existing CGS workforce.

3 In addition to assessing the socioeconomic impacts from the building and operations of two  
4 additional nuclear units on the CGS site, the cumulative impact is also considered. The  
5 cumulative analysis considers other past, present, and reasonably foreseeable future actions  
6 that could contribute to the cumulative socioeconomic impacts on a given region, including other  
7 Federal and non-Federal projects and the projects listed in Table 9-13. The projects identified  
8 in Table 9-13 have contributed or would contribute to the demographics, economic climate, and  
9 community infrastructure of the region and generally result in increased urbanization and  
10 industrialization. However, many impacts such as those on housing or public services are able  
11 to adjust over time, particularly with increased tax revenues. Furthermore, State and county  
12 plans along with modeled demographic projections include forecasts of future development and  
13 population increases. Because the other projects described in Table 9-13 do not include any  
14 significant reasonably foreseeable changes in socioeconomic impacts within 50 mi of the CGS  
15 site, the review team determined there would not be any significant additional cumulative  
16 socioeconomic impacts in the region from those activities. Any economic impacts associated  
17 with activities listed in Table 9-13 would have been considered as part of the socioeconomic  
18 baseline.

19 The review team concludes that the socioeconomic impacts of the building and operation of a  
20 new two unit nuclear plant at the CGS site would be SMALL and adverse across most of the  
21 region but could be MODERATE and adverse for Orangeburg and Bamberg Counties in terms  
22 of demographic and education system impacts during the building phase. The cumulative  
23 impacts on the Orangeburg County tax base during plant building and operation likely would be  
24 beneficial and LARGE. The cumulative impacts from project-related activities on creating new  
25 jobs likely would be beneficial and MODERATE in Orangeburg and Bamberg Counties.  
26 Building and operating a new plant at the CGS site would make a significant incremental  
27 contribution to these impact levels.

#### 28 **9.3.4.7 Environmental Justice**

29 In addition to environmental justice impacts from building and operations, the cumulative  
30 analysis considers other past, present, and reasonably foreseeable future actions that could  
31 contribute to disproportionate and adverse impacts on minority and low-income populations,  
32 including other Federal and non-Federal projects and the projects listed in Table 9-13. For the  
33 analysis of environmental justice impacts at the CGS site, the geographic area of interest is  
34 considered to be the 50-mi region centered on the CGS site.

35 The CGS site is located in a rural area of southern Orangeburg County. The site currently hosts  
36 a 430-MW(e) coal-fired power station that is surrounded by wetlands and pine forest, with  
37 residential and agricultural development in the vicinity. The site is about 4.5 mi north of

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1 Bamberg (2007 population 3463), the Bamberg County Seat, and about 13.5 mi southwest of  
2 Orangeburg (2007 population 12,756), the Orangeburg County Seat. The 50-mi region includes  
3 Columbia and Aiken, South Carolina, two larger urban areas. The economy of the region has  
4 been and continues to be largely agriculture-based. Most of the current CGS workforce  
5 (90 percent) lives in Orangeburg, Bamberg, Lexington, Colleton, Aiken, and Barnwell Counties  
6 (SCE&G 2009a).

7 From an environmental justice perspective, the review team determined there is a potential for  
8 minority and low-income populations to be disproportionately and adversely affected by  
9 environmental impacts. In and around the town of Bamberg, the review team found low-income,  
10 African American, and aggregated minority populations that exceed the percentage criteria  
11 established in Section 2.6.1 for environmental justice analyses. Furthermore, several of these  
12 populations are clustered in the vicinity of the CGS site (see Figure 9-7 and Figure 9-8).

13 Because the other projects described in Table 9-13 do not include any significant reasonably  
14 foreseeable changes in socioeconomic impacts within 50 mi of the CGS site, the review team  
15 concluded there would not be any significant additional cumulative environmental justice  
16 impacts in the region from those activities. Any economic impacts associated with activities  
17 listed in Table 9-13 already have been considered as part of the socioeconomic baseline. For  
18 example, the economic impacts of existing enterprises such as mining, other electrical utilities,  
19 etc., are part of the base used for establishing the RIMS II multipliers. Regional planning efforts  
20 and associated demographic projections formed the basis for the review team's assessment of  
21 reasonably foreseeable future impacts.

22 The review team based its environmental justice determinations on the methodology discussed  
23 in Section 2.6.1, including a closer look at potential areas of interest using a series of health and  
24 physical considerations. Because of the rural nature of the two sites and the fact that the CGS  
25 site also hosts an existing power plant, the review team determined the hypothetical  
26 development of the proposed new units on the CGS site would have similar environmental  
27 justice impacts in most respects to adding two new units to the VCSNS site. However, as  
28 discussed in Section 9.3.4.6, the traffic-related impacts expected at the VCSNS site and the  
29 FA-1 site would not be expected at the CGS site because of the extensive road network  
30 providing access to the site from many directions. Under the limitations of a reconnaissance-  
31 level analysis, the review team found no other health or physical considerations and no unique  
32 characteristics or practices that could lead to a disproportionately high and adverse impact on  
33 any minority or low-income community at the CGS site.



1  
 2 **Figure 9-7. Aggregate Minority Populations in Block Groups that Meet the Environmental**  
 3 **Justice Selection Criteria at the CGS Site**

# Environmental Impacts of Alternatives



1  
2  
3

**Figure 9-8.** Low-Income Populations in Block Groups that Meet the Environmental Justice Selection Criteria at the CGS Site

1 Based on the above considerations, information provided by SCE&G, visits to the site, and the  
2 review team's independent review, the review team concludes that when viewed in the context  
3 of the wider region, locating the proposed action at the CGS site would not contribute additional  
4 cumulative impacts beyond the impacts described in Chapters 4 and 5 for the VCSNS site.  
5 Furthermore, the based on the above discussion, the review team determined any traffic-related  
6 impacts would be less than those described in Chapters 4 and 5 for the VCSNS site. The  
7 review team concluded that the environmental justice impacts would be minimal locally and  
8 would not create pathways to increase expected cumulative impacts on minority and low-  
9 income populations in the region. Based on its evaluation, the review team concludes that  
10 cumulative environmental justice impacts associated with building and operating two new  
11 nuclear units at the CGS site would be SMALL.

#### 12 **9.3.4.8 Historic and Cultural Resources**

13 The following cumulative impact analysis includes building and operating two new nuclear  
14 generating units at the CGS Site. The analysis also considers other past, present, and  
15 reasonably foreseeable future actions that could impact cultural resources, including other  
16 Federal and non-Federal projects and the projects listed in Table 9-13. For the analysis of  
17 cultural impacts at the CGS site, the geographic area of interest is considered to be the APE  
18 that would be defined for this proposed undertaking. This includes the physical APE, defined as  
19 the area directly affected by the site-development and operation activities at the site and  
20 transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi radius  
21 around the physical APE as a reasonable assumption for defining a maximum distance from  
22 which the structures can be seen.

23 Reconnaissance activities in a cultural resource review have particular meaning. For example,  
24 these activities include preliminary field investigations to confirm the presence or absence of  
25 cultural resources. However, in developing its EISs, the review team relies upon  
26 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-  
27 level information is data that are readily available from agencies and other public sources. It  
28 can also include information obtained through visits to the site area. To identify the historic and  
29 cultural resources at the CGS site the following information was used:

- 30 • SCE&G ER (SCE&G 2009a) – including records held by the South Carolina Institute of  
31 Archeology and Anthropology and the South Carolina Department of Archives and History,  
32 which include the results of a cultural resource survey completed in 1991 prior to  
33 construction of the CGS.
- 34 • NRC Alternative Sites Visit, March 2009.

35 Historically, the CGS site and vicinity was largely undisturbed by land development and likely  
36 contained intact archaeological sites associated with the past 10,000 years of human  
37 settlement. Over time, the CGS site has been disturbed first by forestry practices and later by

## Environmental Impacts of Alternatives

1 development of the coal-fired facility (SCE&G 2009a, j). Eight standing structures were  
2 identified in 1991, none were determined to be eligible for the National Register. The closest  
3 archaeological sites identified near the CGS include a ceramic scatter and a lithic scatter that  
4 are located 5 mi away. The physical and visual APEs for a proposed plant at the CGS site do  
5 not appear to have any significant historic properties located within the area likely to be affected  
6 by building or operating new plants. The Cope Depot is the closest significant National  
7 Register-listed resource to the CGS site (within 6 mi of the CGS site) (SCE&G 2009a). In  
8 addition, SCE&G found that there are 94 historic sites listed in the National Register within  
9 several counties in the vicinity of the CGS site (SCE&G 2009a).

10 SCE&G has stated that if the proposed project was sited at the CGS site, the project would be  
11 developed in previously disturbed areas (SCE&G 2009a). SCE&G has also stated that  
12 identification of cultural resources would be accomplished through cultural resource surveys.  
13 The results would be used in the site-planning process to avoid cultural resource impacts. If  
14 significant cultural resources were identified by these surveys, SCE&G would also develop  
15 protective measures similar to what it has in place for the VCSNS site. In addition, inadvertent  
16 discovery procedures would be developed if cultural resources were discovered during site-  
17 development activities (SCE&G 2009i).

18 A nuclear facility located at this site would require three 230-kV transmission lines for each unit  
19 with a 100-ft-wide transmission-line corridor. The new transmission lines would either be  
20 installed via expansion of existing transmission-line corridors or they would follow a new  
21 transmission-line corridor. If the proposed project is located at the CGS site, the staff assumes  
22 SCE&G would conduct its transmission-line-related cultural resource activities in ways similar to  
23 what it has committed to do for the VCSNS site described in Section 4.6.

24 Past actions in the geographic area of interest that have similarly affected cultural and historic  
25 resources include forestry practices at the CGS site, road development and logging activities  
26 associated with those practices, development of the coal-fired plant, and ground-clearing  
27 associated with building the Kaiser Agricultural Chemical Plant.

28 Activities associated with building two nuclear units and supporting facilities that can potentially  
29 affect cultural and historic resources include land clearing, excavation and grading activities.  
30 Given SCE&G's site-planning process, and the lack of significant cultural resources known to  
31 exist at the CGS site based on reconnaissance-level information and the land disturbance  
32 where the new plant would be located, the impacts on cultural resources due to site-  
33 development activities would be negligible.

34 In addition, visual impacts from transmission lines may result in significant alterations to the  
35 visual landscape within the geographic area of interest. Given that there are no known cultural  
36 resources where the historic setting and character of the resources are important, the visual  
37 impacts would be negligible. The staff assumes that SCE&G and Santee Cooper would

1 develop a management agreement in consultation with the SHPO similar to the one that would  
2 be developed for VCSNS.

3 Impacts on cultural and historic resources from operation of two new nuclear units at the CGS  
4 site include those associated with the operation of new units and maintenance of transmission  
5 lines. The review team assumes that the same procedures currently used by SCE&G and  
6 Santee Cooper would be used for onsite and offsite maintenance activities. Consequently, the  
7 incremental effects of the maintenance of transmission-line corridors and operations of the two  
8 new units and associated impacts on cultural resources would be negligible in the physical and  
9 visual APEs.

10 Table 9-13 identifies projects within the geographic area of interest and includes the CGS,  
11 Kaiser Agricultural Chemical, and future urbanization. These projects could affect historic and  
12 cultural resources in a manner similar to those associated with the operation of two new units.

13 Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources  
14 is cumulative. Based on the information provided by the applicant and the review team's  
15 independent evaluation, the review team concludes that the cumulative impacts from building  
16 and operating two new nuclear generating units on the CGS site would be SMALL. This impact-  
17 level determination reflects no known cultural resource surveys, which may reveal important  
18 historic properties that could result in greater cumulative impacts.

#### 19 **9.3.4.9 Air Quality**

20 Because the CGS site is located in a climate regime similar to the VCSNS site, the air quality  
21 impacts of building and operating a nuclear facility at the CGS site would be similar to the air  
22 quality impacts at the VCSNS site. As described in Sections 4.7 and 5.7, the review team  
23 determined that the impacts of building and operating two new nuclear units on air quality at the  
24 VCSNS site would be SMALL. Therefore, the impacts of building and operating two new  
25 nuclear units on air quality at the CGS site would be minimal.

26 The CGS site is located in the Augusta-Aiken Interstate Air Quality Control Region, which is  
27 designated as being in attainment with the NAAQSs (40 CFR 81.341) (SCE&G 2009a). The  
28 resource area defined for this evaluation is Orangeburg County, South Carolina. A single  
29 county was selected because designations of attainment or non-attainment are made on a  
30 county-by-county basis. As listed in Table 9-13, sources of gaseous emissions near the  
31 proposed location include the CGS. The CGS is a 430-MW(e) coal-fired electrical generating  
32 plant, and emissions include sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen  
33 oxides. Given the intermittent operation of the diesel generators at the proposed two new units,  
34 and that Orangeburg County is currently in attainment, the review team concludes the  
35 cumulative impacts, including the impacts from building and operating two new units on air  
36 quality, would be SMALL.



## Environmental Impacts of Alternatives

1 Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6. As  
2 pointed out in Chapter 7, the impacts of the emissions are independent of emission location.  
3 Consequently, the discussions in the previous chapters and in Section 9.2.5 are applicable to  
4 two AP1000 reactors located at the CGS site. The impacts of greenhouse gas emissions at the  
5 CGS site considered in isolation would be minor, and the cumulative impact of greenhouse gas  
6 emissions would be MODERATE, primarily due to national and world-wide impacts of emissions  
7 of greenhouse gases. Building and operating two new nuclear reactor units at the CGS site  
8 would not be a significant contributor to the MODERATE impact.

### 9 **9.3.4.10 Nonradiological Health Impacts**

10 The following impact analysis includes direct, indirect, and cumulative impacts from building  
11 activities and operations. The analysis also considers past, present, and reasonably  
12 foreseeable future actions that impact the nonradiological health resources, including other  
13 Federal and non-Federal projects and the projects listed in Table 9-13. For the analysis of  
14 nonradiological health impacts at the CGS site, the geographic area of interest is considered to  
15 be the 6-mi area centered on the CGS site and the associated transmission-line corridors. This  
16 6-mi radius is expected to encompass all nonradiological health impacts.

#### 17 ***Building Impacts***

18 Nonradiological health impacts from building two new nuclear units on construction workers and  
19 members of the public at the CGS site would be similar to those evaluated in Section 4.8. They  
20 include occupational injuries, noise, vehicle exhaust, and dust. Applicable Federal and State  
21 regulations on air quality and noise would be complied with during the site-preparation and  
22 building phase. The CGS site is located in a rural area and building impacts would likely be  
23 negligible on the surrounding populations that are classified as medium- and low-population  
24 areas.

25 Past actions in the geographic area of interest that have similarly affected nonradiological  
26 resources include the development and operation of the CGS, located in the same general  
27 location as the CGS site, and the Kaiser Agricultural Chemical Company, located less than 1 mi  
28 east-northeast of the CGS site. There are no major current projects in the geographic area of  
29 interest that would cumulatively impact nonradiological health in a similar way.

30 Proposed future actions that would affect nonradiological health in a similar way to development  
31 at the CGS site would include transmission-line creation and/or upgrading throughout the  
32 designated geographic region of interest, and future urbanization would also be expected to  
33 occur. The review team concludes that the impacts on nonradiological health from building two  
34 new nuclear units and associated transmission lines at the CGS site would be minimal.

## 1 **Operational Impacts**

2 Occupational health impacts on operational employees would include those associated with the  
3 operation of cooling towers and transmission lines and are fully described in Section 5.8. Based  
4 on the configuration of the proposed new units at the CGS site (closed-cycle, wet cooling  
5 system with mechanical draft cooling towers), etiological agents would not likely increase the  
6 incidence of waterborne diseases in the vicinity of the site. Impacts on workers health from  
7 occupational injuries, noise, and electric fields would be similar. Noise and electric fields would  
8 be monitored and controlled in accordance with applicable OSHA regulations.

9 No past, present, or future actions in the geographic area of interest were identified that would  
10 significantly affect nonradiological health in ways similar to those associated with the operation  
11 of two new units at the CGS site. The review team therefore concludes that the impacts on  
12 nonradiological health from operating two new nuclear units and associated transmission lines  
13 at the CGS site would be minimal.

## 14 **Summary Statement**

15 Impacts on nonradiological health from development and operation of two new units at the CGS  
16 site are estimated based in the information provided by SCE&G and the review team's  
17 independent evaluation. The review team concludes that health impacts on construction  
18 workers and the public resulting from the development of two new nuclear units at the CGS site  
19 would be SMALL. The review team expects that the occupational health impacts on the  
20 operations employees of two new nuclear units at the CGS site would be SMALL. Similarly,  
21 impacts on public health of two new nuclear units operating at the CGS site would be expected  
22 to be SMALL.

23 There are past and future activities in the geographic area of interest that could affect  
24 nonradiological health in ways similar to the building of two units at the CGS site. The review  
25 team concludes, however, that cumulative impacts from past, present, and future actions on  
26 nonradiological health from building and operating two new units at the CGS would be SMALL.

## 27 **9.3.4.11 Radiological Impacts of Normal Operations**

28 The following impact analysis includes radiological impacts on the public and workers from  
29 building activities and operations for two nuclear units at the CGS alternative site. The analysis  
30 also considers other past, present, and reasonably foreseeable future actions that affect  
31 radiological health, including other Federal and non-Federal projects and the projects listed in  
32 Table 9-13. As described in Section 9.3.4, a 430-MW(e) coal-fired generating plant is located at  
33 the CGS site along with an adjacent greenfield site; there are currently no nuclear facilities on  
34 the site. The geographic area of interest is the area within a 50-mi radius of the CGS site.  
35 Facilities potentially affecting radiological health within this geographic area of interest are the

## Environmental Impacts of Alternatives

1 operating Vogtle Electric Generating Plant (VEGP) Units 1 and 2, the proposed VEGP Units 3  
2 and 4, DOE's Savannah River Site (SRS), the Mixed Oxide (MOX) Fuel Fabrication facility at  
3 the SRS, the Energy Solutions (Barnwell) Low-Level Radioactive Waste Disposal Facility, and  
4 the Westinghouse Fuel Fabrication Plant outside of Columbia, South Carolina. In addition,  
5 there are likely to be hospitals and industrial facilities within 50 mi of the CGS site that use  
6 radioactive material.

7 The radiological impacts of building and operating the proposed two AP1000 plants at the CGS  
8 site include doses from direct radiation and liquid and gaseous radioactive effluents. These  
9 pathways would result in low doses to people and biota offsite that would be well below  
10 regulatory limits. The impacts are expected to be similar to those estimated for the VSCNS site.

11 The radiological impacts of existing VEGP Units 1 and 2 also include doses from direct radiation  
12 and liquid and gaseous radioactive effluents. These pathways result in low doses to people and  
13 biota offsite that are well below regulatory limits as demonstrated by the ongoing radiological  
14 environmental monitoring program conducted around the Vogtle site. The EIS for proposed  
15 VEGP Units 3 and 4 indicates that operation of the proposed reactors would result in  
16 radiological impacts from direct radiation and liquid and gaseous radioactive effluents. The EIS  
17 indicates that these pathways would result in low doses to people and biota offsite that would be  
18 well below regulatory limits (NRC 2008b).

19 SRS, the MOX Fuel Fabrication facility at SRS, the Barnwell Low-Level Radioactive Waste  
20 Disposal Facility, and the Westinghouse Fuel Fabrication Plant are all located 25 mi or more  
21 from the CGS site. The NRC staff concludes that these non-reactor facilities are located far  
22 enough from the CGS site that there would be no significant cumulative radiological impact.  
23 This conclusion is consistent with the results of the ongoing radiological environmental  
24 monitoring program conducted around the Vogtle site. In addition, the NRC staff concludes that  
25 the dose from direct radiation and effluents from hospitals and industrial facilities that use  
26 radioactive material would be an insignificant contribution to the cumulative impact around the  
27 CGS site. This conclusion is based on data from the radiological environmental monitoring  
28 programs conducted around currently operating nuclear power plants.

29 The NRC staff concludes that the cumulative radiological impacts from building and operating  
30 the two proposed AP1000 plants and other existing and planned projects and actions in the  
31 geographic area of interest around the CGS site would be SMALL.

### 32 **9.3.4.12 Postulated Accident Impacts**

33 The following impact analysis includes radiological impacts from postulated accidents from  
34 operations for two nuclear units at the CGS alternative site. The analysis also considers other  
35 past, present, and reasonably foreseeable future actions that affect radiological health from  
36 postulated accidents, including other Federal and non-Federal projects and the projects listed in

1 Table 9-13. As described in Section 9.3.4, a 430-MW(e) coal-fired generating plant is located at  
2 the CGS site along with an adjacent greenfield site; there are currently no nuclear facilities on  
3 the site. The geographic area of interest considers all existing and proposed nuclear power  
4 plants that have the potential to increase the probability-weighted consequences (i.e., risks)  
5 from a severe accident at any location within 50 mi of the CGS alternative site. Existing facilities  
6 potentially affecting radiological accident risk within this geographic area of interest are the  
7 existing VCSNS Unit 1, H.B. Robinson Unit 1, and VEGP Units 1 and 2. In addition, two  
8 AP1000 reactors have been proposed at the Vogtle site. DOE's SRS, the MOX Fuel  
9 Fabrication Facility at the SRS, the Energy Solutions (Barnwell) Low-Level Radioactive Waste  
10 Disposal Facility, and the Westinghouse Fuel Fabrication Plant outside of Columbia, South  
11 Carolina are also within the geographic area of interest.

12 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences  
13 of DBAs at the VCSNS site would be minimal for AP1000 reactors. DBAs are addressed  
14 specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria.  
15 The AP1000 design is independent of site conditions, and the meteorology of the CGS  
16 alternative and VCSNS sites are similar; therefore, the NRC staff concludes that the  
17 environmental consequences of DBAs at the CGS alternative site would be minimal. Because  
18 the meteorology, population distribution, and land use for the CGS alternative site are expected  
19 to be similar to the proposed VCSNS site, risks from a severe accident for an AP1000 reactor  
20 located at the CGS alternative site are expected to be similar to those analyzed for the  
21 proposed VCSNS site. These risks for the proposed VCSNS site are presented in Tables 5-17  
22 and 5-19 and are well below the median value for current-generation reactors. In addition, as  
23 discussed in Section 5.11.1, estimates of average individual early fatality and latent cancer  
24 fatality risks are well below the Commission's safety goals (51 FR 30028). For existing plants  
25 within the geographic area of interest (VCSNS Unit 1, H.B. Robinson Unit 1, and VEGP Units 1  
26 and 2), the Commission has determined that the probability-weighted consequences of severe  
27 accidents are small (10 CFR Part 51, Appendix B, Table B-1). According to the Vogtle ESP  
28 (NRC 2008b), the risks from this proposed site are also well below current-generation reactors  
29 and meet the Commission's safety goals.

30 There are no reactors currently operating at DOE's SRS; however, there is some severe  
31 accident risk associated with the spent nuclear fuel and other high-level radioactive wastes that  
32 may be processed or stored at SRS. The severe accident risks associated with stored spent  
33 fuel at operating nuclear power plants are lower than the risks for severe accidents involving the  
34 reactor core. Likewise, the severe accident risks associated any spent reactor fuel or other  
35 high-level radioactive waste processed or stored at SRS would be lower than the risks for  
36 severe accidents involving the reactor core. There is no irradiated fuel at the Westinghouse  
37 Fuel Fabrication Plant or the MOX Fuel Fabrication Facility at SRS, and these facilities are  
38 designed to prevent inadvertent criticalities. Other facilities at SRS and the Barnwell Low-Level  
39 Radioactive Waste Disposal Facility may contain substantial amounts of radioactive material,  
40 but there is no credible severe accident risk like there is for an operating reactor. Therefore, the

## Environmental Impacts of Alternatives

1 additional risk from these facilities is not significant in the evaluation of the cumulative severe  
2 accident risk for a nuclear power plant at the CGS site.

3 On this basis, the NRC staff concludes that the cumulative risks from severe accidents at any  
4 location within 50 mi of the CGS alternative site would be SMALL.

### 5 **9.3.5 The Saluda Site**

6 This section covers the review team's evaluation of the potential environmental impacts of siting  
7 a two-unit nuclear power plant) at the 850-ac Saluda site in Saluda County, South Carolina.  
8 The following sections describe a cumulative impact assessment conducted for each major  
9 resource area. The specific resources and components that could be affected by the  
10 incremental effects of the proposed action if it were implemented at the Saluda site and other  
11 actions in the same geographic area were assessed. This assessment includes the impacts of  
12 NRC-authorized construction, operations, and preconstruction activities. Also included in the  
13 assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and  
14 private actions that could have meaningful cumulative impacts when considered together with  
15 the proposed action if implemented at the Saluda site. Other actions and projects considered in  
16 this cumulative analysis are described in Table 9-19.

17 **Table 9-19.** Past, Present, and Reasonably Foreseeable Projects and Other Actions  
18 Considered in the Saluda Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
VCSNS Unit 1	VCSNS Unit 1 consists of one 996-MW(e) nuclear power generating plant.	About 25 mi east of the Saluda site	VCSNS Unit 1 is currently operational and is licensed to continue operations through August 6, 2042 <sup>(a)</sup>
Carolinas-Virginia Tube Reactor (CVTR)	Experimental pressurized tube heavy water nuclear power reactor	About 24 mi east of the Saluda site	Undergoing Decommissioning <sup>(b)</sup>
Independent Spent Fuel Storage Installation	Dry spent-fuel storage	About 25 mi east of the Saluda site	Proposed <sup>(c)</sup>
Old Steam Generator Recycle Facility	Decommissioned steam generator storage	About 25 mi east of the Saluda site	Operational <sup>(c)</sup>
Lee Nuclear Station	Two Westinghouse Advanced Passive 1000 (AP1000) pressurized water reactors	About 60 mi north of the Saluda site	Proposed new nuclear plant. Operation would begin in 2018-2021 <sup>(d)</sup>
Vogtle Electric Generating Plant (VEGP)	Nuclear power generating plant with 2 units, VEGP 1 (1109 MW(e)) and VEGP 2 (1127 MW(e))	About 70 mi south of the Saluda site	Operational <sup>(e)</sup>

19

Table 9-19. (contd)

Project Name	Summary of Project	Location	Status
VEGP Units 3 and 4	Nuclear power generating plant with two Westinghouse AP1000 pressurized water reactors	About 70 mi south of the Saluda site	Proposed <sup>(f)</sup>
H.B. Robinson Steam Electric Plant, Unit 2	Nuclear power generating plant with one 710-MW(e) unit	About 90 mi east of the Saluda site	Operational <sup>(g)</sup>
Catawba Nuclear Station, Units 1 and 2	Two 1129-MW(e) Westinghouse reactors	About 70 mi northeast of the Saluda site	Operational <sup>(h)</sup>
Oconee Nuclear Station, Units 1, 2 and 3	Three 846-MW(e) Babcock and Wilcox reactors	About 80 mi west-northwest of the Saluda site	Operational <sup>(i)</sup>
McGuire Nuclear Station, Units 1 and 2	Two 1100-MW(e) Westinghouse reactors	About 96 mi northeast of the Saluda site	Operational <sup>(j)</sup>
SCE&G Parr Hydroelectric Plant	A 14-MW(e) hydroelectric plant	About 24 mi east of the Saluda site	Parr Hydro Plant is currently operational <sup>(k)</sup>
SCE&G Fairfield Pumped Storage Plant	A 511.2-MW(e) hydroelectric plant. VCSNS Units 2 and 3 will use water supply from this facility.	About 25 mi east of the Saluda site	The Fairfield Pumped Storage Plant is currently operational <sup>(c)</sup>
Buzzard Roost Combustion Turbine Station	A 196-MW oil/gas-fired peaking facility	About 6 mi west of Saluda site	Operational <sup>(l)</sup>
Buzzard's Roost Dam	A 15-MW hydroelectric facility	About 6 mi west of Saluda site	Operational <sup>(m)</sup>
Saluda Dam (SCE&G, commonly called the Lake Murray Dam)	A 206-MW hydroelectric facility; the Saluda Dam created Lake Murray	About 32 mi southeast of Saluda site	Operational, currently in process of relicensing <sup>(n)</sup>
McMeekin Station	252-MW coal-fired plant	About 32 mi southeast of Saluda site	Operational
Westinghouse Fuel Fabrication Plant in Columbia SC	Design and fabricate completed nuclear fuel assemblies and fuel-related products	About 42 mi east of Saluda site	Operational <sup>(o)</sup>
Mining Projects			
Hanson Brick East/Minchew Pit	Surface mining operation for Hanson Brick	About 2 mi southwest of the Saluda site	Operational <sup>(p)</sup>
Hanson Brick East/Bauknight Pit	Surface mining operation for Hanson Brick	About 8 mi southwest of the Saluda site	Operational <sup>(p)</sup>
Hanson Brick East/Hicks Pit	Surface mining operation for Hanson Brick	About 10 mi west-southwest of the Saluda site	Operational <sup>(p)</sup>

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**Table 9-19. (contd)**

<b>Project Name</b>	<b>Summary of Project</b>	<b>Location</b>	<b>Status</b>
<b>Transportation Projects</b>			
South Carolina Strategic Corridor System Plan	Strategic system of corridors forming the backbone of the State's transportation system.	State-wide	Planning document with no explicit schedules for projects; however, many strategic corridors coincide with routes that would/could be used for development at the CGS site <sup>(q)</sup>
<b>Other Facilities</b>			
International Paper Silverstreet Chip Mill	Paper mill	About 2 mi northwest of the Saluda site	Operational <sup>(r)</sup>
George Hugh Connelly WWTP	Waste water treatment facilities	Within 10–15 mi of the Saluda site	Operational <sup>(s)</sup>
Newbury/Bush River WWTF			
Ninety Six CPW Pier 96 WWTP			
WR Wise WTF			
Wilson Creek WWTP			
NCW&SA/Broad River WWT			
<b>Parks and Aquaculture Facilities</b>			
Greenwood State Park	Small park on Lake Greenwood	About 10 mi west of the Saluda site.	Currently managed by South Carolina Department of Parks, Recreation and Tourism <sup>(t)</sup>
Sumter National Forest	371,000-acre national forest.	Throughout 40- to 50-mi region.	Currently managed by U.S. Forest Service <sup>(u)</sup>
Parr Hydro Wildlife Management Area	4400-acre wildlife management area	About 20 mi east-northeast	Currently managed by SCDNR <sup>(v)</sup>
Other parks, forests, and reserves	Several parks, recreation, and conservation areas are located within the 50-mi region. Examples of such areas include the following: Lake Wateree, the Catawba River, Monticello and Parr reservoirs, Broad River, Lake Murray, Dreher Island State Park, Lake Greenwood, Riverbanks Zoo and Garden,	Throughout region	Currently managed by various local, State, and Federal agencies and organizations.

**Table 9-19. (contd)**

<b>Project Name</b>	<b>Summary of Project</b>	<b>Location</b>	<b>Status</b>
	Congaree National Park, Harbison State Forest, and Sesquicentennial State Park.		
<i>Other Actions/Projects</i>			
Various hospitals	Medical isotopes	Within 50 mi	Operational in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens, Greenwood, and Camden
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroad; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region.	Construction would occur in the future, as described in State and local land-use planning documents

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(a) Source: NRC 2004  
 (b) Source: NRC 1996  
 (c) Source: SCE&G 2009a  
 (d) Source: NRC 2007  
 (e) Source: NRC 2009e  
 (f) Source: NRC 2009f  
 (g) Source: NRC 2009b  
 (h) Source: NRC 2009a  
 (i) Source: NRC 2009d  
 (j) Source: NRC 2009c  
 (k) Source: EPA 2009g  
 (l) Source: Duke 2009b  
 (m) Source: Greenwood County 2008  
 (n) Source: SCE&G 2009h  
 (o) Source: Westinghouse 2009  
 (p) Source: EPA 2009i  
 (q) Source: SCDOT 2009  
 (r) Source: EPA 2009j  
 (s) Source: EPA 2009k  
 (t) Source: South Carolina Department of Parks, Recreation and Tourism 2009  
 (u) Source: USFS 2004  
 (v) Source: SCE&G 2010a

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## Environmental Impacts of Alternatives

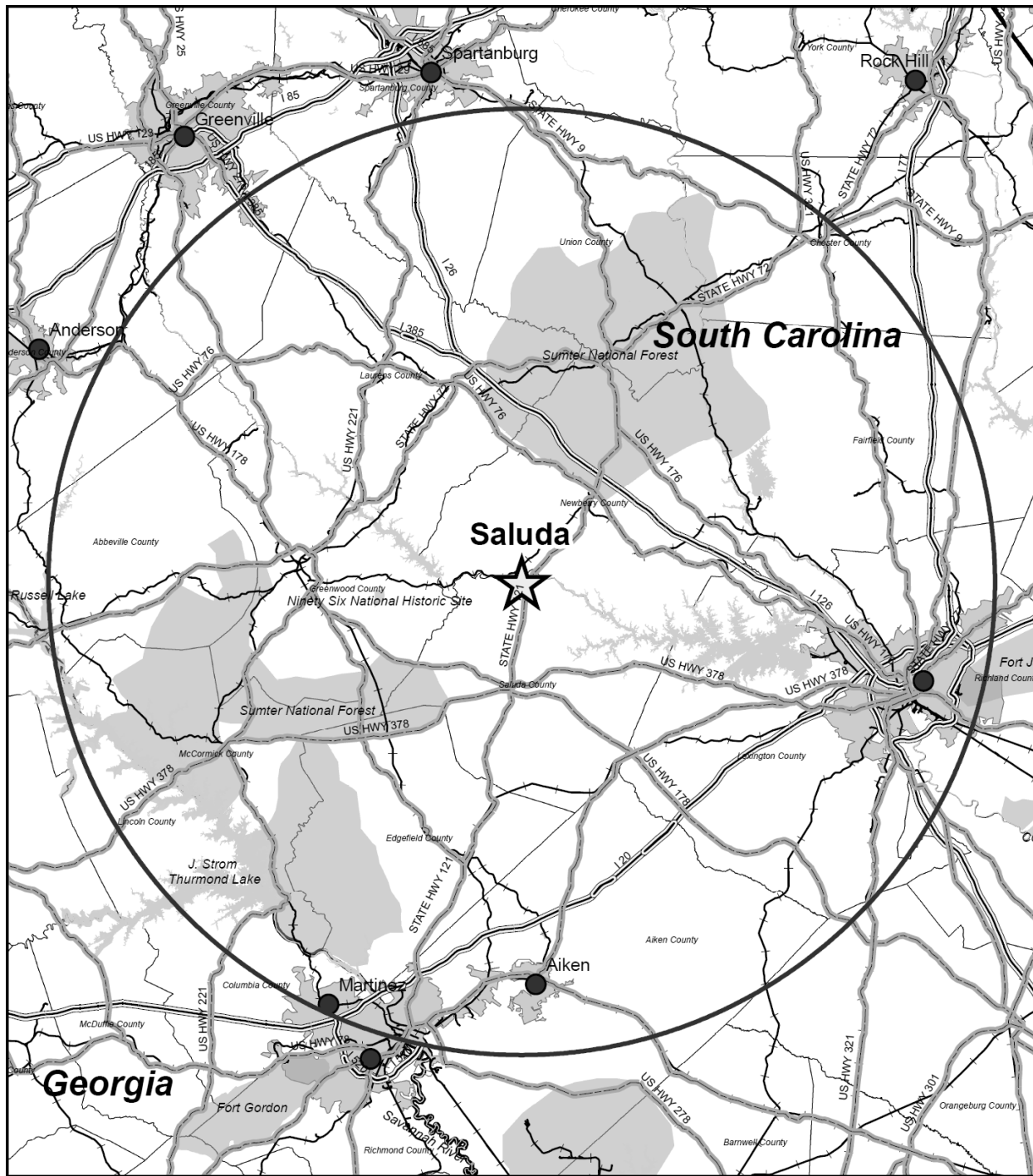
1 The Saluda site is an approximately 850-ac undeveloped property owned by SCE&G in Saluda  
2 County on the Saluda River arm of Lake Murray at the confluence with Mill Creek. The site is  
3 bounded on the north side by the Saluda River arm of Lake Murray and SC-121 borders the  
4 eastern portion of the site. Figure 9-9 shows the Saluda alternative site region.

5 The Saluda site is an SCE&G-owned, greenfield site located in a predominantly rural area of  
6 Saluda County characterized by moderately rolling topography. The undeveloped sections of  
7 the site consist primarily of pine, hardwood, and mixed forested land with a significant portion of  
8 the forest land dedicated to silviculture and routine harvesting. There has historically been little  
9 use of the site for any alternative purposes other than its current use, but it is maintained by  
10 SCE&G as a potential site for future development if required.

### 11 **9.3.5.1 Land Use and Transmission-Line Corridors**

12 In addition to land-use impacts from building and operations, the cumulative analysis for the  
13 Saluda site also considers other past, present, and reasonably foreseeable future actions that  
14 could contribute to the cumulative land-use impacts, including other Federal and non-Federal  
15 projects and the projects listed in Table 9-19. For the analysis of land-use impacts at the  
16 Saluda site, the geographic area of interest is considered to be the 50-mi region centered on the  
17 Saluda site, plus any transmission-line corridors that extend beyond that range. Most but not all  
18 of the transmission-line corridor length falls within a 50-mi radius of the site. Land-use planning  
19 for transmission-line routing over wide areas must consider land-use plans of adjoining counties  
20 and other land-managing agencies, rather than considering one county in isolation.  
21 Furthermore, in predominantly rural settings such as that surrounding the Saluda site, land-use  
22 changes occurring substantial distances away from a project site can substantially influence  
23 land-use planning decisions close to the site.

24 The Saluda site presently is mostly undeveloped and predominantly forested. It is located in a  
25 sparsely populated, largely rural area, with forests and small farms composing the dominant  
26 land use, typical of much of rural South Carolina. Historically, most upland areas have been  
27 used for crop production, but presently are used for silviculture. Several electric transmission  
28 lines, state routes, and interstate highways currently traverse the region. In many respects the  
29 Saluda site is similar to the VCSNS site, although it is much smaller. The land is owned by  
30 SCE&G and the review team expects that development of the site for power generation would  
31 not be inconsistent with local land-use plans and zoning ordinances.



1  
2

Figure 9-9. Saluda Alternative Site Region

## Environmental Impacts of Alternatives

1 Development of the proposed new units on the Saluda site would convert existing land uses on  
2 about 400 ac of currently forested land to utility uses for the nuclear facility and associated  
3 structures and infrastructure. In addition, the principal access route, SC-121 would need to be  
4 slightly rerouted to conform to exclusion area boundaries, and this rerouting would affect about  
5 50 ac of additional land. A makeup water intake line, approximately 9 mi long, would be  
6 constructed along the Saluda River valley from the site to a location near the confluence of the  
7 Bush River and Lake Murray. Although this impact would be locally noticeable, in the  
8 cumulative it would not represent a significant land-use impact. Similar to the VCSNS site, each  
9 AP1000 unit would require the addition of three 230-kV transmission lines, each of which would  
10 occupy a 100-ft-wide transmission-line corridor. Based on information provided by SCE&G,  
11 (SCE&G 2009d) describing the dimensions of conceptual transmission-line corridors for the  
12 Saluda site, approximately 468 mi covering nearly 5720 ac of land would be needed. The  
13 proposed routing would use existing corridors to the extent practicable, so that although the  
14 linear runs extend nearly 470 mi, relatively little of that distance would require entirely new  
15 corridor. The actual area of land disturbance, used for assessing impacts on terrestrial ecology  
16 and cultural resources, is therefore substantially lower than suggested by the overall land-use  
17 requirements. The review team concludes that the land-use impact of the transmission-line  
18 installation activities would be generally similar to those described for the VCSNS site in Section  
19 4.1.2. SCE&G stated that all land clearing associated with nuclear facility and transmission-line  
20 development would be conducted according to Federal, State, and local regulations, permit  
21 requirements, existing SCE&G and Santee Cooper procedures, good construction practices,  
22 and established BMPs (SCE&G 2009a).

23 Because the other projects described in Table 9-19 do not include any reasonably foreseeable  
24 significant changes in land-use types within 50 mi of the Saluda site, there would not be any  
25 significant additional cumulative impacts on land use from those activities.

26 As described above, installation of new transmission-line corridors to support the proposed new  
27 units could need as much as 5720 ac over nearly 470 mi of length; however, the review team  
28 expects that final routing would lead to significantly less land-use impacts. If additional  
29 transmission lines are built from other energy projects, there would be a cumulative land-use  
30 impact from the additional amount of land converted to utility corridor use for transmission lines.  
31 Because transmission lines are often co-located and are relatively narrow, the review team  
32 expects that the cumulative impact would be consistent with the land-use plans and zoning  
33 regulations of the affected counties. However, multiple new transmission-line corridors could  
34 noticeably alter the land-use classification acreage proportions, both within the vicinity and  
35 within the 50-mi region.

36 Cumulative land-use impacts within the region are expected to be manageable because the  
37 activities would be consistent with existing land-use plans and zoning. However, due to the  
38 potential reclassification of acreage within the region caused by the transmission-line

1 development, the review team concludes that the cumulative land-use impacts associated with  
2 the proposed project at the Saluda site, related transmission-line corridor development, and  
3 other projects in the geographic area of interest would be MODERATE. Building and operating  
4 two new nuclear units at the CGS site would be a significant contributor to these impacts.

#### 5 **9.3.5.2 Water Use and Quality**

6 Saluda site hydrology, water use, and water quality are discussed in ER Section 9.3.3.3.3  
7 (SCE&G 2009a); this EIS section draws from information presented in the ER and in responses  
8 to subsequent requests by the review team for additional information, as well as the Nuclear  
9 Plant Site Selection Study Report (Tetra Tech NUS, Inc. 2009).

10 The cooling- and service-water supply for a two-unit nuclear generating station located at the  
11 Saluda site would most likely be Lake Murray, a run-of-the-river impoundment on the Saluda  
12 River near Columbia, South Carolina (SGE&G 2010a). A 9-mi-long pipeline would be needed to  
13 transfer water to and from the lake to the nuclear facility. Lake Murray's surface area is over  
14 49,000 ac and the total and useable water storages for the reservoir are 2,200,000 and  
15 1,056,000 ac-ft, respectively. The mean annual inflow to Lake Murray is 2595 cfs. Two nuclear  
16 units located at the Saluda site would withdraw approximately 83 cfs of makeup water from  
17 Lake Murray. Sixty-two cubic feet per second would be consumptively lost through evaporation  
18 and drift from the station cooling towers and 21 cfs would be returned via pipeline to the lake at  
19 the discharge location.

20 For the purposes of assessing water-use impacts, the review team compared the station  
21 consumptive water loss from evaporation and drift from the cooling towers (62 cfs) to the mean  
22 annual inflow to Lake Murray (2595 cfs). The consumptive water loss would be about 2.4  
23 percent of the average annual inflow. Based on the use of Lake Murray as the source of cooling  
24 water and sink for blowdown, the large storage capacity of the reservoir, the relatively high  
25 mean annual inflow to the reservoir from the upstream tributaries when compared to the  
26 anticipated consumptive losses related to station operation, and the lack of reliance on the free  
27 flowing section of the Saluda River near the site for a source of cooling water, the review team  
28 concludes the impact on surface waters of two units at the Saluda site would be negligible.

29 SCE&G does not plan to use groundwater for the project, so no impacts on groundwater supply  
30 are expected (SCE&G 2009a).

31 SCE&G indicates that blowdown from the proposed units would be discharged to Lake Murray  
32 upstream of the intake embayment (SCE&G 2010a). A SCDHEC-issued NPDES permit would  
33 be required to operate the nuclear project at this site. Effluent discharge through an NPDES-  
34 permitted outfall would ensure that the discharges complied with the Clean Water Act. Such  
35 permits are designed to ensure the protection of water quality and therefore the impact on water  
36 quality is assessed to be minor.

## Environmental Impacts of Alternatives

1 Impacts of building and operation of the proposed units on groundwater quality may occur due  
2 to leaching of spilled pollutants and effluents into the subsurface. However, based on the  
3 review team's experience with other facilities, the review team concludes that with the  
4 implementation of BMPs the impacts on groundwater quality from building and operating two  
5 new nuclear units at the Saluda site would likely be minimal.

### 6 ***Cumulative Impacts***

7 In addition to water-use and water-quality impacts from building and operations activities,  
8 cumulative analysis considers past, present, and reasonably foreseeable future actions that  
9 affect the same environmental resources. For the cumulative analysis of impacts on surface  
10 water, the geographic area of interest for the Saluda Site is considered to be the drainage basin  
11 of the Saluda River upstream of the site and Lake Murray because this is the resource that  
12 would be affected by the proposed project. Key actions that have past, present, and future  
13 potential impacts on water supply and water quality in Lake Murray and the Saluda River basin  
14 include Buzzards Roost Dam and Saluda Dam on the Saluda River. These dams serve to  
15 increase the reliability of water supply to the region and to provide power. The McMeekin  
16 Station, a 252-MW coal-fired plant located just below Saluda Dam, has past, present, and future  
17 impacts on water quality and water supply in the region because it uses Lake Murray as a  
18 source of cooling water.

### 19 ***Water Use***

20 The surface-water-use impacts of building and operating two nuclear power plants at the Saluda  
21 site are dominated by the higher demands that would occur under normal operation. The  
22 projected consumptive water use of proposed units from Lake Murray is expected to be about  
23 62 cfs or approximately 2.4 percent of the average inflow to Lake Murray. The average flow  
24 rate is influenced by upstream cumulative consumptive uses of current users. Increases in  
25 consumptive use of water in the Saluda River drainage is anticipated in the future. The impacts  
26 of operational projects listed in Table 9-19 are considered in the above analysis or would have  
27 little or no impact on surface-water use.

28 Because of the availability of surface water and the relatively low yield of groundwater wells no  
29 groundwater would be used during building and operations. Potential impacts on groundwater  
30 use would be limited to groundwater withdrawal for dewatering excavations. Dewatering, if  
31 required, would require limited withdrawal of water because of the low permeability of the  
32 geologic materials in this area and would be temporary.

33 As discussed in Section 7.2 the review team considered potential climate changes that could  
34 affect the water resources available for cooling and the impacts of reactor operations on water  
35 resources for other users. The impact of climate change would be similar for all of the  
36 alternative sites.

1 The review team concludes that the cumulative impact of past, present, and future uses of water  
2 resources, both surface water and groundwater including any incremental impact associated  
3 with the building and operation of two units at the Saluda site would be SMALL.

#### 4 ***Water Quality***

5 Water-quality impacts of building and operation of the proposed units are described above in the  
6 context of current conditions in the Saluda River. The conditions include the impact of operating  
7 Buzzards Roost Dam and Lake Murray Dam. The impacts of other projects listed in Table 7-1  
8 are either considered in the analysis included above or would have little or no impact on  
9 surface-water quality. As mentioned above, blowdown water from the site would be discharged  
10 to Lake Murray and the requirements of the NPDES-permitted outfall would ensure that the  
11 discharges comply with the Clean Water Act and therefore the impact on surface-water quality  
12 is assessed to be minor.

13 Impacts of the building and operation of the proposed units on groundwater may occur due to  
14 leaching of spilled pollutants and effluents into the subsurface. However, based on the review  
15 team's experience with other facilities, the review team concludes that with the implementation  
16 of BMPs the impacts on groundwater from building and operating two new nuclear units at the  
17 Saluda site would likely be minimal. Due to the low permeability of geologic materials on the  
18 site and in the surrounding region no impacts on groundwater quality off the site are anticipated,  
19 and therefore no cumulative impacts on groundwater quality are anticipated.

20 The review team also concludes that with the implementation of BMPs, the impacts on  
21 groundwater quality from building and operating two units at the Saluda would likely be minimal  
22 and therefore, concludes the cumulative impact on surface and groundwater quality would be  
23 SMALL.

#### 24 **9.3.5.3 Terrestrial and Wetland Resources**

##### 25 ***Site Description***

26 The following impact analysis includes impacts from building activities and operations on  
27 terrestrial ecology resources. The analysis also considers past, present, and reasonably  
28 foreseeable future actions that affect the terrestrial ecological resources, including other Federal  
29 and non-Federal projects and the projects listed in Table 9-19. For the analysis of terrestrial  
30 ecological impacts at the Saluda site, the geographic area of interest is considered to be the  
31 6-mi region centered on the Saluda site, plus the associated transmission-line corridors. This 6-  
32 mi radius is expected to encompass the ecologically relevant landscape features and species.  
33 The natural history of the site is similar to that of the VCSNS site, described in Section 2.4.1.

34 The Saluda site is located in Saluda County on a primarily forested 1233-ac piece of property  
35 owned by SCE&G (SCE&G 2009a). The land surrounding the proposed site is predominately

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1 rural and habitats are typical of the Southern Outer Piedmont ecoregion, consisting of planted  
2 and naturally vegetated pine, mixed pine-hardwood, and hardwood forests. Common canopy  
3 species include white oak, southern red oak, black oak, mockernut and pignut hickories,  
4 intermixed with some loblolly pine and shortleaf pine. Beech, northern red oak, tulip poplar, and  
5 red maple are found on more mesic sites (Griffith et al. 2002).

6 The associated proposed transmission-line corridors begin in the Southern Outer Piedmont  
7 ecoregion and cross the Sandhills into the Coastal Plain ecoregion (see Section 2.2.2).  
8 Vegetation community types in the Sandhills ecoregion include grassland and early  
9 successional habitats, Sandhills pine woodland, seepage slopes, ponds and depressions,  
10 blackwater stream systems, and river bottoms (SCDNR 2005). The sandy soils create a xeric  
11 environment that supports a distinctive type of vegetation dominated by longleaf pines and  
12 turkey oaks. The Coastal Plain, the largest ecoregion in South Carolina, include bottomland  
13 hardwood forest consisting of bottomland oaks, red maple, sweetgum, green ash, bitternut  
14 hickory, and cypress-gum swamps dominated by water tupelo, swamp tupelo, bald cypress, and  
15 pond cypress (Griffith et al. 2002).

16 Common wildlife associated with the Piedmont ecoregion that also occur on the Saluda site and  
17 proposed transmission-line corridors include white-tailed deer, eastern cottontail, gray squirrel,  
18 opossum, and raccoon. Various bird, reptile, and amphibian species also reside on the Saluda  
19 site (SCE&G 2009a).

20 No Federally listed species are known to occur on the Saluda site, but formal surveys have not  
21 been conducted. Two species are listed as endangered in Saluda County: the red-cockaded  
22 woodpecker, and the vascular plant harperella (*Ptilimnium nodosum*). The pool-sprite  
23 (*Amphianthus pusillus*) is listed as threatened. The wood stork is the only Federally listed  
24 species in neighboring Newberry County. In addition to the Federally listed species, the State of  
25 South Carolina has listed Webster's salamander (*Plethodon websteri*) as endangered in Saluda  
26 County.

27 The proposed transmission-line corridors would cross Aiken, Bamberg, Calhoun, Chester,  
28 Colleton, Dorchester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, and  
29 Saluda Counties to connect to the proposed St. George substation in Colleton County (FP&S  
30 2008). Table 9-20 lists all Federally and State-listed species that occur in counties crossed by  
31 the proposed transmission-line corridors. SCE&G has stated that on-the-ground field surveys  
32 would be conducted prior to commencement of any ground-disturbing activities related to the  
33 site or transmission-line corridors as part of the permitting process (SCE&G 2009a).

1 **Table 9-20.** Federally and State-Listed Species that May Occur on the Saluda Alternative Site,  
 2 Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	SE	Aiken, Bamberg, Colleton, Dorchester, Orangeburg, Richland
<b>Birds</b>			
<i>Charadrius melodus</i>	Piping plover	FT/ST	Colleton
<i>Charadrius wilsonia</i>	Wilson's plover	ST	Colleton
<i>Elanoides forficatus</i>	American swallow-tailed kite	SE	Dorchester
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA/SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Saluda
<i>Mycteria americana</i>	Wood stork	FE/SE	Aiken, Bamberg, Calhoun, Colleton, Dorchester, Lexington, Newberry, Richland
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	Aiken, Bamberg, Calhoun, Chester, Colleton, Dorchester, Lexington, Orangeburg, Richland, Saluda
<i>Sterna antillarum</i>	Least tern	ST	Colleton
<b>Reptiles</b>			
<i>Caretta caretta</i>	Loggerhead turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT/ST	Colleton
<i>Clemmys guttata</i>	Spotted turtle	ST	Aiken, Bamberg, Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE/SE	Colleton
<i>Gopherus polyphemus</i>	Gopher tortoise	SE	Aiken, Colleton, Dorchester
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE/SE	Colleton
<b>Amphibians</b>			
<i>Ambystoma cingulatum</i>	Flatwoods salamander	FT/SE	Orangeburg
<i>Hyla andersonii</i>	Pine barrens tree frog	ST	Richland
<i>Plethodon websteri</i>	Webster's salamander	SE	Saluda
<i>Pseudobranchius striatus</i>	Dwarf siren	ST	Orangeburg



## Environmental Impacts of Alternatives

1

**Table 9-20.** (contd)

Scientific Name	Common Name	Legal Status	County
<i>Rana capito</i>	Gopher frog	SE	Aiken, Dorchester
Vascular Plants			
<i>Amphianthus pusillus</i>	Pool sprite	FT/ST	Lancaster, Saluda
<i>Echinacea laevigata</i>	Smooth coneflower	FE/SE	Aiken, Lancaster, Lexington, Richland
<i>Helianthus schweinitzii</i>	Schweinitz's sunflower	FE/SE	Lancaster, Lexington
<i>Isoetes melanospora</i>	Black-spored quillwort	FE/SE	Lancaster
<i>Lindera melissifolia</i>	Pondberry	FE/SE	Dorchester
<i>Lysimachia asperulifolia</i>	Rough-leaved loosestrife	FE/SE	Richland
<i>Oxypolis canbyi</i>	Canby's dropwort	FE/SE	Bamberg, Colleton, Dorchester, Orangeburg, Richland
<i>Ptilimnium nodosum</i>	Harperella	FE/SE	Aiken, Saluda
<i>Trillium reliquum</i>	Relict trillium	FE/SE	Aiken

Source: SCDNR 2006a; FWS 2008, Southeast Region County Lists

BGEPA = Bald and Golden Eagle Protection Act; FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered; ST = State listed as threatened

## 2 **Building Impacts**

3 The proposed project would require clearing approximately 500 ac of terrestrial habitats. The  
 4 nuclear facility footprint would be approximately 240 ac, which would include the switchyard,  
 5 parking lots, temporary facilities, laydown yards, and spoils storage area (SCE&G 2009a).  
 6 Because the site is greenfield, a substantial amount of infrastructure to facilitate the building and  
 7 operation of a new nuclear power facility would be required. An additional approximately 130 ac  
 8 of land would be disturbed for the building of roads, railroad spur, and bridge. A new 9-mi  
 9 makeup-water line would also be required, which would temporarily disturb approximately 55 ac  
 10 along the Saluda River valley (SCE&G 2009a). Based on a preliminary site layout of the  
 11 tabletop footprint provided by SCE&G, approximately 7.3 ac of the 17.4 ac of wetlands present  
 12 on the 1,232.8-ac site would be affected during building activities for the two proposed units  
 13 (SCE&G 2010a).

14 Each AP1000 unit would require the addition of three 230-kV transmission lines, which would  
 15 each occupy a 100-ft-wide transmission-line corridor. The total length and acreage of new  
 16 transmission-line corridor required (collectively) that would affect terrestrial ecological resources  
 17 would be approximately 254 mi and 2456 ac, which is a portion of the total 468 mi and 5720 ac  
 18 required (SCE&G 2009c, d). Acreages were determined by calculating the total number of  
 19 miles and acres of clearing required for right-of-way widening and/or development activities

1 (SCE&G 2009c, d). SCE&G and Santee Cooper would both have a portion of the new  
 2 transmission lines and details are provided in the Table 9-21 and Table 9-22 below (SCE&G  
 3 2009c, d).

4 **Table 9-21.** SCE&G Transmission-Line Information for the Saluda Alternative Site

Transmission-Line Segment	Length of Corridor (mi)	Acres of Corridor	Acres of Forested Wetlands	Acres of Nonforested Wetlands	Acres of Open Water	Linear Feet of Streams
Saluda-Saluda Switching	14	157	6	0.3	0.1	5249
Saluda Switching-St. George	101	1143	180	40	4	13,352
Saluda-VCSNS-Parr	1	12	--	--	--	176
Saluda-VCSNS	30	337	11	1	14	7680
Total	146	1649	197	41	18	26,457

Source: SCE&G 2009c, d

NOTE: Acreages were determined by calculating the total number of miles and acres of clearing required for right-of-way widening and/or development activities.

5 **Table 9-22.** Santee Cooper Transmission-Line Information for the Saluda Alternative Site

Wetlands Estimate	New Corridor (108 mi, 807ac)		Existing Corridor (213 mi, 3257 ac)		Total Corridor (4064 ac)	
	Acres	Percent of Corridors	Acres	Percent of Corridors	Acres	Percent of Corridors
Hydric Soils	73	9	1135	35	1208	30
NWI Wetlands	9	1	255	8	264	6

Source: SCE&G 2009c, d

NWI = National Wetlands Inventory

NOTE: Acreages were determined by calculating the total number of miles and acres of clearing required for right-of-way widening and/or development activities.

6 SCE&G stated that all land clearing associated with plant and transmission-line site preparation  
 7 and development would be conducted according to Federal, State, and local regulations, permit  
 8 requirements, existing SCE&G and Santee Cooper procedures, and established BMPs (SCE&G  
 9 2009a).

10 Past actions in the geographic area of interest that have similarly affected terrestrial resources  
 11 include the development and operation of the Buzzard's Roost Combustion Turbine Station,  
 12 located approximately 6 mi west of the Saluda site. The building of this 196-MW oil/gas-fired  
 13 peaking facility resulted in the loss of terrestrial habitat. The development of the Buzzard's  
 14 Roost Dam, located approximately 6 mi west of the Saluda site, dammed the Saluda River and  
 15 created Lake Greenwood. The creation of Lake Greenwood flooded approximately 11,400 ac of  
 16 terrestrial habitat (SCDPRT 2009). The Hanson Brick East/Minchew Plant, approximately 2 mi

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1 southwest of the Saluda site, and the International Paper Silverstreet Chip Mill, approximately  
2 2 mi from the Saluda site, also contributed to the loss of terrestrial habitat. There are no major  
3 current projects in the geographic area of interest that would cumulatively affect terrestrial  
4 ecological resources in a similar way.

5 Proposed future actions that would affect terrestrial resources in a similar way to development  
6 at the Saluda site would include transmission-line building and/or upgrading throughout the  
7 designated geographic region of interest, and future urbanization would also be expected to  
8 occur.

9 Impacts from building two nuclear units and supporting facilities on wildlife habitat would be  
10 unavoidable. Activities that would affect wildlife include land clearing and grading (temporary  
11 and permanent), filling and or draining of wetlands, increased human presence, heavy  
12 equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would  
13 likely displace or destroy wildlife that inhabits the affected areas. Some wildlife, including some  
14 individuals of important species, would perish or be displaced during land clearing for any of the  
15 above projects as a consequence of habitat loss, fragmentation, and competition for remaining  
16 resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be  
17 at greater risk of incurring mortality than more mobile animals, such as birds, many of which  
18 would be displaced to adjacent communities. Undisturbed land adjacent to the project could  
19 provide habitat to support displaced wildlife, but increased competition for available space and  
20 resources could affect population levels. Wildlife would also be subjected to impacts from noise  
21 and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife  
22 from noise is expected to be temporary and minor. The creation of new transmission-line  
23 corridors could be beneficial for some species, including those that inhabit early successional  
24 habitat or use edge environments, such as white-tailed deer, northern bobwhite quail, eastern  
25 meadowlark, and the gopher tortoise. Birds of prey, such as red-tailed hawks would likely  
26 exploit newly created hunting grounds. Forested wetlands within the corridors would be  
27 converted to and maintained in a herbaceous or scrub-shrub condition that could provide  
28 improved foraging habitat for some waterfowl and wading birds. However, fragmentation of  
29 forests could adversely affect species that are dependent on large tracts of continuous forested  
30 habitat.

31 The review team concludes that the impacts on terrestrial resources from building two new  
32 nuclear units and associated transmission lines at the Saluda site would be noticeable, but not  
33 destabilizing.

### 34 ***Operational Impacts***

35 Impacts on terrestrial ecological resources from the operation of two new nuclear units at the  
36 Saluda site primarily include those associated with cooling towers and transmission lines.

1 Impacts resulting from the operation of cooling towers and transmission lines are discussed in  
 2 detail in Section 9.3.3.3 and would apply to the Saluda site.

3 No past, present, or future actions in the geographic area of interest were identified that would  
 4 significantly affect terrestrial habitat and wildlife including important species in ways similar to  
 5 those associated with the operation of two new units.

6 The review team concludes that the impacts of operating two new units and associated  
 7 transmission lines at the Saluda site on terrestrial resources and wetlands would be minimal.

8 **9.3.5.4 Summary Statement**

9 Impacts on terrestrial ecology resources are estimated based in the information provided by  
 10 SCE&G and the review team's independent review. There are past and future activities in the  
 11 geographic area of interest that could affect wildlife and wildlife habitat in ways similar to the  
 12 building of two units at the Saluda site.

13 The Saluda site and some of the associated transmission lines are natural habitats that would  
 14 be substantially altered by development and maintenance activities, noticeably affecting the  
 15 level and movement of terrestrial wildlife populations in the area of interest. Other anticipated  
 16 development projects would further alter wildlife habitats and migration patterns in the  
 17 surrounding landscape. The review team therefore concludes that cumulative impacts on  
 18 baseline conditions for terrestrial resources would be MODERATE. Building and operating two  
 19 new nuclear units and associated transmission lines at the Saluda site would be significant  
 20 contributor to the MODERATE impact.

21 **9.3.5.5 Aquatic Resources**

22 The following impact analysis includes impacts from building activities and operations on  
 23 aquatic ecology resources. The Saluda River basin consists of 21 watersheds that span 2523  
 24 mi<sup>2</sup> across the Blue Ridge, Piedmont, and Sand Hills physiographic provinces (SCDHEC  
 25 2004b). The Saluda alternative site is located on the Saluda River, downstream of the  
 26 confluence with Mill Creek and upstream of the Little River watershed confluence. This  
 27 segment of the river drains into the Saluda River arm of Lake Murray (SCDHEC 2004b; SCE&G  
 28 2009a). The site vicinity falls within the Saluda River/Lake Murray watershed (HUC 03050109-  
 29 150) in the Piedmont ecoregion. Within the 182,441 ac of the Saluda River/Lake Murray  
 30 watershed, there are 276.8 mi of streams and over 3430.5 ac of lake waters (SCDHEC 2004b).  
 31 The geographic region of interest would include the Saluda River and Lake Murray to the  
 32 Saluda Dam structure as the most affected waterbodies.

33 Historically, Lake Murray was created by impoundment of the Saluda River in 1930 as a part of  
 34 a hydroelectric project by Santee Cooper (iDATA 2009). Of the seven reservoirs and

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1 impoundments in the Saluda River basin, Lake Murray is the largest, covering 48,000 ac that  
2 are bordered by 691 mi of shoreline (Kleinschmidt 2005; SCDNR 2009d). The aquatic habitats  
3 associated with Lake Murray include a diversity of open water, shallow coves, and wetlands.  
4 Submerged artificial structures have been installed throughout the lake by SCDNR to attract fish  
5 for recreational anglers (SCDNR 2009a). Lake Murray serves multiple purposes; it is used for  
6 hydroelectric generation, maintenance of downstream water quality, industrial and municipal  
7 water supply, irrigation, and recreation (SCE&G 2009a).

8 Near the proposed Saluda alternative site, SCDHEC has reported on water-quality conditions at  
9 two stations within the Saluda River/Lake Murray watershed. The following information was  
10 derived from the SCDHEC report titled *Watershed Water Quality Assessment: Saluda River*  
11 *Basin* (SCDHEC 2004b). At the nearest upstream monitoring station, approximately 9 river  
12 miles from the vicinity of the proposed alternative site, SCDHEC determined that water-quality  
13 conditions were hampered by elevated copper concentrations from unknown sources. Water  
14 quality is optimal for supporting aquatic life because the values exceed the acute criteria.  
15 Recreational uses, however, are not restricted. At the nearest downstream monitoring station,  
16 approximately 2 river miles downstream from the vicinity of the proposed alternative site, water  
17 quality is suboptimal for supporting aquatic life; however, there are no restrictions for  
18 recreational activities.

19 Elevated mercury concentrations within the Saluda River/Lake Murray watershed have resulted  
20 in a fish-consumption advisory. The SCDHEC (2009a) suggested that consumption of  
21 largemouth bass and bluegill (*Lepomis macrochirus*) be limited to one meal per week. Bowfin  
22 consumption is advised not to exceed one meal per month.

23 As described in Section 9.3.5.2, the proposed intake and discharge structures would be located  
24 in Lake Murray over 9 mi downstream of the nuclear facility (SCE&G 2009f). The SCDHEC  
25 (2004b) monitoring results indicated that the pH did not meet the established criteria, which  
26 resulted in the assessment that water quality is not able to support aquatic life near the  
27 monitoring station in the vicinity of the proposed intake and discharge structures

### 28 ***Recreationally Important Species***

29 Lake Murray provides abundant recreational opportunities, the most popular being recreational  
30 fishing (Kleinschmidt 2007). Recreational species found in Lake Murray include largemouth  
31 bass, redear sunfish, bluegill, striped bass (*Morone saxatilis*), white bass (*M. chrysops*), white  
32 catfish (*Ameiurus catus*), channel catfish, crappie (*Pomoxis spp.*), and white perch  
33 (*M. americana*) (Kleinschmidt 2005) There is also a small commercial bait fishery for blueback  
34 herring (*Alosa aestivalis*) on the lake. The most predominant forage fish within the lake are  
35 threadfin (*Dorosoma petenense*) and gizzard shad (*D. cepedianum*) (Kleinschmidt 2005).

1 **Invasive Species**

2 Invasive aquatic plants encompass an estimated 100 ac in Lake Murray and include hydrilla  
 3 (*Hydrilla verticillata*), Illinois pondweed (*Potamogeton illinoensis*), water primrose (*Ludwigia*  
 4 *uruguayensis*), and alligatorweed (*Alternanthera philoxeroides*). Management strategies for  
 5 invasive vegetation in Lake Murray include the introduction of sterile grass carp  
 6 (*Ctenopharyngodon idella*), mechanical harvesting, and the targeted application of aquatic  
 7 herbicides (SCDNR 2009b).

8 **Critical Habitats**

9 No critical habitat has been designated by the FWS in the vicinity of the Saluda site. However,  
 10 critical habitat for the Carolina heelsplitter is present in waterbodies proposed for transmission-  
 11 line crossing in Chester and Lancaster Counties.

12 **Federally and State-Listed Species**

13 Federally and State-listed species that may occur in the vicinity of the site or in aquatic habitats  
 14 crossed by the proposed transmission-line corridors are listed in Table 9-23. The proposed  
 15 transmission-line corridors would cross Calhoun, Chester, Colleton, Dorchester, Fairfield,  
 16 Greenwood, Hampton, Lancaster, Lexington, Newberry, Orangeburg, Richland, and Saluda  
 17 Counties (FP&S 2008; SCE&G 2009d). SCE&G has stated that on-the-ground field surveys  
 18 would be conducted once final routes are determined and prior to commencement of any  
 19 building activities related to the site or transmission-line corridors as part of the permitting  
 20 process (SCE&G 2009a).

21 **Table 9-23.** Federal and State-listed Aquatic Species that May Occur on the Saluda  
 22 Alternative Site, Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Status	County
Reptiles			
<i>Caretta caretta</i>	Loggerhead sea turtle	FT/ST	Colleton
<i>Chelonia mydas</i>	Green sea turtle	FT	Colleton
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	Colleton
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	FE	Colleton
Fish			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	FE/SE	Calhoun, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
<i>Etheostoma collis</i>	Carolina darter	ST	Richland
Mollusks			
<i>Lasmigona decorata</i>	Carolina heelsplitter	FE/SE	Chester, Fairfield, Greenwood, Lancaster, Richland, Newberry, Saluda, Lexington

Sources: FP&S 2008; MACTEC 2008; FWS 2008; SCDNR 2006a  
 FE = Federally Endangered, SE = State Endangered, FT = Federally Threatened, ST = State Threatened

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1 There are four Federally listed species of sea turtles in South Carolina. The loggerhead and  
2 green sea turtles are listed as threatened whereas the leatherback and Kemp's ridley sea turtles  
3 are listed as endangered (FWS 2008). The loggerhead sea turtle is also listed as a State  
4 threatened species for Colleton County (SCDNR 2006a). The siting of the Pomaria-Varnville  
5 transmission line is projected to run to the west of I-95, which is well over 50 mi from the  
6 coastline, and does not cross any marine habitats (MACTEC 2009). Therefore, although the  
7 four species of sea turtles occur in Colleton County, no activities associated with transmission  
8 lines for the Saluda site would affect these species.

9 The shortnose sturgeon is a State and Federal endangered species (FWS 2008). It is unknown  
10 whether the shortnose sturgeon occurs in the immediate vicinity of the proposed alternative site;  
11 however, populations are known to reside in the Edisto River, which is proposed for  
12 transmission corridor crossing. The shortnose sturgeon was initially listed as a Federally  
13 endangered species in 1967 and is designated as a species of highest conservation priority by  
14 SCDNR (McCord 2006; NMFS 1998). This amphidromous species uses freshwater, estuarine,  
15 and marine habitats to complete its life cycle (Rohde et al. 2009; McCord 2006; NMFS 1998).  
16 In South Carolina, populations of shortnose sturgeon exist in the Ashepoo, Combahee, and  
17 Edisto rivers (flowing to St. Helena Sound); the Pee Dee, Waccamaw, and Black rivers (flowing  
18 to Winyah Bay); and the Savannah, Cooper and Santee rivers. There is also a small landlocked  
19 population of shortnose sturgeon in the Santee-Cooper Lake system (Collins et al. 2003).

20 In freshwater habitats, shortnose sturgeon are associated with soft bottom substrates in deep  
21 water. Spawning occurs in freshwaters characterized by low to moderate velocities and over  
22 substrates that include clay, sand, gravel, and woody debris (Rohde et al. 2009; McCord 2006).  
23 Eggs are adhesive and survival is reportedly dependent on water having little turbidity (McCord  
24 2006).

25 The Carolina darter, a Federal species of concern, is listed as a State threatened species for  
26 Richland County (SCDNR 2009). While there are reported accounts pertaining to the  
27 distribution of the Carolina darter within the Piedmont ecoregion, the overall abundance of this  
28 species is unknown (Hayes and Bettinger 2006).

29 The Carolina heelsplitter is a Federally listed aquatic species (FWS 2008). It is unknown  
30 whether the Carolina heelsplitter occurs in the vicinity of the proposed alternative site.  
31 However, there are six known populations of the Carolina heelsplitter within the state defined by  
32 geographic location; (1) Savannah River tributaries in Edgefield and McCormick Counties,  
33 (2) Cuffeytown Creek in Greenwood and McCormick Counties, (3) Lynches River and Flat  
34 Creek in Chesterfield, Kershaw, and Lancaster Counties, (4) Gills Creek in Lancaster County,  
35 (5) Fishing Creek in Chester County, and (6) Bull Run Creek in Chester County (Price 2006d;  
36 67 FR 44502).

1 Designated critical habitat includes 103.2 km of streams and rivers in South Carolina that occur  
2 in conjunction with the known populations. The lateral boundaries of the critical habitats for the  
3 Carolina heelsplitter are denoted by the ordinary high-water mark along channel edges (67 FR  
4 44502). Designated critical habitats for the Carolina heelsplitter do not occur in the vicinity of  
5 the Saluda site. However, critical habitat for the Carolina heelsplitter is present in waterbodies  
6 proposed for transmission-line crossings in Chester and Lancaster Counties.

## 7 ***Building Impacts***

8 Cooling-system makeup water would be derived from the Lake Murray arm of the Saluda River,  
9 which is also proposed to receive station blowdown water (SCE&G 2009f). The transport of  
10 cooling-system makeup water and plant discharge water between the intake and discharge  
11 structures to the proposed plant would require the installation of a 9-mi-long pipeline along the  
12 Saluda River Valley from Lake Murray to the nuclear facility. As previously mentioned in  
13 Section 9.3.5.3, the installation footprint for this task would require disturbing approximately  
14 55 ac (SCE&G 2009a). Installation activities associated with new intake and discharge  
15 structures would likely include impacts on water quality stemming from direct (e.g., dredging,  
16 shoreline excavation, removal of riparian vegetation) and indirect sources (e.g., stormwater  
17 runoff, sedimentation). These activities would result in temporary displacement of fish within the  
18 vicinity of the intake and discharge construction areas. Sedimentation due to disturbances of  
19 the shoreline and bottom could affect local benthic populations; however, the impacts on aquatic  
20 organisms would be temporary and largely mitigable through the use of appropriate BMPs.

21 The proposed alternative site would require the disturbance of undeveloped land to  
22 accommodate the infrastructure necessary for plant operations (i.e., cooling towers, switchyard,  
23 powerblock, roads). Development of the site would also include a rail spur to connect to the  
24 nearest rail line, which is located approximately 1.2 mi northwest of the proposed site. The spur  
25 would require constructing new supports for a rail line across the Saluda River (SCE&G 2009a).  
26 Building activities that include land clearing associated with new infrastructure (roads, site  
27 footprint) and upgrading existing features (railroad lines) would affect approximately 6106 linear  
28 feet out of a total of approximately 28,508 linear feet of onsite streams and approximately 1.3 ac  
29 out of a total of 17.2 ac of open water (SCE&G 2010a). Transmission-line corridors would be  
30 maintained by both SCE&G and Santee Cooper. For SCE&G lines, approximately 26,457 linear  
31 feet of streams and 18 ac of open water are located within the new transmission-line rights-of-  
32 way (Table 9-19) (SCE&G 2009d). The Santee Cooper transmission-line corridors associated  
33 with the Saluda site would include an estimated 54 stream crossings, 11 of which would be  
34 State Navigable Waters crossings (SCE&G 2009d). SCE&G stated that all land clearing  
35 associated with plant and transmission-line site preparation and development would be  
36 conducted according to Federal, State, and local regulations, permit requirements, existing  
37 SCE&G and Santee Cooper procedures, and established BMPs (SCE&G 2009a).



## Environmental Impacts of Alternatives

1 No past or present actions in the geographic area of interest were identified that would  
2 significantly affect aquatic resources, including important species, in ways similar to those  
3 associated with the building of two new units at the Saluda site. Proposed future actions that  
4 would affect aquatic resources in a similar way to development at the Saluda alternative site  
5 would include transmission-line creation and/or upgrading throughout the designated  
6 geographic area of interest, and future urbanization would also be expected to occur.

### 7 ***Operational Impacts***

8 Aquatic impacts associated with operation of the Saluda alternative site would include intake-  
9 related impingement and entrainment losses of aquatic biota as well as water-quality impacts  
10 near the vicinity of the intake and discharge structures at Lake Murray. There are several  
11 intake/discharge configurations designed to minimize impacts on aquatic biota. Assuming  
12 SCE&G would use a closed-cycle cooling system designed to meet the EPA's 316(b) Phase I  
13 requirements for new facilities (66 FR 65256), the intake would have a maximum through-  
14 screen velocity at the cooling-water intake of 0.5 fps or less and adverse impacts on aquatic  
15 biota from impingement and entrainment effects would not be anticipated. Operational impacts  
16 associated with water quality and discharge are likely to be minor and discharges would be  
17 NPDES compliant. The diverse fish found within Lake Murray exhibit a range of life-history  
18 characteristics that include a variety of habitat associations during certain life phases. It is  
19 unknown whether the intake and/or discharge areas support important aquatic life-history  
20 events. Impacts would likely be greatest on nonmotile benthic aquatic organisms that occur  
21 within the vicinity of the discharge. However, based on the review team's experience with other  
22 facilities sited on large reservoirs, the review team concludes that with proper design the  
23 impacts on aquatic resources from operation of two new nuclear units at the Saluda site would  
24 likely be minimal.

25 The review team also concludes that operational impacts on aquatic biota from maintenance of  
26 the transmission-line corridor would also be minimal assuming that appropriate BMPs are used.

27 Cumulative impacts that could result from the operation of two new units at the Saluda site  
28 would include intake-related impingement and entrainment losses, and chemical and thermal  
29 discharge of station blowdown. Past, present, or future actions in the geographic area of  
30 interest that would affect aquatic ecological resources include aquatic biota impacts from the  
31 operation of the Saluda Dam, a 206-MW hydroelectric facility 32 mi to the southeast, which  
32 created Lake Murray, and the International Paper Silverstreet Chip Mill, which discharges to the  
33 Saluda River within 2 mi of the Saluda alternative site. The International Paper Silverstreet Chip  
34 Mill is compliant with NPDES permitting for discharges (SCE&G 2009a). Although detailed  
35 information regarding the presence of important aquatic biota in the vicinity of the discharge  
36 effluent is unknown, NPDES permitting requirements are likely to minimize any potential impact  
37 for additional discharge to the Saluda River from the operation of two units at the Saluda site.

1 Anthropogenic activities such as residential or industrial development near the vicinity of the  
2 nuclear facility may also contribute to cumulative impacts.

### 3 **Summary Statement**

4 Impacts on aquatic ecology resources are estimated based on the information provided by  
5 SCE&G, the State of South Carolina, and the review team's independent review. There are  
6 past and future activities in the geographic area of interest that could affect aquatic ecology  
7 resources in ways similar to the building and operation of two units at the Saluda site. Proper  
8 siting of intake and discharge structures; avoiding critical habitat or habitat for protected  
9 species; proper siting of associated transmission lines; minimizing interactions with waterbodies  
10 and watercourses along the transmission-line corridors; and using appropriate BMPs during  
11 site, vicinity, corridor preparation and tower placement would minimize impacts. Based on the  
12 information provided by SCE&G, the State of South Carolina, and the review team's  
13 independent evaluation the review team concludes that the cumulative impacts of building and  
14 operating two new reactors on the Saluda site combined with other past, present, and future  
15 activities on most aquatic resources in the Saluda River drainage would be SMALL.

### 16 **9.3.5.6 Socioeconomics**

17 For the analysis of socioeconomic impacts at the Saluda site, the geographic area of interest is  
18 considered to be the 50-mi region centered on the Saluda site with special consideration of  
19 Saluda, Lexington, Newberry, and Richland Counties, because that is where the review team  
20 expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of  
21 building and operations at the Saluda site in Saluda County, South Carolina, the review team  
22 undertook a reconnaissance survey of the region using readily obtainable data from the ER, the  
23 alternative site audit, Federal, State, and local government agencies. The analysis also  
24 considers other past, present, and reasonably foreseeable future actions that affect the same  
25 environmental resources, including other Federal and non-Federal projects and the projects  
26 listed in Table 9-19. The impacts of building and operating the new units are discussed below.

### 27 **Physical Impacts**

28 Many of the physical impacts of building and operation would be similar regardless of the site.  
29 Building activities can cause temporary and localized physical impacts such as noise, odor,  
30 vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public  
31 roadways, railways, and waterways would be necessary to transport construction materials and  
32 equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and  
33 disposal sites) would be expected to be already permitted and operational.

34 Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and  
35 visual intrusions (the latter are discussed under aesthetics and recreation). New units would

## Environmental Impacts of Alternatives

1 produce noise from the operation of pumps, cooling towers, transformers, turbines, generators,  
2 and switchyard equipment. Traffic at the site also would be a source of noise. The review team  
3 assumed that same standard noise protection and abatement procedures used for the VCSNS  
4 site would be used to control noise coming from the Saluda site. This practice also would be  
5 expected to apply to all alternative sites. Commuter traffic would be controlled by speed limits.  
6 Good road conditions and appropriate speed limits would minimize the noise level generated by  
7 the workforce commuting to the alternative site.

8 The new units at the Saluda site would likely have standby diesel generators and auxiliary  
9 power systems. Permits obtained for these generators would ensure that air emissions comply  
10 with applicable regulations. In addition, the generators would be operated on a limited, short-  
11 term basis. During normal plant operation, new units would not use a significant quantity of  
12 chemicals that could generate odors that exceed odor threshold values. Good access roads  
13 and appropriate speed limits would minimize the dust generated by the commuting workforce.  
14 Based on the information provided by SCE&G and the review team's independent evaluation,  
15 the review team concludes that the physical impacts of building and operating two new nuclear  
16 units at the Saluda site would be minimal.

### 17 ***Demography***

18 The Saluda site is located in Saluda County in South Carolina, approximately 34 air mi  
19 southeast of the closest economic center, Columbia, South Carolina (2007 population 124,818).  
20 Due to the Saluda site's close proximity to the VCSNS site, the review team assumed that the in  
21 migrating workforce would be similarly distributed. Because 95 percent of the VCSNS  
22 workforce lives in one of four counties, and the staff assumes a similar distribution around the  
23 Saluda site – Saluda (2007 population 18,748), Lexington (2007 population 243,270), Newberry  
24 (2007 population 37,633), and Richland (2007 population 357,734) – counties compose the  
25 economic impact area and are the focus of the following analysis (see Table 2-23).

26 Currently, 36.8 percent of the VCSNS workforce is located in Lexington County, 18.9 percent in  
27 Newberry County, 34.7 percent in Richland County, and 9.5 percent in Fairfield County. The in-  
28 migrating population would be expected to reside within a four-county area in a similar pattern to  
29 the VCSNS workforce, with Saluda County being the host county instead of Fairfield County. At  
30 peak project employment, SCE&G would expect the onsite workforce to be 3600. Based on the  
31 close proximity of the Saluda site to the VCSNS site, the review team used similar labor force  
32 assumptions and estimated that 50 percent of the project workforce (1800) would migrate to the  
33 four-county economic impact area with their families. Using South Carolina's average  
34 household size of 2.53, this would bring the total in-migrating population to 4554. Considering  
35 that the estimate of the in-migrating population would be less than 1 percent of the population of  
36 the economic impact area in 2007, the regional and local demographic impacts of the project  
37 are expected to be minimal. Once the facility is operational, the workforce would include 800  
38 operations workers and 130 site support personnel for a total of 930 workers for the operation of

1 the facility. The review team expects that as much as 50 percent of these workers would  
2 migrate to the economic impact area. The review team expects the demographic impacts would  
3 be similar to those estimated for the VCSNS site, based on the close proximity of the Saluda  
4 site. Based on the information provided by SCE&G and the review team's independent  
5 evaluation, the review team concludes that the demographic impacts of building and operating  
6 two new nuclear units at the Saluda site would be minimal.

## 7 ***Taxes and Economy***

8 If the proposed nuclear facility were located at the Saluda site, taxes and fee-in-lieu-of-taxes  
9 agreements would be governed by South Carolina law. Corporate and personal income taxes  
10 along with sales and use taxes would be collected during the project, but property taxes would  
11 not be paid until operations begin. Once operations begin, SCE&G would have likely entered  
12 into a fee-in-lieu-of-taxes agreement with the State. Based on the agreement SCE&G has with  
13 the State in regard to VCSNS, which has an assessment ratio of four percent and a special  
14 revenue credit of 20 percent of the fee-in-lieu-of-taxes payments during the first 20 years,  
15 SCE&G estimates VCSNS annual payments to be between \$13.7 million and \$31.6 million over  
16 40 years of the license period. If SCE&G entered into a similar agreement for the Saluda site,  
17 the tax payments would increase Saluda County property tax revenues (currently \$10.7 million  
18 [SCBCB 2007]) by 128 to 295 percent. The total fee-in-lieu-of-taxes payments to Saluda  
19 County are expected to be substantial and beneficial during operations.

20 The four-county economic impact area had 324,230 people in the labor force in 2007 with an  
21 unemployment rate of 5.9 percent, which is under the State average. Saluda and Newberry  
22 Counties have the smallest economies with a predominantly manufacturing base, while  
23 Lexington and Richland Counties have larger service-based economies. The wages and  
24 salaries of the project workforce would have a multiplier effect that could result in increases in  
25 business activity, particularly in the retail and service sectors.

26 SCE&G acquired RIMS II economic multiplier values specific to this economic impact area from  
27 the U.S. Bureau of Economic Analysis (BEA 2006), which permit detailed examination of  
28 potential economic impacts with individual multipliers attributable to construction activities and  
29 plant operations activities. Using the RIMS multiplier of 2.02, the 3600 construction jobs would  
30 create 3672 indirect jobs in the economic impact area, for a total of 7272 jobs supported by the  
31 project. Because the review team assumes 50 percent of the project workforce would migrate  
32 to the region, the approximate net employment effect of the project would be 3636 new jobs  
33 spread over the four counties. This would have a beneficial but temporary impact on the  
34 business community and could provide (1) opportunities for new businesses to get started and  
35 (2) increased job opportunities for local residents. Once the new units are operational,  
36 approximately 930 new operations jobs would be added to the local economy. Using a  
37 multiplier of 3.34, the 930 operations and support jobs would create 2176 indirect jobs in the  
38 economic impact area, for a total of 3106 jobs supported by plant operations. Because the

## Environmental Impacts of Alternatives

1 review team assumes 50 percent of the workforce would migrate to the region, the approximate  
2 net employment effect of operations would be 1553 new jobs spread over the four counties.  
3 Based on the information provided by SCE&G and the review team's independent evaluation,  
4 the review team concludes that the economic and tax base impacts of building and operating  
5 two new nuclear units at the Saluda site would be minor in the four-county area, but would be  
6 substantial in Saluda County.

### 7 ***Transportation and Housing***

8 The nuclear facility entrance would be accessed by SC-121, a north-south paved two-lane road  
9 that has a 2005 AADT count of about 4000 vehicles between Saluda and Newberry Counties.  
10 Similar to the VCSNS site, a new access road would be constructed to access the Saluda site  
11 from SC-121. Because access to the Saluda site would be provided using a single two-lane  
12 highway (SC-121), the review team estimates traffic volumes during peak project employment  
13 are likely to represent a 25- to 45-percent increase or more above baseline AADT levels of  
14 affected roadways, based on analysis of the VCSNS site (see Section 4.4.4.1). The review  
15 team concludes that these impacts would be noticeable and would likely be especially acute  
16 during periods of shift change. These impacts would be further exacerbated by truck traffic and  
17 site delivery traffic that have no other route options available. The review team concludes  
18 traffic-related impacts would be locally acute, but of short duration and temporary, and would be  
19 substantially mitigated by traffic management planning by SCE&G. A rail spur, linking the site  
20 with the Norfolk Southern rail line in the Newberry area, would be constructed to deliver the  
21 heaviest components and construction materials to the site. Because of existing impoundments  
22 on the Saluda River, the review team concludes that barge service to the Saluda site would not  
23 be feasible. The review team concludes that the transportation impacts from building the new  
24 units at the Saluda site would be minor in the region, but noticeable in the immediate vicinity  
25 along SC-121 and mitigation may be warranted. Facility operations would likely have a minimal  
26 impact on the transportation network.

27 Approximately 1800 construction workers could migrate into the region during peak project  
28 employment. Approximately 465 operations workers could migrate into the region by the time  
29 the facility becomes operational. Construction workers may choose to buy housing, rent, use  
30 mobile homes, or stay in a hotel/motel, while operations workers would likely choose to buy a  
31 house. According to the 2000 U.S. Census there were 246,119 housing units in the four-county  
32 economic impact area, of which 7738 in Lexington County, 2779 in Newberry County, 9692 in  
33 Richland County, and 1416 in Saluda County were vacant, for a total of 21,625 vacant units  
34 (SCE&G 2009a). The review team expects that the in-migrating workforce could be absorbed  
35 fairly easy by the region and the impacts likely would be minimal.

**1    Public Services and Education**

2    In-migrating construction workers and plant operations workers would likely impact local  
3    municipal water, wastewater treatment facilities, and other public services in the region. These  
4    impacts would likely be in proportion with the demographic impacts experienced in the region,  
5    unless these resources have excess capacity or are particularly strained during building, which  
6    would decrease or increase the impact, respectively. The in-migrating workers represent a  
7    small portion of the total population of Saluda County and likely would not have a noticeable  
8    impact on their public services. During operations the impact on public services would likely be  
9    minimal.

10   SCE&G reports in its ER (SCE&G 2009a) that during the 2004–2005 school year, Lexington  
11   County had 66 PK-12 schools, Newberry County had 14 schools, Richland County had 93  
12   schools, and Saluda County had 5 schools. Total enrollment for Lexington, Newberry, Richland,  
13   and Saluda Counties for the 2004-2005 school year was 51,276, 5948, 50,159, and 2149,  
14   respectively. A maximum of 938 students are expected to migrate into the four-county  
15   economic impact area, during peak project employment and would decline to 484 during  
16   operations. This would increase the student population during peak project employment in  
17   Lexington County by 0.7 percent, Newberry by 3 percent, Richland by 0.6 percent, and Saluda  
18   by 4.1 percent. During operation, this impact on schools would be significantly less due to the  
19   lower number of in-migrating students. Based on the information provided by SCE&G and the  
20   review team’s independent evaluation, the review team concludes that public services and  
21   education impacts of building and operating two new nuclear units at the Saluda site would be  
22   minimal.

**23   Aesthetics and Recreation**

24   The four-county economic impact area is a defined tourism region called Capital City/Lake  
25   Murray Country. The region includes Congaree National Monument, parts of Sumter National  
26   Forest, and a couple of State parks. Near the Saluda site are several trails and State heritage  
27   preserves that offer wildlife viewing, hunting, camping, boating, fishing, and other recreational  
28   activities. Based on the review team’s visit to this site, public dispersed recreation activities  
29   such as hunting and fishing occur on the site. Public boating access to the Saluda River  
30   currently exists. These uses would be precluded if the site were to be developed (SCE&G  
31   2009a).

32   Most development would occur near the center of the property and wouldn’t be visible from afar  
33   except from elevated areas. The intake and discharge structures would be located on the Lake  
34   Murray approximately 9 mi southeast of the site. These and other structures may be visible  
35   from certain angles. During certain weather conditions the cooling tower plumes may also be  
36   visible. The review team concludes that taken together, the visual impact of the project on this  
37   site would have a noticeable impact on the aesthetics and recreational resources in the area.

## Environmental Impacts of Alternatives

1 Based on the information provided by SCE&G and the review team's independent evaluation,  
2 the review team concludes that noticeable public aesthetics and recreation impacts would result  
3 from building and operating two new nuclear units at the Saluda site.

### 4 ***Summary of Socioeconomics***

5 Physical impacts on workers and the general public include impacts on existing buildings,  
6 transportation, aesthetics, noise levels, and air quality. Social and economic impacts span  
7 issues of demographics, economy, taxes, infrastructure, and community services. In summary,  
8 on the basis of information provided by SCE&G and the review team's independent evaluation,  
9 the review team concludes that the impacts of building and operating a new nuclear plant at the  
10 Saluda site on socioeconomics would be minimal and adverse for most of the region, but could  
11 be noticeable but not destabilizing for Saluda County in terms of transportation during the  
12 building phase and aesthetics and recreation impacts during both the building and operating  
13 phases. The impacts on the Saluda County tax base during operations likely would be  
14 substantial and beneficial; however only minor beneficial impacts would result in the rest of the  
15 region.

### 16 ***Cumulative Impacts***

17 The projects identified in Table 9-19, particularly the future urbanization of the Columbia  
18 metropolitan area, have contributed or would contribute to the demographics, economic climate,  
19 and community infrastructure of the region and generally result in increased urbanization and  
20 industrialization. Because the projects within the review area identified in Table 9-19 would be  
21 consistent with applicable land-use plans and control policies, the review team considers the  
22 cumulative socioeconomic impacts from the projects to be manageable.

23 For the analysis of socioeconomic impacts at the Saluda site, the geographic area of interest is  
24 considered to be the 50-mi region centered on the Saluda site, with special consideration of  
25 Saluda, Lexington, Newberry, and Richland Counties, because that is where the review team  
26 expects socioeconomic impacts to be the greatest.

27 The Saluda site is located in a rural area of northern Saluda County. The site currently is a  
28 greenfield site surrounded pine forests and wetlands, with primarily agricultural development  
29 and forestry production in the vicinity. The site is about 9 mi southwest of Newberry (2007  
30 population 10,893), the Newberry County Seat and about 12 mi north of Saluda (2007  
31 population 2935), the Saluda County Seat. The 50-mi region includes Columbia and Aiken,  
32 South Carolina, two larger urban areas. The economy of the region has been and continues to  
33 be largely agriculture-based. Newberry County has significant manufacturing employment. The  
34 review team believes development of the Saluda site would have demographic impacts similar  
35 to the original development of the VCSNS site, because Saluda County is somewhat similar to  
36 Fairfield County. The review team expects that the economic impact area for the Saluda site

1 would include Saluda, Newberry, Lexington, and Richland Counties. The review team assumes  
2 the project workforce would be distributed within the economic impact area in approximately the  
3 same proportion as the existing VCSNS workforce, with the exception that the workforce  
4 attributed to Fairfield County would be attributed to Saluda County. SCE&G made these  
5 assumptions as part of its alternative sites analysis (SCE&G 2009a), and the review team did  
6 not find them unreasonable.

7 In addition to assessing the marginal socioeconomic impacts from the building and operations of  
8 two additional nuclear units on the Saluda site, the cumulative impact is also considered. The  
9 cumulative analysis considers other past, present, and reasonably foreseeable future actions  
10 that could contribute to the cumulative socioeconomic impacts on a given region, including other  
11 Federal and non-Federal projects and the projects listed in Table 9-19. The projects identified  
12 in Table 9-19 have contributed or would contribute to the demographics, economic climate, and  
13 community infrastructure of the region and generally result in increased urbanization and  
14 industrialization. However, many impacts such as those on housing or public services are able  
15 to adjust over time, particularly with increased tax revenues. Furthermore, State and county  
16 plans along with modeled demographic projections include forecasts of future development and  
17 population increases. Because the other projects described in Table 9-19 do not include any  
18 significant reasonably foreseeable changes in socioeconomic impacts within 50 mi of the  
19 Saluda site, the review team determined there would be no significant additional cumulative  
20 socioeconomic impacts in the region from those activities. Any economic impacts associated  
21 with activities listed in Table 9-19 would have been considered as part of the socioeconomic  
22 baseline.

23 The review team concludes that the socioeconomic impacts of the building and operation of a  
24 new two-unit nuclear plant at the Saluda site would be SMALL and adverse across most of the  
25 region, but could be MODERATE and adverse for Saluda County in terms of transportation  
26 during the building phase and aesthetics and recreation impacts during both the building and  
27 operating phases. The cumulative impacts on the Saluda County tax base during plant building  
28 and operation likely would be beneficial and LARGE. Building and operating a new plant at the  
29 Saluda site would make a significant incremental contribution to these impact levels.

### 30 **9.3.5.7 Environmental Justice**

31 In addition to environmental justice impacts from building and operations, the cumulative  
32 analysis considers other past, present, and reasonably foreseeable future actions that could  
33 contribute to disproportionate and adverse impacts on minorities and low-income populations,  
34 including other Federal and non-Federal projects and the projects listed in Table 9-19. For the  
35 analysis of environmental justice impacts at the Saluda site, the geographic area of interest is  
36 considered to be the 50-mi region centered on the Saluda site.



## Environmental Impacts of Alternatives

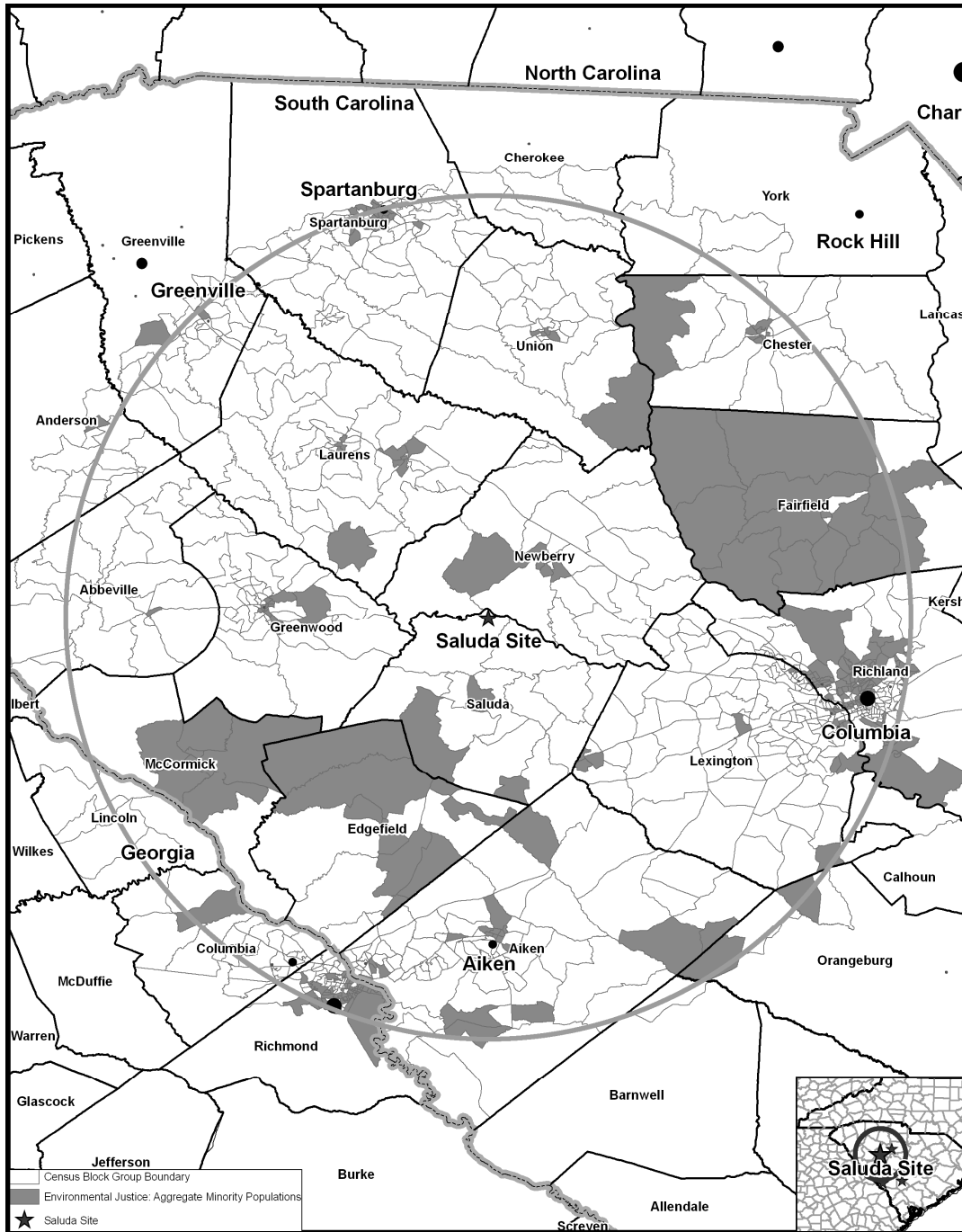
1 The Saluda site is located in a rural area of northern Saluda County. The site currently is a  
2 greenfield site surrounded by pine forests and wetlands, with primarily agricultural development  
3 and forestry production in the vicinity. The site is about 9 mi southwest of Newberry (2007  
4 population 10,893), the Newberry County Seat and about 12 mi north of Saluda (2007  
5 population 2935), the Saluda County Seat.

6 The review team based its environmental justice determinations on the methodology discussed  
7 in Section 2.6.1, including a closer look at potential areas of interest using a series of health and  
8 physical considerations. The review team determined there is a potential for minority and low-  
9 income populations to be disproportionately and adversely affected by environmental impacts.  
10 Although Richland County and immediately adjacent counties are urban population centers,  
11 there are a number of farms within the region. The review team found low-income, African  
12 American, and aggregated minority populations that exceed the percentage criteria established  
13 in Section 2.6.1 for environmental justice analyses. However, none of these populations is  
14 clustered in the immediate vicinity of the Saluda site (see Figure 9-10 and Figure 9-11).

15 Because the other projects described in Table 9-19 do not include any significant reasonably  
16 foreseeable changes in socioeconomic impacts within 50 mi of the Saluda site, the review team  
17 concluded there would not be any significant additional cumulative environmental justice  
18 impacts in the region from those activities. Any economic impacts associated with activities  
19 listed in Table 9-19 already have been considered as part of the socioeconomic baseline. For  
20 example, the economic impacts of existing enterprises such as mining, other electrical utilities,  
21 etc., are part of the base used for establishing the RIMS II multipliers. Regional planning efforts  
22 and associated demographic projections formed the basis for the review team's assessment of  
23 reasonably foreseeable future impacts.

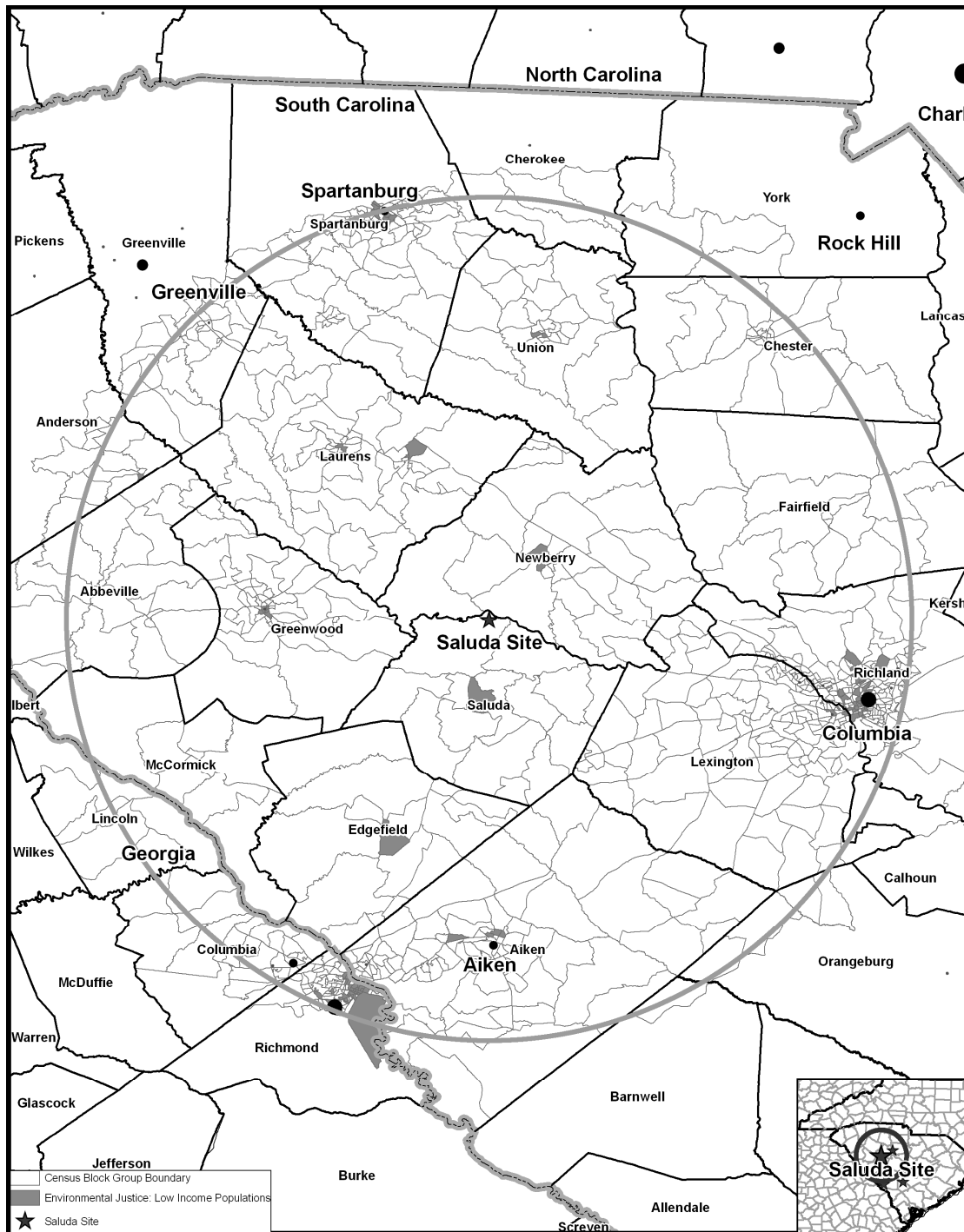
24 Because access to the Saluda site would be provided using a single two-lane road in the  
25 vicinity, the review team estimates traffic volumes during building activities are likely to  
26 represent a 50- to 125-percent increase or more above baseline AADT levels of the affected  
27 roadway. The review team concludes that these impacts would be significant and would likely  
28 be especially acute during periods of shift change. The impacts would be further exacerbated  
29 by truck traffic and site delivery traffic that have no other route options available. The review  
30 team expects the impacts would be of short duration and temporary, and could be substantially  
31 mitigated by traffic-management planning by SCE&G. Because the traffic impacts would take  
32 place in areas without an environmental justice population of interest, the review concluded no  
33 pathway exists for disproportionate and adverse impacts on minority or low-income populations.

34 Based on the above considerations, information provided by SCE&G, visits to the site, and the  
35 review team's independent review, the review team concludes that when viewed in the context of  
36 the wider region, locating the proposed action at the Saluda site would not contribute additional  
37 cumulative impacts beyond the impacts described in Chapters 4 and 5 for the VCSNS site. The  
38 review team did not identify any other environmental pathways by which disproportionate and



1  
2 **Figure 9-10.** Aggregate Minority Populations in Block Groups that Meet the Environmental  
3 Justice Selection Criteria at the Saluda Site

Environmental Impacts of Alternatives



1  
2 **Figure 9-11.** Low-Income Populations in Block Groups that Meet the Environmental Justice  
3 Selection Criteria at the Saluda Site

1 adverse impacts could affect minority or low-income populations or communities. Under the  
2 limitations of a reconnaissance-level analysis, the review team found no other health or physical  
3 consideration and no unique characteristics or practices that could lead to a disproportionately  
4 high and adverse impact on any minority or low-income community within the region surrounding  
5 the Saluda site. Based on its evaluation, the review team concludes that cumulative  
6 environmental justice impacts associated with building and operating two new nuclear units at  
7 the Saluda site would be SMALL.

#### 8 **9.3.5.8 Historic and Cultural Resources**

9 The following cumulative impact analysis includes building and operating two new nuclear  
10 generating units at the Saluda site. The analysis also considers the other past, present, and  
11 reasonably foreseeable future actions that could impact cultural resources, including other  
12 Federal and non-Federal projects and the projects listed in Table 9-19. For the analysis of  
13 cultural impacts at the Saluda site, the geographic area of interest is considered to be the APE  
14 that would be defined for this proposed undertaking. This includes the physical APE, defined as  
15 the area directly affected by the site-development and operation activities at the site and  
16 transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi radius  
17 around the physical APE as a reasonable assumption for defining a maximum distance from  
18 which the structures can be seen.

19 Reconnaissance activities in a cultural resource review have particular meaning. For example,  
20 these activities include preliminary field investigations to confirm the presence or absence of  
21 cultural resources. However, in developing its EISs, the review team relies upon  
22 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-  
23 level information is data that are readily available from agencies and other public sources. It  
24 can also include information obtained through visits to the site area. To identify the historic and  
25 cultural resources at the Saluda Site the following information was used:

- 26 • SCE&G ER (SCE&G 2009a) – including National Park Service National Register Information  
27 system and documents associated with the Saluda Hydro relicensing project.
- 28 • NRC Alternative Sites Visit, March 2009.

29 The Saluda site is a greenfield site. Historically, the Saluda site and vicinity was largely  
30 undisturbed by land development and likely contained intact archaeological sites associated  
31 with the past 10,000 years of human settlement. Over time, the Saluda site has been disturbed  
32 by forestry practices (SCE&G 2009j). The physical and visual APEs for a proposed plant at the  
33 Saluda site do not appear to have any historic properties located within the area likely to be  
34 affected by building or operating new plants. No archaeological and/or architectural surveys  
35 have been conducted at the Saluda site. Significant cultural resources have been located in the  
36 Saluda River/Lake Murray watershed located adjacent to the Saluda site (SCE&G 2009a).  
37 SCE&G's records search identified more than 150 archaeological sites, 8 historic structures, 32

## Environmental Impacts of Alternatives

1 historic home sites, and 5 historic cemeteries, most of which have not been evaluated for their  
2 eligibility for listing in the National Register (SCE&G 2009a)

3 To accommodate the building of two nuclear units on the Saluda site, SCE&G would need to  
4 clear approximately 240 ac of undeveloped land for the nuclear facility and associated  
5 structures and infrastructure (SCE&G 2009a). SCE&G has stated that as part of the site-  
6 selection process, known cultural resource locations would be considered as avoidance areas  
7 (SCE&G 2009i, j). SCE&G has also stated that if the proposed project was sited at the Saluda  
8 site, identification of cultural resources would be accomplished through cultural resource  
9 surveys. The results would be used in the site-planning process to avoid cultural resource  
10 impacts. If significant cultural resources were identified by these surveys, SCE&G would also  
11 develop protective measures similar to what it has in place for the VCSNS site. In addition,  
12 inadvertent discovery procedures would be developed if cultural resources were discovered  
13 during site-development activities (SCE&G 2009i).

14 A nuclear facility located at this site would require three 230-kV transmission lines for each unit  
15 with a 100-ft-wide transmission-line corridor. The total length and acreage of new transmission-  
16 line corridor required (collectively) would be approximately 254 mi and 2456 ac. The most direct  
17 route would be used, avoiding populated areas, residences, and natural or manufactured  
18 conflicts when possible (SCE&G 2009a). If the proposed project was sited at the Saluda site,  
19 the staff assumes SCE&G would conduct its transmission-line-related cultural resource  
20 activities in ways similar to what they have committed to do for the VCSNS site, as described in  
21 Section 4.6.

22 Past actions in the geographic area of interest that have similarly affected cultural and historic  
23 resources include forestry practices at the Saluda site and any road development and logging  
24 activities associated with those practices. None of the projects listed in Table 9-19 is located  
25 within the geographic area of interest, and therefore they have no potential for cumulative  
26 impact on cultural resources.

27 Activities associated with building two nuclear units and supporting facilities that can  
28 potentially directly affect cultural and historic resources include land clearing, excavation and  
29 grading activities. Given SCE&G's site-planning process, and the lack of significant cultural  
30 resources known to exist at the CGS site based on reconnaissance-level information, and the  
31 land disturbance where the new plant would be located, the impacts on cultural resources due  
32 to site-development activities would be negligible.

33 In addition, visual impacts from transmission lines may result in significant alterations to the  
34 visual landscape within the geographic area of interest. Given that there are no known cultural  
35 resources where the historic setting and character of the resources are important, the visual  
36 impacts would be negligible. The staff assumes that SCE&G and Santee Cooper would

1 develop a management agreement in consultation with SHPO similar to the one that would be  
2 developed for VCSNS.

3 Impacts on cultural and historic resources from operation of two new nuclear units at the Saluda  
4 site include those associated with the operation of new units and maintenance of transmission  
5 lines.

6 The staff assumes that the same procedures currently used by SCE&G and Santee Cooper  
7 would be used for onsite and offsite maintenance activities. Consequently, the incremental  
8 effects of the maintenance of transmission-line corridors and operations of the two new units  
9 and associated impacts on cultural resources would be negligible.

10 Table 9-19 identifies projects within the geographic area of interest and includes the South  
11 Carolina Strategic Corridor System Plan; Sumter National Forest; other parks, forests, and  
12 reserves; and future urbanization that could affect historic and cultural resources in a manner  
13 similar to those associated with the operation of two new units. Cultural resources are  
14 nonrenewable; therefore, the impact of destruction of cultural resources is cumulative. Based  
15 on the information provided by the applicant and the review team's independent evaluation, the  
16 review team concludes that the cumulative impacts from building and operating two new nuclear  
17 generating units on the Saluda site would be SMALL. This impact-level determination reflects  
18 no known cultural resources that could be affected; however, if the Saluda site was to be  
19 developed, then cultural resource surveys may reveal important historic properties that could  
20 result in greater cumulative impacts.

#### 21 **9.3.5.9 Air Quality**

22 Because the Saluda site is located in a climate regime similar to the VCSNS site, the air quality  
23 impacts of building and operating a nuclear facility at the Saluda site would be similar to the air  
24 quality impacts at the VCSNS site. As described in Sections 4.7 and 5.7, the review team  
25 determined that the impacts of building and operating two new nuclear units on air quality at the  
26 VCSNS site would be SMALL. Therefore, the impacts of building and operating two new  
27 nuclear units on air quality at the Saluda site would be minimal.

28 The Saluda site is located in the Greenwood Interstate Air Quality Control Region, which is  
29 designated as being unclassified or in attainment with the NAAQSs (40 CFR 81.341) (SCE&G  
30 2009a). The resource area defined for this evaluation is Saluda County, South Carolina. The  
31 single county was selected because designations of attainment or non-attainment are made on  
32 a county-by-county basis. None of the projects listed in Table 9-19 is within Saluda County.  
33 Given the intermittent operation of the diesel generators at the proposed two new units, and that  
34 Saluda County is currently in attainment, the review team concludes the cumulative impacts,  
35 including the impacts from building and operating two new units on air quality, would be SMALL.

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1 Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6. As  
2 pointed out in Chapter 7, the impacts of the emissions are independent of emission location.  
3 Consequently, the discussions in the previous chapters and in Section 9.2.5 are applicable to  
4 two AP1000 reactors located at the Saluda site. The impacts of greenhouse gas emissions at  
5 the Saluda site considered in isolation would be minimal, and the cumulative impact of  
6 greenhouse gas emissions would be MODERATE, primarily due to national and world-wide  
7 impacts of emissions of greenhouse gases. Building and operating two new nuclear units at the  
8 Saluda site would not be a significant contributor to the MODERATE impact.

### 9 **9.3.5.10 Nonradiological Health Impacts**

10 The following impact analysis for the Saluda site includes impacts from building activities and  
11 operations. The analysis also considers past, present, and reasonably foreseeable future  
12 actions that affect the nonradiological health resources, including other Federal and non-Federal  
13 projects and the projects listed in Table 9-19. For the analysis of nonradiological health impacts  
14 at the Saluda site, the geographic area of interest is considered to be the 6-mi area centered on  
15 the Saluda site and the associated transmission-line corridors. This 6-mi radius is expected to  
16 encompass all nonradiological health impacts.

#### 17 ***Building Impacts***

18 Nonradiological health impacts from building two new nuclear units on construction workers and  
19 members of the public at the Saluda site would be similar to those evaluated in Section 4.8.  
20 They include occupational injuries, noise, vehicle exhaust, and dust. Applicable Federal and  
21 State regulations on air quality and noise would be complied with during the site-preparation  
22 and building phase. The Saluda site is located in a rural area and building impacts would likely  
23 be negligible on the surrounding populations that are classified as medium- and low-population  
24 areas.

25 Past actions in the geographic area of interest that have similarly affected nonradiological health  
26 include the development and operation of the Buzzard's Roost Combustion Turbine Station,  
27 located approximately 6 mi west of the Saluda site; the construction of the Buzzard's Roost  
28 Dam, located approximately 6 mi west of the Saluda site; the Hanson Brick East/Minchew Plant,  
29 approximately 2 mi southwest of the Saluda site; and the International Paper Silverstreet Chip  
30 Mill, approximately 2 mi from the Saluda site. There are no major current projects in the  
31 geographic area of interest that would cumulatively affect nonradiological health in a  
32 similar way.

33 Proposed future actions that would affect nonradiological health in a similar way to development  
34 at the Saluda site would include transmission-line creation and/or upgrading throughout the  
35 designated geographic region of interest, and future urbanization would also be expected to  
36 occur. The review team concludes that the cumulative impacts on nonradiological health from

1 building two new nuclear units and associated transmission lines at the Saluda site would be  
2 minimal.

### 3 ***Operational Impacts***

4 Occupational health impacts on operational employees would include those associated with  
5 plant operation and operation of the associated transmission lines, as are fully described in  
6 Section 5.8. Based on the configuration of the proposed new units at the Saluda site (closed-  
7 cycle, wet cooling system with mechanical draft cooling towers), etiological agents would not  
8 likely increase the incidence of waterborne diseases in the vicinity of the site. Impacts on  
9 workers health from occupational injuries, noise, and electric fields would be similar. Noise and  
10 electric fields would be monitored and controlled in accordance with applicable OSHA  
11 regulations.

12 No past, present, or future actions in the geographic area of interest were identified that would  
13 significantly affect nonradiological health in ways similar to those associated with the operation  
14 of two new units at the Saluda site. The review team therefore concludes that the impacts on  
15 nonradiological health from operating two new nuclear units and associated transmission lines  
16 at the Saluda site would be minimal.

### 17 ***Summary Statement***

18 Impacts on nonradiological health from the building and operation of two new units and  
19 associated transmission lines at the Saluda site are estimated based in the information provided  
20 by SCE&G and the review team's independent evaluation. The review team concludes that  
21 health impacts on construction workers and the public resulting from the building of two new  
22 nuclear units at the Saluda site would be SMALL. The review team expects that the  
23 occupational health impacts on the operations employees of two new nuclear units at the  
24 Saluda site would be SMALL. Similarly, impacts on public health of two new nuclear units  
25 operating at the Saluda site would be expected to be SMALL.

26 There are past and future activities in the geographic area of interest that could affect  
27 nonradiological health in ways similar to the building of two units at the Saluda site. The review  
28 team concludes, however, that cumulative impacts from past, present, and future actions on  
29 nonradiological health from building and operating two new units at the Saluda would be  
30 SMALL.

### 31 **9.3.5.11 Radiological Impacts of Normal Operations**

32 The following impact analysis includes radiological impacts on the public and workers from  
33 building activities and operations for two nuclear units at the Saluda alternative site. The  
34 analysis also considers other past, present, and reasonably foreseeable future actions that



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1 affect radiological health, including other Federal and non-Federal projects and the projects  
2 listed in Table 9-19. As described in Section 9.3.5, Saluda is a greenfield site; there are  
3 currently no nuclear facilities at this site. The geographic area of interest is the area within a  
4 50-mi radius of the Saluda site. Facilities potentially affecting radiological health within this  
5 geographic area of interest are the existing VCSNS Unit 1 nuclear power plant, the Old Steam  
6 Generator Recycle Facility, the proposed ISFSI facility at VCSNS Unit 1, and the Westinghouse  
7 Fuel Fabrication Plant outside of Columbia, South Carolina. In addition, there are likely to be  
8 hospitals and industrial facilities within 50 mi of the Saluda site that use radioactive materials.

9 The radiological impacts of building and operating the proposed two AP1000 plants at the  
10 Saluda site include doses from direct radiation and liquid and gaseous radioactive effluents.  
11 These sources would result in low doses to people and biota offsite that would be well below  
12 regulatory limits. The impacts are expected to be similar to those estimated for the VCSNS site.

13 The radiological impacts of existing VCSNS Unit 1 (including the Old Steam Generator Recycle  
14 Facility) include doses from direct radiation and liquid and gaseous radioactive effluents. These  
15 pathways would result in low doses to people and biota offsite that are well below regulatory  
16 limits as demonstrated by the ongoing radiological environmental monitoring program  
17 conducted around the VCSNS site. The proposed ISFSI would produce negligible direct  
18 radiation offsite as discussed in Section 4.9.1.

19 The Westinghouse Fuel Fabrication Plant is located over 40 mi from the Saluda site. The NRC  
20 staff concludes that this non-reactor facility is located far enough from the Saluda site that there  
21 would be no significant cumulative radiological impact. This conclusion is consistent with the  
22 results of the ongoing radiological environmental monitoring program conducted around the  
23 VCSNS site. In addition, the NRC staff concludes that the dose from direct radiation and  
24 effluents from hospitals and industrial facilities that use radioactive material would be an  
25 insignificant contribution to the cumulative impact around the Saluda site. This conclusion is  
26 based on data from the radiological environmental monitoring programs conducted around  
27 currently operating nuclear power plants.

28 Based on the information provided by SCE&G and the NRC staff's independent analysis, the  
29 NRC staff concludes that the cumulative radiological impacts from building and operating the  
30 two proposed AP1000 plants and other existing and planned projects and actions in the  
31 geographic area of interest around the Saluda site would be SMALL.

### 32 **9.3.5.12 Postulated Accident Impacts**

33 The following impact analysis includes radiological impacts from postulated accidents from the  
34 operation of two nuclear units at the Saluda alternative site. The analysis also considers other  
35 past, present, and reasonably foreseeable future actions that affect radiological health from  
36 postulated accidents, including other Federal and non-Federal projects and the projects listed in

1 Table 9-19. As described in Section 9.3.5, Saluda is a greenfield site; there are currently no  
2 nuclear facilities at the site. The geographic area of interest considers all existing and proposed  
3 nuclear power plants that have the potential to increase the probability-weighted consequences  
4 (i.e., risks) from a severe accident at any location within 50 mi of the Saluda alternative site.  
5 Facilities potentially affecting radiological accident risk within this geographic area of interest are  
6 the existing VCSNS Unit 1; H.B. Robinson Unit 1; Oconee Units 1, 2, and 3; McGuire Units 1  
7 and 2; Catawba Units 1 and 2; and VEGP Units 1 and 2. Two AP1000 reactors have been  
8 proposed at the Lee site and two AP1000 reactors have been proposed at the Vogtle site as  
9 well. Also the Westinghouse Fuel Fabrication Plant outside of Columbia, South Carolina, is  
10 within the geographic area of interest.

11 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences  
12 of DBAs at the VCSNS site would be minimal for AP1000 reactors. DBAs are addressed  
13 specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria.  
14 The AP1000 design is independent of site conditions, and the meteorology of the Saluda  
15 alternative and VCSNS sites are similar; therefore, the NRC staff concludes that the  
16 environmental consequences of DBAs at the Saluda alternative site would be minimal.

17 Because the meteorology, population distribution, and land use for the Saluda alternative site  
18 are expected to be similar to the proposed VCSNS site, risks from a severe accident for an  
19 AP1000 reactor located at the Saluda alternative site are expected to be similar to those  
20 analyzed for the proposed VCSNS site. The risks for the proposed VCSNS site are presented  
21 in Tables 5-17 and 5-19 and are well below the median value for current-generation reactors. In  
22 addition, as discussed in Section 5.11.1, estimates of average individual early fatality and latent  
23 cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing  
24 plants within the geographic area of interest (VCSNS Unit 1; H.B. Robinson Unit 1; Oconee  
25 Units 1, 2, and 3; McGuire Units 1 and 2; Catawba Units 1 and 2; and VEGP Units 1 and 2), the  
26 Commission has determined that the probability-weighted consequences of severe accidents  
27 are small (10 CFR Part 51, Appendix B, Table B-1). Finally, according to the Lee Nuclear  
28 Station ER (NRC 2007) and the Vogtle ESP (NRC 2008a), the risks from these proposed sites  
29 are also well below current-generation reactors and meet the Commission's safety goals. There  
30 is no irradiated fuel at the Westinghouse Fuel Fabrication Plant, and the plant is designed to  
31 prevent inadvertent criticalities; therefore, the additional risk is not significant in the evaluation of  
32 the cumulative severe accident risk for a nuclear power plant at the Saluda site. On this basis,  
33 the NRC staff concludes that the cumulative risks from severe accidents at any location within  
34 50 mi of the Saluda alternative site would be SMALL.

### 35 **9.3.6 The Savannah River Alternative Site**

36 This section covers the review team's evaluation of the potential environmental impacts of siting  
37 a two-unit nuclear power plant at the Savannah River (SR) alternative site, which would be co-

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1 located at DOE's Savannah River Site (SRS) in Aiken, Barnwell, and Allendale Counties in  
 2 South Carolina. The following sections describe a cumulative impact assessment conducted for  
 3 each major resource area. The specific resources and components that could be affected by  
 4 the incremental effects of the proposed action if it were implemented at the SR site and other  
 5 actions in the same geographic area were considered. This assessment includes the impacts of  
 6 NRC-authorized construction, operations, and preconstruction activities. Also included in the  
 7 assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and  
 8 private actions that could have meaningful cumulative impacts when considered together with  
 9 the proposed action if implemented at the SR site. Other actions and projects considered in this  
 10 cumulative analysis are described in Table 9-24.

11 The greater SRS itself is quite large at 310 mi<sup>2</sup>, as part of the current reindustrialization effort at  
 12 the site, selected locations have been proposed as potential sites for the development of both  
 13 Federal and privately held industrial projects. Accordingly, SCE&G is considering a 500-ac  
 14 portion of the site located on the Aiken County-Barnwell County line that would be required to  
 15 be cleared for future development of a two-unit nuclear power plant (SCE&G 2009a).  
 16 Figure 9-12 shows the SR alternative site region.

17 The SRS is an industrial complex that has been extensively studied and characterized as the  
 18 Federal government has supported nuclear materials based research and development there  
 19 since the site opened in the early 1950s. Additionally, the SRS is home to a DOE National  
 20 Laboratory and the nation's first designated National Environmental Research Park.

21 **Table 9-24.** Past, Present, and Reasonably Foreseeable Projects and Other Actions  
 22 Considered in the Savannah River Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
Vogtle Electric Generating Plant (VEGP)	Nuclear power generating plant with 2 units, VEGP 1 (1109 MW(e)) and VEGP 2 (1127 MW(e))	About 17 mi southwest of the SR alternative site	Operational <sup>(a)</sup>
VEGP Units 3 and 4	Nuclear power generating plant with two Westinghouse AP 1000 pressurized water reactors	About 17 miles southwest of the SR alternative site	Proposed <sup>(b)</sup>
Cope Generating Station	A 430-MW(e) coal-fired electrical generating plant	About 33 mi east of the SR alternative site	Operational <sup>(c)</sup>
VCSNS Unit 1	VCSNS Unit 1 consists of one 996-MW(e) nuclear power generating plant.	About 70 mi north of the SR alternative site	Operational <sup>(d)</sup>

23

Table 9-24. (contd)

Project Name	Summary of Project	Location	Status
Hatch Nuclear Plant	Nuclear power generating plant with 2 units, Hatch 1 (876 MW(e)) and Hatch 2 (883 MW(e))	About 100 mi south of the SR alternative site	Operational
Savannah River Site Mixed Oxide (MOX) Fuel Fabrication facility	Nuclear fuel fabrication	About 5 mi southwest of the SR alternative site	Construction of MOX Facility began in August 2007; operation is expected to begin in 2016 <sup>(e)</sup>
Mining Projects			
Hibbits Dirt Pit Mine	Nonmetallic minerals	About 10 mi northwest of the SR alternative site	Permit expired in May 2009 <sup>(f)</sup>
Threlko Inc/ Holly #1 Mine	Nonmetallic minerals	About 12.4 mi northwest of the SR alternative site	Operational <sup>(g)</sup>
Eagle Construction/ Robert Collins Pit	Nonmetallic minerals	About 10 miles southwest of the SR alternative site	Operational <sup>(g)</sup>
Transportation Projects			
South Carolina Strategic Corridor System Plan	Strategic system of corridors forming the backbone of the State's transportation system.	State-wide	Planning document with no explicit schedules for projects; however, many strategic corridors coincide with routes that would/could be used for development at the SR alternative site <sup>(h)</sup>
Other Actions/Projects			
Clariant Corporation Martin Plant	Dyes	About 21 mi south-southeast of the SR site	Operational <sup>(i)</sup>
International Paper Company	Logging	About 20 mi west of the SR alternative site	Operational <sup>(i)</sup>
Other Actions/Projects			
U.S. Department of Energy Savannah River Site	Research and industrial complex	Same general location as the SR alternative site	Operational <sup>(k)</sup>
Barnwell Low-Level Radioactive Waste Disposal Facility	Low-level radioactive waste disposal	About 8 mi east of the SR alternative site	Operational <sup>(l)</sup>

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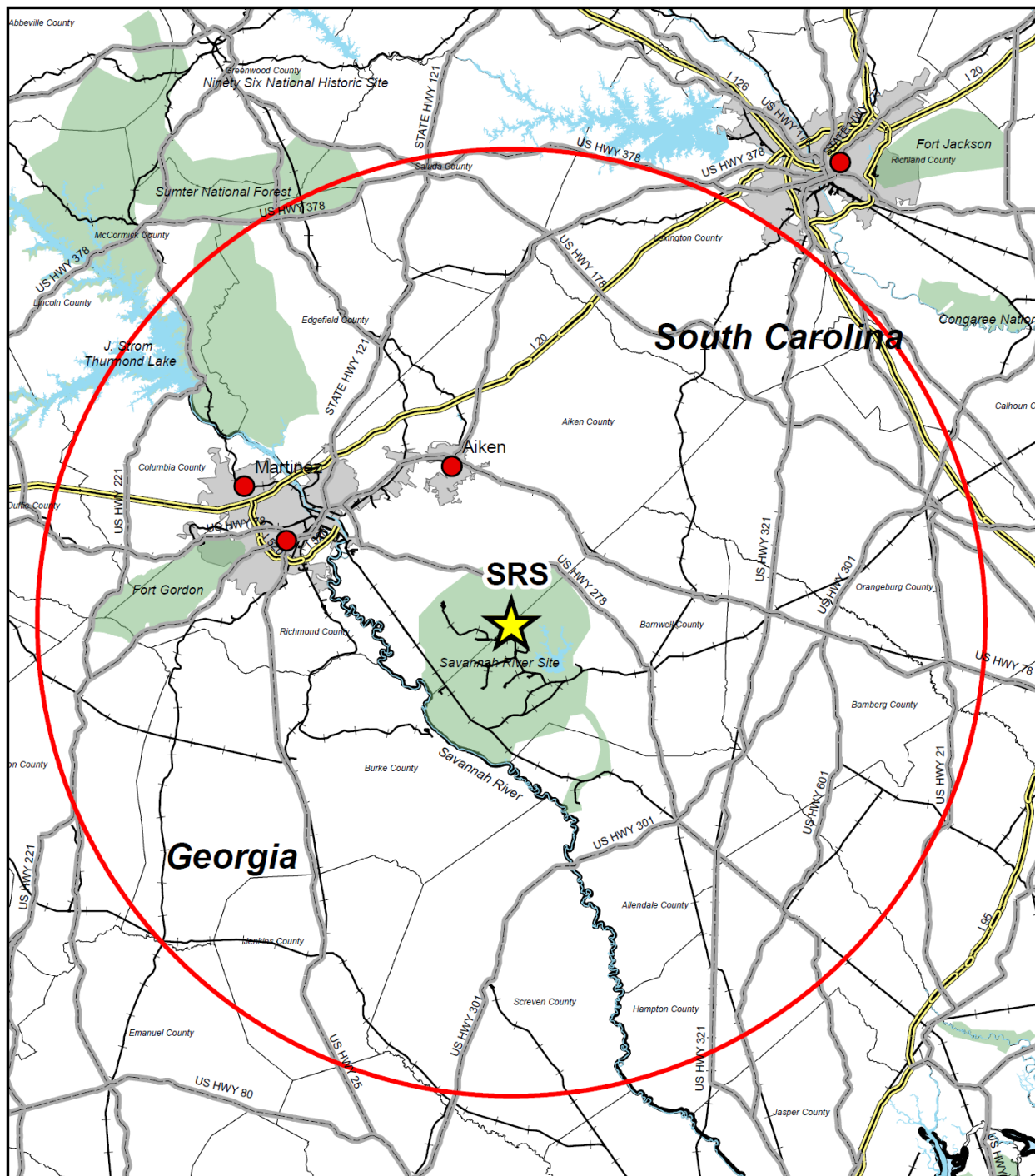
**Table 9-24.** (contd)

<b>Project Name</b>	<b>Summary of Project</b>	<b>Location</b>	<b>Status</b>
Various hospitals	Medical isotopes	Within 50 mi	Operational in Columbia, Lexington, Newberry, Rock Hill, Lancaster, Laurens, Greenwood, and Camden
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroad; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region	Construction would occur in the future, as described in state and local land-use planning documents

(a) Source: NRC 2009e  
 (b) Source: NRC 2009f  
 (c) Source: SCE&G 2009g  
 (d) Source: NRC 2004  
 (e) Source: DOE 2009a  
 (f) Source: EPA 2009l  
 (g) Source: EPA 2009m  
 (h) Source: SCDOT 2009  
 (i) Source: EPA 2009n  
 (j) Source: EPA 2009o  
 (k) Source: DOE 2009b  
 (l) Source: South Carolina Energy Office 2009

### 1 9.3.6.1 Land Use and Transmission-Line Corridors

2 In addition to land-use impacts from building and operations, the cumulative analysis for the SR  
 3 alternative site considers other past, present, and reasonably foreseeable future actions that  
 4 could contribute to the cumulative land-use impacts, including other Federal and non-Federal  
 5 projects and the projects listed in Table 9-24. For the analysis of land-use impacts at the SR  
 6 alternative site, the geographic area of interest is considered to be the 50-mi region centered on  
 7 the SR alternative site, plus any transmission-line corridors that extend beyond that range.  
 8 Most but not all of the transmission-line corridor length falls within a 50-mi radius of the site.  
 9 Land-use planning for transmission-line routing over wide areas must consider land-use plans of  
 10 adjoining counties and other land-managing agencies, rather than considering the SR  
 11 alternative site in isolation. Furthermore, in predominantly rural settings such as that  
 12 surrounding the SR alternative site, land-use changes occurring substantial distances away  
 13 from a project site can substantially influence land-use planning decisions close to the site.  
 14



1  
2

Figure 9-12. Savannah River Alternative Site Region

## Environmental Impacts of Alternatives

1 Roads and other public facilities and services in rural areas tend to serve people who are  
2 spread thinly but broadly over large portions of the landscape. Therefore land-use changes can  
3 affect roads and other facilities at greater distances than similar changes in more densely  
4 populated areas.

5 The SRS presently is moderately developed, but predominantly forested. The site is a large  
6 tract that houses several existing nuclear facilities as part of its DOE mission. It is located in a  
7 sparsely populated, largely rural area straddling Aiken and Barnwell Counties, with forests and  
8 small farms composing the dominant land use in the vicinity of the site boundary. The site was  
9 acquired by the Federal government for development of nuclear weapons facilities after World  
10 War II, and consequently is quite large with ample room for development. Several electric  
11 transmission lines, State routes, and interstate highways currently traverse the region. As  
12 indicated in Section 9.3.6, the site is being actively marketed for development of nuclear  
13 facilities.

14 Development of the proposed new units on the SR alternative site would convert existing land  
15 uses on about 400 ac of currently forested land to utility uses for the nuclear facility and  
16 associated structures and infrastructure. Similar to the VCSNS site, each AP1000 unit would  
17 require the addition of three 230-kV transmission lines, each of which would occupy a 100-ft-  
18 wide transmission-line corridor. Based on information provided by SCE&G (SCE&G 2009d)  
19 describing dimensions of conceptual transmission-line corridors for the SR alternative site,  
20 approximately 259 mi covering 2264 ac of land would be affected. The review team concludes  
21 that the land-use impact of the transmission-line installation activities would be similar to those  
22 described for the VCSNS site in Section 4.1.2. SCE&G stated that all land clearing associated  
23 with nuclear facility and transmission-line development would be conducted according to  
24 Federal, State, and local regulations, permit requirements, existing SCE&G and Santee Cooper  
25 procedures, good construction practices, and established BMPs (SCE&G 2009a).

26 Because the other projects described in Table 9-24 do not include any significant reasonably  
27 foreseeable changes in land-use types within 50 mi of the SR alternative site, there would not  
28 be any significant additional cumulative impacts on land use from those activities.

29 As described above, installation of new transmission-line corridors to support the new units has  
30 the potential to affect as much as 2264 ac over 259 mi of length for SCE&G lines. If additional  
31 transmission lines are built under other energy projects, there would be a cumulative land-use  
32 impact from the additional amount of land converted to utility corridor use for transmission lines.  
33 Because transmission lines are often co-located and are relatively narrow, the review team  
34 expects that the cumulative impact would be consistent with the land-use plans and zoning  
35 regulations of the affected counties. However, multiple new transmission-line corridors could  
36 noticeably alter the land-use classification acreage proportions, both within the vicinity of the SR  
37 alternative site and within the 50-mi region.

1 Cumulative land-use impacts within the region are expected to be manageable because the  
 2 activities would be consistent with existing land-use plans and zoning. However, due to the  
 3 potential reclassification of acreage within the region caused by the transmission-line  
 4 development, the review team concludes that the cumulative land-use impacts associated with  
 5 the proposed project at the SR alternative site, related transmission-line corridor development,  
 6 and other projects in the geographic area of interest would be MODERATE.

7 Building and operating two new nuclear units at the SR alternative site would be a significant  
 8 contributor to these impacts.

9 **9.3.6.2 Water Use and Quality**

10 SR alternative site hydrology, water use, and water quality are discussed in ER Section  
 11 9.3.3.1.3, and this EIS section draws from information presented in the ER (SCE&G 2009a).  
 12 The primary source of surface water is the Savannah River, which bounds SRS on its southern  
 13 boundary. Additional material for this alternative site is available in the *Nuclear Plant Site  
 14 Selection Study Report* (Tetra Tech NUS, Inc. 2009), the NRC staff's recent testimony to the  
 15 Atomic Safety and Licensing Board in the matter of the VEGP Units 3 and 4 ESP review, the  
 16 VEGP Units 3 and 4 COLA ER, and the Vogtle ESP EIS (NUREG 1872). The Vogtle site is in  
 17 the vicinity of the SR alternate site and reactors at this site would rely on the same water  
 18 resource (Savannah River) as does the existing and proposed Vogtle units.

19 The Savannah River annual mean and lower annual mean flows measured near Augusta,  
 20 Georgia, were reported as 9200 and 4470 cfs, respectively, for the 1952–2005 period. The  
 21 review team examined the annual average flow data for the USGS Augusta station (HUC  
 22 03060106, Site Number 02197000) and confirmed that the lowest annual flow for the period  
 23 reported in the ER was 4470 cfs; however, the review team found that 2008 provided an even  
 24 lower annual average of 4194 cfs (USGS 2008c). The annual mean flow for 1952–2008  
 25 reported by the USGS is 9047 cfs, which is lower than the value for the 1952–2005 period found  
 26 in the ER. Both updated values of flow are used in Table 9-25.

27 **Table 9-25. Savannah River Reduction in Flow and Assessed Impact Levels**

Savannah River Flow Condition	River Flow Rate (cfs)	Normal Consumptive Use (cfs)	Percent Flow Reduction
Annual Mean Flow	9047	62	0.7
Lowest Annual Flow	4194	62	1.5

28 Consumptive use rates for two AP1000 reactors are estimated to be the same as reported in  
 29 Chapter 3 of this EIS (62 cfs). Operation of the two proposed units at the SR alternative site  
 30 would require less than 1 percent of the mean annual flow in the Savannah River and would  
 31 require approximately 1.5 percent of the lowest average annual flow reported for 1952–2008.



## Environmental Impacts of Alternatives

1 Therefore, the review team concludes that impacts from surface-water use for building and  
2 operation of the proposed project would be minimal.

3 SCE&G indicates in the ER that groundwater would be used for potable water during building  
4 and operations. During 2005, 2.1 billion gallons of water were withdrawn from the Crouch  
5 Branch aquifer to support current site operations at the SRS with only localized impacts on  
6 water levels. SCE&G estimates that activities associated with the proposed units would  
7 increase this withdrawal rate by approximately 0.03 percent (SCE&G 2009a). Therefore, the  
8 review team concludes that impacts from groundwater use for building and operation of the  
9 proposed project would be minimal.

10 A SCDHEC-issued NPDES permit would be required to operate the nuclear project at this site.  
11 Effluent discharge through an NPDES-permitted outfall would ensure that the discharges  
12 complied with the Clean Water Act. Such permits are designed to ensure the protection of  
13 water quality and therefore the impact on surface-water quality is assessed to be minimal.

14 Impacts of the building and operation of the proposed units on groundwater quality may occur  
15 due to leaching of spilled pollutants and effluents into the subsurfaces. However, based on the  
16 review team's experience with other facilities, the review team concludes that with the  
17 implementation of BMPs the impacts on groundwater quality from building and operating two  
18 new nuclear units at the SR alternative site would likely be minimal.

### 19 ***Cumulative Impacts***

20 In addition to water-use and water-quality impacts from building and operations activities,  
21 cumulative analysis considers past, present, and reasonably foreseeable future actions that  
22 affect the same environmental resources. For the cumulative analysis of impacts on surface  
23 water, the geographic area of interest for the SR alternative site is considered to be the  
24 drainage basin of the Savannah River upstream and downstream of the site, because this is the  
25 resource that would be affected by the proposed project. Key actions that have past, present,  
26 and future potential impacts on water supply and water quality in the Savannah River basin  
27 include operating SCE&G's existing Urquhart Station (a fossil-fueled electrical generating plant)  
28 (SCE&G 2009a, k), operating and decommissioning DOE facilities at the SRS, operating two  
29 existing nuclear power plants at the Vogtle site, building and operating two new power plants  
30 proposed for the Vogtle site, building and operating the proposed SCE&G power plants, and  
31 other municipal and industrial activities in the Savannah River basin.

### 32 Water Use

33 The surface-water-use impacts of building and operating two nuclear power plants at the SR  
34 alternative site are dominated by the higher demands that would occur under normal operation.  
35 The projected consumptive water use of proposed units is expected to be about 62 cfs, or less

1 than 1 percent of the average river discharge of 9047 cfs near the site. This average river flow  
 2 reflects cumulative consumptive uses of current users upstream of the Augusta gauging station.

3 In testimony to the Atomic Safety Licensing Board regarding the ESP review for proposed  
 4 VEGP Units 3 and 4, the NRC staff estimated the consumptive use of all existing water users  
 5 between the Vogtle site and Thurmond Dam to be 79 cfs. Based on streamflow and discharge  
 6 records from Thurmond Dam, the NRC staff also concluded at the hearing that the reach  
 7 between Thurmond Dam and the proposed site is accumulating streamflow from tributaries that  
 8 more than offset the existing consumptive water uses. Based on revised information for the  
 9 expected consumptive use of VEGP Units 3 and 4, the estimated combined consumptive use  
 10 for Units 1, 2, 3, and 4 is 132 cfs (Southern 2009). The consumptive water use by all of these  
 11 users is 211 cfs and the combined consumptive water-use impact, including the proposed new  
 12 units at the SR alternative site, would be 273 cfs (Table 9-26). Because the combined  
 13 consumptive use is below 5 percent of the mean annual flow, the impact is assessed to be  
 14 minimal. Because the combined consumptive use is below 5 percent of the mean annual flow,  
 15 the impact is assessed to be minimal.

16 **Table 9-26.** Savannah River Reduction in Flow and Combined Water-Use Impact

Savannah River Flow Condition	Flow Rate (cfs)	Normal Combined Consumptive Use (cfs)	Percent Flow Reduction	Impact Level
Annual Mean Flow	9047	273	3.0	SMALL
Lower Annual Flow	4194	273	6.5	SMALL

17 As discussed in Section 7.2, the review team is aware of the potential climate changes that  
 18 could affect the water resources available for cooling and the impacts of reactor operations on  
 19 water resources for other users. Because all of the alternative sites are in the same region, the  
 20 impact of climate change may be similar for all of the alternative sites.

21 Increases in consumptive use of water in the Savannah River drainage is anticipated in the  
 22 future. The impacts of the other operational projects listed in Table 9-24 are considered in the  
 23 analysis included above or would have little or no impact on surface-water use.

24 As indicated above, groundwater would be used as a potable water source during building and  
 25 operations. Due to the high yields for the aquifers in this region demonstrated by past use at  
 26 the SRS, no significant impact is anticipated on other nearby users of groundwater. Therefore,  
 27 the review team concludes that the cumulative impacts from surface-water and groundwater use  
 28 for building and operation of the proposed project would be SMALL.

## Environmental Impacts of Alternatives

### 1 Water Quality

2 Point and non-point sources have affected the water quality of the Savannah River upstream  
3 and downstream of the SRS. Water-quality information presented above for the impacts of  
4 building and operating two new units at the SR alternative site would also apply to evaluation of  
5 cumulative impacts. As mentioned above, a SCDHEC-issued NPDES permit would be required  
6 to operate the nuclear project at this site. Effluent discharge through an NPDES-permitted  
7 outfall would ensure that the discharges complied with the Clean Water Act. Such permits are  
8 designed to ensure the protection of water quality. The review team also concludes that with  
9 the implementation of BMPs, the impacts on groundwater quality from building and operating  
10 two new nuclear units at the SR alternative site would likely be minimal, and therefore  
11 concludes the cumulative impact on surface and ground water quality would be SMALL.

12 The impacts of other projects listed in Table 9-24 are either considered in the analysis included  
13 above or would have little or no impact on surface-water quality.

### 14 **9.3.6.3 Terrestrial and Wetland Resources**

#### 15 ***Site Description***

16 The following impact analysis includes impacts from building activities and operations on  
17 terrestrial ecology resources. The analysis also considers past, present, and reasonably  
18 foreseeable future actions that affect the terrestrial ecological resources, including other Federal  
19 and non-Federal projects and the projects listed in Table 9-24. For the analysis of terrestrial  
20 ecological impacts at the SR alternative site, the geographic area of interest is considered to be  
21 the 6-mi region centered on the SR alternative site, plus the associated transmission-line  
22 corridors. This 6-mi radius is expected to encompass the ecologically relevant landscape  
23 features and species.

24 The SR alternative site and associated transmission lines would be located in the Sandhills  
25 ecoregion of South Carolina and lies on the Aiken/Barnwell County line approximately 25 mi  
26 southeast of the city limits of Augusta, Georgia (SCE&G 2009a). The proposed project site  
27 would occupy approximately 1281 ac of Federal land, surrounded by the greater SRS. This  
28 DOE-owned land is approximately 198,000 ac, of which about 181,000 ac are forests and  
29 swampland that are managed by the U.S. Forest Service for the DOE (SCE&G 2009a).

30 The vegetation communities typical of the Sandhills ecoregion include pine-scrub oak sandhill  
31 (longleaf pine, turkey oak, blackjack oak, bluejack oak, and wiregrass) xeric sandhill scrub  
32 (longleaf pine, turkey oak, wiregrass), and streamhead pocosins (pond pine, red maple, tulip  
33 poplar, and evergreen shrubs) (Griffith et al. 2002). The primary cover type at the proposed SR  
34 alternative site is planted pine. Since the 1950s, loblolly and slash pine (*Pinus elliottii*) have  
35 been grown and harvested as part of a designated forest timber unit to remove and sell  
36 harvestable timber (SCE&G 2009a).

1 Common wildlife species found in the Sandhills ecoregion pine forests that occur on the  
2 forested areas of the SR alternative site are white-tailed deer, eastern cottontail, gray squirrel,  
3 opossum, and raccoon. A variety of bird species also inhabit the site and include wild turkey,  
4 northern mockingbird (*Mimus polyglottos*), and several species of warblers (SCE&G 2009a). A  
5 high diversity of reptiles and amphibians reside in the various habitats present on the greater  
6 SRS. The Savannah River Ecology Lab (along with the University of Georgia and others) has  
7 documented over a million individuals representing 100 species of reptiles and amphibians on  
8 the SRS – the most that have been captured on public land in the entire United States  
9 (University of Georgia 2009).

10 Eight Federally listed species are known to occur in the vicinity of the proposed SR alternative  
11 site and/or within the associated proposed transmission-line corridors (SCE&G 2009a).  
12 Endangered species include the wood stork, red-cockaded woodpecker, Canby's dropwort,  
13 harperella, relict trillium (*Trillium reiquum*), smooth coneflower (*Echinacea laevigata*), pondberry  
14 (*Lindera melissifolia*), and American chaffseed (*Schwalbea americana*). The American alligator  
15 (*Alligator mississippiensis*) is Federally listed as threatened due to its similarity in appearance to  
16 the endangered American crocodile (*Crocodylus acutus*) (SCDNR 2006a; FWS 2008).

17 In addition to the Federally listed species above, five State-listed species are known to occur in  
18 Barnwell, Aiken, and Allendale Counties. These endangered species include Rafinesque's big-  
19 eared bat, bald eagle, gopher tortoise, and the gopher frog. The spotted turtle is State-listed as  
20 threatened (SCDNR 2006a). See Table 9-27 for Federally and Stated-listed species that may  
21 occur on the SR alternative site.

22 SCE&G stated it would perform detailed ecological surveys to protect Federally and State-listed  
23 threatened and endangered species that may occur on the project site as part of the permitting  
24 process prior to commencing any building activity for the nuclear facility or associated  
25 transmission lines (SCE&G 2009a).

## 26 **Building Impacts**

27 The SR alternative site is mostly planted pine and on the 1280.8-ac project site, there are  
28 37.8 ac of wetlands, of which approximately 14.6 ac would be affected by building the proposed  
29 two nuclear units (SCE&G 2010a). SCE&G stated that although there are over 300 Carolina  
30 bays (elliptical depressions concentrated along the Atlantic seaboard that vary in size from one  
31 to several thousand acres) on the greater SRS, there would be few impacts on streams or  
32 wetlands on the project site (SCE&G 2009c). SCE&G stated that the nuclear facility could be  
33 sited to avoid wetlands whenever possible and potential impacts on wetlands near building  
34 zones would be minimized through the use of BMPs (SCE&G 2009a).

Environmental Impacts of Alternatives

1 **Table 9-27.** Federally and State-Listed Species that May Occur on the SR Alternative Site,  
 2 Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	County
<b>Mammals</b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	SE	Aiken, Allendale, Barnwell
<b>Birds</b>			
<i>Haliaeetus leucocephalus</i>	Bald eagle	BGEPA/SE	Aiken, Allendale, Barnwell
<i>Mycteria americana</i>	Wood stork	FE/SE	Aiken
<i>Picoides borealis</i>	Red-cockaded woodpecker	FE/SE	Aiken, Allendale, Barnwell
<b>Reptiles</b>			
<i>Clemmys guttata</i>	Spotted turtle	ST	Aiken, Allendale, Barnwell
<i>Gopherus polyphemus</i>	Gopher tortoise	SE	Aiken, Allendale
<b>Amphibians</b>			
<i>Rana capito</i>	Gopher frog	SE	Aiken, Barnwell
<b>Vascular Plants</b>			
<i>Echinacea laevigata</i>	Smooth coneflower	FE/SE	Aiken, Allendale, Barnwell
<i>Oxypolis canbyi</i>	Canby's dropwort	FE/SE	Allendale, Barnwell
<i>Ptilimnium nodosum</i>	Harperella	FE/SE	Aiken, Barnwell
<i>Trillium reliquum</i>	Relict trillium	FE/SE	Aiken

Sources: SCDNR 2006a; FWS 2008, Southeast Region County Lists  
 BGEPA = Bald and Golden Eagle Protection Act; FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered; ST = State listed as threatened

3 Each AP1000 unit would require the addition of three 230-kV transmission lines, which would  
 4 each occupy a 100-ft-wide transmission-line corridor. The total length and acreage of  
 5 transmission-line corridors required (collectively) that would affect terrestrial ecological  
 6 resources would be approximately 259 mi and 2264 ac (SCE&G 2009c, d). SCE&G and Santee  
 7 Cooper would both build and maintain a portion of the new transmission lines and details are  
 8 provided in Table 9-28 and Table 9-29 (SCE&G 2009c, d).

9 **Table 9-28.** SCE&G Transmission-Line Information for the SR Alternative Site

Transmission-Line Segment	Length of Corridor (mi)	Acre of Corridor	Acre of Forested Wetlands	Acre of Nonforested Wetlands	Acre of Open Water	Linear Feet of Streams
SRS-Cope-Edenwood	93	854	159	8	4	12,101
SRS-SRP	7	56	--	6	--	629
SRS-Urquhart	22	183	9	--	--	2864
Total	122	1093	168	14	4	15,594

Source: SCE&G 2009c, d

1 **Table 9-29.** Santee Cooper Transmission-Line Information for the SR Alternative Site

Wetlands Estimate	New Corridor (1171 ac)		Existing Corridor (0 ac)		Total Corridor (1171 ac)	
	Acres	Percent of Corridors	Acres	Percent of Corridors	Acres	Percent of Corridors
Hydric Soils	324	28	0	NA	324	28
NWI Wetlands	65	6	0	NA	65	6

Source: SCE&G 2009c, d

NA = Not applicable; NWI = National Wetlands Inventory

2 The new lines could cause significant wetland impacts through wetland conversion due to forest  
3 clearing. SCE&G stated that all land clearing associated with nuclear facility and transmission-  
4 line development would be conducted in accordance with Federal, State, and local regulations,  
5 permit requirements, existing SCE&G and Santee Cooper procedures, and established BMPs  
6 (SCE&G 2009a).

7 Past actions in the geographic area of interest that have similarly affected terrestrial resources  
8 include the construction of DOE's SRS, portions of which are located less than 1 mi from the SR  
9 alternative site. The building of the DOE SRS contributed to the loss of terrestrial habitat. The  
10 MOX Fuel Fabrication facility at the DOE SRS, which began construction in 2007 approximately  
11 5 mi west of the SR alternative site (see Table 9-24) is a project in the geographic area of  
12 interest that would cumulatively affect terrestrial ecological resources in a similar way.

13 Proposed future actions that would affect terrestrial resources in a similar way to development  
14 at the SR alternative site would include the operation of the SRS MOX Fuel Fabrication facility  
15 (located approximately 5 mi from the alternative SR site), transmission-line creation and/or  
16 upgrading throughout the designated geographic region of interest, and future urbanization,  
17 which would also be expected to occur. However, a large portion of land, approximately  
18 14,000 ac, within the geographic region of interest has been set aside for nondestructive  
19 environmental research. This tract of land is managed for the benefit of wildlife and is  
20 designated as a National Environmental Research Park (SCE&G 2009a). It is important to note  
21 that a portion of the 14,000 ac of the wildlife preserve would be cleared and developed as part  
22 of the proposed action (SCE&G 2009a).

23 Impacts from building two nuclear units and supporting facilities on wildlife habitat would be  
24 unavoidable, and activities that would affect wildlife include land clearing and grading  
25 (temporary and permanent), filling and or draining of wetlands, increased human presence,  
26 heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities  
27 would likely displace or destroy wildlife that inhabits the affected areas. Some wildlife, including  
28 important species, would perish or be displaced during land clearing for any of the above  
29 projects as a consequence of habitat loss, fragmentation, and competition for remaining

## Environmental Impacts of Alternatives

1 resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be  
2 at greater risk of incurring mortality than more mobile animals, such as birds, many of which  
3 would be displaced to adjacent communities. Undisturbed land adjacent to the project could  
4 provide habitat to support displaced wildlife, but increased competition for available space and  
5 resources could affect population levels. Wildlife would also be subjected to impacts from noise  
6 and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife  
7 from noise is expected to be temporary and minor. The creation of new transmission-line  
8 corridors could be beneficial for some species, including those that inhabit early successional  
9 habitat or use edge environments, such as white-tailed deer, northern bobwhite quail, eastern  
10 meadowlark, and the gopher tortoise. Birds of prey, such as red-tailed hawks would likely  
11 exploit newly created hunting grounds. Forested wetlands within the corridors would be  
12 converted to and maintained in a herbaceous or scrub-shrub condition that could provide  
13 improved foraging habitat for waterfowl and wading birds. However, fragmentation of forests  
14 could affect species that are dependent on large tracts of continuous forested habitat.

15 The review team concludes that the impacts on terrestrial resources from building two new  
16 nuclear units and associated transmission lines at the SR alternative site would be noticeable,  
17 but not destabilizing.

### 18 ***Operational Impacts***

19 Impacts on terrestrial ecological resources from the operation of two new nuclear units at the  
20 SR alternative site primarily include those associated with cooling towers and transmission  
21 lines. Impacts resulting from the operation of cooling towers and transmission lines are  
22 discussed in detail in Section 9.3.3.3 and would apply to the SR alternative site.

23 No past, present, or future actions in the geographic area of interest were identified that would  
24 significantly affect terrestrial habitat and wildlife, including important species, in ways similar to  
25 those associated with the operation of two new units.

26 The review team concludes that the impacts of operating two new units and associated  
27 transmission lines at the SR alternative site on terrestrial resources and wetlands would be  
28 minimal.

### 29 **9.3.6.4 Summary Statement**

30 Impacts on terrestrial ecology resources are estimated based on the information provided by  
31 SCE&G and the review team's independent review. There are past and future activities in the  
32 geographic area of interest that could affect wildlife and wildlife habitat in ways similar to the  
33 building of two units at the SR alternative site. The SR alternative site and some of the  
34 associated transmission-line corridors are natural habitats that would be altered by development  
35 and maintenance activities, noticeably affecting the level and movement of terrestrial wildlife

1 populations in the area of interest. Other anticipated development projects would further alter  
2 wildlife habitats and migration patterns in the surrounding landscape. The review team  
3 therefore concludes that cumulative impacts on baseline conditions for terrestrial resources  
4 would be MODERATE. Building and operating two new nuclear units and associated  
5 transmission lines at the SR alternative site would be a significant contributor to the  
6 MODERATE impact.

#### 7 **9.3.6.5 Aquatic Resources**

8 The following impact analysis includes impacts from building activities and operations on  
9 aquatic ecology resources. The SRS encompasses 310 mi<sup>2</sup> of land that are within the  
10 boundaries of three counties in South Carolina: Aiken, Barnwell, and Allendale. The SR  
11 alternative site would occupy 500 ac along the Aiken-Barnwell County line (SCE&G 2009a).  
12 The Savannah River basin encompasses 10,577 mi<sup>2</sup> within the states of North Carolina, South  
13 Carolina, and Georgia. In the State of South Carolina, the Savannah River basin includes 35  
14 watersheds and flows through the Blue Ridge, Piedmont, and Coastal Plain physiographic  
15 provinces (SCDHEC 2003). The SR alternative site falls within the Lower Savannah River basin  
16 and is encompassed by two watersheds: the Savannah River (HUC 03060106-110) and the  
17 Upper Three Runs (HUC 03060106-100) (SCDHEC 2003). The geographic region of interest  
18 includes both the Upper Three Runs and Savannah River watersheds, based on the most  
19 affected waterbodies of the SR alternative site.

20 The following information was derived from the SCDHEC report titled *Watershed Water Quality*  
21 *Assessment: Savannah River Basin* (SCDHEC 2003). Of the 157,409 ac within the watershed  
22 associated with the proposed plant footprint, aquatic resources include forested wetlands  
23 (9.9 percent), water (0.2 percent), and nonforested wetlands (0.1 percent). There are 223.7 mi  
24 of streams and 198.3 ac of lake waters within the Upper Three Runs watershed. Monitoring  
25 data from three waterbodies (Upper Three Runs, Cedar Creek, and Tims Branch) indicate that  
26 water quality would fully support aquatic life. Upper Three Runs and Tims Branch are  
27 blackwater systems, which are typified by naturally low-pH conditions. Historically, the SR  
28 alternative site is a part of the larger DOE SRS, which is a large industrial complex now involved  
29 in various regulated cleanup activities from nuclear weapon production or nuclear materials  
30 preparation and storage that began in the early 1950s.

#### 31 ***Recreationally Important Species***

32 The Savannah River supports diverse fisheries that are ecologically, recreationally, and  
33 commercially important. Recreationally and or commercially important fish within the vicinity of  
34 the SR alternative site include catostomids (i.e., suckers), ictalurids (i.e., catfish, bullheads,  
35 madtoms), moronids (i.e., temperate basses), centrarchids (i.e., sunfishes), and mugilids  
36 (e.g., mullets). Esocids (i.e., pikes and pickerels) are recreationally important fish, and they may  
37 also be considered a keystone species due to their keen predatory capabilities. Some members



## Environmental Impacts of Alternatives

1 of the percid family are recreationally and commercially important (e.g., perches); others  
2 (e.g., darters) are sensitive to disturbance and serve as indicators of ecosystem health (Marcy  
3 et al. 2005).

4 Industrial contamination within the Savannah River has resulted in fish advisories within the  
5 watershed. Contaminants of concern include mercury, cesium, and strontium (Burger et al.  
6 2001). In the vicinity of the SR alternative site, SCDHEC (2009b) advises avoiding the  
7 consumption of bowfin, restricting the consumption of largemouth bass to one meal per month,  
8 and restricting the consumption of chain pickerel, and spotted sucker (*Minytrema melanops*) to  
9 one meal per week.

### 10 ***Invasive Species***

11 Asian clam (*Corbicula fluminea*) has been documented within the vicinity of the SR alternative  
12 site on the Savannah River (The Catena Group 2007).

### 13 ***Critical Habitats***

14 No critical habitat has been designated by the FWS in the vicinity of the SR alternative site.

### 15 ***Federally and State-Listed Species***

16 Federal and State-listed species that may occur in the vicinity of the SR alternative site or  
17 waterbodies associated with transmission-line corridors are listed in Table 9-30. Aquatic  
18 species listed for Burke County, Georgia, are also included because the Savannah River  
19 separates South Carolina and Georgia at the SR alternative site.

20 **Table 9-30.** Federally and State-Listed Aquatic Species that May Occur on the SR Alternative  
21 Site, Including the Vicinity and Associated Transmission-Line Corridors

Scientific Name	Common Name	Status	County
<b>Fish</b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	FE/SE	Aiken, Burke, Hampton, Orangeburg
<i>Moxostoma robustum</i>	Robust redhorse	SE	Burke
<b>Mollusks</b>			
<i>Fusconaia masoni</i>	Atlantic pigtoe	SE	Burke

Sources: FP&S 2008; MACTEC 2008; FWS 2008; SCDNR 2006a, GDNR 2010  
FE = Federally Endangered, SE = State Endangered, FT = Federally Threatened, ST = State Threatened

### 22 Shortnose Sturgeon

23 The shortnose sturgeon, State-endangered in Georgia and South Carolina, is the only Federally  
24 listed species known to occur in Aiken and Barnwell Counties, South Carolina (GDNR 2010;

1 SCDNR 2006a; FWS 2008). The Atlantic sturgeon (*Acipenser oxyrinchus*) is currently a  
2 Federal candidate species. Listing as a candidate species, according to the National Marine  
3 Fisheries Service (NMFS), “does not confer any procedural or substantive protections of the  
4 [Endangered Species Act (ESA)] on the candidate species” (71 FR 61022); however, the NMFS  
5 is preparing a determination on whether listing the Atlantic sturgeon or the multiple distinct  
6 population segments of the Atlantic sturgeon as threatened or endangered is warranted (NMFS  
7 2010). More is known about the life history of the shortnose sturgeon than that of the Atlantic  
8 sturgeon in the southeastern United States (Collins and Smith 1997).

9 The shortnose sturgeon was initially listed as a Federally endangered species in 1967 and is  
10 designated as a species of highest conservation priority by SCDNR (McCord 2006; NMFS  
11 1998). This amphidromous species uses freshwater, estuarine, and marine habitats to  
12 complete its life cycle (Rohde et al. 2009; McCord 2006; NMFS 1998). In South Carolina,  
13 populations of shortnose sturgeon exist in the Ashepoo, Combahee, and Edisto rivers (flowing  
14 to St. Helena Sound), the Pee Dee, Waccamaw, and Black rivers (flowing to Winyah Bay); and  
15 the Savannah, Cooper, and Santee rivers. There is also a small landlocked population of  
16 shortnose sturgeon in the Santee-Cooper Lake system (Collins et al. 2003). In freshwater  
17 habitats, shortnose sturgeon are associated with soft bottom substrates in deep water.  
18 Spawning occurs in fresh waters characterized by low-to-moderate velocities and over  
19 substrates that include clay, sand, gravel and woody debris (Rohde et al. 2009; McCord 2006).  
20 Spawning is known to occur upstream of the SRS facility, and larval shortnose sturgeon were  
21 collected in the vicinity of SRS during ichthyoplankton surveys conducted between 1982 and  
22 1985 (Wike 1998). Eggs are adhesive and survival is reportedly dependent on water having  
23 little turbidity (McCord 2006). The shortnose sturgeon is known to occur in the Savannah River  
24 near the vicinity of the proposed alternative site (Marcy et al. 2005).

### 25 Robust Redhorse

26 The robust redhorse (*Moxostoma robustum*) is listed as endangered by the State of Georgia,  
27 which shares the Savannah River watershed with South Carolina (FWS 2008). The robust  
28 redhorse is known to occur in the Savannah River near the vicinity of the proposed SR  
29 alternative site (Marcy et al. 2005). Robust redhorse prefer medium-to-large creeks and rivers  
30 with gravel or rocky substrate. Spawning season lasts from March to May and fry reach sexual  
31 maturity in 4 to 5 years (Rohde and Parnell 1994).

### 32 Atlantic Pigtoe

33 The Atlantic pigtoe is State-listed as endangered for Burke County, Georgia. The Atlantic pigtoe  
34 is found in habitats that consist of coarse sand and gravel at the downstream edge of riffles  
35 associated with fairly pristine, well oxygenated streams (Bogan and Alderman 2004). Although  
36 this species was first described in the Savannah River, there are no records of occurrences in  
37 the Savannah River near the SR alternative site (NRC 2008b).

## Environmental Impacts of Alternatives

### 1 ***Building Impacts***

2 Because the SRS is a former nuclear power plant site, the vicinity of the SR alternative site  
3 includes some of the infrastructure (e.g., roads, railroad lines, buildings) necessary to support a  
4 new facility. SCE&G has indicated that existing roads and railroad lines on the SRS would be  
5 used where practicable (SCE&G 2009a); however, SCE&G's (2009f) proposed locations of the  
6 powerblock, switchyard, and cooling towers do not occur within the footprint of existing facilities,  
7 so disturbance of aquatic ecosystems may be required during building activities.

8 Cooling-system makeup water would be derived from the Savannah River, which is also  
9 proposed to receive station blowdown water (SCE&G 2009f). Installation of new intake and  
10 discharge structures would result in the temporary displacement of aquatic biota within the  
11 affected areas. There would be impacts on water quality stemming from direct (e.g., dredging,  
12 shoreline excavation, removal of riparian vegetation) and indirect sources (e.g., stormwater  
13 runoff, sedimentation). In addition, activities that include land clearing associated with new  
14 infrastructure (roads, site footprint) and upgrading existing features (railroad lines) would affect  
15 approximately 1628 linear feet out of a total of approximately 6911 linear feet of onsite streams  
16 and the entire 0.6 ac of open water present onsite (SCE&G 2010a).

17 New transmission lines and corridors are a necessary component of the proposed SR  
18 alternative site, because the existing infrastructure cannot support the energy transport needs of  
19 the proposed new units (SCE&G 2009a). According to SCE&G (2009a), the new transmission-  
20 line corridors would be required. The transmission-line corridors would be maintained by both  
21 SCE&G and Santee Cooper. For SCE&G lines, transmission-line corridors would be associated  
22 with approximately 15,594 linear feet of streams and 4 ac of open water are located within the  
23 new transmission-line rights-of-way (Table 9-28) (SCE&G 2009d). The Santee Cooper  
24 transmission-line corridors associated with the SR alternative site would include an estimated  
25 70 stream crossings, 3 of which would be State Navigable Waters crossings (SCE&G 2009d).  
26 SCE&G stated that all land clearing associated with plant and transmission-line site preparation  
27 and development would be conducted according to Federal, State, and local regulations, permit  
28 requirements, existing SCE&G and Santee Cooper procedures, and established BMPs (SCE&G  
29 2009a). Past or present actions in the geographic area of interest that would affect aquatic  
30 ecological resources in ways similar to those associated with the building of the proposed new  
31 units at the SR alternative site include the construction of VEGP Units 1 and 2 across the  
32 Savannah River and approximately 5 river mi downstream from the SR alternative site and the  
33 MOX Fuel Fabrication facility at the DOE SRS, which began construction in 2007 approximately  
34 5 mi west of the SR alternative site (see Table 9-24). Operation of the MOX facility would be a  
35 future action. A proposed future action that would affect aquatic resources in a similar way to  
36 development at the SR alternative site would include building VEGP Units 3 and 4, which,  
37 depending on the timing for building these two new units, may coincide with building the new  
38 units at the SR alternative site. The impacts on the Savannah River for building of the new  
39 VEGP units are expected to be minimal (NRC 2008b). Additional future actions include

1 transmission-line creation and/or upgrading throughout the designated geographic region of  
2 interest and future urbanization that would also be expected to occur.

### 3 ***Operational Impacts***

4 Aquatic impacts associated with the operation of the SR alternative site would include intake-  
5 related impingement and entrainment losses of aquatic biota as well as water-quality impacts  
6 near the vicinity of the intake and discharge structures in the Savannah River. There are  
7 several intake/discharge configurations designed to minimize impacts on aquatic biota.  
8 Assuming SCE&G would use a closed-cycle cooling system designed to meet the EPA's 316(b)  
9 Phase I requirements for new facilities (66 FR 65256), the intake would have a maximum  
10 through-screen velocity at the cooling-water intake of 0.5 fps or less. Additionally, the cooling  
11 water intake would meet the EPA intake flow-to-source water volume criterion. Adverse impacts  
12 on aquatic biota from impingement and entrainment effects would not be anticipated.

13 Operational impacts associated with water quality and discharge are likely to be minimal and  
14 NPDES compliant. The diverse fish found within the vicinity of the SR alternative site exhibit a  
15 range of life-history characteristics that include a variety of habitat associations during certain  
16 life phases. Impacts would likely be greatest on nonmotile benthic aquatic organisms that occur  
17 within the vicinity of the discharge area. Based on the review team's experience with other  
18 facilities, the review team concludes that with proper design the impacts on aquatic resources  
19 from operation of two new nuclear units at the SR alternative site would likely be minimal.

20 The review team also concludes that operational impacts on aquatic biota from maintenance of  
21 the transmission-line corridors would be minimal assuming appropriate BMPs are used.

### 22 ***Cumulative Impacts***

23 Cumulative impacts that could result from the operation of two new units at the SR alternative  
24 site would include intake-related impingement and entrainment losses and chemical and  
25 thermal discharge from station blowdown. Past and present actions in the geographic area of  
26 interest that would affect aquatic ecological resources include the operation of the DOE SRS,  
27 which has current NPDES permits for the D-Area Powerhouse and industrial inorganic  
28 chemicals that are discharged into the Savannah River; the Vogtle nuclear energy facility whose  
29 water withdrawals and discharges to the Savannah River are controlled by a Georgia  
30 Department of Natural Resources NPDES permit; and the SCE&G's Urquhart Station, a fossil  
31 fuel steam electric generating plant whose withdrawals and discharges to the Savannah River  
32 are controlled by a SCDHEC NPDES permit.

33 The former Savannah River Plant (SRP) began operation during the 1950s and has been the  
34 focus of many environmental investigations since that time (Marcy et al. 2005). The rates of  
35 impingement of aquatic biota from the formerly operating SRP were reported to be low

## Environmental Impacts of Alternatives

1 (compared to other facilities) during a 1977 study. Bluespotted sunfish (*Enneacanthus*  
2 *gloriosus*), warmouth (*Lepomis gulosus*), channel catfish, and yellow perch (*Perca flavescens*)  
3 were among the most commonly impinged species. Of these common species, no single  
4 species accounted for more than 10 percent of the samples (McFarlane et al. 1978). Thermal  
5 discharge associated with the SRP was correlated with species assemblages and abundance of  
6 fish in the vicinity of the plant (Paller and Saul 1986). Species assemblages in the intake canal  
7 were dominated by bluegill, redbreast sunfish, and black crappie (*Pomoxis nigromaculatus*).  
8 Habitats with elevated thermal conditions had larger proportions of channel catfish, white  
9 catfish, largemouth bass, and coastal shiner (*Notropis petersoni*), and a lower proportion of flat  
10 bullhead. The low impingement rates reported from the SRS, despite higher withdrawal rates  
11 and through-screen velocities than those planned for the SR alternative site, support the  
12 conclusion that impingement rates at the new intake would not result in a detectable impact on  
13 the Savannah River fishery.

14 Recently, Georgia Power conducted both entrainment (Georgia Power 2008) and impingement  
15 (Georgia Power 2009) assessments to characterize current entrainment and impingement rates  
16 at VEGP Units 1 and 2 and to project impacts for proposed VEGP Units 3 and 4. These data  
17 were also compared with SRS entrainment and impingement studies. The results from these  
18 recent assessments indicate that entrainment and impingement effects on fishery resources of  
19 the Savannah River from VEGP Units 1 and 2 are minimal and that anticipated effects from  
20 proposed Units 3 and 4 would not be significant (Georgia Power 2008, 2009).

21 Future actions in the geographic area of interest that would affect aquatic ecological resources  
22 in ways similar to those associated with the operation of the proposed new units at the SR  
23 alternative site include the operation of two additional units at the Vogtle site. The operation of  
24 proposed VEGP Units 3 and 4 would use the Savannah River for cooling water and discharge of  
25 station blowdown in a manner similar to the operating VEGP Units 1 and 2 (NRC 2008b).  
26 Impingement and entrainment for intake operation of VEGP Units 3 and 4 were determined to  
27 result in minor impacts, as were the potential impacts for thermal and chemical discharges to  
28 the Savannah River (NRC 2008b). Water use from the Savannah River for six reactors is not  
29 likely to result in noticeable impacts as described in Section 9.3.6.2. Anthropogenic activities  
30 such as industrial development near the vicinity of the nuclear facility may also contribute to  
31 future cumulative impacts.

### 32 **Summary Statement**

33 Impacts on aquatic ecology resources are estimated based on the information provided by  
34 SCE&G, the State of South Carolina, and the review team's independent review. There are  
35 past and future activities in the geographic area of interest that could affect aquatic ecology  
36 resources in ways similar to the building and operation of two units at the SR alternative site.  
37 Proper siting of facilities; avoiding habitat for protected species and minimizing interactions with  
38 waterbodies and watercourses along the transmission-line corridors; and using appropriate

1 BMPs during intake and discharge installation, corridor preparation, and tower placement would  
2 minimize impacts. Based on the information provided by SCE&G, the State of South Carolina,  
3 and the review team's independent evaluation, the review team concludes that the cumulative  
4 impacts of building and operating two new reactors on the SR alternative site combined with  
5 other past, present, and future activities on most aquatic resources in the Savannah River  
6 drainage would be SMALL.

#### 7 **9.3.6.6 Socioeconomics**

8 For the analysis of socioeconomic impacts at the SR alternative site, the geographic area of  
9 interest is considered to be the 50-mi region centered on the SR site with special consideration  
10 of Richmond and Columbia Counties in Georgia and Aiken and Barnwell Counties in South  
11 Carolina, because that is where the review team expects socioeconomic impacts to be the  
12 greatest. In evaluating the socioeconomic impacts of site development and operation at the SR  
13 alternative site, the review team undertook a reconnaissance survey of the region using readily  
14 obtainable data from the ER, the alternative site audit, and Federal, State, and local government  
15 agencies. The analysis also considers other past, present, and reasonably foreseeable future  
16 actions that affect the same environmental resources, including other Federal and non-Federal  
17 projects and the projects listed in Table 9-24. The impacts from both building and station  
18 operation are discussed below.

#### 19 ***Physical Impacts***

20 Many of the physical impacts of building and operation would be similar regardless of the site.  
21 Building activities can cause temporary and localized physical impacts such as noise, odor,  
22 vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public  
23 roadways, railways, and waterways would be necessary to transport construction materials and  
24 equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and  
25 disposal sites) would be expected to be already permitted and operational.

26 Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and  
27 visual intrusions (the latter are discussed under aesthetics and recreation). New units would  
28 produce noise from the operation of pumps, cooling towers, transformers, turbines, generators,  
29 and switchyard equipment. Traffic at the site also would be a source of noise. The review team  
30 assumed that the same standard noise protection and abatement procedures used for the  
31 VCSNS site would be used to control noise coming from the SR alternative site. This practice  
32 also would be expected to apply to all alternative sites. Commuter traffic would be controlled by  
33 speed limits. Good road conditions and appropriate speed limits would minimize the noise level  
34 generated by the workforce commuting to the alternative site.

35 The new units at the SR alternative site would likely have standby diesel generators and  
36 auxiliary power systems. Permits obtained for these generators would ensure that air emissions

## Environmental Impacts of Alternatives

1 comply with applicable regulations. In addition, the generators would be operated on a limited,  
2 short-term basis. During normal plant operation, new units would not use a significant quantity  
3 of chemicals that could generate odors that exceed odor threshold values. Good access roads  
4 and appropriate speed limits would minimize the dust generated by the commuting workforce.  
5 Based on the information provided by SCE&G and the review team's independent evaluation,  
6 the review team concludes that the physical impacts of building and operating two new nuclear  
7 units at the SR alternative site would be minimal.

### 8 **Demography**

9 The SRS, within which the SR alternative site is situated, is located in Aiken, Barnwell, and  
10 Allendale Counties in southwestern South Carolina, approximately 25 mi southeast of Augusta,  
11 Georgia. The site is bordered by the Savannah River to the southwest for about 35 mi. The  
12 closest economic center is Aiken, South Carolina (2007 population 29,218), approximately  
13 18 mi from the SRS (USCB 2009). The population within the 50-mi radius of the site is  
14 estimated to be 766,127 (SCE&G 2009a).

15 Currently, 84 percent of the SRS workforce lives in one of four counties, distributed as follows:  
16 Richmond (20.2 percent) and Columbia (11.9 percent) Counties in Georgia and Aiken (60.7  
17 percent) and Barnwell (7.1 percent) Counties in South Carolina (SCE&G 2009a). The in-  
18 migrating population would be expected to reside within this four-county area in the same  
19 pattern as the existing workforce. Therefore, these four counties compose the economic impact  
20 area and are the focus of the following analysis.

21 At the peak of the plant building activities, SCE&G would expect the workforce onsite to be  
22 3600. Because of the rural nature of the two sites and the fact that the SRS also hosts existing  
23 nuclear facilities, development of the proposed new units on the SR alternative site would have  
24 similar socioeconomic impacts in most respects to adding two new units to the VCSNS site.  
25 The review team concludes that because the economic impact area includes portions of two  
26 larger metropolitan areas (Aiken and Augusta), migration patterns would be similar to those  
27 expected at the VCSNS site. About 50 percent or 1800 would migrate to the economic impact  
28 area in rough proportion to the current operating workforce of the SRS. Using South Carolina's  
29 average household size of 2.53, this would bring the total in-migrating population to 4554.  
30 Considering that the estimate of the in-migrating population represents about 1.1 percent of the  
31 population of the economic impact area in 2000, the review team expects the regional  
32 demographic impacts of the project to be minor. Once the facility is operational, SCE&G  
33 estimates that the workforce would be about 800 employees. SCE&G also estimates that the  
34 additional 130 site support workforce already exists at the SRS, based on nuclear facilities  
35 already operating there, and additional support workers would not be needed (SCE&G 2009a).  
36 The review team assumed 50 percent of these workers would migrate into the four-county  
37 economic impact area, similar to what would be expected at the VCSNS site. The review team  
38 expects the demographic impact during operations to be minimal. Based on the information

1 provided by SCE&G and the review team's independent evaluation, the review team concludes  
2 that the demographic impacts of building and operating two new nuclear units at the SR  
3 alternative site would be minimal.

#### 4 ***Taxes and Economy***

5 According to SCE&G, in lieu of property taxes, SRS currently pays a fee to the counties whose  
6 land area includes the SRS. The proposed site sits on the Aiken/Barnwell County line, currently  
7 Aiken County receives \$800,000 and Barnwell County receives \$2 million annually. The  
8 proposed nuclear facility would increase the fee base to the two counties for the life of the  
9 proposed project. The review team finds that increased fees from the proposed project based  
10 on the value of the new facilities would likely be paid to Aiken and Barnwell Counties. These  
11 fee increases are likely to increase the SRS proportion of property tax revenues in Aiken and  
12 Barnwell Counties by some noticeable percentage (SCE&G 2009a).

13 The wages and salaries of the project workforce would have a multiplier effect that could result  
14 in increases in business activity, particularly in the retail and service sectors. SCE&G acquired  
15 RIMS II economic multiplier values specific to this economic impact area from the U.S. Bureau  
16 of Economic Analysis (BEA 2006), which permit detailed examination of potential economic  
17 impacts with individual multipliers attributable to construction activities and plant operations  
18 activities. Using the RIMS multiplier of 1.75, the 3600 construction jobs would create 2700  
19 indirect jobs in the economic impact area, for a total of 6300 jobs supported by the project.  
20 Because the review team assumes 50 percent of the project workforce would migrate to the  
21 region, the approximate net employment effect of the project would be 3150 new jobs spread  
22 over the four counties. This would have a beneficial but temporary impact on the business  
23 community and could provide (1) opportunities for new businesses to get started and (2)  
24 increased job opportunities for local residents. Once the new units are operational,  
25 approximately 800 new operations jobs would be added to the local economy. Using a  
26 multiplier of 2.64, the 800 operations and support jobs would create 1312 indirect jobs in the  
27 economic impact area, for a total of 2112 jobs supported by plant operations. Because the  
28 review team assumes 50 percent of the workforce would migrate to the region, the approximate  
29 net employment effect of operations would be 1056 new jobs spread over the four counties.  
30 Based on the information provided by SCE&G and the review team's independent evaluation,  
31 the review team concludes that the economic and tax base impacts of building and operating  
32 two new nuclear units at the SR alternative site would be minor in the four-county area, but  
33 would be noticeable in Aiken and Barnwell Counties.

#### 34 ***Transportation and Housing***

35 The proposed site can be accessed by a number of routes. The transportation network includes  
36 one east-west interstate highway (I-20), north-south US-1 and US-25/SC-121, and east-west  
37 US-78 and US-278. There are several other US and State highways in the SRS region. Delays



## Environmental Impacts of Alternatives

1 are currently experienced around the Savannah River bridges on I-20, US-25, and US-1.  
2 Sufficient railroad lines exist near the site. Given the extensive transportation network that  
3 exists in the SRS region and implementation of traffic-control measures such as staggering  
4 shifts, the review team expects transportation impacts from building and operating a nuclear  
5 facility on the SR alternative site to be minor.

6 Approximately 1800 construction workers would migrate into the region during peak project  
7 employment. Approximately 465 operations workers would migrate into the region by the time  
8 the facility becomes operational. Construction workers may choose to buy housing, rent, use  
9 mobile homes, or stay in a hotel/motel, while operations workers would likely choose to buy a  
10 house. According to the 2000 U.S. Census there were 187,811 housing units in the four-county  
11 economic impact area, of which 6400 in Aiken County 1170 in Barnwell County, 8392 in  
12 Richmond County, and 2201 in Columbia County were vacant, for a total of 18,163 vacant units  
13 (SCE&G 2009a). The review team expects that the in-migrating workforce could be absorbed  
14 by the region and the impacts would likely be minimal, but if a higher than expected number of  
15 workers decided to reside in one of the smaller counties such as Aiken or Barnwell County then  
16 the impact would be more noticeable. Based on the information provided by SCE&G and the  
17 review team's independent evaluation, the review team concludes that transportation and  
18 housing impacts of building and operating two new nuclear units at the SR alternative site would  
19 be minor across the four-county area, and would be noticeable in Aiken and Barnwell Counties  
20 but not destabilizing.

### 21 ***Public Services and Education***

22 In-migrating construction workers and plant operations workers would likely affect local  
23 municipal water, wastewater treatment facilities, and other public services in the region. These  
24 impacts would likely be in proportion with the demographic impacts experienced in the region,  
25 unless these resources have excess capacity or are particularly strained during building, which  
26 would decrease or increase the impact, respectively. The in-migrating workers represent a  
27 small portion of the total population of Aiken or Barnwell Counties and likely would not have a  
28 noticeable impact on their public services. During operations the impact on public services  
29 would likely be minimal.

30 SCE&G reports in its ER (SCE&G 2009a) that during the 2004–2005 school year, Aiken County  
31 had 40 PK-12 schools, Barnwell County had 11 schools, Richmond County had 89 schools, and  
32 Columbia County had 29 schools (SCE&G 2009a). Total enrollment for Aiken, Barnwell,  
33 Richmond, and Columbia Counties for the 2004–2005 school year was 25,299, 4721, 34,141,  
34 and 20,570, respectively. A maximum of 938 students are expected to migrate into the four-  
35 county economic impact area, during peak project employment and this number would decline  
36 to 484 during operations. Based on the analysis in the demography section above, it is  
37 expected that approximately 60.7 percent of the students would settle in Aiken County,  
38 7.1 percent in Barnwell County, 20.2 percent in Richmond, and 11.9 percent in Columbia

1 County. This would increase the student population in Aiken County by 2.3 percent, Barnwell  
2 County by 1.4 percent, Richmond County by 0.6 percent, and Columbia County by 0.5 percent.  
3 During facility operations, the increase in student body would be one percent for Aiken County,  
4 0.6 percent for Barnwell County, 0.2 percent for Richmond County, and 0.2 percent for  
5 Columbia County (SCE&G 2009a). During operation, this impact on schools would be  
6 significantly less due to the lower number of in-migrating students. Based on the information  
7 provided by SCE&G and the review team's independent evaluation, the review team concludes  
8 that public services and education impacts of building and operating two new nuclear units at  
9 the SR alternative site would be minor.

### 10 ***Aesthetics and Recreation***

11 The SRS is government-owned and not open to the public, but certain recreational activities  
12 such as guided tours, controlled deer hunts, and environmental studies are allowed on the site.  
13 Other recreational areas within 50 mi of the SRS include Sumter National Forest, Santee  
14 National Wildlife Refuge, Thurmond Lake, Crackerneck Wildlife Management Area, and various  
15 other State, county, and local parks. The intake structures would be visible to people recreating  
16 on the Savannah River in the immediate vicinity. Other facility structures would be similar to  
17 existing structures in the area and mainly hidden by river bends, elevated terrain, and  
18 vegetation (SCE&G 2009a). Project activities would increase the noise level at the site, but  
19 because of its location on an industrial site, this would likely only impact the current industrial  
20 residents. Based on the information provided by SCE&G and the review team's independent  
21 evaluation, the review team concludes that public aesthetics and recreation impacts of building  
22 and operating two new nuclear units at the SR site would be minimal.

### 23 ***Summary of Socioeconomics***

24 Physical impacts on workers and the general public include impacts on existing buildings,  
25 transportation, aesthetics, noise levels, and air quality. Social and economic impacts span  
26 issues of demographics, economy, taxes, infrastructure, and community services. In summary,  
27 on the basis of information provided by SCE&G and the review team's independent evaluation,  
28 the review team concludes that the impacts of building and operating a new nuclear plant at the  
29 SR alternative site on socioeconomics would be minimal and adverse for most of the region but  
30 could be noticeable but not destabilizing for Aiken and Barnwell Counties in terms of housing  
31 impacts during the building phase. During operation, these impacts are expected to be minimal.  
32 Impacts on aesthetics are expected to be minor. The impacts on the tax base of Aiken and  
33 Barnwell Counties during operations likely would be noticeable and beneficial; however only  
34 minor beneficial impacts would result in the rest of the region.

### 35 ***Cumulative Impacts***

## Environmental Impacts of Alternatives

1 The projects identified in Table 9-24, particularly the future urbanization of the metropolitan area  
2 of Augusta, Georgia, have contributed or would contribute to the demographics, economic  
3 climate, and community infrastructure of the region and generally result in increased  
4 urbanization and industrialization. Because the projects within the review area identified in  
5 Table 9-24 would be consistent with applicable land-use plans and control policies, the review  
6 team considers the cumulative socioeconomic impacts from the projects to be manageable.

7 For the analysis of socioeconomic impacts at the SR alternative site, the geographic area of  
8 interest is considered to be the 50-mi region centered on the SR alternative site, with special  
9 consideration of Richmond and Columbia Counties in Georgia and Aiken and Barnwell Counties  
10 in South Carolina, because that is where the review team expects socioeconomic impacts to be  
11 the greatest.

12 The SRS is a large site covering parts of Aiken, Barnwell, and Allendale Counties in  
13 southwestern South Carolina. The employment in the area surrounding the SR alternative site  
14 is a mixture of State and local government, retail, manufacturing, and construction. The majority  
15 of the region's workforce resides to the north in Aiken, Lexington, and Orangeburg in South  
16 Carolina, or in Richmond and Columbia Counties in Georgia to the northwest of the site. Since  
17 2001, however, there has been a shift away from the manufacturing sector towards other  
18 sectors. While still the largest single employment sector in the region, manufacturing's  
19 decline during the period of 2001 to 2007 was approximately 15 percent. Hardest hit by the  
20 contraction of the manufacturing sector has been Burke County, Georgia, part of the Augusta  
21 metropolitan area, which lost approximately 11,555 manufacturing jobs during this period of time  
22 (BEA 2009). The healthcare and social assistance sector was the fastest growing sector in the  
23 region, having grown approximately 23 percent from 31,368 employees in 2001 to 38,668  
24 employees in 2007 (BEA 2009). The United States Army Base, Fort Gordon, located in  
25 Richmond County and Columbia County, Georgia, also employs approximately 16,000 active  
26 personnel in addition to 3800 civilian employees (Augusta 2006). The facilities located at the  
27 SRS itself, although employing fewer now than it has in the past, continues to employ  
28 approximately 13,373 people combined as of 2003, 7845 (83 percent) of whom live in Aiken,  
29 Barnwell, or Richmond Counties (Augusta 2006).

30 In addition to assessing the socioeconomic impacts from the building and operations of two  
31 additional nuclear units on the SR alternative site, the cumulative impact is also considered.  
32 The cumulative analysis considers other past, present, and reasonably foreseeable future  
33 actions that could contribute to the cumulative socioeconomic impacts on a given region,  
34 including other Federal and non-Federal projects and the projects listed in Table 9-24. The  
35 projects identified in Table 9-24 have contributed or would contribute to the demographics,  
36 economic climate, and community infrastructure of the region and generally result in increased  
37 urbanization and industrialization. However, many impacts such as those on housing or public  
38 services are able to adjust over time, particularly with increased tax revenues. Furthermore,

1 State and county plans along with modeled demographic projections include forecasts of future  
2 development and population increases.

3 Because most projects described in Table 9-24 do not include any significant reasonably  
4 foreseeable changes in socioeconomic impacts within 50 mi of the SR alternative site, the  
5 review team determined there would be no significant additional cumulative socioeconomic  
6 impacts in the region from those activities. Any economic impacts associated with activities  
7 listed in Table 9-24 would have been considered as part of the socioeconomic baseline. For  
8 example, the construction and operation of the SRS MOX Fuel Fabrication facility is currently in  
9 year 3 of construction. The NRC estimated that at project peak employment a total of 1820 jobs  
10 would be supported by that project including direct and indirect employment (NRC 2003). Also,  
11 the VEGP received an ESP from NRC for two nuclear units to be constructed about 17 mi south  
12 of the SRS in Burke County, Georgia. The NRC staff estimated that project would require 3500  
13 direct construction jobs at peak employment, and the project is underway with an in-service date  
14 expected in 2016 if the NRC issues a COL. Of the 3500 direct jobs at peak employment, the  
15 NRC staff expects 2500 to migrate to the economic impact area, generating an additional 900  
16 indirect jobs, for a total employment impact of 3400 jobs at peak construction (NRC 2008). The  
17 review team concludes that because current employment numbers would reflect jobs created by  
18 these projects in their current state of progress, these projects already have been accounted for  
19 in the socioeconomic baseline of the Augusta and Aiken metropolitan areas, and would not  
20 noticeably increase the current cumulative economic activity. Upon operation of the VEGP  
21 Units 3 and 4, the NRC staff concluded that Burke County, Georgia would experience  
22 substantial beneficial tax revenue impacts, but that these impacts would be minor elsewhere in  
23 the Augusta metropolitan area.

24 The review team concludes that the socioeconomic impacts of the building and operation of a  
25 new two-unit nuclear plant at the SR alternative site would be SMALL and adverse across most  
26 of the region, but could be MODERATE and adverse for Aiken and Barnwell Counties in terms  
27 of housing impacts during the building phase. The cumulative impacts on the tax base of Aiken  
28 and Barnwell Counties during plant building and operation likely would be MODERATE and  
29 beneficial. Building and operating a new plant at the SR alternative site would make a  
30 noticeable incremental contribution to these impact levels.

### 31 **9.3.6.7 Environmental Justice**

32 In addition to environmental justice impacts from building and operations, the cumulative  
33 analysis considers other past, present, and reasonably foreseeable future actions that could  
34 contribute to disproportionate and adverse impacts on minorities and low-income populations,  
35 including other Federal and non-Federal projects and the projects listed in Table 9-24. For the  
36 analysis of environmental justice impacts at the SR alternative site, the geographic area of  
37 interest is considered to be the 50-mi region centered on the SR alternative site.

## Environmental Impacts of Alternatives

1 The SRS is a large site covering parts of Aiken, Barnwell, and Allendale Counties in  
2 southwestern South Carolina. The farms and residents in the area were affected by the original  
3 acquisition of the lands in the 1940s and 1950s making up the current site.

4 From an environmental justice perspective, the review team determined there is a potential for  
5 minority and low-income populations to be disproportionately and adversely affected by  
6 environmental impacts. Bordering the SRS, the review team found low-income, African  
7 American, and aggregated minority populations that exceed the percentage criteria established  
8 in Section 2.6.1 for environmental justice analyses, including the city of Aiken (2007 population  
9 29,218), which is within the vicinity of the SR alternative site (see Figure 9-13 and Figure 9-14).

10 Because the other projects described in Table 9-24 do not include any significant reasonably  
11 foreseeable changes in socioeconomic impacts within 50 mi of the SR alternative site, the  
12 review team concludes there would not be any significant additional cumulative environmental  
13 justice impacts in the region from those activities.

14 For example, the review team considered the SRS MOX Fuel Fabrication facility and VEGP  
15 Units 3 and 4 specifically for socioeconomic impacts. In the case of the MOX facility, the NRC  
16 staff concluded that environmental justice impacts would be minor. The NRC staff concluded  
17 that only minor environmental justice impacts would be expected from construction and  
18 operation of Units 3 and 4 at the VEGP. Any economic impacts associated with activities listed  
19 in Table 9-24 already have been considered as part of the socioeconomic baseline. For  
20 example, the economic impacts of existing enterprises such as mining, other electrical utilities,  
21 etc., are part of the base used for establishing the RIMS II multipliers. Regional planning efforts  
22 and associated demographic projections formed the basis for the review team's assessment of  
23 reasonably foreseeable future impacts.

24 Because of the rural nature of the two sites and the fact that the SRS also hosts an existing  
25 power plant, development of the proposed new units on the SR alternative site would have  
26 similar environmental justice impacts in most respects to adding two new units to the VCSNS  
27 site. However, as discussed in Section 9.3.3.6, the traffic-related impacts expected at the  
28 VCSNS site and the FA-1 site would not be expected at the SR alternative site because of the  
29 extensive road network providing access to the site from many directions. The review team  
30 expects that other potential environmental justice impacts would be similar to those analyzed for  
31 the VCSNS site, and would not result in disproportionate and adverse impacts on minority or  
32 low-income populations.

33 Based on the above considerations, information provided by SCE&G, visits to the site, and the  
34 review team's independent review, the review team concludes that when viewed in the context  
35 of the wider region, locating the proposed action at the SR alternative site would not contribute  
36 additional cumulative impacts beyond the impacts described in Chapters 4 and 5 for the VCSNS  
37 site. The review team did not identify any environmental pathways by which disproportionate  
38 and adverse impacts could affect minority or low-income populations or communities. Under



1  
 2 **Figure 9-13.** Aggregate Minority Populations in Block Groups that Meet the Environmental  
 3 Justice Selection Criteria at the Savannah River Alternative Site

# Environmental Impacts of Alternatives



1  
2 **Figure 9-14.** Low-Income Populations in Block Groups that Meet the Environmental Justice  
3 Selection Criteria at the Savannah River Alternative Site

1 the limitations of a reconnaissance-level analysis, the review team found no other health or  
2 physical considerations and no unique characteristics or practices that could lead to a  
3 disproportionately high and adverse impact on any minority or low-income community within  
4 region around the SR alternative site. Therefore, the review team concludes that the  
5 environmental justice impacts would be minimal locally and would not create pathways to  
6 increase expected cumulative impacts on minority and low-income populations in the region.

7 Based on its evaluation, the review team concludes that cumulative environmental justice  
8 impacts associated with building and operating two new nuclear units at the SR alternative site  
9 would be SMALL.

#### 10 **9.3.6.8 Historic and Cultural Resources**

11 The following cumulative impact analysis includes building and operating two new nuclear  
12 generating units at the SR alternative site. The analysis also considers other past, present, and  
13 reasonably foreseeable future actions that could impact cultural resources, including other  
14 Federal and non-Federal projects and the projects listed in Table 9-24. For the analysis of  
15 cultural impacts at the SR alternative site, the geographic area of interest is considered to be  
16 the APE that would be defined for this proposed undertaking. This includes the physical APE,  
17 defined as the area directly affected by the site-development and operation activities at the site  
18 and transmission lines, and the visual APE. The visual APE is defined as an additional 1-mi  
19 radius around the physical APE as a reasonable assumption for defining a maximum distance  
20 from which the structures can be seen.

21 Reconnaissance activities in a cultural resource review have particular meaning. For example,  
22 these activities include preliminary field investigations to confirm the presence or absence of  
23 cultural resources. However, in developing its EISs, the review team relies upon  
24 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-  
25 level information is data that are readily available from agencies and other public sources. It  
26 can also include information obtained through visits to the site area. To identify the historic and  
27 cultural resources at the SR alternative site the following information was used:

- 28 • SCE&G ER (SCE&G 2009a) – including the National Park Services National Register  
29 Information and information from the Savannah River Archaeological Research Program
- 30 • NRC EIS for the MOX facility (NRC 2005)
- 31 • NRC Alternative Sites Visit, March 2009.

32 Historically, the SRS and vicinity was largely undisturbed by land development and likely  
33 contained intact archaeological sites associated with the past 10,000 years of human  
34 settlement. Over time, portions of the SRS have been disturbed by forestry practices and  
35 development of the Federal nuclear facility (SCE&G 2009a, j). The Savannah River



## Environmental Impacts of Alternatives

1 Archaeological Research Program has extensive knowledge of the cultural resources located on  
2 the greater SRS, because the program has been conducting cultural resources work at DOE's  
3 Federal facility since the early 1970s. The SRS contains over 1000 prehistoric and historic  
4 American Indian and Euro-American cultural resources, most of which have not been formally  
5 evaluated for listing in the National Register (SCE&G 2009a). SCE&G also conducted a search  
6 to identify National Register properties within the five counties around the SR alternative site.  
7 SCE&G found that there are 103 properties listed in the National Register within those counties,  
8 but that none are within 6 mi of the SR alternative site (SCE&G 2009a). Extensive cultural  
9 resources knowledge of the SRS has resulted in the categorization of the SRS based on the  
10 potential for archaeological resources to be present. The proposed alternative site location is  
11 located in an area that is considered to have a low potential to contain archaeological resources  
12 (SCE&G 2009a) due to a general low density of archaeological sites in the area. The physical  
13 and visual APEs for a proposed plant at the SR alternative site do not appear to have any  
14 historic properties located within the area likely to be affected by building or operating new  
15 plants.

16 To accommodate the building of two nuclear units on the SR alternative site, SCE&G would  
17 need to clear approximately 500 ac of undeveloped land for the nuclear facility and associated  
18 structures and infrastructure (SCE&G 2009a). SCE&G has stated that as part of the site-  
19 selection process known cultural resource locations would be considered as avoidance areas  
20 (SCE&G 2009i, j). SCE&G has also stated that if the proposed project was sited at the SR  
21 alternative site, identification of cultural resources would be accomplished through cultural  
22 resource surveys. The results would be used in the site-planning process to avoid cultural  
23 resource impacts. If significant cultural resources were identified by these surveys, SCE&G  
24 would also develop protective measures similar to what it has in place for the VCSNS site. In  
25 addition, inadvertent discovery procedures would be developed if cultural resources were  
26 discovered during site-development activities (SCE&G 2009i).

27 To accommodate a nuclear power facility at the SR alternative site, SCE&G would need to  
28 construct three 230-kV transmission lines requiring a 100-ft-wide transmission-line corridor for a  
29 total of 2264 ac of transmission-line corridor. The most direct route would be used, avoiding  
30 populated areas, residences, and natural or manufactured conflicts when possible (SCE&G  
31 2009a). If the proposed project was sited at the SR alternative site, the staff assumes SCE&G  
32 would conduct its transmission-line-related cultural resource activities in ways similar to what  
33 they have committed to do for VCSNS site, as described in Section 4.6.

34 Past actions in the geographic area of interest that have similarly affected cultural and historic  
35 resources include forestry practices at the SRS and any road development and logging activities  
36 associated with those practices. None of the projects listed in Table 9-24 is located within the  
37 geographic area of interest and therefore, they have no potential for cumulative impact on  
38 cultural resources.

1 Activities associated with building two nuclear units and supporting facilities that can potentially  
2 directly affect cultural and historic resources include land clearing, excavation, and grading.  
3 Given SCE&G's site-planning process, and the lack of significant cultural resources known to  
4 exist at the SR alternative site based on reconnaissance-level information and the land  
5 disturbance where the new plant would be located, the impacts on cultural resources due to  
6 site-development activities would be negligible.

7 In addition, visual impacts from cooling towers and transmission lines could result in significant  
8 alterations to the visual landscape within the geographic area of interest. Given that there are  
9 no known cultural resources where the historic setting and character of the resources are  
10 important, the visual impacts would be negligible. The staff assumes that SCE&G and Santee  
11 Cooper would develop a management agreement in consultation with SHPO similar to the one  
12 that would be developed for the VCSNS site.

13 Impacts on cultural and historic resources from operation of two new nuclear units at the SR  
14 alternative site include those associated with the operation of new units and maintenance of  
15 transmission lines. The staff assumes that the same procedures currently used by SCE&G and  
16 Santee Cooper would be used for onsite and offsite maintenance activities. Consequently, the  
17 incremental effects of the maintenance of transmission-line corridors and operations of the two  
18 new units and associated impacts on cultural resources would be negligible.

19 Table 9-24 identifies projects within the geographic area of interest and includes the South  
20 Carolina Strategic Corridor System Plan, DOE's Savannah River Site, and future urbanization  
21 that could affect historic and cultural resources in a manner similar to those associated with the  
22 operation of two new units.

23 Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources  
24 is cumulative. Based on the information provided by the applicant and the review team's  
25 independent evaluation, the review team concludes that the cumulative impacts from building  
26 and operating two new nuclear generating units on the SR alternative site would be SMALL.  
27 This impact-level determination reflects no known cultural resources that could be affected;  
28 however, if the SR alternative site was to be developed, then cultural resource surveys may  
29 reveal important historic properties that could result in greater cumulative impacts.

### 30 **9.3.6.9 Air Quality**

31 Because the SR alternative site is located in a climate regime similar to the VCSNS site, the air  
32 quality impacts of building and operating a nuclear facility at the SR alternative site would be  
33 similar to the air quality impacts at the VCSNS site. As described in Sections 4.7 and 5.7, the  
34 review team determined that the impacts of building and operating two new nuclear units on air  
35 quality at the VCSNS site would be SMALL. Therefore, the impacts of building and operating  
36 two new nuclear units on air quality at the SR alternative site would be minimal.

## Environmental Impacts of Alternatives

1 The SR alternative site is located in the Augusta-Aiken Interstate Air Quality Control Region,  
2 which is designated as being in attainment with the NAAQSs (40 CFR 81.341) (SCE&G 2009a).  
3 The resource area defined for this evaluation includes Aiken and Barnwell Counties, South  
4 Carolina. Two counties were selected in this case because the SR alternative site could be  
5 located in either county. In general, designations of attainment or non-attainment are made on  
6 a county-by-county basis. As listed in Table 9-24, sources of gaseous emissions in Aiken and  
7 Barnwell Counties include facilities at DOE's SRS. The DOE SRS is classified as a major  
8 source and includes approximately 22 emission units that have a SCDHEC Air Quality Permit  
9 (TV-0080-0041). Emissions from these sources include, but are not limited to, sulfur dioxide,  
10 particulates, and nitrogen oxides (SRS 2009). Given the intermittent operation of the diesel  
11 generators at two new units, and that both Aiken and Barnwell Counties are currently in  
12 attainment, the review team concludes that the cumulative impacts on air quality from the  
13 operation of two new units would be SMALL.

14 Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6. As  
15 pointed out in Chapter 7, the impacts of the emissions are independent of emission location.  
16 Consequently, the discussions in the previous chapters and in Section 9.2.5 are applicable to  
17 two AP1000 reactors located at the SR alternative site. The impacts of greenhouse gas  
18 emissions at the SR alternative site considered in isolation would be minimal, and the  
19 cumulative impact of greenhouse gas emissions would be MODERATE, primarily due to  
20 national and world-wide impacts of emissions of greenhouse gases. Building and operating two  
21 new nuclear units at the SR alternative site would not be a significant contributor to the  
22 MODERATE impact.

### 23 **9.3.6.10 Nonradiological Health Impacts**

24 The following impact analysis for the SR alternative site includes impacts from building activities  
25 and operations. The analysis also considers past, present, and reasonably foreseeable future  
26 actions that affect the nonradiological health resources, including other Federal and non-Federal  
27 projects and the projects listed in Table 9-24. For the analysis of nonradiological health impacts  
28 at the SR alternative site, the geographic area of interest is considered to be the 6-mi area  
29 centered on the SR alternative site and the associated transmission-line corridors. This 6-mi  
30 radius is expected to encompass all nonradiological health impacts.

#### 31 ***Building Impacts***

32 Nonradiological health impacts from building two new nuclear units on construction workers and  
33 members of the public at the SR alternative site would be similar to those evaluated in Section  
34 4.8 for the proposed site. They include occupational injuries, noise, vehicle exhaust, and dust.  
35 Applicable Federal and State regulations on air quality and noise would be complied with during  
36 the site-preparation and building phase. The SR alternative site is located in a rural area and

1 building impacts would likely be negligible on the surrounding populations. These areas are  
2 classified as medium- and low-population areas.

3 There is only one past action in the geographic area of interest that has similarly affected  
4 nonradiological health and it is the construction of the DOE SRS, portions of which are located  
5 within less than 1 mi of the SR alternative site. There are no major current projects in the  
6 geographic area of interest that would cumulatively affect nonradiological health in a similar way.

7 Proposed future actions that would affect nonradiological health in a similar way to development  
8 at the SR alternative site would include the building and operation of the SRS MOX Fuel  
9 Fabrication facility (located approximately 5 mi from the proposed SR alternative site),  
10 transmission-line creation and/or upgrading, and future urbanization that would occur  
11 throughout the designated geographic region of interest. The review team concludes that the  
12 cumulative impacts on nonradiological health from building two new nuclear units and  
13 associated transmission lines at the SR alternative site would be minimal considering the low  
14 population density on and around the SR alternative site and its position within a DOE-  
15 controlled tract of more than 300 mi<sup>2</sup> of land.geographic

#### 16 ***Operational Impacts***

17 Occupational health impacts on operational employees would include those associated with  
18 plant operation and operation of the associated transmission lines, and they are fully described  
19 in Section 5.8. Based on the configuration of the proposed new units at the SR alternative site  
20 (closed-cycle, wet cooling system with mechanical draft cooling towers), etiological agents  
21 would not likely increase the incidence of waterborne diseases in the vicinity of the site.  
22 Impacts on workers' health from occupational injuries, noise, and electric fields would be similar  
23 to the proposed site. Noise and electric fields would be monitored and controlled in accordance  
24 with applicable OSHA regulations.

25 No past, present, or future actions in the geographic area of interest were identified that would  
26 significantly affect nonradiological health in ways similar to those associated with the operation  
27 of two new units at the SR alternative site. The review team therefore concludes that the  
28 impacts on nonradiological health from operating two new nuclear units and associated  
29 transmission lines at the SR alternative site would be minimal.

#### 30 ***Summary Statement***

31 Impacts on nonradiological health from the building and operation of two new units at the SR  
32 alternative site were estimated based in the information provided by SCE&G and the review  
33 team's independent evaluation. The review team concludes that health impacts on construction  
34 workers and the public resulting from the building of two new nuclear units at the SR alternative  
35 site would be SMALL. The review team expects that the occupational health impacts on the  
36 operations employees of two new nuclear units at the SR alternative site would be SMALL.

## Environmental Impacts of Alternatives

1 Similarly, impacts on public health of two new nuclear units operating at the SR alternative site  
2 would be SMALL.

3 There are past and future activities in the geographic area of interest that could affect  
4 nonradiological health in ways similar to the building of two units at the SR alternative site. The  
5 review team concludes, however, that cumulative impacts from past, present, and future actions  
6 on nonradiological health from building and operating two new units at the SR alternative site  
7 would be SMALL.

### 8 **9.3.6.11 Radiological Impacts of Normal Operations**

9 The following impact analysis includes radiological impacts on the public and workers from  
10 building activities and operations for two nuclear units at the SR alternative site. The analysis  
11 also considers other past, present, and reasonably foreseeable future actions that affect  
12 radiological health, including other Federal and non-Federal projects and the projects listed in  
13 Table 9-24. As described in Section 9.3.6, SRS is a DOE site. There are no reactors currently  
14 operating at the SRS, but there are mothballed reactors and other nuclear facilities on the SRS.  
15 The geographic area of interest is the area within a 50-mi radius of the SR alternative site.  
16 Facilities potentially affecting radiological health within this geographic area of interest are  
17 operating VEGP Units 1 and 2, proposed VEGP Units 3 and 4, the facilities throughout the DOE  
18 SRS containing radioactive material, the MOX Fuel Fabrication facility at the SRS, and the  
19 Energy Solutions (Barnwell) Low-Level Radioactive Waste Disposal Facility. In addition, there  
20 are likely to be hospitals and industrial facilities within 50 mi of the SR alternative site that use  
21 radioactive material.

22 The radiological impacts of building and operating the proposed two AP1000 plants at the SR  
23 alternative site include doses from direct radiation and liquid and gaseous radioactive effluents.  
24 These sources would result in low doses to people and biota offsite that would be well below  
25 regulatory limits. The impacts are expected to be similar to those estimated for the VSCNS site.

26 The radiological impacts of existing VEGP Units 1 and 2 include doses from direct radiation and  
27 liquid and gaseous radioactive effluents. These pathways would result in low doses to people  
28 and biota offsite that are well below regulatory limits as demonstrated by the ongoing  
29 radiological environmental monitoring program conducted around the Vogtle site. The EIS for  
30 proposed VEGP Units 3 and 4 indicates that operation of the proposed reactors would result in  
31 radiological impacts from direct radiation and liquid and gaseous radioactive effluents. The EIS  
32 indicates that these pathways would result in low doses to people and biota offsite that would be  
33 well below regulatory limits (NRC 2008b).

34 The SRS has active high-level radioactive waste processing facilities, processing and storage  
35 facilities for radioactive materials used in defense applications, mothballed nuclear reactors, and  
36 other nuclear facilities that would potentially have an impact on radiological health. The

1 radiological impacts of the various facilities at SRS and the SRS MOX facility would include  
2 doses from direct radiation and liquid and gaseous radioactive effluents. The radiological  
3 impacts from the Barnwell Low-Level Radioactive Waste Disposal Facility could also include  
4 doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result  
5 in low doses to people and biota offsite that are below applicable DOE and NRC regulatory  
6 limits. SRS conducts a radiological environmental monitoring program that measures radiation  
7 and concentrations of radioactive material from all sources in the environs of the SRS, including  
8 the Barnwell facility and confirms that the doses meet the regulatory limits.

9 In addition, the NRC staff concludes that the dose from direct radiation and effluents from  
10 hospitals and industrial facilities that use radioactive material would be an insignificant  
11 contribution to the cumulative impact around the SR alternative site. This conclusion is based  
12 on data from the radiological environmental monitoring programs conducted around currently  
13 operating nuclear power plants.

14 Based on the information provided by SCE&G and the NRC staff's independent analysis, the  
15 NRC staff concludes that the cumulative radiological impacts from building and operating the  
16 two proposed AP1000 plants and other existing and planned projects and actions in the  
17 geographic area of interest around the SR alternative site would be SMALL

#### 18 **9.3.6.12 Postulated Accident Impacts**

19 The following impact analysis includes radiological impacts from postulated accidents from  
20 operations for two nuclear units at the SR alternative site. The analysis also considers other  
21 past, present, and reasonably foreseeable future actions that affect radiological health from  
22 postulated accidents, including other Federal and non-Federal projects and the projects listed in  
23 Table 9-24. As described in Section 9.3.6, SRS is a DOE site. There are no reactors currently  
24 operating at the SRS, but there are mothballed reactors and other nuclear facilities on the SRS.  
25 The geographic area of interest considers all existing and proposed nuclear power plants that  
26 have the potential to increase the probability-weighted consequences (i.e., risks) from a severe  
27 accident at any location within 50 mi of the SR alternative site. Facilities potentially affecting  
28 radiological accident risk within this geographic area of interest are existing VCSNS Unit 1,  
29 VEGP Units 1 and 2, Hatch Units 1 and 2, facilities throughout the DOE SRS containing  
30 radioactive material, the MOX Fuel Fabrication facility at the SRS, and the Energy Solutions  
31 (Barnwell) Low-Level Radioactive Waste Disposal Facility. Also, two AP1000 reactors have  
32 been proposed at the Vogtle site. As described in Section 5.11.1, the NRC staff concludes that  
33 the environmental consequences of DBAs at the VCSNS site would be minimal for AP1000  
34 reactors. DBAs are addressed specifically to demonstrate that a reactor design is robust  
35 enough to meet NRC safety criteria. The AP1000 design is independent of site conditions, and  
36 the meteorology of the SR alternative and VCSNS sites are similar; therefore, the NRC staff  
37 concludes that the environmental consequences of DBAs at the SR alternative site would be  
38 minimal. Because the meteorology, population distribution, and land use for the SR alternative

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1 site are expected to be similar to the proposed VCSNS site, risks from a severe accident for an  
2 AP1000 reactor located at the SR alternative site are expected to be similar to those analyzed  
3 for the proposed VCSNS site. The risks for the proposed VCSNS site are presented in  
4 Tables 5-17 and 5-19 and are well below the median value for current-generation reactors. In  
5 addition, as discussed in Section 5.11.1, estimates of average individual early fatality and latent  
6 cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing  
7 plants within the geographic area of interest (VCSNS Unit 1, Hatch Units 1 and 2, and VEGP  
8 Units 1 and 2), the Commission has determined that the probability-weighted consequences of  
9 severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). Finally, according to the  
10 Vogtle ESP (NRC 2008a), the risks from this proposed site are also well below current-  
11 generation reactors and meet the Commission's safety goals.

12 There are no reactors currently operating at DOE's SRS; however, there is some severe  
13 accident risk associated with the spent nuclear fuel and other high-level radioactive wastes that  
14 may be processed or stored at SRS. The severe accident risks associated with stored spent  
15 fuel at operating nuclear power plants are lower than the risks for severe accidents involving the  
16 reactor core. Likewise, the severe accident risks associated any spent reactor fuel or other  
17 high-level radioactive waste processed or stored at SRS would be lower than the risks for  
18 severe accidents involving the reactor core. There is no irradiated fuel at the MOX Fuel  
19 Fabrication Facility at SRS, and this facility is designed to prevent inadvertent criticalities. Other  
20 facilities at SRS and the Barnwell Low-Level Radioactive Waste Disposal Facility may contain  
21 substantial amounts of radioactive material, but there is no credible severe accident risk like  
22 there is for an operating reactor. Therefore, the additional risk from these facilities is not  
23 significant in the evaluation of the cumulative severe accident risk for a nuclear power plant at  
24 the SR alternative site. On this basis, the NRC staff concludes that the cumulative risks from  
25 severe accidents at any location within 50 mi of the SR alternative site would be SMALL.

### 26 **9.3.7 Comparison of the Impacts of the Proposed Action and the Alternative** 27 **Sites**

28 This section summarizes the review team's characterization of the cumulative impacts related to  
29 locating a two-unit AP1000 nuclear power facility at the proposed VCSNS site and at each  
30 alternative site. The four sites selected for detailed review as part of the alternative sites  
31 environmental analysis included the FA-1 site located in Fairfield County, South Carolina; the  
32 CGS site located in Orangeburg County, South Carolina; the Saluda site located in Saluda  
33 County, South Carolina; and the SR alternative site located in Aiken County, South Carolina.  
34 Comparisons are made between the proposed site and alternatives to evaluate whether one of  
35 the alternative sites is environmentally preferable to the proposed site. The NRC's  
36 determination is independent of the USACE's determination under Section 404(b)(1) and its  
37 Guidelines at 40 CFR Part 230 of whether this site is the least environmentally damaging  
38 practical alternative (LEDPA). The USACE will conclude its analysis of both offsite and onsite

1 alternatives in its Record of Decision. The USACE alternatives evaluation is discussed in  
2 Section 9.5. The need to compare the proposed site with alternative sites arises from the  
3 requirement in NEPA Section 102(2)(C)(iii) (42 USC 4332) that EISs include an analysis of  
4 alternatives to the proposed action. The NRC criterion to be used in assessing whether a  
5 proposed site is to be rejected in favor of an alternative site is based on whether the alternative  
6 site is “obviously superior” to the site proposed by the applicant (Public Service Company of  
7 New Hampshire 1977). An alternative site is “obviously superior” to the proposed site if it is  
8 “clearly and substantially” superior to the proposed site (Rochester Gas & Electric Corp. 1978).  
9 The standard of obviously superior “...is designed to guarantee that a proposed site will not be  
10 rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can  
11 be confident that such action is called for” (New England Coalition on Nuclear Pollution 1978).

12 The “obviously superior” test is appropriate for two reasons. First, the analysis performed by  
13 NRC in evaluating alternative sites is necessarily imprecise. Key factors considered in the  
14 alternative site analysis, such as population distribution and density, hydrology, air quality,  
15 aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics, are  
16 difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site  
17 must have a wide range of uncertainty. Second, the applicant’s proposed site has been  
18 analyzed in detail, with the expectation that most of the adverse environmental impacts  
19 associated with the site have been identified. The alternative sites have not undergone a  
20 comparable level of detailed study. For these reasons, a proposed site may not be rejected in  
21 favor of an alternative site when the alternative site is marginally better than the proposed site,  
22 but only when it is obviously superior (Rochester Gas & Electric Corp. 1978). NEPA does not  
23 require that a nuclear plant be constructed on the single best site for environmental purposes.  
24 Rather, “...all that NEPA requires is that alternative sites be considered and that the effects on  
25 the environment of building the plant at the alternative sites be carefully studied and factored  
26 into the ultimate decision” (New England Coalition on Nuclear Pollution 1978).

27 Section 9.3.7.1 discusses the process the review team used to compare the alternative sites to  
28 the proposed VCSNS site. Cumulative impact levels from Chapter 7 (for the VCSNS), and the  
29 four alternative sites (from Sections 9.3.3 through 9.3.6) are listed in Table 9-31. Section  
30 9.3.7.2 and Section 9.3.7.3 discuss the cumulative impacts of the proposed project located at  
31 the VCSNS site and at the alternative sites as they relate to a determination of environmental  
32 preference or obvious superiority.

### 33 **9.3.7.1 Comparison of Cumulative Impacts at the Proposed and Alternative Sites**

34 The following section summarizes the review team’s independent assessment of the proposed  
35 and alternative sites. The team characterized the expected cumulative environmental impacts  
36 of building and operating new units at the VCSNS site and alternative sites; these impacts are  
37 summarized by category in Table 9-31. Full explanations for the specific impact  
38 characterizations are provided cumulatively in Chapter 7 for the proposed site and in Sections  
39 9.3.3, 9.3.4, 9.3.5, and 9.3.6 for each of the alternative sites. The review team’s impact



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1 **Table 9-31.** Comparison of Cumulative Impacts at the VCSNS Site and Alternative Sites

<b>Resource Category</b>	<b>VCSNS<sup>(a)</sup></b>	<b>FA-1</b>	<b>CGS</b>	<b>Saluda</b>	<b>SR</b>
Land Use	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Water-Related					
Surface-water use	SMALL	SMALL	MODERATE	MODERATE	SMALL
Groundwater use	SMALL	SMALL	MODERATE	SMALL	SMALL
Surface-water quality	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecological					
Terrestrial ecosystems	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic ecosystems	SMALL	SMALL	MODERATE	SMALL	SMALL
Socioeconomic					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL
Taxes and Economy	SMALL to LARGE and beneficial	SMALL to LARGE and beneficial	SMALL to LARGE and beneficial	SMALL to LARGE and beneficial	SMALL to MODERATE and beneficial
Public Services and Education	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Environmental Justice	SMALL to MODERATE (localized)	SMALL to MODERATE (localized)	SMALL	SMALL	SMALL
Historic and Cultural	MODERATE	SMALL	SMALL	SMALL	SMALL
Air Quality	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Nonradiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Radiological Impacts of Normal Operations	SMALL	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL	SMALL

(a) From Chapter 7, Cumulative Impacts Analysis for VCSNS

1 category levels are based on professional judgment, experience, and consideration of controls  
2 likely to be imposed under Federal, State or local permits that would not be acquired until after  
3 the review of a COL application is underway. The considerations and assumptions were  
4 similarly applied at each of the alternative sites to provide a common basis for comparison. In  
5 the following discussion, the review team compares the impact levels between the proposed site  
6 and each alternative site.

7 The cumulative environmental impact areas listed in the table have been evaluated using the  
8 NRC's three-level standard of significance: SMALL, MODERATE, or LARGE. These levels  
9 were developed using CEQ guidelines and are set forth in the footnotes to Table B-1 of 10 CFR  
10 Part 51, Subpart A, Appendix B:

11 SMALL – Environmental effects are not detectable or are so minor that they will  
12 neither destabilize nor noticeably alter any important attribute of the resource.

13 MODERATE – Environmental effects are sufficient to alter noticeably, but not to  
14 destabilize important attributes of the resource.

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

### 17 **9.3.7.2 Environmentally Preferable Sites**

18 The cumulative impacts of building and operating a two-unit nuclear power plant at the VCSNS  
19 site and at each alternative site are generally SMALL for many impact categories. The resource  
20 categories for which the impact level at an alternative site would be the same as the proposed  
21 site would not contribute to the determination that the alternative site is environmentally  
22 preferable to the proposed site. Therefore, these categories are not discussed further in  
23 determining whether an alternate site is environmentally preferable to the proposed site. Where  
24 there is a range of impacts for a resource, the upper range of the resource is used for the  
25 comparison. In addition, for those cases in which the cumulative impacts for a resource would  
26 be greater than SMALL, consideration is given to those cases in which the impacts of the  
27 project at the specific site would not make a significant contribution to the cumulative impact  
28 level. As shown in Table 9-31, there would be some differences in impacts among the sites.

29 Distinguishing cumulative impacts are primarily related to the development of greenfield sites  
30 and the impacts from likely transmission-line routing for the alternative sites on terrestrial and  
31 aquatic ecology, as well as socioeconomic impacts associated with a sudden influx of workers  
32 on existing infrastructure and populations. In addition, distinctions between the VCSNS site and  
33 alternative sites are found in the cumulative impacts associated with the consumptive water use  
34 and the potential impact on the available resources. Specific variations in cumulative impacts  
35 are discussed in the following paragraphs, which compare the VCSNS to each alternative site.

## Environmental Impacts of Alternatives

1 **VCSNS and FA-1:** Due to the proximity of VCSNS to the FA-1 alternative site, most of the  
2 cumulative impacts at the FA-1 site would be expected to be similar to the cumulative impacts  
3 described for the VCSNS site in Chapters 4 and 5. The only resource area for which the impact  
4 level differs between the VCSNS site and the FA-1 site is historic and cultural resources. The  
5 review team evaluated the impact on these resources at the VCSNS site as MODERATE based  
6 on impacts on the General Pearson Cemetery and the Daughters of the American Revolution  
7 Monument. As discussed in Section 4.6, the South Carolina SHPO has concurred with a finding  
8 of no adverse effect to the above historic sites, based on protective and avoidance measures  
9 being implemented by SCE&G (SCE&G 2009k). The impacts at the FA-1 site were evaluated  
10 as SMALL based on reconnaissance-level information. The review team also recognizes that  
11 the VCSNS site is a brownfield site with existing infrastructure and ancillary services, and it is  
12 likely that the impacts on ecology of building two new units at the VCSNS site would be  
13 somewhat less than the impacts of building the units at a greenfield site, such as the FA-1 site.  
14 On balance, the review team concludes that there would be little if any difference in the overall  
15 environmental impacts between the two sites. Therefore, the review team determined that the  
16 FA-1 site is not an environmentally preferable site to the VCSNS site.

17 **VCSNS and CGS:** The CGS site is a developed brownfield site with an existing coal-fired  
18 power plant. The proposed project would be co-located at the CGS site and would draw on the  
19 same resources as the existing plant. The VCSNS site is characterized more favorably than the  
20 CGS site in Table 9-24 for the following resource areas: groundwater use, aquatic ecosystems,  
21 demography, and public services and education. In all of these resource areas, the differences  
22 in ratings are specifically related to higher impacts at the CGS site from building and operating  
23 the two new units. The most significant difference relates to groundwater use. The new units  
24 would have to withdraw water from both the South Fork Edisto River and from groundwater to  
25 meet their needs and the amount of withdrawals would have a noticeable impact on the  
26 resource. The amount of surface-water withdrawals from the South Fork Edisto River would  
27 also have a noticeable impact on aquatic ecosystems. Impacts on Bamberg County in the area  
28 of demography and education would be noticeable during the building period.

29 The CGS site is rated more favorably than the VCSNS site for the following resource areas:  
30 transportation, environmental justice, and cultural and historic resources. For transportation and  
31 environmental justice the impacts are related to traffic near the VCSNS site during the building  
32 phase. The transportation and environmental justice issue related to traffic are the result of  
33 economic activity from thousands of relatively high-paying construction jobs being created by  
34 the building of VCSNS Units 2 and 3. The transportation and environmental justice issue  
35 related to traffic would subside once the building phase was completed. The impacts on cultural  
36 and historic resources at the CGS site were evaluated as SMALL based on reconnaissance-  
37 level information. The review team evaluated the impact on these resources at the VCSNS site  
38 as MODERATE based on impacts on the General Pearson Cemetery and the Daughters of the  
39 American Revolution Monument. As discussed in Section 4.6, the South Carolina SHPO has

1 concurred with a finding of no adverse effect on the above historic sites, based on protective  
2 and avoidance measures being implemented by SCE&G (SCE&G 2009k).

3 On balance, because of the greater impact on surface water and groundwater at CGS, the  
4 review team concludes that the impacts of building and operating two new nuclear units at the  
5 CGS site would be greater than the impacts of the same project at the VCSNS site. Therefore,  
6 the review team determined that the CGS site is not an environmentally preferable site to the  
7 VCSNS site.

8 **VCSNS and Saluda:** The Saluda site is an undeveloped greenfield site located on the Saluda  
9 River arm of Lake Murray. The VCSNS site is characterized more favorably than the Saluda  
10 site for aesthetics and recreation. As a greenfield site along a river, the impacts on aesthetics  
11 and recreation are greater at the Saluda site than at the VCSNS site.

12 The Saluda site is characterized more favorably than the VCSNS site for environmental justice  
13 and for historic and cultural resources. The environmental justice impacts are related to traffic  
14 near the VCSNS site during the building phase. The transportation and environmental justice  
15 issues related to traffic are the result of economic activity from thousands of relatively high-  
16 paying construction jobs being created by the building of VCSNS Units 2 and 3. The  
17 transportation and environmental justice issues related to traffic would subside once the building  
18 phase was completed. For historic and cultural resources, the review team evaluated the  
19 impact on these resources at the VCSNS site as MODERATE based on impacts on the General  
20 Pearson Cemetery and the Daughters of the American Revolution Monument. As discussed in  
21 Section 4.6, the South Carolina SHPO has concurred with a finding of no adverse effect on the  
22 above historic sites, based on protective and avoidance measures being implemented by  
23 SCE&G (SCE&G 2009k).

24 On balance, the review team concludes that the Saluda site and the VCSNS site rank closely  
25 and it would be difficult through a comparison of impacts in different resource categories to  
26 precisely state that one is better than the other from an environmental perspective. In such a  
27 case, the proposed site prevails because the alternative is not clearly environmentally  
28 preferable. Therefore, the review team has determined that the Saluda site is not an  
29 environmentally preferable site to the VCSNS site.

30 **VCSNS and SR:** The SR alternative site, situated within the SRS, is a large geographic site  
31 with well-developed existing infrastructure that would be capable of supporting the proposed  
32 project such as roads, railways, and site control. The VCSNS site is characterized more  
33 favorably than the SR site for taxes and the economy. The taxes and the economic impact  
34 would have a greater beneficial impact at the VCSNS site than it would at the SR alternative  
35 site. The SR alternative site is characterized more favorably than the VCSNS site in the areas  
36 of environmental justice and historic and cultural resources. The environmental justice impacts  
37 are related to traffic near the VCSNS site during the building phase. The transportation and

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1 environmental justice issues related to traffic are the result of economic activity from thousands  
2 of relatively high-paying construction jobs being created by the building of VCSNS units 2 and 3.  
3 The transportation and environmental justice issue related to traffic would subside once the  
4 building phase was completed. The environmental justice issues related to traffic would subside  
5 once the building phase was completed. For historic and cultural resources, the review team  
6 evaluated the impact on these resources at the VCSNS site as MODERATE based on impacts  
7 to the General Pearson Cemetery and the Daughters of the American Revolution Monument.  
8 As discussed in Section 4.6, the South Carolina SHPO has concurred with a finding of no  
9 adverse effect to the above historic sites, based on protective and avoidance measures being  
10 implemented by SCE&G (SCE&G 2009k). On balance, the review team concludes that there  
11 would be little if any overall difference in the environmental impacts between the two sites.  
12 Therefore, the review team has determined that the SR historic and cultural resources site is not  
13 an environmentally preferable site to the VCSNS site.

14 Although there are differences and distinctions between the cumulative environmental impacts  
15 of building and operating two new generating units at the VCSNS site and the alternative sites,  
16 the review team concludes that none of these differences is sufficient to determine that any one  
17 of the alternative sites is environmentally preferable to the VCSNS site.

### 18 **9.3.7.3 Obviously Superior Sites**

19 None of the alternative sites was determined to be environmentally preferable to the VCSNS  
20 site. Therefore, none of the alternative sites is obviously superior to the VCSNS site.

## 21 **9.4 System Design Alternatives**

22 The review team considered a variety of heat-dissipation systems and circulating-water system  
23 (CWS) alternatives. While other heat-dissipation systems and water systems exist in a nuclear  
24 power plant, by far the largest and the most likely to dominate the environmental consequences  
25 of operation is the CWS that cools and condenses the steam for the turbine generator. Other  
26 water systems, such as the service-water system, are much smaller than the CWS. As a result,  
27 the review team only considers alternative heat-dissipation and water-treatment systems for the  
28 CWS. The proposed CWS is a closed-cycle system that uses mechanical draft cooling towers  
29 for heat dissipation (SCE&G 2009a). The proposed system is discussed in detail in Chapter 3.

### 30 **9.4.1 Heat-Dissipation Systems**

31 About two-thirds of the heat from a commercial nuclear reactor is rejected as heat to the  
32 environment. The remaining one-third of the reactor-generated heat is converted into electricity.  
33 Normal heat-sink cooling systems transfer the rejected heat load into the atmosphere and/or  
34 nearby waterbodies, primarily as latent heat exchange (evaporating water) or sensible heat

1 exchange (warmer air or water). Different heat-dissipation systems rely on different exchange  
2 processes. The following sections describe alternative heat-dissipation systems considered by  
3 the review team for proposed VCSNS Units 2 and 3.

4 In its ER, SCE&G considered a range of heat-dissipation systems, including a once-through  
5 cooling system and several closed-cycle cooling systems. In addition to the closed-cycle  
6 mechanical draft cooling towers selected, SCE&G considered natural draft cooling towers,  
7 once-through cooling into Monticello Reservoir, cooling ponds, spray ponds, dry cooling towers,  
8 and a combination wet-dry cooling tower system (SCE&G 2009a). The review team also  
9 considered mechanical draft cooling towers with plume abatement.

#### 10 **9.4.1.1 Wet Natural Draft Cooling Towers**

11 Wet natural draft cooling towers, which use about the same amount of water as the proposed  
12 design, induce airflow up through large (600 ft tall and 400 ft in diameter) towers by cascading  
13 warm water downward in the lower portion of the cooling tower. As heat transfers from the  
14 water to the air in the tower, the air becomes more buoyant and rises. This buoyant circulation  
15 induces more air to enter the tower through its open base. The environmental aspects of wet  
16 natural draft cooling towers and mechanical draft cooling towers are very similar (SCE&G  
17 2009a). Because the water use is similar between natural and mechanical draft cooling towers,  
18 the entrainment and impingement of aquatic biota would be similar. Notable differences include  
19 that the natural draft cooling towers would be able to be seen from a great distance and the  
20 additional height increases the potential for avian collisions. The large size of the natural draft  
21 cooling towers has a greater visual and aesthetic impact than a mechanical draft cooling tower.  
22 The natural draft cooling towers would use slightly less energy than the mechanical draft cooling  
23 towers. The review team concludes that because the impacts of mechanical draft and natural  
24 draft cooling towers are similar; wet natural draft cooling towers would not be an  
25 environmentally preferable alternative for the VCSNS site.

#### 26 **9.4.1.2 Once-Through Cooling**

27 Once-through cooling systems withdraw water from the source waterbody and return virtually  
28 the same volume of water to the receiving waterbody at an elevated temperature. Typically the  
29 source waterbody and the receiving waterbody are the same body, and the intake and  
30 discharge structures are separated to limit recirculation. While there is essentially no  
31 consumptive use of water in a once-through heat-dissipation system, the elevated temperature  
32 of the receiving waterbody would result in some induced evaporative loss that decreases the net  
33 water supply. The large intake and discharge flows associated with once-through cooling  
34 systems require large intake and discharge structures, result in higher levels of impingement  
35 and entrainment, and may result in hydrologic alterations in the source/receiving waterbodies.  
36 Based on recent changes to implementation plans to meet Section 316(b) of the Clean Water

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1 Act, the review team has determined that once-through cooling systems for new nuclear  
2 reactors are unlikely to be permitted in the future, except in rare and unique situations.

3 VCSNS Unit 1 uses a once-through cooling system using Monticello Reservoir as a cooling  
4 pond. If VCSNS Units 2 and 3 were to adopt this design to be used with the AP1000 reactors,  
5 the water-supply needs for these two units would be 1,700,000 gpm (SCE&G 2009a). SCE&G  
6 has determined that this volume of water cannot be practically supplied by the Monticello  
7 Reservoir and Broad River. For this reason, in addition to the Clean Water Act considerations,  
8 the review team determined that once-through designs were not a feasible alternative design  
9 and eliminated it from further consideration as part of the VCSNS Units 2 and 3 cooling system.

### 10 **9.4.1.3 Cooling Pond**

11 Use of a recirculating cooling pond separate from Monticello Reservoir, Parr Reservoir, and the  
12 Broad River was considered as an alternative cooling system design. Previous studies for  
13 VCSNS Unit 1 have shown that a recirculating pond would likely need to cover an area of 900 to  
14 1800 ac (SCE&G 2009a) for each of the two additional units. The dedication of an area of this  
15 size was weighed against the SMALL thermal impact on Monticello and Parr reservoirs from the  
16 current design of the VCSNS Units 2 and 3 cooling system. The other option was to create a  
17 3600-ac cooling pond by isolating part of the Monticello Reservoir and using that as a cooling  
18 pond. This option would avoid taking additional land out of use for a cooling pond, but it would  
19 have the environmental disadvantage of causing significant aquatic impact on 3600 ac of the  
20 reservoirs. The review team determined that due to the impact of the loss of land associated  
21 with development of additional cooling ponds or the increase in aquatic impacts if the cooling  
22 pond used part of the existing reservoirs, a cooling system using a recirculating cooling pond  
23 was not an environmentally preferable alternative to the VCSNS site.

### 24 **9.4.1.4 Spray Ponds**

25 Spray-pond cooling systems use manufactured ponds to cool water and enhance evaporative  
26 cooling by spraying water into the atmosphere. In addition to evaporation, heat transfer from  
27 the spray ponds to the atmosphere occurs through black-body radiation and conduction. A  
28 spray-pond system alternative was evaluated for cooling VCSNS Units 2 and 3, and it would  
29 require a 150-ac pond. Based on the additional land required to build the spray-pond and the  
30 impact from spray drift, the review team concludes that use of a spray pond would not be an  
31 environmentally preferable alternative for the VCSNS site.

### 32 **9.4.1.5 Dry Cooling Towers**

33 Dry cooling towers would eliminate virtually all water-related impacts from the cooling system  
34 operation. No makeup water would be needed, and no blowdown water would be generated.  
35 However, dry cooling systems require much larger cooling systems, result in some loss in

1 electrical generation efficiency because the theoretical approach temperature is limited to the  
2 dry-bulb temperature and not the lower wet-bulb temperature, and they result in parasitic energy  
3 losses for the large array of fans involved. This loss in generation efficiency translates into  
4 increased impacts on the fuel cycle. Dry cooling could reduce water-related impacts. However,  
5 the aquatic impacts at the VCSNS site were determined to be SMALL; therefore, the wet cooling  
6 towers have only a minimal impact, and any incremental gain by the dry cooling towers would  
7 be offset by the increased impacts on the fuel cycle. The review team determined that building  
8 and operation of dry cooling towers would not be an environmentally preferable alternative for  
9 the VCSNS site because of the availability of cooling water, inefficiencies in energy production  
10 associated with dry cooling resulting in higher fuel cycle impacts, and the lack of sensitive  
11 biological resources that would be affected by water withdrawn for cooling.

#### 12 **9.4.1.6 Combination Wet/Dry Cooling-Tower System**

13 A combination mechanical draft wet/dry cooling tower system uses both wet and dry cooling  
14 cells to limit consumption of cooling water, often with the added benefit of reducing plume  
15 visibility. Water used to cool the turbine generators generally passes first through the dry  
16 portion of the cooling tower where heat is removed by drawing air at ambient temperature over  
17 tubes through which the water is moving. Cooling water leaving the dry portion of the tower  
18 then passes through the wet tower where the water is sprayed into a moving air stream and  
19 additional heat is removed through evaporation and sensible heat transfer. When ambient air  
20 temperatures are low, the dry portion of these cooling towers may be sufficient to meet cooling  
21 needs. The use of the dry portion of the system would result in a loss in generating efficiency  
22 that would translate into increased impacts on the fuel cycle. As discussed in Chapters 4 and 5,  
23 the impacts of the proposed cooling system (mechanical draft tower) for aquatic ecology, water  
24 use, and water quality for the building and operation are SMALL. While a combination wet/dry  
25 cooling system would reduce these impacts, there would be an increase in fuel cycle impacts  
26 because the increased use of resources to generate electricity. Therefore, the review team  
27 concludes that the building and operation of a combined wet/dry cooling tower system would not  
28 be an environmentally preferable alternative for the VCSNS site.

#### 29 **9.4.1.7 Mechanical Draft with Plume Abatement**

30 Adding additional heat to a saturated cooling tower exhaust, without adding additional water,  
31 would result in subsaturated water vapor. Subsaturated water vapor reduces the potential for a  
32 visible plume. The concept behind a mechanical draft cooling tower with plume abatement is  
33 similar to the wet/dry cooling system described above with the design parameters focused on  
34 reducing the visual plume. Such designs may also result in less consumptive water use.  
35 However, there is sufficient water at VCSNS site for use of a mechanical draft cooling system  
36 without plume abatement. The aesthetic impacts at the VCSNS site with a mechanical draft  
37 cooling tower without plume abatement were determined to be SMALL; therefore a mechanical  
38 draft tower with plume abatement offers no real advantage. These towers often have a larger



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1 footprint and require additional energy to operate, resulting in a net loss of energy available to  
2 meet the demand for power. For these reasons, the review team concludes that the building  
3 and operation of mechanical draft cooling towers with plume abatement would not be an  
4 environmentally preferable alternative for the VCSNS site.

### 5 **9.4.2 Circulating-Water Systems**

6 The review team evaluated alternatives to the proposed intakes and discharges for the normal  
7 heat-sink cooling system, based on the proposed heat-dissipation system water requirements.  
8 The capacity requirements of the intake and discharge system are defined by the proposed  
9 heat-dissipation system. For proposed VCSNS Units 2 and 3, the proposed heat-dissipation  
10 system is a closed-loop system that uses mechanical draft cooling towers for heat dissipation.  
11 SCE&G (2009a) indicated that the maximum makeup-water demand for two AP1000 units at the  
12 site is estimated to be 58,800 gpm. SCE&G identified two potential sources of makeup-water  
13 supply for the VCSNS site: Monticello Reservoir and Parr Reservoir. In addition, the review  
14 team considered water reuse and groundwater in its evaluation of alternative water supplies.

#### 15 **9.4.2.1 Intake Alternatives**

16 The proposed intake structures for VCSNS Units 2 and 3 are described in detail in Section  
17 3.2.2.2. SCE&G plans to construct an intake-approach channel, intake structure, water pumps,  
18 and biofouling-treatment systems on Monticello Reservoir. The intake structure would be 60 ft  
19 long and 75 ft wide, with six pump bays including a pump, trash rack, and traveling screen  
20 (SCE&G 2009a). The intake structure would be designed to have a through-trash-rack velocity  
21 of less than 0.5 fps.

22 SCE&G selected the location of the intake structure for the proposed action to avoid the FPSF  
23 and the VCSNS Unit 1 discharge. SCE&G considered two alternatives for the intake system in  
24 addition to the proposed system: (1) offshore intake with offshore pump and active screening,  
25 and (2) onshore pump intake with submerged passive screens. In addition, the review team  
26 considered the use of radial collector wells located on the shore of Monticello Reservoir.

27 The offshore intake alternative has an advantage, if shoreline structures would conflict with a  
28 shoreline intake or if bathymetry or vegetation considerations make a shoreline intake less  
29 desirable. At the VCSNS site, the conditions that would make a shoreline intake advantageous  
30 do not occur. The shoreline option is preferable to an offshore intake with offshore pumps due  
31 to the ease of its installation. Offshore intakes with submerged passive screens are more  
32 difficult to maintain when ambient currents do not facilitate the removal of debris. For intakes on  
33 reservoirs, ambient currents are not typically strong enough to facilitate the removal of debris.

34 A radial collector-well system was considered by the review team because in many cases it  
35 reduces the impact on aquatic resources and, when water is being withdrawn from turbid

1 environments, can reduce the water treatment needed prior to its introduction into the cooling  
2 system. A radial collector-well system consists of an excavated central concrete caisson with  
3 well screens projected laterally outward in a radial pattern (Riegert 2006). Radial collector wells  
4 slowly draw surface water through the subsurface layer and, thereby, filter out some sediment  
5 that might have required treatment if the water had been directly withdrawn from the surface  
6 waterbody. In general, collecting surface water in this way eliminates most of the direct  
7 operational impacts on aquatic ecosystems (e.g., entrainment and impingement) associated  
8 with water withdrawal and eliminates some of the construction and preconstruction impacts  
9 (e.g., dredging). The review team determined that radial collector wells, which would induce  
10 flow through the sediments the Monticello Reservoir into lateral subterranean pipes extending  
11 from the shoreline out beneath the reservoir, would require multiple large structures near the  
12 shoreline. SCE&G did not consider this alternative water source, but the review team  
13 independently determined that a radial collector-well system is not environmentally preferable to  
14 the proposed direct withdrawal from the river due to the requirement for multiple new shoreline  
15 structures.

16 Therefore, the review team concludes that there would be no alternative intake designs that  
17 would be environmentally preferable to proposed intake design for the VCSNS site.

#### 18 **9.4.2.2 Discharge Alternatives**

19 SCE&G proposes to discharge blowdown from VCSNS Units 2 and 3 to Parr Reservoir through  
20 a 36-in. diffuser that extends out into the reservoir. A detailed description of the proposed  
21 discharge system is presented in Section 3.2.2.2.

22 SCE&G considered shoreline discharge and two alternative locations of the diffuser at the  
23 selected discharge location, and examined a number of diffuser port designs before arriving at  
24 the selected alternative. Shoreline discharge was rejected because of the shallow bathymetry  
25 of Parr Reservoir in the possible outfall locations. Water depth was a key consideration in  
26 evaluating alternative diffuser locations. Increased depth of placement offers better conditions  
27 for mixing prior to the thermal plume rising to the surface. Cornell Mixing Zone Expert System  
28 (CORMIX) modeling performed by SCE&G helped to confirm the advantages of the  
29 offshore/deeper location. CORMIX was also used to evaluate a number of diffuser options. A  
30 20-port diffuser was found to provide better conditions than the originally proposed 4-port  
31 diffuser and was sufficient to meet mixing objectives (SCE&G 2009a).

32 Alternative paths for the blowdown lines were also considered. The proposed route of these  
33 lines is along the eastern shore of Parr Reservoir. An alternative path would have taken the  
34 blowdown lines along the existing transmission-line corridor. This alternative would have  
35 transected a wetland and therefore was determined to be environmentally less preferable to the  
36 proposed route.

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1 The review team also considered the option of discharging blowdown from proposed VCSNS  
2 Units 2 and 3 through the Unit 1 discharge canal into Monticello Reservoir. Unit 1 is a once-  
3 through cooling plant that currently discharges 534,000 gpm to the reservoir. The total  
4 discharge under normal conditions from Units 2 and 3 via the blowdown pipeline would be  
5 9383 gpm; maximum discharge would be 30,547 gpm (SCE&G 2009a). Under normal  
6 conditions this would be less than 2 percent of the volume of water discharged from Unit 1 and  
7 the impact of discharging this additional water to the reservoir would likely be insignificant. The  
8 cooling-tower basins for proposed Units 2 and 3 are at an elevation approximately 25 ft below  
9 the elevation of Monticello Reservoir (SCE&G 2009I). As a result, discharge from the cooling-  
10 tower basins would need to be pumped up to the Unit 1 discharge canal. The energy consumed  
11 to operate these pumps would reduce the overall efficiency of the plant without any  
12 compensating environmental benefit and would not be environmentally preferable to the  
13 proposed design.

14 The review team determined that the impacts of operation of the proposed discharge system  
15 would be SMALL and that there are no alternative discharge designs that would be  
16 environmentally preferable to the proposed discharge design at the VCSNS site.

### 17 **9.4.2.3 Water Supplies**

18 The review team considered alternative sources for the CWS, including water reuse,  
19 groundwater, and surface water.

#### 20 ***Water Reuse***

21 Sources of water for reuse can come either from the plant itself or from other local water users.  
22 Sanitary wastewater-treatment plants are the most ubiquitous sources of water for reuse.  
23 Agricultural processing, industrial processing, and oilfield production can also provide significant  
24 supplies of water for reuse. Additional treatment (e.g., tertiary treatment, chlorination) may be  
25 required to provide water of appropriate quality for the specific plant need. The population is  
26 very low, and there is little industry around the VCSNS site, so adequate reliable wastewater  
27 sources are not currently available. As a result, no sources of water for reuse at the site were  
28 identified. Therefore, the review team determined that water reuse would not be a feasible  
29 alternative to SCE&G's proposed water supply and was not evaluated further.

#### 30 ***Groundwater***

31 Groundwater is not considered a viable source of cooling water for VCSNS Units 2 and 3  
32 because the geologic formations in the vicinity of the site generally are not pervious enough to  
33 sustain well yields greater than a few gallons per minute (SCE&G 2009a). Characterization  
34 performed at the proposed site of Units 2 and 3 supports this assertion (SCE&G 2009a), and  
35 the review team finds that the groundwater resource could not meet the cooling water demands

1 of proposed VCSNS Units 2 and 3. Therefore, the review team determined that groundwater  
2 would not be a feasible alternative to SCE&G's proposed water supply.

### 3 **Surface Water**

4 The two potential sources of surface water to supply makeup water to VCSNS Units 2 and 3 are  
5 the Monticello Reservoir and Parr Reservoir. Both of these reservoirs obtain most of their water  
6 from the Broad River. SCE&G has chosen to withdraw water from Monticello Reservoir  
7 because it is at a higher elevation and requires less lift to move water from the reservoir to the  
8 cooling tower basins for the proposed units, and because water from Monticello Reservoir does  
9 not experience the variation in turbidity that Parr Reservoir experiences during periods of high  
10 runoff. For these reasons the review team concludes that withdrawing makeup water from Parr  
11 Reservoir would not be an environmentally preferable alternative to SCE&G's proposal to  
12 withdraw makeup water from Monticello Reservoir.

#### 13 **9.4.2.4 Water Treatment**

14 Both inflow and effluent water may require treatment to ensure that they meet plant water needs  
15 and effluent water standards. SCE&G proposes to add chemicals to plant water to meet  
16 appropriate water-quality process needs. The chemistry of effluent water is regulated by the  
17 EPA through the NPDES permitting process. The largest chemical inputs are required to  
18 maintain the appropriate chemistry in the cooling towers to preclude biofouling. The review  
19 team identified no environmentally preferable alternative to SCE&G's proposed chemical water  
20 treatment. The effluents from cooling-tower blowdown are specifically regulated in 40 CFR Part  
21 423 by the EPA to protect the environment.

#### 22 **9.4.3 Summary**

23 The review team considered alternative systems designs, including five alternative heat-  
24 dissipation systems and alternative intake, discharge, and water-supply systems. As discussed  
25 in previous sections, the review team identified no alternative that was environmentally  
26 preferable to the proposed VCSNS plant systems design.

## 27 **9.5 U.S. Army Corps of Engineers Alternatives Evaluation**

28 The 404(b)(1) Guidelines stipulate that no discharge of dredged or fill material into waters of the  
29 United States (including jurisdictional wetlands) shall be permitted if there is a practicable  
30 alternative that would have a less adverse impact on the aquatic environment, as long as the  
31 alternative does not have other significant adverse environmental consequences. An alternative  
32 is practicable if it is available and capable of being done after taking into consideration cost,  
33 existing technology, and logistics in light of overall project purposes. If it is otherwise a

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1 practicable alternative, an area not presently owned by the applicant that could reasonably be  
2 obtained, used, expanded, or managed in order to fulfill the basic purpose of the proposed  
3 activity may be considered. Thus, this analysis is necessary to determine which alternative is  
4 the LEDPA that meets the project purpose and need. Even if an applicant's proposed  
5 alternative is determined to be the LEDPA, the USACE must still determine whether the LEDPA  
6 is in the public interest. The USACE Public Interest Review, described in 33 CFR 320.4, directs  
7 the USACE to consider a number of factors in a balancing process. A permit would not be  
8 issued for an alternative that is not the LEDPA, nor would a permit be issued for an activity that  
9 is determined to be contrary to the public interest.

### 10 **9.5.1 Onsite Alternatives**

11 As part of its process for evaluating permits, the USACE reviewed SCE&G's application and ER  
12 for the proposed VCSNS Units 2 and 3 project, responses to RAIs, data regarding impacts on  
13 alternative sites, and SCE&G information addressing onsite alternatives for the VCSNS site to  
14 minimize impacts on wetlands and other waters of the United States. Within this  
15 documentation, SCE&G provided a detailed description of the steps taken to minimize onsite  
16 impacts, including alternative site layouts. According to information provided by SCE&G, the  
17 site layout with the least impact on waters of the United States for the proposed VCSNS site has  
18 0.26 ac of permanent wetland fill impacts and 774 linear feet of permanent fill impacts on a  
19 single stream (Stream L).

20 This draft EIS provides environmental information and analyses upon which the LEDPA  
21 judgment will be based. However, the LEDPA evaluation cannot be completed by the USACE  
22 until it receives public feedback in the form of public comments on the draft EIS. The USACE  
23 will address whether the LEDPA criterion is met in the Record of Decision.

### 24 **9.5.2 SCE&G Alternative Sites**

25 As noted previously, the evaluation and comparison of potential impacts on waters of the United  
26 States among the proposed and four alternative sites is limited by the lack of detailed data for all  
27 but the VCSNS site. SCE&G requested and received a jurisdictional determination from the  
28 USACE (valid through June 29, 2014) that identified 44.3 ac of wetlands and 49,288 linear feet  
29 of streams subject to Clean Water Act jurisdiction. Waters of the United States were estimated  
30 for FA-1, CGS, Saluda, and SR alternative sites using a combination of available data  
31 resources, including FWS National Wetlands Inventory mapping, U.S. Department of  
32 Agriculture-Natural Resources Conservation Service soils mapping, 2006 infrared aerial  
33 imagery, SCDHEC State Navigable Waters mapping, USGS 7.5-minute quadrangle maps, and  
34 National Hydrography Dataset. For alternative sites and their associated transmission lines,  
35 data were reported as acres of forested and nonforested wetlands, as well as linear distance for  
36 streams. It is important to note that transmission-line routes are not finalized and therefore may

1 be subject to change. Note also that impacts on alternative sites include those areas that would  
 2 be occupied by principal site component footprints such as the powerblock, cooling towers, and  
 3 switchyard, as well as impacts resulting from intake and discharge water lines. In the absence  
 4 of detailed topographic design data, it is not feasible to include impacts from associated fill  
 5 slopes for these components or from other necessary ancillary facilities. Using this information,  
 6 Table 9-32 presents the impacts on waters of the United States for each alternative considered,  
 7 including each site and its associated transmission lines. Impacts for transmission lines are  
 8 calculated based solely on the total area of permanent clearing that would be required for  
 9 forested wetlands.

10 **Table 9-32.** Comparison of Impacts on Waters of the United States for the Proposed and Four  
 11 Alternative Sites

	FA-1	CGS	Saluda	SR	VCSNS
Sites					
Wetland impacts (fill, ac)	3.1	15.9	7.3	14.6	0.3
Stream impacts (fill, linear ft)	5344.4	432.2	6106.4	1628.3	774
Open water impacts (fill, ac)	1.4	0	1.3	0.6	1.0
<b>Total wetland and open water impacts (fill, ac)</b>	<b>4.5</b>	<b>15.9</b>	<b>8.6</b>	<b>15.2</b>	<b>1.3</b>
Transmission Lines					
SCE&G T-lines					
Wetland impacts (clearing forest, ac) <sup>(a)</sup>	238.6	103.5	197.5	168.2	219.2
Santee Cooper lines					
Wetlands impacts (clearing forest, ac) <sup>(a)</sup>	14	138	9	65	0.6
<b>Total wetland impacts for transmission lines (clearing forest, ac)</b>	<b>252.6</b>	<b>241.5</b>	<b>206.5</b>	<b>233.2</b>	<b>219.8</b>
<b>Total wetland impacts (fill plus clearing forest, ac)</b>	<b>257.1</b>	<b>257.4</b>	<b>215.1</b>	<b>248.4</b>	<b>221.1</b>
(a) Wetland impacts for FA-1, CGS, Saluda, and SR alternatives based on published mapping data, including but not limited to NWI maps. Wetland impacts for VCSNS alternative (proposed action) based on onsite routine wetland delineation.					

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## 10.0 Conclusions and Recommendations

This chapter provides a discussion of the conclusions reached in earlier parts of this environmental impact statement (EIS), as well as the U.S. Nuclear Regulatory Commission (NRC) staff's recommendations. Section 10.1 summarizes the impacts of the proposed action, Section 10.2 summarizes the proposed project's unavoidable adverse impacts with an accompanying table, and Section 10.3 discusses the relationship between the short-term use of resources and long-term productivity of the human environment. Section 10.4 summarizes the irretrievable and irreversible use of resources and Section 10.5 summarizes the alternatives to the proposed action. Section 10.6 discusses benefits and costs. Section 10.7 includes the NRC staff's recommendation.

On March 27, 2008, the NRC received an application from South Carolina Electric and Gas (SCE&G), acting for itself and for Santee Cooper (the State-owned electric and water utility, formally called the South Carolina Public Service Authority), for combined construction permits and operating licenses (COLs) for two new nuclear reactors at the Virgil C. Summer Nuclear Station (VCSNS) in Fairfield County, South Carolina (SCE&G 2008). The proposed VCSNS Units 2 and 3 would be jointly owned by SCE&G (55 percent) and Santee Cooper (45 percent), and operated by SCE&G (SCE&G 2009a). VCSNS Unit 1 is also jointly owned by SCE&G (66.7 percent) and Santee Cooper (33.3 percent), and operated by SCE&G (NRC 2004). With the exception of transmission systems needed to route power from the proposed units, all of the construction and operation related to VCSNS Units 2 and 3 would be completely within the confines of the VCSNS site (SCE&G 2009b). The reactors specified in the application are Westinghouse Electric Company, LLC (Westinghouse) Advanced Passive 1000 (AP1000) pressurized water reactors. The application references Revision 17 of the AP1000 certified design. On March 2, 2010, SCE&G submitted an application to the U.S. Army Corps of Engineers (USACE) for a Department of the Army (DA) permit to conduct construction activities that would result in alteration of waters of the United States, including wetlands. The USACE is participating in preparing this environmental impact statement (EIS) as a cooperating agency.

The proposed actions in the COL and USACE joint permit applications are (1) NRC issuance of COLs for construction and operation of two new nuclear power reactors at the VCSNS site in Fairfield County, South Carolina, and (2) USACE issuance of permits pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251 et. seq. [Clean Water Act]), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403) to perform certain construction activities on the site.

SCE&G submitted the *Combined Application of South Carolina Electric and Gas Company for a Certificate of Environmental Compatibility and Public Convenience and for a Base Load Review Order for the Construction and Operation of a Nuclear Facility in*

## Conclusions and Recommendations

1 *Jenkinsville, South Carolina*, to the Public Service Commission of South Carolina (PSCSC) on  
2 May 30, 2008. The final order issued by the PSCSC approving the combined application and  
3 Certificate of Environmental Compatibility and Public Convenience and Necessity (CPCN) was  
4 issued to SCE&G on March 2, 2009 (PSCSC 2009, p. 123).

5 Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC  
6 4321) directs that an EIS is required for major Federal actions that significantly affect the quality  
7 of the human environment. Section 102(2)(C) of NEPA requires that an EIS include information  
8 about the following:

- 9 • the environmental impact of the proposed action
- 10 • any adverse environmental effects that cannot be avoided should the proposal be  
11 implemented
- 12 • alternatives to the proposed action
- 13 • the relationship between local short-term uses of the environment and the maintenance and  
14 enhancement of long-term productivity
- 15 • any irreversible and irretrievable commitments of resources that would be involved if the  
16 proposed action is implemented.

17 The NRC has implemented NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51.  
18 In 10 CFR 51.20, the NRC requires preparation of an EIS for issuance of COLs. Subpart C of  
19 10 CFR Part 52 contains the NRC regulations related to COLs.

20 Included in this EIS are (1) the results of the review team's preliminary analyses, which consider  
21 and weigh the environmental effects of the proposed action and of constructing and operating  
22 two new nuclear units at the VCSNS; (2) mitigation measures for reducing or avoiding adverse  
23 effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the NRC  
24 staff's recommendation regarding the proposed action based on its environmental review. The  
25 USACE will base its evaluation of the DA Individual Permit application on the requirements of  
26 USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public  
27 interest review process. The USACE permit decision will be made following issuance of the  
28 final EIS.

29 The environmental review described in this EIS was conducted by a joint NRC/USACE team.  
30 The review team was composed of NRC staff, its contractor's staff, and staff from the USACE.  
31 During the course of preparing this EIS, the team reviewed the Environmental Report (ER)  
32 submitted by SCE&G (2009a); consulted with Federal, State, Tribal, and local agencies; and  
33 followed the guidance set forth in Regulatory Guide 4.2, Revision 2 (NRC 1976), and NUREG-  
34 1555, *Environmental Standard Review Plans* (NRC 2000). In addition, the NRC considered the

1 public comments related to the environmental review received during the scoping process.  
2 These comments are provided in Appendix D of this EIS.

3 As a cooperating agency, the USACE has participated in the environmental review of the  
4 proposed action and has participated in the scoping meetings, public meetings, public-comment  
5 resolution, and EIS preparation. The proposed action includes impacts on waters of the United  
6 States, including wetlands. For action requiring a Section 404 Clean Water Act permit for the  
7 discharge of dredged and/or fill material into waters of the United States, regulations  
8 promulgated by the U.S. Environmental Protection Agency (EPA) require the USACE to limit its  
9 authorization to the least environmentally damaging practicable alternative. The USACE will  
10 document its conclusion of the review process, including the requirement for compensatory  
11 mitigation, in accordance with 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic  
12 Resources, in its permit-decision document.

13 Following the practice of the *Generic Environmental Impact Statement for License Renewal of*  
14 *Nuclear Plants* (NUREG-1437) (NRC 1996) and supplemental license renewal EISs,  
15 environmental issues are evaluated using the three-level standard of significance—SMALL,  
16 MODERATE, or LARGE—developed by the NRC using guidelines from the Council on  
17 Environmental Quality (CEQ) (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,  
18 Appendix B, provides the following definitions of the three significance levels:

19 SMALL — Environmental effects are not detectable or are so minor that they would neither  
20 destabilize nor noticeably alter any important attribute of the resource.

21 MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize,  
22 important attributes of the resource.

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

25 Mitigation measures were considered for each environmental issue and are discussed in the  
26 appropriate sections. During its environmental review, the review team considered planned  
27 activities and actions that SCE&G indicates it and others would likely take should SCE&G  
28 receive the COLs. In addition, SCE&G provided estimates of the environmental impacts  
29 resulting from building and operation of two new nuclear units on the VCSNS site.

## 30 **10.1 Impacts of the Proposed Action**

31 In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of  
32 “construction” to those activities that fall within its regulatory authority (10 CFR 51.4). Many of  
33 the activities required to construct a nuclear power plant are not part of the NRC action to  
34 license the plant. Activities associated with building the plant that are not within the purview of

## Conclusions and Recommendations

1 the NRC action are grouped under the term “preconstruction.” Preconstruction activities include  
2 clearing and grading, excavating, erection of support buildings and transmission lines, and other  
3 associated activities. Because the “preconstruction” activities are not part of the NRC action,  
4 their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the  
5 preconstruction activities are considered in the context of cumulative impacts. Certain  
6 preconstruction activities require permits from the USACE, as well as other Federal, State, and  
7 local agencies.

8 Chapter 4 of this EIS describes the relative magnitude of impacts related to preconstruction and  
9 construction activities with a summary of impacts in Table 4-17. Impacts associated with  
10 operation of the proposed facilities are discussed in Chapter 5 and are summarized in  
11 Table 5-22. Chapter 6 describes the impacts associated with the fuel cycle, transportation, and  
12 decommissioning. Chapter 7 describes the impacts associated with preconstruction and  
13 construction activities and operation of VCSNS Units 2 and 3 when considered along with the  
14 cumulative impacts of other past, present, and reasonably foreseeable future projects in the  
15 geographical region around the VCSNS site.

## 16 **10.2 Unavoidable Adverse Environmental Impacts**

17 Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse  
18 environmental effects that cannot be avoided should the proposal be implemented.  
19 Unavoidable adverse environmental impacts are those potential impacts of the NRC action and  
20 the USACE action that cannot be avoided and for which no practical means of mitigation are  
21 available.

22 The unavoidable adverse environmental impacts associated with the granting of the COLs for  
23 VCSNS Units 2 and 3 would include impacts of both construction and operation.

### 24 **10.2.1 Unavoidable Adverse Impacts During Construction and Preconstruction** 25 **Activities**

26 Chapter 4 discusses in detail the potential impacts from construction and preconstruction of the  
27 proposed Units 2 and 3 at the VCSNS site. Table 10-1 presents the adverse impacts  
28 associated with construction and preconstruction activities to each of the resource areas  
29 evaluated in this EIS and the mitigation measures that would reduce impacts. All building  
30 activities for VCSNS Units 2 and 3, including ground-disturbing activities, would occur within the  
31 existing VCSNS site boundary. Unavoidable adverse impacts are the result of both construction  
32 and preconstruction activities, unless otherwise noted.

1 The impact determinations in Table 10-1 are for the combined impacts of construction and  
 2 preconstruction, but the impact determinations for NRC-regulated construction are the same for  
 3 water use, water quality, aquatic ecology, socioeconomic and environmental justice, air quality,  
 4 and nonradiological and radiological health resource areas. The impact determinations for  
 5 building and NRC-related construction are different for land use, terrestrial and wetland  
 6 ecosystems, and historic and cultural resources. For the impact determinations that differ for  
 7 the NRC-regulated activities, the impacts from the NRC-regulated activities are discussed below  
 8 the table.

9 **Table 10-1.** Unavoidable Adverse Environmental Impacts from Construction and  
 10 Preconstruction Activities

Resource Area	Impact Level	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
<b>Land Use</b>	MODERATE for transmission lines SMALL for other offsite areas; SMALL for NRC-authorized construction activities	Follow best management practices (BMPs); use flexibility in transmission-line corridor routing	Use of roughly 500 ac of land throughout period of construction and preconstruction. New transmission -line routing would require narrow tracts of land along approximately 174 mi of length to be converted from undeveloped or forested uses to utility corridor use.
<b>Water-Related Impacts</b>			
Water Use	SMALL	Implement BMPs to control erosion; use of turbidity curtain to control sediment from dredge operations	Temporary degradation of surface water quality because of sediment loading.
Water Quality	SMALL		
<b>Ecology</b> (Terrestrial)	MODERATE; SMALL for NRC-authorized construction activities	Implement wetland mitigation as required by USACE; implement BMPs during construction and preconstruction; use flexibility in transmission-line corridor routing to avoid adverse impacts on important species and habitats.	Approximately 0.26 ac of wetlands would be filled; vegetation would be cleared and up to 220 ac of wetlands traversed by new transmission lines; permanent loss of terrestrial habitat onsite and in proposed new transmission-line corridors; increased habitat fragmentation from transmission lines; and potential impacts on important species in proposed transmission-line corridors.

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**Table 10-1.** (contd)

<b>Resource Area</b>	<b>Impact Level</b>	<b>Actions to Mitigate Impacts</b>	<b>Unavoidable Adverse Impacts</b>
<b>Ecology</b> (Aquatic)	SMALL	Comply with Federal permits and State 401 water quality certification. Prepare and implement SWPPP and use appropriate BMPs to control erosion and sedimentation.	Stream L would be filled. Temporary benthic habitat disturbance associated with the installation of cooling-water intake, water-treatment plant intake, discharge pipeline and diffuser, and temporary sanitary waste-treatment plant discharge.  Loss of river bottom habitat associated with the installation of one or two transmission-line tower foundations in Parr Reservoir for the VCSNS-Varnville line.  Localized, temporary site-preparation impacts on onsite streams include the widening of an existing rail spur right-of-way adjacent to a seasonal stream and the construction of a new bridge at Mayo Creek.
<b>Socioeconomic</b>			
Infrastructure and Community Services	MODERATE for traffic impacts, SMALL for other infrastructure and community service impacts; MODERATE for traffic impacts SMALL for other infrastructure and community service impacts for NRC-authorized construction activities	Implement traffic-management plan during site development.	Temporary highly localized periodic traffic impacts.
Physical Impacts	SMALL		
Demography	SMALL		
Economic Impacts on the Community	SMALL		

**Table 10-1.** (contd)

<b>Resource Area</b>	<b>Impact Level</b>	<b>Actions to Mitigate Impacts</b>	<b>Unavoidable Adverse Impacts</b>
<b>Environmental Justice</b>			
Health and Environmental	SMALL		
Socioeconomic	MODERATE; MODERATE for NRC-authorized construction activities	Implement traffic management plan during site development.	Temporary highly localized traffic impacts would occur in an environmental justice community.
Subsistence and Special Conditions	SMALL		
<b>Historic and Cultural</b>	MODERATE; SMALL for NRC-authorized construction activities	Implement management agreement with SHPO. Develop resource-specific mitigation plans if significant cultural resources are located within transmission-line corridors.	Cultural resources would be permanently altered by the proposed action and from the installation of transmission lines. Cultural resource attributes that will be impacted include the context and landscape of the surrounding area, the relationship of these resources with regional history, settlement patterns, and the historical use of the land. Visual impacts (alteration of the historic landscape) would affect the integrity of the resources.
<b>Air Quality</b>	SMALL	Development of a dust-control plan prior to construction that would include specific dust-mitigation measures. Air quality permits would be obtained from the SCDHEC (as required).	Temporary degradation of local air quality due to dust particle emissions during ground clearing, grading excavation activities, and operation of concrete batch plant.
<b>Nonradiological Health</b>	SMALL	Train all workers in appropriate safety requirements.	Occupational injuries to personnel

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**Table 10-1.** (contd)

<b>Resource Area</b>	<b>Impact Level</b>	<b>Actions to Mitigate Impacts</b>	<b>Unavoidable Adverse Impacts</b>
<b>Radiological Health</b>	SMALL	Noise-limiting devices on vehicles and equipment. Restrict noise-related activities to daylight hours.	Noise from construction activities
		Doses to construction workers would be maintained below NRC public dose limits.	Small doses to construction workers that would be less than NRC public dose limits.

SCDHEC = South Carolina Department of Health and Environmental Control  
 SHPO = State Historic Preservation Office  
 SWPPP = Stormwater Pollution Prevention Plan

- 1 The NRC staff concludes that the potential unavoidable adverse impacts on land use, terrestrial
- 2 and wetland ecosystems, and historic and cultural resources from NRC-authorized construction
- 3 activities would be SMALL. Nearly all such unavoidable adverse impacts would be attributable
- 4 to preconstruction activities due mainly to the conversion of about 174 mi from undeveloped or
- 5 forested uses to utility corridor use.
  
- 6 The NRC staff concludes that the potential unavoidable adverse impacts for infrastructure and
- 7 community services from NRC-authorized construction activities would be MODERATE for
- 8 traffic impacts and SMALL for other infrastructure and community service impacts. SCDOT
- 9 road-capacity standards would not be exceeded, but the increase in traffic would be noticeable
- 10 to local residents in the Jenkinsville area for the worker commuting hours during the limited
- 11 period of peak building activity. Impacts would be largely temporary and of short duration,
- 12 based on the size of the workforce during any one period, and would abate as construction and
- 13 preconstruction activities wind down.
  
- 14 Construction and preconstruction traffic-related unavoidable adverse impacts would be
- 15 noticeable but not destabilizing to the Jenkinsville community. The Socioeconomic
- 16 Environmental Justice impacts from NRC-authorized construction is estimated to be 80 percent
- 17 of combined construction and preconstruction.
  
- 18 The primary unavoidable adverse environmental impacts during building activities would be
- 19 related to land use and terrestrial habitat loss, as approximately 500 ac would be permanently
- 20 disturbed.



1 **10.2.2. Unavoidable Adverse Impacts During Operation**

2 Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed  
 3 Units 2 and 3 at the VCSNS site. The unavoidable adverse impacts related to operation are  
 4 listed in Table 10-2 and are summarized below.

5 **Table 10-2.** Unavoidable Adverse Environmental Impacts from Operation

Resource Area	Impact Level	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
<b>Land Use</b>	SMALL	None	Long-term dedication of up to 300 ac of land.
<b>Water-Related Impacts</b>			
Water Use	SMALL	Comply with Federal and State permits	Increased water use because of the addition of Units 2 and 3
Water Quality	SMALL		
<b>Ecology (Terrestrial)</b>	SMALL	Implement BMPs during vegetation maintenance on transmission-line rights-of-way	Vegetation maintenance on transmission-line rights-of-way
<b>Ecology (Aquatic)</b>	SMALL	Comply with SCDHEC NPDES permit.	Cooling-water withdrawal results in impingement and entrainment of aquatic biota from Monticello Reservoir.
		Comply with SCDHEC NPDES permit	Thermal, chemical, and physical effects associated with station blowdown into Parr Reservoir have the potential to affect the distribution and abundance of some aquatic species.
		Comply with SWPPP and implement BMPs.	Lack of stormwater management could introduce sediments and pollutants into onsite waterbodies and waterways crossed by transmission-line corridors and injure aquatic biota.

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Conclusions and Recommendations

**Table 10-2.** (contd)

<b>Resource Area</b>	<b>Impact Level</b>	<b>Actions to Mitigate Impacts</b>	<b>Unavoidable Adverse Impacts</b>
		Use EPA-approved herbicides in adjacent streams and waterbodies.	Maintenance and operation activities (e.g., application of chemicals for vegetation management) along transmission-line corridor could harm aquatic species.
<b>Socioeconomics</b>	SMALL	Traffic mitigation would have been performed during the construction phase.	Increased traffic; increased use of services.
<b>Environmental Justice</b>	SMALL		None
<b>Historic and Cultural</b>	SMALL	Finalize and implement management agreement with SHPO	Potential for inadvertent discoveries during maintenance and operational activities.
<b>Air Quality</b>	SMALL	Cooling towers are operated with drift eliminators to limit salt deposition. Operation of generators is regulated by SCDHEC.	Impact on local aesthetic due to cooling tower plumes, increased salt deposition in and near the site due to operation of the cooling towers. Emissions associated with intermittent operation of standby and ancillary generators.
<b>Nonradiological Health</b>	SMALL	Strict adherence to NRC and Occupational Safety and Health Administration safety standards.	Occupational injuries such as falls, noise and inhalation of air contaminants.
<b>Radiological Health</b>	SMALL	Doses to members of the public would be maintained below NRC and EPA standards; worker doses would be maintained below NRC limits and ALARA; and doses to biota other than humans would be maintained below NCRP and IAEA guidelines.	Small radiation doses to members of the public, below NRC and EPA standards; ALARA doses to workers; and biota doses less than NCRP and IAEA guidelines.

**Table 10-2.** (contd)

Resource Area	Impact Level	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
BMPs = best management practices EAB = exclusion area boundary SCDHEC = South Carolina Department of Health and Environmental Control SHPO = State Historic Preservation Office SWPPP = Stormwater Pollution Prevention Plan			

- 1 Increased water use is an unavoidable adverse impact due to operation of the proposed plant.  
 2 Stormwater would be managed with a site-specific SWPPP and operations-related monitoring  
 3 would be performed to ensure compliance with SCDHEC requirements.
- 4 Unavoidable adverse impacts to terrestrial resources would include herbicide use, mowing, and  
 5 similar activities for vegetation maintenance on transmission-line rights-of-way. Assuming that  
 6 BMPs are followed, terrestrial impacts during operation would be minor. Within transmission-  
 7 line corridors, low-growing vegetated buffer zones would be maintained adjacent to streams and  
 8 waterbodies to minimize soil erosion and sedimentation. Only EPA-approved and registered  
 9 herbicides would be used.
- 10 Unavoidable adverse aquatic impacts would be minimal during operation because the design of  
 11 the intake structure on Monticello Reservoir would have minimal effects to aquatic organisms  
 12 from impingement and entrainment. Aquatic impacts from station blowdown to Parr Reservoir  
 13 would also have minimal effects to aquatic organisms due to design of the diffuser. Operation  
 14 of the intake and discharge structures would comply with any NPDES permit.
- 15 Adverse socioeconomic impacts likely would be similar in character to those during the building  
 16 phase but much smaller due to the smaller project-related population and the fact that much of  
 17 the mitigation of housing and infrastructure shortages would have occurred in response to the  
 18 larger impacts during the building period. Socioeconomic impacts would primarily be increased  
 19 traffic, some damage to roads, an increase in the demand for housing and public services,  
 20 along with increased employment opportunities and an increase in tax revenue to support the  
 21 increase in service-demand.
- 22 Unavoidable adverse air-quality impacts would be negligible and that pollutants emitted during  
 23 operations would be insignificant. Nonradiological and radiological health impacts would be  
 24 minimal. Nonradiological health impacts to members of the public from operation, including  
 25 etiological agents, noise, electromagnetic fields, occupational health and transportation of  
 26 materials and personal, would be minimal through controls and measures by SCE&G  
 27 associated with compliance to Federal and State regulations.

### 1 **10.3 Relationship Between Short-Term Uses and Long-Term** 2 **Productivity of the Human Environment**

3 Section 102(2)(C)(iv) of NEPA requires that an EIS include information on the relationship  
4 between local short-term uses of the environment and the maintenance and enhancement of  
5 long-term productivity.

6 The local use of the human environment by the proposed project can be summarized in terms of  
7 the unavoidable adverse environmental impacts of preconstruction, construction, and operation  
8 and the irreversible and irretrievable commitments of resources. With the exception of the  
9 consumption of depletable resources as a result of plant construction and operation, these uses  
10 may be classed as short term. The principal short-term benefit of the plant is represented by  
11 the production of electrical energy; and the economic productivity of the site, when used for this  
12 purpose, would be extremely large compared to the productivity from agriculture or from other  
13 probable uses for the site.

14 The maximum long-term impact on productivity would result if the plant were not immediately  
15 dismantled at the end of the period of plant operation, and consequently the land occupied by  
16 the plant structures would not be available for any other use. However, the enhancement of  
17 regional productivity resulting from the electrical energy produced by the plant is expected to  
18 result in a correspondingly large increase in regional long-term productivity that would not be  
19 equaled by any other long-term use of the site. In addition, most long-term impacts resulting  
20 from land-use preemption by plant structures can be eliminated by removing these structures or  
21 by converting them to other productive uses. Once the plants are shut down, they would be  
22 decommissioned according to NRC regulations. Once decommissioning is complete and the  
23 NRC license is terminated, the site would be available for other uses.

24 The review team concludes that the negative aspects of plant construction, preconstruction, and  
25 operation as they affect the human environment are outweighed by the positive long-term  
26 enhancement of regional productivity through the generation of electrical energy.

### 27 **10.4 Irreversible and Irretrievable Commitments of Resources**

28 Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and  
29 irretrievable commitments of resources that would occur if the proposed actions are  
30 implemented. The term "irreversible commitments of resources" refers to environmental  
31 resources that would be irreparably changed by the new units and that could not be restored at  
32 some later time to the resource's state before the relevant activities. "Irretrievable commitments  
33 of resources" refers to materials that would be used for or consumed by the new units in such a  
34 way that they could not, by practical means, be recycled or restored for other uses. The  
35 irreversible commitment of resources are the environmental resources discussed in Chapters 4,  
36 5, and 6 of this EIS.

1 **10.4.1 Irreversible Commitments of Resources**

2 Irreversible commitments of environmental resources resulting from Units 2 and 3, in addition to  
3 the materials used for the nuclear fuel, include those described in the following sections.

4 **10.4.1.1 Land Use**

5 Land committed to the disposal of radioactive and nonradioactive wastes is committed to that  
6 use, and cannot be used for other purposes. The land used for Units 2 and 3, with the  
7 exception of any filled wetlands, would not be irreversibly committed because once Units 2 and  
8 3 cease operations and the plant is decommissioned in accordance with NRC requirements, the  
9 land supporting the facilities could be returned to most other industrial or nonindustrial uses.

10 **10.4.1.2 Water Use**

11 Under average conditions, 27,160 gpm of cooling water would be lost through consumptive use  
12 (evaporation) during operation.

13 **10.4.1.3 Aquatic and Terrestrial Biota**

14 Construction and preconstruction would temporarily adversely affect the abundance and  
15 distribution of local flora and fauna on the VCSNS site and transmission-line rights-of-way.  
16 However, the staff expects that only minimal irretrievable commitment of resources affecting  
17 shoreline, stream, reservoir benthic habitat, terrestrial habitat, or individual species is expected  
18 to occur at the VCSNS site. Similar impacts could occur on the new transmission corridors.  
19 Once construction and preconstruction are complete, the staff expects that flora and fauna  
20 would recover in areas that are not directly adjacent to or part of operations. Also, impacts to  
21 biota would cease post operations. The staff considers that the 0.26 ac of wetlands that would  
22 be filled during preconstruction of Units 2 and 3 would be irreversible.

23 **10.4.1.4 Socioeconomic Resources**

24 The staff expects that no irreversible socioeconomic commitments would be made to  
25 socioeconomic resources because they would be relocated for other purposes once the plant is  
26 decommissioned.

27 **10.4.1.5 Historical and Cultural Resources**

28 Cultural resource attributes would be permanently altered by the construction, preconstruction  
29 and operation of the proposed plant and transmission lines. Nearly all impacts would be  
30 attributable to preconstruction activities, particularly transmission lines. Cultural resource  
31 attributes that could be impacted include the context and landscape of the surrounding area, the  
32 relationship of these resources with regional history, settlement patterns, and the historical use  
33 of the land. Visual impacts (alteration of the historic landscape) could affect the integrity of the  
34 resources.

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### 1 **10.4.1.6 Air and Water**

2 Air pollutants would be released to the environment during routine operations. Because these  
3 releases would conform to applicable Federal and State regulations, their impact to the public  
4 health and the environment would be limited.

5 Dust and other emissions such as vehicle exhaust would be released to the air during  
6 construction. During operations, vehicle exhaust emissions would continue and other air  
7 pollutants and chemicals including very low concentrations of radioactive gases and particulates  
8 would be released from the facility to the air and surface water. The staff expects no irreversible  
9 commitment to air or water resources because all Unit 2 and 3 releases would be made in  
10 accordance with duly issued permits.

### 11 **10.4.2 Irretrievable Commitments of Resources**

12 Irretrievable commitments of resources during construction of the proposed new units generally  
13 would be similar to that of any major construction project. A study by the U.S. Department of  
14 Energy (DOE) (DOE 2004) of new reactor construction estimated that the following quantities of  
15 materials would be required for the reactor building of a typical new 1300-MW (e) nuclear power  
16 plant: 12,239 yd<sup>3</sup> of concrete, 3107 tons of rebar, and 2,500,000 ft of cable. An estimated  
17 additional 6,500,000 ft of cable and 275,000 ft of piping would be required for each unit. A total  
18 of approximately 182,900 yd<sup>3</sup> of concrete and 20,512 tons of structural steel would be required  
19 to construct the reactor building, major auxiliary buildings, the turbine-generator building, and  
20 the turbine-generator pedestal. Therefore, about twice these amounts would be needed for the  
21 construction of two units at the VCSNS site. Hazardous materials such as asbestos would not  
22 be used, if possible. Use of materials such as asbestos would be in accordance with applicable  
23 safety regulations and practices.

24 The review team expects that the use of construction materials in the quantities associated with  
25 those expected for VCSNS Units 2 and 3, while irretrievable, would be of small consequence  
26 with respect to the availability of such resources.

27 The main resource that would be irretrievably committed during operation of the new nuclear  
28 units would be uranium. The availability of uranium ore and existing stockpiles of highly  
29 enriched uranium in the United States and Russia that could be processed into fuel is sufficient  
30 (OECD NEA and IAEA 2008) so that the irreversible and irretrievable commitment of this  
31 resource would be negligible.

## 32 **10.5 Alternatives to the Proposed Action**

33 Alternatives to the proposed action are discussed in Chapter 9 of this EIS. Alternatives  
34 considered are the no-action alternative, energy-production alternative, system-design

1 alternatives, and alternative sites. For the purposes of the USACE's evaluation, onsite  
2 alternatives are also addressed.

3 The no-action alternative, described in Section 9.1, refers to a scenario in which the NRC would  
4 deny the request for COLs. Upon such a denial, the construction and operation of two new  
5 nuclear units at the VCSNS site would not occur and the predicted environmental impacts  
6 associated with the project would not occur. The USACE could deny SCE&G's permit request.  
7 If the permit were denied, SCE&G's construction of the two new units would not go forward as  
8 proposed. If no other power plant were built or electrical power supply strategy implemented to  
9 take its place, the electrical capacity to be provided by the project would not become available,  
10 and the benefits (electricity generation) associated with the proposed action would not occur  
11 and the need for power would not be met. Failure to supply the needed electricity would have  
12 significant adverse impacts within the region of interest and the staff expects that the PSCSC  
13 would take steps to confirm that the need for power would be met.

14 Alternative energy sources are described in Section 9.2 of this EIS. Alternatives not requiring  
15 additional generating capacity are described in Section 9.2.1. Detailed analyses of coal- and  
16 natural-gas-fired alternatives are provided in Section 9.2.2. Other energy sources are  
17 discussed in Section 9.2.3 and a combination of energy alternatives is discussed in  
18 Section 9.2.4. The staff concluded that none of the alternative power production options were  
19 both practical and environmentally preferable to the proposed action.

20 Alternative sites are discussed in Section 9.3 of this EIS, and the cumulative impacts in the  
21 VCSNS site vicinity, including the proposed VCSNS Units 2 and 3 increment, are compared with  
22 the impacts of the same physical facilities at each of the alternative sites in Chapter 9 of this  
23 EIS. Table 9-31 contains the staff's characterization of cumulative impacts at the proposed and  
24 alternative sites. Based on this review, the NRC staff concludes that while there are differences  
25 in cumulative impacts at the proposed and alternative sites, none of the alternative sites is  
26 environmentally preferable or obviously superior to the proposed VCSNS site. The NRC's  
27 determination is independent of the USACE's determination of a Least Environmentally  
28 Damaging Practicable Alternative pursuant to Section 404(b)(1) Guidelines. The USACE will  
29 conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

30 Alternative system designs are discussed in Section 9.4 of this EIS, focusing on alternative  
31 cooling-system designs. The staff determined none of the alternative system designs were  
32 environmentally preferable to the proposed design.

## 33 **10.6 Benefit-Cost Balance**

34 NEPA (42 USC 4321 et seq.) requires that all agencies of the Federal Government prepare  
35 detailed EISs on proposed major Federal actions that can significantly affect the quality of the  
36 human environment. A principal objective of NEPA is to require each Federal agency to

## Conclusions and Recommendations

1 consider, in its decisionmaking process, the environmental impacts of each proposed major  
2 action and the available alternative actions. In particular, Section 102 of NEPA requires all  
3 Federal agencies to the fullest extent possible:

4 (B) identify and develop methods and procedures, in consultation with the  
5 Council on Environmental Quality established by Title II of this Act, which will  
6 insure that presently unquantified environmental amenities and values may be  
7 given appropriate consideration in decisionmaking along with economic and  
8 technical considerations. (42 USC 4321)

9 However, neither NEPA nor CEQ requires the costs and benefits of a proposed action be  
10 quantified in dollars or any other common metric.

11 The intent of this section is not to identify and quantify all of the potential societal benefits of the  
12 proposed actions and compare these to the potential costs of the proposed actions. Instead,  
13 this section will focus on only those the benefits and costs of such magnitude or importance that  
14 their inclusion in this analysis can inform the decision-making process. This section compiles  
15 and compares the pertinent analytical conclusions reached in earlier chapters of this EIS. It  
16 gathers all of the expected impacts from building and operations of the proposed VCSNS Units  
17 2 and 3 and aggregates them into two final categories; the expected costs and the expected  
18 benefits. The benefit-cost balancing for the NRC action will be based on a balancing of the  
19 benefits and costs of construction and operation.

20 Although the analysis in this section is conceptually similar to a purely economic benefit-cost  
21 analysis, which determines the net present dollar value of a given project, the analysis identifies  
22 the important potential societal benefits of the proposed action and compares them to the  
23 potential internal (i.e., private) and external (i.e., societal) costs of the proposed actions. In this  
24 section, the benefits assessment provides the insight to determine if the benefits of the  
25 proposed actions outweigh the aggregate costs.

26 General issues related to SCE&G's financial viability and those of its parent organizations are  
27 outside NRC's mission and authority and, thus, would not be considered in this EIS. Issues  
28 related to the financial qualifications of SCE&G's will be addressed in the NRC staff's safety  
29 evaluation report. It is not possible to quantify and assign a value to all benefits and costs  
30 associated with the proposed action. This analysis, however, attempts to identify, quantify, and  
31 provide monetary values for benefits and costs when reasonable estimates are available.

32 Section 10.6.1 discusses the benefits associated with the proposed action. Section 10.6.2  
33 discusses the costs associated with the proposed action. A summary of benefits are shown in  
34 Table 10-3. Section 10.6.3 provides a summary of the impact assessments by integrating  
35 information from previous sections to frame the relative magnitude of the proposed actions'  
36 benefits and costs.



1 **Table 10-3.** Monetary and Nonmonetary Benefits of the Proposed VCSNS Units 2 and 3

Category of Benefit	Description of Benefit	Value of Benefit Over License Period
<b>Net Electrical Generating Benefits</b>		
Net generating capacity	~2200 MW(e)	
Electricity generated (operating at 85-percent to 93-percent capacity)	16,400,000 – 17,900,000 MWh per year	
<b>Taxes and Other Revenue During Plant Construction and Operation Period (transfer payments – not independent benefits)</b>		
Annual property taxes from operating plant (paid to Fairfield County)	Proposed Unit 2 and Unit 3 could pay on average \$21.5 million in property taxes annually	\$860 Million
Local direct income generated during construction	\$266.4 million annual income during peak employment	\$513.1 million total regional income impact
Local direct income generated during operation	\$121 million per year during 40-year life of plant	\$220 million total regional income impact
<b>Effects on Regional Productivity</b>		
Construction workers	Direct Impact: Approximately 3600 workers at project peak.	7362 regional employment supported by peak direct employment
Operational workers	Direct Impact: 800 operations workers added over 40-year life of plant	2504 total regional employment supported by the direct employment
Socioeconomics	Increased tax revenue supports improvements to public infrastructure and social services. The increased revenue spurs future growth and development	
Technical and other non-monetary benefits	Fuel diversity reduces exposure to supply and price risks associated with reliance on any single fuel source	
Price volatility	Dampens potential for fuel price volatility.	
Electrical reliability	Enhances reliability of the electricity supply.	
Source: SCE&G 2008		

## Conclusions and Recommendations

### 1 **10.6.1 Benefits**

2 The most apparent benefit from a power plant is that it generates power and provides  
3 thousands of residential, commercial, and industrial consumers with electricity. Maintaining an  
4 adequate supply of electricity in any given region has social and economic importance, because  
5 the resource is the foundation for economic stability and growth and is fundamental to  
6 maintaining the current standard of living. In addition to nuclear power, however, a number of  
7 different power-generation technology options could meet the need for baseload power,  
8 including natural-gas-fired, coal-fired plants, or a combination of alternatives. Because the  
9 focus of this EIS is on the proposed expansion of the VCSNS site generating capacity, this  
10 section focuses primarily on the relative benefits of the VCSNS option rather than the broader,  
11 more generic benefits of electricity supply.

#### 12 **10.6.1.1 Societal Benefits**

13 For the production of electricity to be beneficial to a society, there must be a corresponding  
14 demand, or “need for power,” in the region. Chapter 8 defines and discusses the need for  
15 power in more detail. From a societal perspective, price stability and longevity and energy  
16 security and fuel diversity are the primary benefits associated with nuclear power generation  
17 relative to most other alternative generating options. These benefits are described in this  
18 section.

#### 19 ***Price Stability and Longevity***

20 Because of the relatively low and nonvolatile cost of nuclear power (approximately  
21 0.5 cents/kWh) and the reactor’s projected availability rate of 85 to 93 percent, nuclear energy is  
22 a dependable source of electricity that can be provided at relatively stable prices. Nuclear  
23 power plants are generally not subject to fuel-price volatility as are natural-gas-fired and oil-fired  
24 power plants; there is less price volatility with coal than the other fossil fuels. In addition,  
25 uranium fuel constitutes only 3 to 5 percent of the cost of a kilowatt-hour of nuclear-generated  
26 electricity. Doubling the price of uranium increases the cost of electricity by about 7 percent,  
27 while doubling the price of natural gas would add about 70 percent to the cost of gas-fired  
28 electricity generation, and doubling the cost of coal would add about 36 percent to the cost of  
29 coal-fired electricity generation (WNA 2010).

#### 30 ***Energy Security and Fuel Diversity***

31 Currently, more than 70 percent of the electricity generated in the United States is from fossil-  
32 based technologies. Nuclear power contributes to the diverse U.S. energy mix, thereby hedging  
33 the risk of shortages and price fluctuations for any one type of power-generation system.

34 In Chapter 8 of this EIS the NRC staff analyzed the relevant load forecasts, which revealed a  
35 need for an additional 2214 MW(e) of baseload power capacity in the region of interest by the

1 year 2020. The proposed VCSNS Units 2 and 3 would generate approximately 2200 MW(e)  
2 net, which would help meet this baseload need in the region. Assuming a reasonably low  
3 capacity factor of 85 percent, the plant's average annual electrical energy generation would be  
4 about 16,400,000 MWh. A reasonably high-capacity factor of 93 percent would result in slightly  
5 more than 17,900,000 MWh of electricity.

#### 6 **10.6.1.2 Regional Benefits**

7 The region would benefit from additional VCSNS-related tax revenues, regional productivity,  
8 and community impacts.

#### 9 ***Tax Revenue Benefits***

10 In recent years, SCE&G's property tax payments to Fairfield County for Unit 1 on the VCSNS  
11 site have been between \$12.2 million to \$14.3 million, annually. On average, 37 to 45 percent  
12 of the Fairfield County property tax revenue comes from real property taxes generated by Unit 1  
13 operations (see Table 2-33). With the completion of VCSNS Units 2 and 3, Fairfield County  
14 would receive additional property tax revenue.

15 Upon completion and operation of Units 2 and 3, based on information provided by SCE&G  
16 (SCE&G 2009b), the staff expects SCE&G will enter an agreement with Fairfield County to pay  
17 from \$13 to \$31 million annually in property taxes over the 40-year operating life of the new  
18 units (see Table 5-5). Taxes on the new units would be in addition to existing taxes being  
19 collected by Fairfield County on Unit 1 operations.

20 In addition to property taxes, the construction-related and preconstruction jobs and salaries  
21 would generate State income tax revenue. The review team assumed that 50 percent of the  
22 skilled crafts workforce would relocate into the region while the plant is being built. However,  
23 impacts in the state would occur only to the degree that construction and operations workers  
24 would be relocating from out of state or when in-state workers significantly upgrading their  
25 disposable income compared to previous in-state employment. The review team concludes,  
26 when viewed in the context of total sales tax revenue to the State of South Carolina, the net  
27 impact on sales tax revenue caused by potential relocations to South Carolina, or from the  
28 effect of upgrading disposable income through better employment, would be minimal.

29 Once the plant is operational, it would be subject to corporate income tax, which in South  
30 Carolina is 5.533 percent of net taxable income. Sales taxes would be levied on materials  
31 purchased in-state to construct VCSNS Units 2 and 3. Retail sales of tangible personal property  
32 are subject to general State sales or use taxes of 6.0 percent. In addition, the local counties  
33 collect an additional 1.0 percent in sales and use taxes bringing the total rate to 7 percent  
34 (SCE&G 2009b).

## Conclusions and Recommendations

### 1 **Regional Productivity and Community Impacts**

2 The new units would require a peak-level workforce of approximately 3600 workers and an  
3 operating workforce of about 800. The long-term impact would be realized from the operations  
4 employment multiplier effect, which suggests that 1704 additional indirect and induced jobs  
5 would be created to support the 800 jobs during the operation period. In total, approximately  
6 2504 jobs (apart from outage employment impacts) within the economic impact area affected by  
7 the site would be supported by the startup of the new units and would be maintained throughout  
8 the life of the plant. The economic multiplier effect of the increased spending by the direct and  
9 indirect workforce created as a result of two new units would increase the economic activity in  
10 the region. The final demand economic multiplier effect means that every dollar spent by  
11 nuclear plants results in the creation of an additional \$0.33 of induced income in the community.  
12 Sections 4.5.4 and 5.5.4 provide additional information about the economic impacts of  
13 constructing and operating Units 2 and 3 on the VCSNS site.

### 14 **10.6.2 Costs**

15 Internal costs to SCE&G and external costs to the surrounding region and environment would  
16 be incurred during the preconstruction, construction, and operation of proposed VCSNS Units 2  
17 and 3. Internal costs include the costs to physically construct the power plant (capital costs), as  
18 well as operating and maintenance costs, fuel costs, waste disposal costs, and  
19 decommissioning costs. External costs include all costs imposed on the environment and  
20 region surrounding the plant that are not internalized by the company and may include such  
21 things as a loss of regional productivity, environmental degradation, or loss of wildlife habitat.  
22 The external costs listed in Table 10-4 summarize environmental impacts to resources that  
23 could result from preconstruction, construction, and operation of the proposed VCSNS Units 2  
24 and 3. Because Table 10-4 includes costs from preconstruction activities, it overestimates the  
25 costs for the proposed NRC action

### 26 **10.6.2.1 Internal Costs**

27 The most substantial monetary cost associated with nuclear energy is the cost of capital.  
28 Nuclear power plants typically have relatively high capital costs for building the plant, but very  
29 low fuel costs relative to alternative power-generation systems. Because of the large capital  
30 costs for nuclear power plants, and the relatively long construction period before return on  
31 capital investment, servicing the capital costs of a nuclear power plant is one of the most  
32 important factors in determining the economic competitiveness of nuclear energy. Construction  
33 delays can add significantly to the cost of a plant. Because no new nuclear plants have been  
34 built in the United States in many years to establish an empirical cost basis, there is some  
35 uncertainty regarding the actual costs of constructing a new unit and how it would relate to  
36 construction costs for similarly large industrial facilities.

1 **Table 10-4.** Internal and External Costs of Proposed VCSNS Units 2 and 3

Category of Cost	Description of Cost	Impact Assessment <sup>(a)</sup>
<b>Internal Costs</b>		
Construction (overnight cost) for both units (including preconstruction costs)	\$9.8 billion (about \$4500 per installed kW(e))	
Transmission, distribution, and general plant costs	\$925 million (about \$420 per installed kW(e))	
Levelized cost of operation (includes fuel costs, decommissioning, and waste disposal)	\$66 to \$84 per MWh (MIT 2009, p. 6, Table 1)	
Fuel costs	\$2.00 MWh (calculated based on MIT 2009, p. 6, Table 1)	
Decommissioning (NRC minimum)	Approximately \$1–\$2 per MWh	
<b>External Costs</b>		
Land use	Project impacts including site and transmission lines would impact about 2600 acres of land. (See Sections 4.1 and 5.1.)	MODERATE for transmission lines; SMALL for other offsite areas; SMALL for NRC-authorized construction activities
Water use and water quality	There are some costs associated with providing water for various needs during construction and operation. Cooling water is taken from Monticello Reservoir. Impact on water quality would be regulated by the South Carolina Department of Health and Environmental Control (SCDHEC) and the South Carolina Department of Natural Resources (SCDNR). (See Sections 4.2 and 5.2.)	SMALL
Terrestrial and wetlands ecosystems	Some impacts on wildlife due to mortality during construction operations are anticipated. However, these impacts do not affect long-term wildlife populations. Wildlife mortality during operations is expected to be minimal. (See Sections 4.3 and 5.3.)	SMALL

2  
3

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**Table 10-4.** (contd)

<b>Category of Cost</b>	<b>Description of Cost</b>	<b>Impact Assessment<sup>(a)</sup></b>
Aquatic ecosystems	Filling in of the headwaters for Stream L, which flows into Mayo Creek, would result in a noticeable change for that immediate area. However, water-quality impacts are likely to be negligible with the use of BMPs to control sedimentation. (See Sections 4.3 and 5.3.)	SMALL
Radioactive effluents and emissions	Radioactive waste is generated. The plant produces radioactive air emissions. Relatively small levels of radioactive effluents are introduced into the Broad River. (See Sections 4.9 and 5.9.)	SMALL
Hazardous and radioactive waste	Storage, treatment, and disposal of high-level radioactive spent nuclear fuel. Commitment of underground geological resources for disposal of radioactive spent fuel. (See Sections 4.9 and 5.9.)	SMALL
Air quality	Air emissions from diesel generators, auxiliary boilers, equipment, and vehicles that have a small impact on workers and local residents. Emission sources would be operated intermittently and emissions would be within Federal, State, and local air quality limits. Avoidance of sulfur dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, and particulate emissions (relative to other baseload fossil-fired generation). (See Sections 4.7 and 5.7.)	SMALL
Materials, energy, and uranium	Irreversible and irretrievable commitments of materials and energy, including depletion of uranium. Construction materials include concrete, aggregate, rebar, conduit, cable, piping, building supplies, tools. Equipment needs include cranes, cement trucks, excavation equipment, dump trucks, and graders.	SMALL
Socioeconomics	The external costs of building and operating Units 2 and 3 have been discussed in detail in Chapters 4 and 5. The review team determined all of these external costs would be SMALL, with the exception of building-related traffic impacts, which were identified as	MODERATE for traffic impacts, SMALL for other infrastructure and community service impacts; MODERATE for traffic impacts, SMALL for other infrastructure and community service impacts for NRC-authorized

**Table 10-4.** (contd)

Category of Cost	Description of Cost	Impact Assessment <sup>(a)</sup>
Cultural Resources	<p>MODERATE for each preconstruction and construction. (See Sections 4.4 and 5.4)</p> <p>SCE&amp;G has committed to developing procedures for managing cultural resources in the event of an inadvertent discovery onsite. (See Sections 4.6 and 5.6.)</p>	<p>construction activities</p> <p>MODERATE; SMALL for NRC-authorized construction activities</p>
Health impacts (nonradiological and radiological)	<p>Small estimated temperature increases would not significantly increase the abundance of thermophilic microorganisms. Radiological doses and nonradiological health hazards to the public and occupational workers would be monitored and controlled in accordance with regulatory limits. (See Sections 4.8, 4.9, 5.8, and 5.9.)</p>	SMALL

(a) Impact assessments are listed for all impacts evaluated in detail as part of this EIS. The details on impact assessments are found in the indicated sections of this EIS.

1 **Construction Costs**

2 In evaluating the monetary costs related to constructing VCSNS Units 2 and 3, SCE&G  
 3 reviewed recently published literature and internally generated, site-specific information.  
 4 Construction cost estimates are provided below in Table 10-4. These estimates are based on a  
 5 number of studies that were conducted by government agencies, universities, and other entities;  
 6 the estimates include a significant contingency to account for uncertainty. In its ER, SCE&G  
 7 expressed the construction-cost estimate in terms of “overnight capital cost,” which is a  
 8 commonly used approach in the construction industry. “Overnight capital cost” is a term used to  
 9 describe the monetary cost of constructing large capital projects such as a power plant, where  
 10 costs are exclusive of interest and escalation, but include engineering, procurement, and  
 11 construction costs, as well as owner’s costs and contingencies. The owner’s costs include such  
 12 things as site work and preparation, cooling-water intake structures and cooling towers, import  
 13 duties on components, insurance, spare parts, transmission interconnection, development  
 14 costs, project management costs, owner’s engineering, State and local permitting, legal fees,  
 15 and staffing-related training.

16 SCE&G’s cost analysis was primarily based on the four following studies:

- 17 • Massachusetts Institute of Technology (MIT). 2003. *The Future of Nuclear Power: An*  
 18 *Interdisciplinary MIT Study.*

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- 1 • University of Chicago (UC). 2004. *The Economic Future of Nuclear Power*.
- 2 • U.S. Department of Energy (DOE). 2004. *Study of Construction Technologies and*  
3 *Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for*  
4 *Advanced Reactor Designs*.
- 5 • Organization for Economic Co-Operation and Development and International Energy  
6 Agency (OECD/IEA). 2005. *Projected Costs of Generating Electricity, 2005 Update*.

7 In addition to the four studies referenced by SCE&G, the NRC staff reviewed two additional  
8 reports, one published by The Keystone Center entitled *Nuclear Power Joint Fact-Finding* (The  
9 Keystone Center 2007), which concluded, based upon alternative discount rates and  
10 construction times, overnight construction costs range between \$3600 and \$4200 per kW(e).  
11 The second study is a 2009 update to the MIT study (2003) that revised capital cost estimates  
12 to \$4000 per kW(e).

13 In its ER, SCE&G concluded \$2000 per kW(e) would be applicable to VCSNS Units 2 and 3,  
14 which equates to roughly \$4.4 billion to construct both units (SCE&G 2008). However,  
15 considering that these studies were completed from 2003 through 2005 (and expressed in  
16 various dollar-years), and more recent information became available subsequent to the  
17 publication of the ER, SCE&G concluded that the estimate of \$2000 per kW(e) would represent  
18 the low range of estimates. The estimate used in this EIS equates to approximately \$4400 per  
19 kW(e), which more closely reflects estimates reported in the 2007 Keystone study (The  
20 Keystone Center 2007) and MIT (2009).

### 21 **Operation Costs**

22 Operation costs are frequently expressed as levelized cost of electricity, which is the price per  
23 kWh of producing electricity, including the amounts needed to cover operating costs and  
24 annualized capital costs. Overnight capital costs account for one-third of the levelized cost, and  
25 interest costs on the overnight costs account for another 25 percent (University of Chicago  
26 2004). SCE&G concluded that, based on the UC study results, the projected cost associated  
27 with operating a new nuclear facility similar in size to the one proposed for the VCSNS site  
28 would be in the range of \$31 to \$46 per MWh (\$0.031 to \$0.046 per kWh). Levelized cost  
29 estimates based on the MIT study (2009) range from \$66 to \$84 per MWh (6.6 to 8.4 cents per  
30 kWh). A number of factors can affect the range, such as the choice of discount rate,  
31 construction duration, plant lifespan, capacity factor, tax rates, and premium for uncertainty.  
32 Estimates include decommissioning, but because of the effect of discounting a cost that would  
33 occur as much as 40 years in the future, decommissioning costs have relatively little effect on  
34 the levelized cost. Based on the more recent information from the MIT study, the review team  
35 determined that levelized cost estimates ranging from \$66 to \$84 per MWh (6.6 to 8.4 cents  
36 per kWh) (MIT 2009) are more reasonable.



1 **Fuel Costs**

2 The cost of fuel is included in the calculation of levelized cost. Based on the recent World  
3 Nuclear Association's study (WNA 2010), the review team estimates nuclear fuel costs to be  
4 \$0.449 per kWh.

5 **Waste Disposal**

6 The back-end costs of nuclear power contribute a very small share of total cost, both because of  
7 the long lifetime of a nuclear reactor and the fact that provisions for waste-related costs can be  
8 accumulated over that time. It also should be recognized, however, that radioactive nuclear  
9 waste poses unique disposal challenges for long-term management. While spent fuel and  
10 radioactive nuclear waste are being stored successfully in onsite facilities, the United States and  
11 other countries have yet to implement final disposition of spent fuel or high-level radioactive  
12 waste streams created at various stages of the nuclear fuel cycle.

13 **Decommissioning**

14 In accordance with 10 CFR 50.75, the NRC requires that licensees provide reasonable  
15 assurance that funds will be available for the decommissioning process. Because of the effect  
16 of discounting a cost that would occur as much as 40 years in the future, decommissioning  
17 costs have relatively little effect on the levelized cost of electricity generated by a nuclear power  
18 plant. Decommissioning costs are about 9 to 15 percent of the initial capital cost of a nuclear  
19 power plant. However, when discounted, decommissioning costs contribute only a few percent  
20 to the investment cost and even less to the generation cost. In the United States, they account  
21 for 0.1 to 0.2 cents per kWh, which is no more than 5 percent of the cost of the electricity  
22 produced (WNA 2010).

23 **10.6.2.2 External Costs**

24 External costs are social and/or environmental effects that would be caused by the building of  
25 and generation of power by two new reactors at the VCSNS site. This EIS includes the review  
26 team's analysis that considers and weighs the environmental impacts of building and operating  
27 new nuclear units at the VCSNS site or at alternative sites, and mitigation measures available  
28 for reducing or avoiding these adverse impacts. It also includes the NRC staff's  
29 recommendation to the Commission regarding the proposed action.

30 **Environmental and Social Costs**

31 The impacts of building and operating the VCSNS Units 2 and 3 have been identified and  
32 analyzed in Chapters 4 and 5, and a significance level of potential adverse impacts  
33 (i.e., SMALL, MODERATE, or LARGE) has been assigned. Such impacts cannot be universally  
34 monetized. Chapter 6 similarly addresses the environmental impacts from (1) the uranium fuel

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1 cycle and solid waste management, (2) the transportation of radioactive material, and (3) the  
2 decommissioning of nuclear units at the VCSNS site. A summary of project internal and  
3 external costs is shown in Table 10-4. Because Table 10-4 includes costs from preconstruction  
4 activities, it overestimates the costs for the proposed NRC action.

5 Unlike generation of electricity from coal and natural gas, normal operation of a nuclear power  
6 plant does not result in significant emissions of criteria air pollutants (e.g., oxides of nitrogen or  
7 sulfur dioxide), methyl mercury, or greenhouse gases associated with global warming and  
8 climate change. Whereas combustion-based power plants are responsible for at least 70  
9 percent of the sulfur dioxide, at least 21 percent of nitrogen oxides, and 51 percent of the  
10 mercury emissions from industrial sources in the United States (EPA 2009), and 40 percent of  
11 the carbon dioxide (DOE/EIA 2008). Eighty-two percent of the electric power industry's  
12 emissions are from coal-fired plants (DOE/EIA 2008). Chapter 9 of this EIS analyzes coal- and  
13 natural-gas-fired alternatives to the construction and operation of VCSNS Units 2 and 3. Air  
14 emissions from these alternatives and nuclear power are summarized in Chapters 4, 5, and 9.

15 As discussed previously, Table 10-4 summarizes the external costs (i.e., environmental  
16 impacts) associated with the building and operation of the proposed VCSNS Units 2 and 3.  
17 Impacts to air quality, aquatic ecology, housing, public services, aesthetics and recreation,  
18 cultural resources, and radiological and nonradiological health all would be SMALL. Because  
19 the overall impact to these resources from the proposed project in its entirety would be SMALL,  
20 the impacts from the NRC action (i.e., construction as defined in 10 CFR 51.4, and operation of  
21 the proposed new units) accordingly would also be SMALL. For land use, the impact from the  
22 total project would be MODERATE, the impact from the NRC portion of the project would be  
23 SMALL. For terrestrial ecology the impact from the total project would be MODERATE, the  
24 impact from the NRC portion of the project would be SMALL. For traffic near the VCSNS site,  
25 the review team determined the total impact would be MODERATE and the NRC portion of the  
26 project would be MODERATE.

### 27 **10.6.3 Summary of Benefits and Costs**

28 SCE&G's business decision to pursue expansion of VCSNS generating capacity by adding two  
29 additional nuclear reactors is an economic decision, based on private financial factors subject to  
30 regulation by the PSCSC. The internal costs to construct additional units appear to be  
31 substantial; however, SCE&G's decision to pursue this expansion is an indication that the  
32 company has already concluded that the private, or internal, benefits of the proposed facility  
33 outweigh the internal costs. Although the identified societal benefits are not specifically  
34 monetized, the review team determined that the potential societal benefits of the proposed  
35 expansion of the VCSNS site are substantial. In comparison, the external socio-environmental  
36 costs imposed on the region appear to be relatively small.

1 Table 10-3 and Table 10-4 include summaries of the internal and external costs of the proposed  
2 activities at the VCSNS site, as well as the identified benefits. The tables include references to  
3 other sections of this EIS when impact assessments or more detailed analyses are available for  
4 specific topics.

5 On the basis of the assessments summarized in this EIS, the construction and operation of the  
6 proposed VCSNS Units 2 and 3, with the mitigation measures identified by the staff, would have  
7 accrued benefits that most likely would outweigh the economic, environmental, and social costs.  
8 For the NRC-proposed action (NRC-authorized construction and operation) the accrued benefits  
9 would also outweigh the costs of construction and operation of Units 2 and 3.

## 10 **10.7 Staff Recommendation**

11 The NRC staff's preliminary recommendation to the Commission related to the environmental  
12 aspects of the proposed action is that the COL should be issued. The staff's evaluation of the  
13 safety and emergency preparedness aspects of the proposed action will be addressed in the  
14 staff's safety evaluation report that is anticipated to be published in 2011.

15 This preliminary recommendation is based on (1) the ER submitted by SCE&G (2009a),  
16 (2) consultation with Federal, State, Tribal, and local agencies, (3) the review team's  
17 independent review, (4) the NRC staff's consideration of comments related to the environmental  
18 review that were received during the public scoping process, and (5) the assessments  
19 summarized in this EIS, including the potential mitigation measures identified in the ER and in  
20 the EIS.

21 The NRC's determination is independent of the USACE's determination of whether the VCSNS  
22 site is the Least Environmentally Damaging Practicable Alternative pursuant to Clean Water Act  
23 Section 404(b)(1) Guidelines. The USACE will conclude its analysis of both offsite and onsite  
24 alternatives in its Record of Decision.

## 25 **10.8 References**

26 10 CFR Part 50. Code of Federal Regulations, Title 10 *Energy*, Part 50, "Domestic Licensing of  
27 Production and Utilization Facilities."

28 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental  
29 Protection Regulations for Domestic Licensing and Related Regulatory Functions."

30 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses,  
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## Conclusions and Recommendations

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**BIBLIOGRAPHIC DATA SHEET**

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11. ABSTRACT (200 words or less)

This environmental impact statement (EIS) has been prepared in response to an application submitted by South Carolina Electric & Gas (SCE&G) to the U.S. Nuclear Regulatory Commission (NRC) for combined licenses (COLs) for Units 2 and 3 at the Virgil C. Summer Nuclear Station (VCSNS) site in Fairfield County, South Carolina. This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action and mitigation measures for reducing and avoiding adverse impacts.

The NRC staff's preliminary recommendation to the Commission, considering the environmental aspects of the proposed action, is that the COLs be issued. This recommendation is based on (1) the COL application, including the Environmental Report submitted By SCE&G; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS.

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