

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 15

**Regarding
Virgil C. Summer Nuclear Station**

Draft Report for Comment

**U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001**



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Impact Statement for
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**Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001**



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Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1437, Supplement 15, draft, in your comments, and send them by October 03, 2003 to the following address:

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Abstract

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

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by the South Carolina Electric and Gas Company (SCE&G) to renew the operating license for the Virgil C. Summer Nuclear Station (V.C. Summer) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither SCE&G nor the staff has identified information that is both new and significant for any issue that applies to V.C. Summer. The staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the V.C. Summer operating license will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the staff's conclusion in the GEIS is that the impact is of SMALL^(a) significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to V.C. Summer are addressed in this draft SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental impacts of renewal of the operating license is SMALL. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

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

Abstract

1 The NRC staff's preliminary recommendation is that the Commission determine that the
2 adverse environmental impacts of license renewal for V.C. Summer are not so great that
3 preserving the option of license renewal for energy-planning decisionmakers would be
4 unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS;
5 (2) the Environmental Report submitted by SCE&G; (3) consultation with Federal, State, and
6 local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public
7 comments received during the scoping process.
8

Contents

Abstract	iii
Executive Summary	xv
Abbreviations/Acronyms	xx
1.0 Introduction	1-1
1.1 Report Contents	1-2
1.2 Background	1-3
1.2.1 Generic Environmental Impact Statement	1-3
1.2.2 License Renewal Evaluation Process	1-5
1.3 The Proposed Federal Action	1-7
1.4 The Purpose and Need for the Proposed Action	1-8
1.5 Compliance and Consultations	1-8
1.6 References	1-9
2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment	2-1
2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term	2-1
2.1.1 External Appearance and Setting	2-4
2.1.2 Reactor Systems	2-5
2.1.3 Cooling and Auxiliary Water Systems	2-5
2.1.4 Radioactive Waste Management Systems and Effluent Control Systems	2-9
2.1.4.1 Liquid Waste Processing Systems and Effluent Controls	2-10
2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls ..	2-12
2.1.4.3 Solid Waste Processing	2-14
2.1.5 Nonradioactive Waste Systems	2-15
2.1.6 Plant Operation and Maintenance	2-16
2.1.7 Power Transmission System	2-17
2.2 Plant Interaction with the Environment	2-20

Contents

1	2.2.1	Land Use	2-20
2	2.2.2	Water Use	2-21
3	2.2.3	Water Quality	2-22
4			
5	2.2.3.1	Monticello Reservoir Hydrology and Water Quality	2-23
6	2.2.3.2	Broad River and Parr Reservoir Hydrology and Water Quality	2-24
7	2.2.3.3	Groundwater Quality	2-24
8			
9	2.2.4	Air Quality	2-25
10	2.2.5	Aquatic Resources	2-27
11	2.2.6	Terrestrial Resources	2-33
12	2.2.7	Radiological Impacts	2-38
13	2.2.8	Socioeconomic Factors	2-39
14			
15	2.2.8.1	Housing	2-39
16	2.2.8.2	Public Services	2-41
17	2.2.8.3	Offsite Land Use	2-46
18	2.2.8.4	Visual Aesthetics and Noise	2-49
19	2.2.8.5	Demography	2-49
20	2.2.8.6	Economy and Taxes	2-54
21			
22	2.2.9	Historic and Archaeological Resources	2-57
23			
24	2.2.9.1	Cultural Background	2-57
25	2.2.9.2	Historic and Archaeological Resources at V.C. Summer	2-60
26			
27	2.2.10	Related Federal Project Activities and Consultations	2-61
28			
29	2.3	References	2-62
30			
31	3.0	Environmental Impacts of Refurbishment	3-1
32			
33	3.1	References	3-4
34			
35	4.0	Environmental Impacts of Operation	4-1
36			
37	4.1	Cooling System	4-2
38			
39	4.1.1	Water Use Conflicts (Make-up Water from a Small River)	4-10
40	4.1.2	Entrainment of Fish and Shellfish in Early Life Stages	4-13

1	4.1.3	Impingement of Fish and Shellfish	4-15
2	4.1.4	Heat Shock	4-17
3	4.1.5	Microbial Organisms (Public Health)	4-18
4			
5	4.2	Transmission Lines	4-20
6			
7	4.2.1	Electromagnetic Fields—Acute Effects	4-24
8	4.2.2	Electromagnetic Fields—Chronic Effects	4-25
9			
10	4.3	Radiological Impacts of Normal Operations	4-26
11	4.4	Socioeconomic Impacts of Plant Operations during the License	
12		Renewal Term	4-27
13			
14	4.4.1	Housing Impacts During Operations	4-30
15	4.4.2	Public Services: Public Utility Impacts During Operations	4-31
16	4.4.3	Offsite Land Use During Operations	4-32
17	4.4.4	Public Services: Transportation Impacts During Operations	4-34
18	4.4.5	Historic and Archaeological Resources	4-35
19	4.4.6	Environmental Justice	4-36
20			
21	4.5	Groundwater Use and Quality	4-41
22			
23	4.5.1	Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling	
24		Ponds that Withdraw Make-up Water from a Small River)	4-42
25	4.5.2	Groundwater Quality Degradation (Cooling Ponds at Inland Sites) ...	4-44
26			
27	4.6	Threatened or Endangered Species	4-45
28			
29	4.6.1	Aquatic Species	4-45
30	4.6.2	Terrestrial Species	4-46
31			
32	4.7	Evaluation of Potential New and Significant Information on Impacts of	
33		Operations During the Renewal Term	4-47
34			
35	4.8	Evaluation of Cumulative Impacts of Operations During the Renewal Term ..	4-47
36			
37	4.8.1	Cumulative Impacts Resulting from Operation of the	
38		Plant Cooling System	4-48
39	4.8.2	Cumulative Impacts Resulting from Continued Operation of the	
40		Transmission Lines	4-48

Contents

1	4.8.3	Cumulative Radiological Impacts	4-49
2	4.8.4	Cumulative Socioeconomic Impacts	4-49
3	4.8.5	Cumulative Impacts on Groundwater Use and Quality	4-50
4	4.8.6	Cumulative Impacts on Threatened or Endangered Species	4-50
5			
6	4.9	Summary of Impacts of Operations During the Renewal Term	4-51
7			
8	4.10	References	4-51
9			
10	5.0	Environmental Impacts of Postulated Accidents	5-1
11			
12	5.1	Postulated Plant Accidents	5-1
13			
14	5.1.1	Design-Basis Accidents	5-2
15	5.1.2	Severe Accidents	5-3
16			
17	5.2	Severe Accident Mitigation Alternatives	5-4
18			
19	5.2.1	Introduction	5-5
20	5.2.2	Estimate of Risk	5-5
21	5.2.3	Potential Plant Improvements	5-7
22	5.2.4	Risk Reduction Potential of Plant Improvements	5-8
23	5.2.5	Cost Impacts of Candidate Plant Improvements	5-9
24	5.2.6	Cost-Benefit Comparison	5-10
25	5.2.7	Conclusions	5-11
26			
27	5.3	References	5-12
28			
29	6.0	Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management .	6-1
30			
31	6.1	The Uranium Fuel Cycle	6-2
32	6.2	References	6-9
33			
34	7.0	Environmental Impacts of Decommissioning	7-1
35			
36	7.1	References	7-4
37			
38	8.0	Environmental Impacts of Alternatives to License Renewal	8-1
39			
40	8.1	No-Action Alternative	8-1

1	8.2	Alternative Energy Sources	8-7
2			
3	8.2.1	Coal-Fired Power Generation	8-9
4			
5	8.2.1.1	Once-Through Cooling System	8-10
6	8.2.1.2	Closed-Cycle Cooling System	8-25
7			
8	8.2.2	Natural Gas-Fired Power Generation	8-25
9			
10	8.2.2.1	Once-Through Cooling System	8-27
11	8.2.2.2	Closed-Cycle Cooling System	8-37
12			
13	8.2.3	Nuclear Power Generation	8-37
14			
15	8.2.3.1	Once-Through Cooling System	8-38
16	8.2.3.2	Closed-Cycle Cooling System	8-46
17			
18	8.2.4	Purchased Electrical Power	8-48
19	8.2.5	Other Alternatives	8-48
20			
21	8.2.5.1	Oil-Fired Generation	8-48
22	8.2.5.2	Wind Power	8-49
23	8.2.5.3	Solar Power	8-49
24	8.2.5.4	Hydropower	8-50
25	8.2.5.5	Geothermal Energy	8-50
26	8.2.5.6	Wood Waste	8-50
27	8.2.5.7	Municipal Solid Waste	8-51
28	8.2.5.8	Other Biomass-Derived Fuels	8-52
29	8.2.5.9	Fuel Cells	8-52
30	8.2.5.10	Delayed Retirement	8-53
31	8.2.5.11	Utility-Sponsored Conservation	8-53
32			
33	8.2.6	Combination of Alternatives	8-53
34			
35	8.3	Summary of Alternatives Considered	8-57
36			
37	8.4	References	8-57
38			
39	9.0	Summary and Conclusions	9-1
40			

Contents

1	9.1	Environmental Impacts of the Proposed Action—License Renewal	9-4
2			
3	9.1.1	Unavoidable Adverse Impacts	9-5
4	9.1.2	Irreversible or Irretrievable Resource Commitments	9-6
5	9.1.3	Short-Term Use Versus Long-Term Productivity	9-6
6			
7	9.2	Relative Significance of the Environmental Impacts of License Renewal	
8		and Alternatives	9-7
9	9.3	Staff Conclusions and Recommendations	9-7
10	9.4	References	9-9
11			
12	Appendix A -	Comments Received on the Environmental Review	A-1
13	Appendix B -	Contributors to the Supplement	B-1
14	Appendix C -	Chronology of NRC Staff Environmental Review Correspondence	
15		Related to the South Carolina Electric and Gas Company's Application	
16		for License Renewal of Virgil C. Summer Nuclear Station	C-1
17	Appendix D -	Organizations Contacted	D-1
18	Appendix E -	V.C. Summer Compliance Status and Consultation Correspondence .	E-1
19	Appendix F -	GEIS Environmental Issues Not Applicable to V.C. Summer	F-1
20	Appendix G -	NRC Staff Evaluation of Severe Accident Mitigation Alternatives for V.C.	
21		Summer Nuclear Station in Support of License Renewal Application .	G-1
22			

Figures

2-1	Location of V.C. Summer 80-km (50-mi) Region	2-2
2-2	Location of V.C. Summer 10-km (6-mi) Region	2-3
2-3	V.C. Summer Powerblock Area	2-7
2-4	V.C. Summer Transmission Lines	2-18
4-1	Geographic Distribution of Minority Populations within 80 km (50 mi) of V.C. Summer	4-39
4-2	Locations of Low-income Populations within 80 km (50 mi) of V.C. Summer	4-40

Tables

2-1	V.C. Summer Transmission Line Corridors	2-17
2-2	Standing Stock of Dominant Fishes of Monticello Reservoir	2-29
2-3	Aquatic Species Listed or Candidates for Listing as Endangered or Threatened by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, or the State of South Carolina that Occur or Potentially Occur Within or Near the V.C. Summer Site or the Associated Transmission Line Right-of-Way	2-31
2-4	Terrestrial Species Listed or Candidates for Listing as Endangered or Threatened by the U.S. Fish and Wildlife Service or the State of South Carolina that Occur or Potentially Occur Within or Near the V.C. Summer Site or the Associated Transmission Line Right-of-Way	2-35
2-5	V.C. Summer Employee Residence Information by County	2-40
2-6	Housing Units and Housing Units Vacant (Available) by County during 1990 and 2000	2-42
2-7	Fairfield County Public and Private Water Suppliers and Capacities	2-43
2-8	Traffic Counts for Roads in the Vicinity of V.C. Summer	2-45
2-9	Land Use in Fairfield County, 1997	2-47
2-10	Population Growth in the Central Midlands Region of South Carolina 1980 to 2040	2-50
2-11	Resident Population Within 80 km (50 mi) of V.C. Summer	2-50
2-12	Age Distribution of Population in Fairfield County	2-52
2-13	Unemployment, Poverty Level, and Median Household Income Comparison	2-54
2-14	Major Employers in Fairfield County, South Carolina	2-56
2-15	Fairfield County Property Tax Revenues, Property Taxes Paid by V.C. Summer, and Fairfield County Operating Budget 1995 to 2000	2-58
3-1	Category 1 Issues for Refurbishment Evaluation	3-2
3-2	Category 2 Issues for Refurbishment Evaluation	3-3
4-1	Category 1 Issues Applicable to the Operation of the V.C. Summer Cooling System During the Renewal Term	4-3
4-2	Category 2 Issues Applicable to the Operation of the V.C. Summer Cooling System During the Renewal Term	4-11
4-3	Species Comprising More than One Percent of Impingement Samples: Results of 316(b) Impingement Studies, V.C. Summer (Dames and Moore 1985a)	4-16
4-4	Category 1 Issues Applicable to the V.C. Summer Transmission Lines During the Renewal Term	4-21
4-5	Category 2 and Uncategorized Issues Applicable to the V.C. Summer Transmission Lines During the Renewal Term	4-23
4-6	Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term	4-26
4-7	Category 1 Issues Applicable to Socioeconomics During the Renewal Term	4-27
4-8	Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the Renewal Term	4-29

1	4-9	Category 1 Issue Applicable to Groundwater Use and Quality During the	
2		Renewal Term	4-42
3	4-10	Category 2 Issues Applicable to Groundwater Use and Quality During the	
4		Renewal Term	4-43
5	4-11	Category 2 Issue Applicable to Threatened or Endangered Species During the	
6		Renewal Term	4-46
7			
8	5-1	Category 1 Issue Applicable to Postulated Accidents During the Renewal Term	5-3
9	5-2	Category 2 Issue Applicable to Postulated Accidents During the Renewal Term	5-4
10	5-3	V.C. Summer Core Damage Frequency	5-6
11	5-4	Breakdown of Population Dose by Containment Release Mode	5-7
12			
13	6-1	Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste	
14		Management During the Renewal Term	6-2
15			
16	7-1	Category 1 Issues Applicable to the Decommissioning of V.C. Summer Following the	
17		Renewal Term	7-2
18			
19	8-1	Summary of Environmental Impacts of the No-Action Alternative	8-3
20	8-2	Summary of Environmental Impacts of Coal-Fired Generation at V.C. Summer Site	
21		and an Alternate Greenfield Site Using Once-Through Cooling	8-11
22	8-3	Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Site	
23		with Closed-Cycle Cooling System	8-26
24	8-4	Summary of Environmental Impacts of Natural Gas-Fired Generation at V.C. Summer.	
25		and an Alternate Greenfield Site Using Once-Through Cooling	8-27
26	8-5	Summary of Environmental Impacts of Natural Gas-Fired Generation at an	
27		Alternate Site with Closed-Cycle Cooling	8-38
28	8-6	Summary of Environmental Impacts of New Nuclear Power Generation at the	
29		V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling ...	8-39
30	8-7	Summary of Environmental Impacts of a New Nuclear Power Plant at an Alternate	
31		Site with Closed-Cycle Cooling	8-47
32	8-8	Summary of Environmental Impacts for an Assumed Combination of Generating	
33		and Acquisition Alternatives	8-54
34			
35	9-1	Summary of Environmental Significance of License Renewal, the No-Action	
36		Alternative, and Alternative Methods of Generation Using Once-Through Cooling	9-8
37			
38			
39			
40			
41			

Tables

1	A-1	Individuals Providing Comments During Scoping Comment Period	A-2
2			
3	E-1	Federal, State, and Local Licenses, Permits, and Consultations and other Approvals	
4		for V.C. Summer	E-2
5			
6	F-1	GEIS Environmental Issues Not Applicable to the Virgil C. Summer Nuclear Station ..	F-1
7			
8	G-1	V.C. Summer Core Damage Frequency	G-3
9	G-2	Breakdown of Population Dose By Containment Release Mode	G-4
10	G-3	SAMA Cost/Benefit Screening Analysis	G-15
11	G-4	Uncertainty in the Calculated CDF for V.C. Summer	G-23

Executive Summary

By letter dated August 6, 2002, South Carolina Electric and Gas Company (SCE&G) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for the Virgil C. Summer Nuclear Station (V.C. Summer) for an additional 20-year period. If the OL is renewed, State regulatory agencies and SCE&G will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OL is not renewed, then the plant must be shut down at or before the expiration date of the current OL, which is August 6, 2022.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.^(a)

Upon acceptance of the SCE&G application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the V.C. Summer site in December 2002 and held public scoping meetings on December 11, 2002, in Jenkinsville, South Carolina. In the preparation of this draft supplemental environmental impact statement (SEIS) for V.C. Summer, the staff reviewed the V.C. Summer Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Jenkinsville, South Carolina, in August 2003, to describe the preliminary results of the NRC environmental review and answer questions to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ends, the staff will consider and disposition all of the

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

Executive Summary

1 comments received. These comments will be addressed in Appendix A, Part 2, of the final
2 SEIS.

3
4 This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the
5 environmental effects of the proposed action, the environmental impacts of alternatives to the
6 proposed action, and mitigation measures for reducing or avoiding adverse effects. It also
7 includes the staff's preliminary recommendation regarding the proposed action.

8
9 The Commission has adopted the following statement of purpose and need for license renewal
10 from the GEIS:

11
12 The purpose and need for the proposed action (renewal of an operating license) is to
13 provide an option that allows for power generation capability beyond the term of a current
14 nuclear power plant operating license to meet future system generating needs, as such
15 needs may be determined by State, utility, and, where authorized, Federal (other than NRC)
16 decisionmakers.

17
18 The goal of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is
19 to determine

20
21 ... whether or not the adverse environmental impacts of license renewal are so great that
22 preserving the option of license renewal for energy planning decisionmakers would be
23 unreasonable.

24
25 Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that
26 there are factors, in addition to license renewal, that will ultimately determine whether an
27 existing nuclear power plant continues to operate beyond the period of the current OL.

28
29 NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of
30 SEISs prepared at the license renewal stage:

31
32 The supplemental environmental impact statement for license renewal is not required to
33 include discussion of need for power or the economic costs and economic benefits of the
34 proposed action or of alternatives to the proposed action except insofar as such benefits
35 and costs are either essential for a determination regarding the inclusion of an alternative in
36 the range of alternatives considered or relevant to mitigation. In addition, the supplemental
37 environmental impact statement prepared at the license renewal stage need not discuss
38 other issues not related to the environmental effects of the proposed action and the
39 alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the
40 generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of

reactor operation—generic determination of no significant environmental impact”] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC’s three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

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

Executive Summary

1 Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2
2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues,
3 environmental justice and chronic effects of electromagnetic fields, were not categorized.
4 Environmental justice was not evaluated on a generic basis and must be addressed in a plant-
5 specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields
6 was not conclusive at the time the GEIS was prepared.

7
8 This draft SEIS documents the staff's evaluation of all 92 environmental issues identified in the
9 GEIS. The staff considered the environmental impacts associated with alternatives to license
10 renewal and compared the environmental impacts of license renewal and the alternatives. The
11 alternatives to license renewal that were considered include the no-action alternative (not
12 renewing the OL for V.C. Summer) and alternative methods of power generation. Based on
13 projections made by the U.S. Department of Energy's Energy Information Administration, gas-
14 and coal-fired generation appear to be the most likely power-generation alternatives if the
15 power from V.C. Summer is replaced. These alternatives are evaluated assuming that the
16 replacement power generation plant is located at either the
17 V.C. Summer site or some other unspecified alternate location in South Carolina.

18
19 SCE&G and the staff have established independent processes for identifying and evaluating the
20 significance of any new information on the environmental impacts of license renewal. Neither
21 SCE&G nor the staff has identified information that is both new and significant related to
22 Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither
23 the scoping process nor the staff has identified any new issue applicable to V.C. Summer that
24 has a significant environmental impact. Therefore, the staff relies upon the conclusions of the
25 GEIS for all of the Category 1 issues that are applicable to V.C. Summer.

26
27 SCE&G's license renewal application presents an analysis of the Category 2 issues plus
28 environmental justice and chronic effects from electromagnetic fields. The staff has reviewed
29 the SCE&G analysis for each issue and has conducted an independent review of each issue.
30 Three Category 2 issues are not applicable because they are related to plant design features or
31 site characteristics not found at V.C. Summer. Four Category 2 issues are not discussed in this
32 draft SEIS because they are specifically related to refurbishment. SCE&G has stated that its
33 evaluation of structures and components, as required by 10 CFR 54.21, did not identify any
34 major plant refurbishment activities or modifications as necessary to support the continued
35 operation of V.C. Summer for the license renewal period. In addition, any replacement of
36 components or additional inspection activities are within the bounds of normal plant component
37 replacement and, therefore, are not expected to affect the environment outside of the bounds of
38 the plant operations evaluated in the U.S. Atomic Energy Commission's 1981 *Final*
39 *Environmental Statement Related to Operation of V.C. Summer Plant*.

40

1 Fifteen Category 2 issues related to operational impacts and postulated accidents during the
2 renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are
3 discussed in detail in this draft SEIS. Four of the Category 2 issues and environmental justice
4 apply to both refurbishment and to operation during the renewal term and are only discussed in
5 this draft SEIS in relation to operation during the renewal term. For all 15 Category 2 issues
6 and environmental justice, the staff concludes that the potential environmental effects are of
7 SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff
8 determined that appropriate Federal health agencies have not reached a consensus on the
9 existence of chronic adverse effects from electromagnetic fields. Therefore, no further
10 evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the
11 staff concludes that a reasonable, comprehensive effort was made to identify and evaluate
12 SAMAs. Based on its review of the SAMAs for V.C. Summer, and the plant improvements
13 already made, the staff concludes that none of the candidate SAMAs are cost-beneficial.
14

15 Mitigation measures were considered for each Category 2 issue. Current measures to mitigate
16 the environmental impacts of plant operation were found to be adequate, and no additional
17 mitigation measures were deemed sufficiently beneficial to be warranted.
18

19 If the V.C. Summer OL is not renewed and the unit ceases operation on or before the expiration
20 of the current OL, then the adverse impacts of likely alternatives will not be smaller than those
21 associated with continued operation of V.C. Summer. The impacts may, in fact, be greater in
22 some areas.
23

24 The preliminary recommendation of the NRC staff is that the Commission determine that the
25 adverse environmental impacts of license renewal for V.C. Summer are not so great that
26 preserving the option of license renewal for energy planning decisionmakers would be
27 unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS;
28 (2) the ER submitted by SCE&G; (3) consultation with other Federal, State, and local agencies;
29 (4) the staff's own independent review; and (5) the staff's consideration of public comments
30 received during the scoping process.
31
32

Abbreviations/Acronyms

1		
2		
3		
4	°	degree(s)
5		
6	μCi	microcurie(s)
7	μCi/mL	microcurie(s) per milliliter
8	μm	micrometer(s)
9		
10	AADT	annual average daily traffic (volume)
11	ac	acres
12	AD	Anno Domini
13	AEA	Atomic Energy Act of 1954
14	ALARA	as low as reasonably achievable
15	AQCR	Air Quality Control Region
16		
17	BC	before Christ
18	Bq/L	becquerel per liter
19	Bq/mL	becquerel per milliliter
20	Btu/ft ³	British thermal units per cubic foot
21	Btu/h	British thermal units per hour
22	Btu/kWh	British thermal units per kilowatt-hour
23		
24	C	Celsius
25	CFR	Code of Federal Regulations
26	cfs	cubic feet per second
27	Ci	curie(s)
28	cm	centimeter(s)
29	CWA	Clean Water Act
30		
31	DO	dissolved oxygen
32	DOE	U.S. Department of Energy
33	DSM	demand-side management
34		
35	EIA	Energy Information Administration (U.S. DOE)
36	EIS	environmental impact statement
37	ELF-EMF	extremely low frequency-electromagnetic field
38	EPA	U.S. Environmental Protection Agency
39	ER	Environmental Report
40		
41	F	Fahrenheit
42	FERC	Federal Energy Regulatory Commission
43	FPSF	Fairfield Pumped Storage Facility
44	FR	Federal Register
45	ft	foot/feet
46	ft ³	cubic feet

Abbreviations/Acronyms

1	FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act)
2		
3	gal	gallon(s)
4	gal/d	gallons per day
5	GEIS	<i>Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG 1437</i>
6		
7	gpm	gallons per minute
8	GWPS	gaseous waste processing system
9		
10		
11	ha	hectares
12	HEPA	high-efficiency particulate air (filter)
13	HLW	high-level waste
14	Hz	Hertz
15		
16	in	inch(es)
17	ISFSI	independent spent fuel storage installation
18		
19	J	joule(s)
20		
21	KkW	thousand kilowatts
22	km	kilometers
23	km ²	square kilometers
24	kPa	kilopascal
25	kV	kilovolts
26	kWh	kilowatt-hour
27		
28	L	liter(s)
29	lb/MWh	pounds per megawatt hour
30	L/d	liters per day
31	LLW	low-level waste
32	L/s	liters per second
33	LWPS	liquid waste processing systems
34		
35	m	meters
36	m/s	meters per second
37	m ³	cubic meters
38	m ³ /d	cubic meters per day
39	m ³ /s	cubic meters per second
40	m ³ /yr	cubic meters per year
41	mA	milliamperes
42	MGD	million gallons per day
43	mGy	milligray(s)
44	mi	mile(s)

Abbreviations/Acronyms

1	mi ²	square miles
2	mJ	millijoule(s)
3	mph	miles per hour
4	mrads	millirad(s)
5	mrem	millirem(s)
6	mSv	millisievert(s)
7	MT	metric ton(s)
8	MWd/MTU	megawatt-days per metric ton of uranium
9	MW(e)	megawatts electric
10	MWh	megawatt hour(s)
11	MW(t)	megawatts thermal
12		
13	NA	not applicable
14	NAS	National Academy of Sciences
15	NEPA	National Environmental Policy Act of 1969
16	NESC	National Electrical Safety Code
17	ng/J	nanogram(s) per joule
18	NHPA	National Historic Preservation Act of 1966
19	NIEHS	National Institute of Environmental Health Sciences
20	NMFS	National Marine Fisheries Service
21	NO _x	nitrogen oxides
22	NPDES	National Pollutant Discharge Elimination System
23	NRC	U.S. Nuclear Regulatory Commission
24	NRHP	National Register of Historic Places
25		
26	ODCM	Offsite Dose Calculation Manual
27	OL	operating license
28		
29	pCi/L	picocuries per liter
30	PM ₁₀	particulate matter, 10 microns or less in diameter
31	ppm	parts per million
32	psig	pounds per square inch gauge
33		
34	rem	roentgen equivalent man
35	REMP	radiological environmental monitoring program
36		
37	SAMA	severe accident mitigation alternative
38	SCANA	South Carolina Public Service Authority
39	SCDAH	South Carolina Department of Archives and History
40	SCDHEC	South Carolina Department of Health and Environmental Control
41	SCE&G	South Carolina Electric and Gas Company
42	SCDNR	South Carolina Department of Natural Resources
43	SEIS	supplemental environmental impact statement
44	SHPO	State Historic Preservation Officer

Abbreviations/Acronyms

1	SO ₂	sulfur dioxide
2	SO _x	sulfur oxides
3	Sv	sevier(s)
4		
5	TBq	tera becquerel(s)
6		
7	U.S.	United States
8	USC	United States Code
9		
10	V.C. Summer	Virgil C. Summer Nuclear Station
11		
12	yr	year
13		
14		

1.0 Introduction

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

The South Carolina Electric and Gas Company (SCE&G) operates Virgil C. Summer Nuclear Power Station (V.C. Summer) in South Carolina on behalf of itself and of the South Carolina Public Service Authority (Santee Cooper), which has a one-third non-operating interest in the station. SCE&G operates V.C. Summer under OL NPF-12, which was issued by the NRC. This OL will expire on August 6, 2022. On August 6, 2002, SCE&G submitted an application to the NRC to renew the V.C. Summer OL for an additional 20 years under 10 CFR Part 54. SCE&G is a *licensee* for the purposes of its current OL and an *applicant* for the renewal of the OL. Pursuant to 10 CFR 54.23 and 51.53(c), SCE&G submitted an Environmental Report (ER) (SCE&G 2002a) in which SCE&G analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

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

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

1.1 Report Contents

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

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

Additional information is included in appendices. Appendix A contains public comments received on the environmental review for license renewal and staff responses. Appendices B through G, respectively, list the following:

- the preparers of the supplement,
- the chronology of correspondence between NRC and SCE&G with regard to this SEIS,
- the organizations contacted during the development of this SEIS,
- SCE&G's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and issued during the evaluation process),
- GEIS environmental issues that are not applicable to V.C. Summer, and
- SAMAs.

1.2 Background

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

1.2.1 Generic Environmental Impact Statement

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

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

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

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

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

Introduction

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

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

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.**
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).**
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.**

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

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

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The latter two issues, environmental justice and chronic effects of electromagnetic fields, are to be addressed in a plant-specific analysis. Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

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

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

- provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B in accordance with 10 CFR 51.53(c)(3)(ii) and
- discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

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

- consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered or (2) relevant to mitigation,
- consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives,
- discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b), and
- contain an analysis of any Category 1 issue unless there is significant new information on a specific issue—this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

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

In preparing to submit its application to renew the V.C. Summer OL, SCE&G developed a process to ensure that information not addressed in or available during the GEIS evaluation

Introduction

1 regarding the environmental impacts of license renewal for V.C. Summer would be properly
2 reviewed before submitting the ER, and to ensure that such new and potentially significant
3 information related to renewal of the license for V.C. Summer would be identified, reviewed,
4 and assessed during the period of NRC review. SCE&G reviewed the Category 1 issues that
5 appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of
6 the GEIS remained valid with respect to V.C. Summer. This review was performed by
7 personnel from SCE&G and its support organization who were familiar with NEPA issues and
8 the scientific disciplines involved in the preparation of a license renewal ER.

9
10 The NRC staff also has a process for identifying new and significant information. That process
11 is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power*
12 *Plants, Supplement 1: Operating License Renewal*, NUREG-1555, Supplement 1 (NRC 2000).
13 The search for new information includes (1) review of an applicant's ER and the process for
14 discovering and evaluating the significance of new information; (2) review of records of public
15 comments; (3) review of environmental quality standards and regulations; (4) coordination with
16 Federal, State, and local environmental protection and resource agencies; and (5) review of the
17 technical literature. New information discovered by the staff is evaluated for significance using
18 the criteria set forth in the GEIS. For Category 1 issues where new and significant information
19 is identified, reconsideration of the conclusions for those issues is limited in scope to the
20 assessment of the relevant new and significant information; the scope of the assessment does
21 not include other facets of the issue that are not affected by the new information.

22
23 Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are
24 applicable to V.C. Summer. At the beginning of the discussion of each set of issues, there is a
25 table that identifies the issues to be addressed and lists the sections in the GEIS where the
26 issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For
27 Category 1 issues for which there is no new and significant information, the table is followed by
28 a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR
29 Part 51, Subpart A, Appendix B, followed by the staff's analysis and conclusion. For Category 2
30 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the
31 subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the draft SEIS
32 sections where the analysis is presented. The draft SEIS sections that discuss the Category 2
33 issues are presented immediately following the table.

34
35 The NRC prepares an independent analysis of the environmental impacts of license renewal
36 and compares these impacts with the environmental impacts of alternatives. The evaluation of
37 the SCE&G license renewal application began with publication of a notice of acceptance for
38 docketing and opportunity for a hearing in the *Federal Register* (67 FR 62272 [NRC 2002a]) on
39 October 4, 2002. The staff published a notice of intent to prepare an EIS and conduct scoping
40 (67 FR 65612 [NRC 2002b]) on October 25, 2002. Two public scoping meetings were held on

December 11, 2002, in Jenkinsville, South Carolina. Comments received during the scoping period were summarized in the *Environmental Scoping Summary Report, V.C. Summer Nuclear Station, Fairfield County, South Carolina* (NRC 2003) dated January 14, 2003. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1, in the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff and contractors retained to assist the staff visited the V.C. Summer site on December 10 and 11, 2002, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping and consulted with Federal, State, regional, and local agencies. A list of the organizations contacted is provided in Appendix D. Other documents related to V.C. Summer were reviewed and are referenced.

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

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency FR Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff's review. During this comment period, two public meetings will be held in Jenkinsville, South Carolina, in August 2003. During these meetings, the staff will describe the preliminary results of the NRC environmental review and answer questions related to it to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OL for V.C. Summer. V.C. Summer is located in north-central South Carolina, in Fairfield County, approximately 42 km (26 mi) northwest of Columbia, South Carolina. The current OL for V.C. Summer expires on August 6, 2022. By letter dated August 6, 2002, SCE&G submitted an application to the NRC (SCE&G 2002b) to renew this OL for an additional 20 years of operation (i.e., until August 6, 2042).

Introduction

The plant has one Westinghouse-designed pressurized light-water reactor, with a design rating for a net electrical power output of 966 megawatts electric [MW(e)]. Plant cooling is provided by a once-through cooling water system that dissipates heat primarily by discharge into Monticello Reservoir. V.C. Summer produces electricity to supply the needs of more than 13,000 homes.

1.4 The Purpose and Need for the Proposed Action

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

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

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

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

1.5 Compliance and Consultations

SCE&G is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, SCE&G provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with V.C. Summer license renewal.

1 Authorizations and consultations relevant to the proposed OL renewal action are included in
2 Appendix E.

3
4 The staff has reviewed SCE&G's authorizations and consultations and has consulted with the
5 appropriate Federal, State, and local agencies to identify any compliance or permit issues or
6 significant environmental issues of concern to the reviewing agencies. These agencies did not
7 identify any new and significant environmental issues. The ER states that SCE&G is in
8 compliance with applicable environmental standards and requirements for V.C. Summer. The
9 staff has not identified any environmental issues that are both new and significant.
10

11 1.6 References

12
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
16 10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for
17 Renewal of Operating Licenses for Nuclear Power Plants."

18
19 40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part
20 1508, "Terminology and Index."

21
22 Atomic Energy Act of 1954 (AEA). 42 USC 2011, et seq.

23
24 National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

25
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2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

Virgil C. Summer Nuclear Station (V.C. Summer), owned by South Carolina Electric and Gas (SCE&G) and South Carolina Public Service Authority (Santee Cooper), is located in Fairfield County, in predominantly rural north-central South Carolina. It is situated on the shore of Monticello Reservoir about 42 km (26 mi) northwest of Columbia, the State capital. The plant consists of a nuclear reactor, cooling and auxiliary water systems, and transmission facilities. The nuclear reactor is a pressurized light-water reactor with three steam generators turning turbines to generate electricity. Cooling system water is provided from Monticello Reservoir. The plant and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

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

V.C. Summer is located on 909 ha (2245 ac) of SCE&G-owned land approximately 130 m (425 ft) above sea level, 24 km (15 mi) west of the county seat of Winnsboro, and 42 km (26 mi) northwest of Columbia, the State capital. Fairfield County is part of the Central Midlands Region (approximately 600,000 residents in year 2000) that also encompasses Lexington, Richland, and Newberry counties. Figures 2-1 and 2-2 depict the site location and features within 80 and 10 km (50 and 6 mi), respectively. The site exclusion area boundary's western axis is slightly longer (1783 m [5850 ft]) than its eastern axis (1631 m [5350 ft]) (SCE&G 1978). The exclusion area boundary also represents the site boundary.

V.C. Summer is located in a sparsely populated, largely rural area, with forests and small farms composing the dominant land use. This Piedmont terrain varies from gently rolling to hilly and includes broad stream valleys. Jenkinsville and Peak are the closest settlements, although there are also homes built along the main plant access road. The Broad River flows in a northwest-to-southeast direction approximately 1.6 km (1 mi) west of the site and serves as the boundary between Fairfield County (to the east) and Newberry County (to the west).

V.C. Summer is co-located with a hydroelectric facility. The general area has been used for energy production since 1914 when this reach of the Broad River was impounded for a small, run-of-the-river hydroelectric plant and Parr Reservoir was created. Later, a coal-fired power plant operated for decades nearby. Originally 750 ha (1850 ac), Parr Reservoir was enlarged to approximately 1780 ha (4400 ac) in 1977, by raising the level of the dam by 2.7 m (9 ft) (SCE&G 1978). This modification was necessary to support the development of the Fairfield Pumped Storage Facility (FPSF), which was built on Frees Creek, a small tributary of the Broad River. Monticello Reservoir, a 2630-ha (6500-ac) impoundment, was built in the Frees Creek

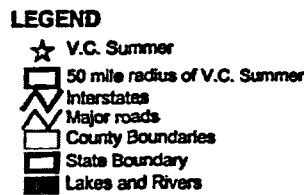
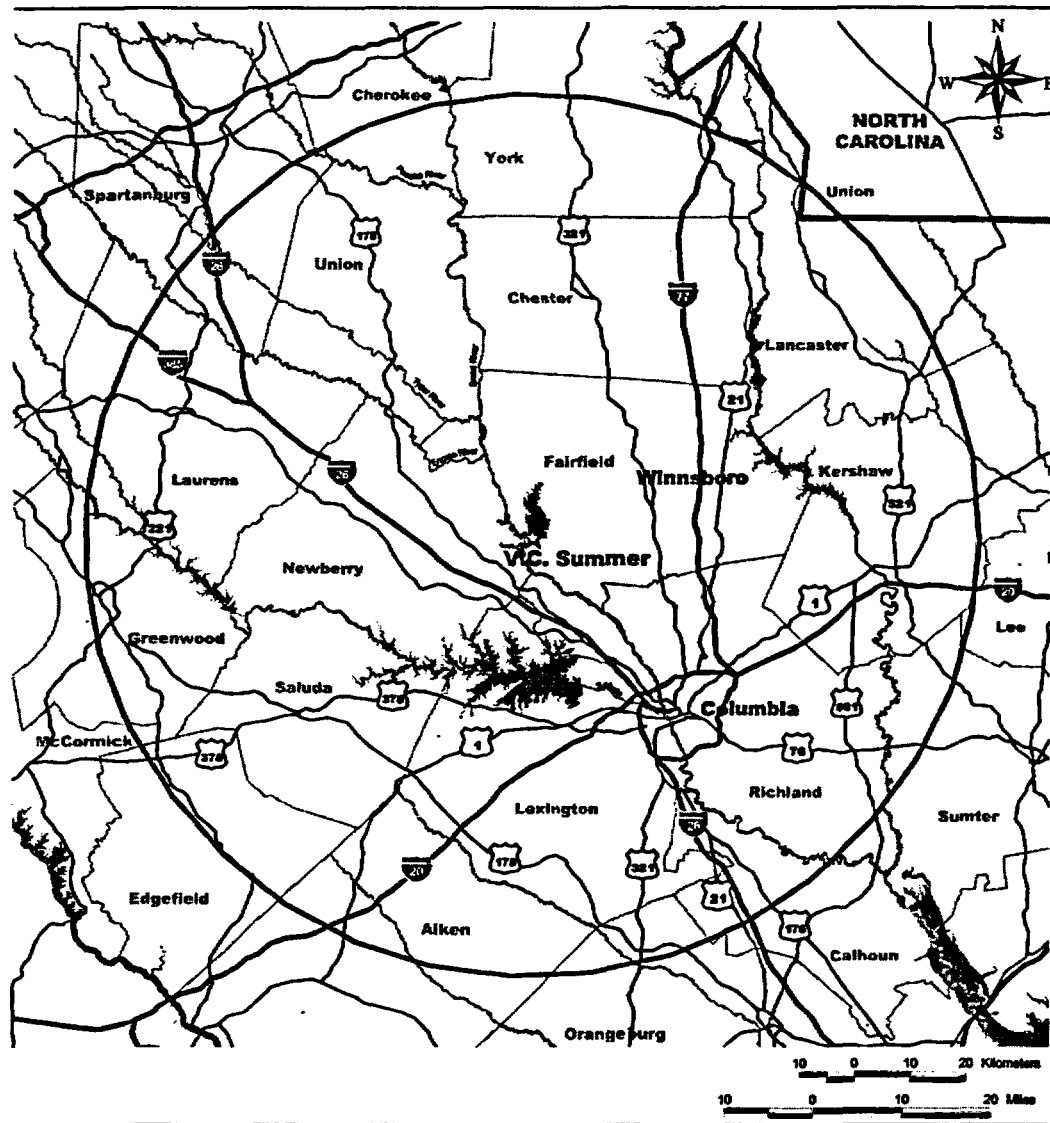


Figure 2-1. Location of V.C. Summer 80-km (50-mi) Region

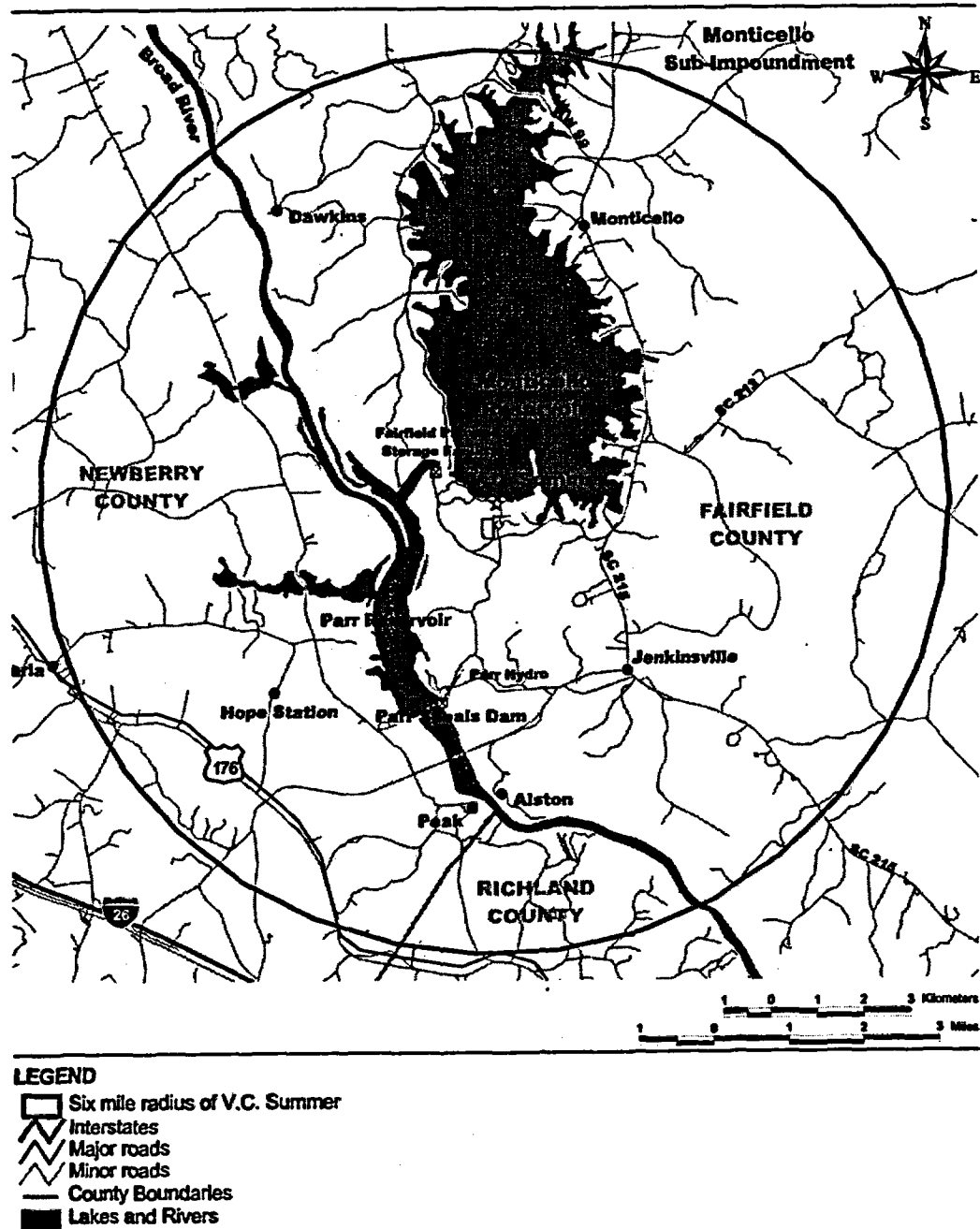


Figure 2-2. Location of V.C. Summer 10-km (6-mi) Region

Plant and the Environment

1 valley to serve as the upper pool for FPSF and the cooling water source for V.C. Summer. Parr
2 Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual
3 function, providing water for both Parr Hydro and FPSF.

4
5 V.C. Summer is located on the south shore of Monticello Reservoir (Figure 2-2). Monticello
6 Reservoir is hydrologically connected (by a conduit that passes under the Highway 99
7 causeway) to a smaller 121-ha (300-ac) body of water known as the Monticello
8 Subimpoundment that is managed for recreational boating and fishing by SCE&G and
9 South Carolina Department of Natural Resources (SCDNR). SCE&G maintains the property,
10 which includes boat launch, swimming, and picnic facilities. Lake Monticello Park, situated on
11 the eastern shore of Monticello Reservoir, provides day use recreation including a playground,
12 tennis courts, ball fields, picnic sites, and swimming.

13
14 Lake Murray State Park to the southwest of V.C. Summer impounds the Saluda River and
15 offers marinas with fishing and boating and camping opportunities and includes Dreher Island
16 State Recreation Area. Lake Wateree State Recreation Area, 24 km (15 mi) to the east of
17 Winnsboro, permits motorized boating and is popular for fishing. The Sumter National Forest is
18 about 48 km (30 mi) north of V.C. Summer and provides multi-use recreation. The
19 approximately 9000-ha (22,200-ac) Congaree Swamp National Monument at the Broad and
20 Saluda river confluence is located in lower Richland County, southwest of Columbia. It
21 preserves the last significant tract of old-growth bottomland hardwood forest in the
22 United States along with outstanding wetland habitat.

23 24 **2.1.1 External Appearance and Setting**

25
26 The domed reactor building is the tallest structure at V.C. Summer. It is surrounded by the
27 auxiliary buildings, the control building, turbine building, and diesel generator building. There
28 are facilities for fuel handling and related support shops, warehouses, and storage. Service
29 water pond dams extend into Monticello Reservoir to the east as do the discharge bay and
30 canal. The intake structure is located north of the station. A wastewater treatment area and
31 the substation are located to the south. The FPSF is about one-half mile to the west.

32
33 The entire nuclear station and support facilities are not easily visible from adjacent communities
34 because of the topography and forested cover. The station can be viewed from SC 215 and
35 lands along the eastern shore of Monticello Reservoir.

36
37 The V.C. Summer site lies within the Piedmont Physiographic Province and is underlain by
38 igneous and metamorphic crystalline rocks, including migmatites in transitional areas between
39 metamorphic and igneous bodies. Bedrock within this portion of the Piedmont is
40 metasedimentary and metavolcanic and contains granites, gneisses, and schists

(SCE&G 2002a). Crystalline bedrock has been deeply weathered into a saprolitic mantle of soil 40 to 20 m (40 to 85 ft) thick at the site. The upper soil profile is characterized by a silty and clayey horizon (SCE&G 2002a).

2.1.2 Reactor Systems

V.C. Summer is a single-unit plant with a domed concrete containment building. The station includes a pressurized light-water reactor nuclear steam supply system designed and furnished by Westinghouse Electric Company and a turbine generator manufactured by General Electric Corporation. The unit was designed for an output of 2775 megawatts thermal [MW(t)] with corresponding net electrical output of approximately 900 megawatts electric [MW(e)]. It achieved initial criticality in October 1982 and began commercial operation in January 1983 (SCE&G 2002a).

In 1996, SCE&G sought approval from the Nuclear Regulatory Commission (NRC) to upgrade performance to a core power output of 2900 MW(t) with a net electrical output of 945 MW(e). In August 1997, instrument changes improving measurement accuracy resulted in a 9-MW increase in indicated electrical power output, to 954 MW(e). In the Spring of 1999 a more efficient high-pressure turbine rotor increased the net electrical output to 966 MW(e) (SCE&G 2002a).

The reactor containment structure is a steel-lined, reinforced-concrete, 46.9-m- (154-ft-) diameter cylinder with a hemispheric dome and a flat reinforced concrete foundation mat (SCE&G 2002a). The concrete vertical walls are 1.2 m (4 ft) thick, with an outside diameter of 40.8 m (134 ft). The dome is 0.9 m (3 ft) thick, and the overall height is approximately 50.6 m (166 ft) above grade. Air pressure inside the containment structure is maintained at between -0.1 and +1.5 psig below atmospheric pressure for routine operations. Together with its engineered safety features, the containment structure is designed to withstand an internal pressure of 57 psig above atmospheric pressure and provides radiation shielding for both normal operation and design basis accident conditions (SCE&G 2002a).

2.1.3 Cooling and Auxiliary Water Systems

V.C. Summer operates as a once-through cooling plant that withdraws from and discharges to a cooling pond, Monticello Reservoir. Monticello Reservoir was built to supply cooling water to the station and to provide an upper reservoir for the FPSF located on Parr Reservoir.

To limit the heat load rejected to Monticello Reservoir, in 1996 SCE&G installed the Turbine Building closed-cycle cooling water system to provide cooling for certain station loads that were

Plant and the Environment

1 previously handled by the circulating water system. The closed system does not handle any of
2 the heat load directly associated with reactor cooling. The closed-cycle cooling water system
3 supplies cooling water to equipment associated with the turbine, generator, and other non-
4 nuclear systems in the Turbine Building. The system uses a forced-draft (closed-cycle) cooling
5 facility with four fans and eight cooling coils to reject waste heat to the atmosphere. This
6 cooling structure is 26 by 13 m (86.9 by 41.9 ft) with a maximum elevation of 140 m (459.5 ft)
7 (grade elevation is 133 m [435 ft]) (SCE&G 1996). It is located outside of the protected area
8 fence, approximately 152 m (500 ft) northwest of the Reactor Building. Under normal
9 operation, one of the two closed-cycle cooling water pumps circulates treated water through the
10 cooling coils, transferring heat removed from the various components to spray water and then
11 to the atmosphere by evaporation of the spray water in the air stream produced by the cooling
12 fans. The Turbine Building closed-cycle water system is independent of plant emergency
13 cooling facilities, and is not required for reactor protection or safe shutdown (SCE&G 2002a).

14
15 The main cooling system at V.C. Summer is the circulating water system. It is designed to
16 remove 6.67×10^9 Btu/h of heat from the main and auxiliary condensers as well as the turbine
17 auxiliaries (NRC 1981). Cooling water is drawn from the Monticello Reservoir at a rate of
18 approximately 32 m³/s (1143 cfs), passed through the condensers, and ultimately returned to
19 Monticello Reservoir. The intake structure, located along the south shoreline of the reservoir,
20 has three pump bays, each with two entrances. Each entrance is 4 m (13 ft) wide and 8 m
21 (25.5 ft) high, extending from the bottom of the pump house (elevation 119 m [390.0 ft]) to the
22 bottom of a skimmer wall (elevation 127 m [415.5 ft]). The entrances are each equipped with
23 vertical traveling screens (mesh size 1.0 x 0.89 cm [0.4 x 0.35 in.]) and two sets of trash racks
24 of conventional design (NRC 1981).

25
26 After leaving the condensers, circulating water moves via a 3.7-m- (12-ft-) diameter pipe from
27 the plant to a semi-enclosed discharge basin. From the basin, the heated effluent moves
28 through a 305-m- (1000-ft-) long discharge canal to Monticello Reservoir. The discharge canal
29 directs the discharge flow (heated effluent) to the northeast. A 790-m- (2600-ft-) long jetty
30 prevents the recirculation of the heated water. Figure 2-3 shows the intake structure, discharge
31 basin, discharge canal, and associated features of the V.C. Summer circulating water system.

32
33 To mitigate the effects of excessively warm water in the discharge canal on the fishery, the
34 entire length of the discharge canal was dredged during July and August of 1993. The
35 dredging increased the amount of cool water that flows into the canal during low reservoir
36 levels. Dredging altered the circulation patterns in the canal and increased the cool water flow
37 such that the temperature at the bottom of the discharge bay in summer remained 10 to 15
38 degrees cooler than "end-of-pipe" discharge temperatures (SCE&G 1996). Between 1995 and
39

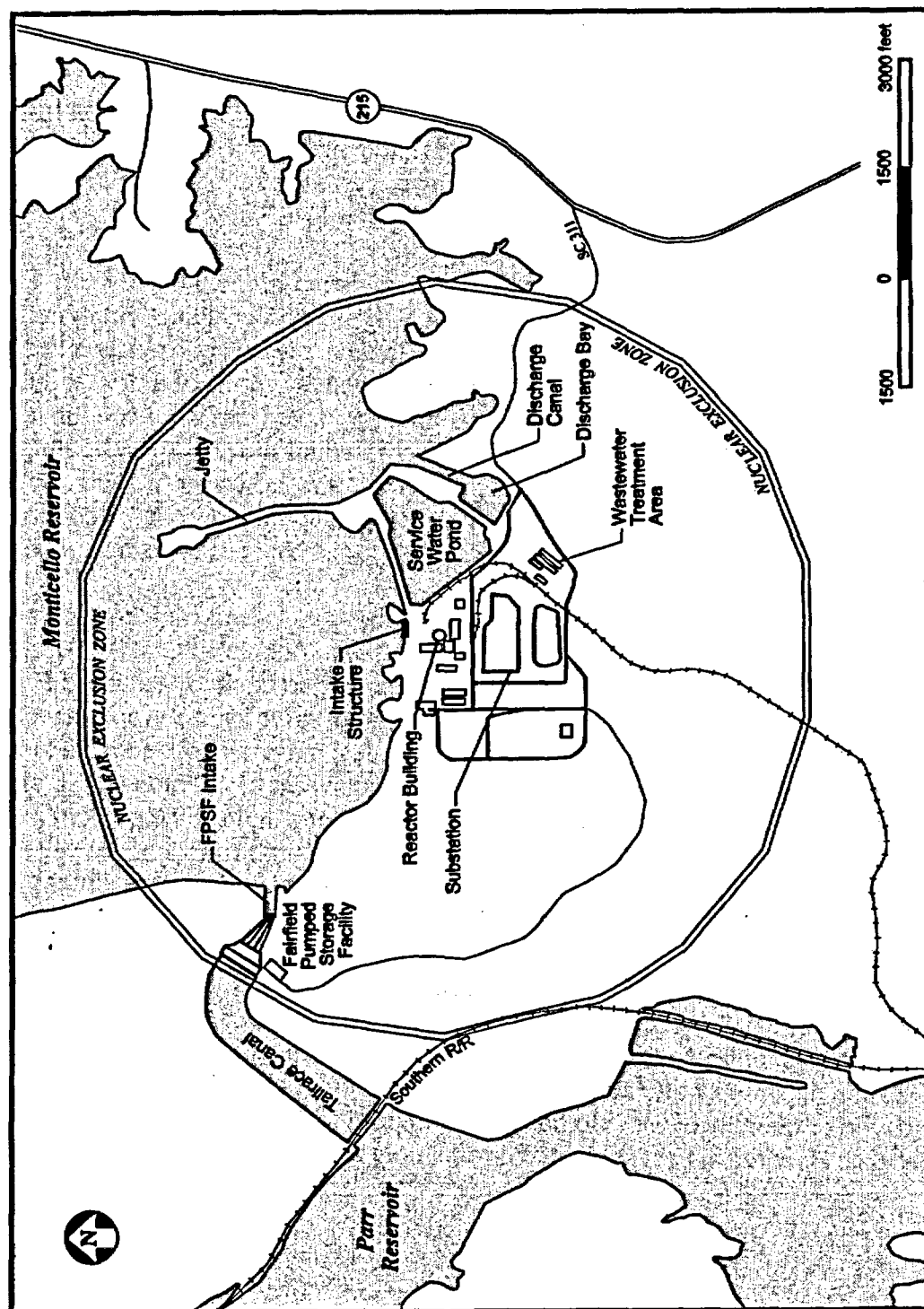


Figure 2-3. V.C. Summer Powerblock Area

Plant and the Environment

2000, the maximum water temperatures measured in Monticello Reservoir at a sampling station just outside the mouth of the discharge canal ranged between 35.1 and 39.8 °C (95.2 and 103.7 °F). The maximum discharge temperature established by the National Pollutant Discharge Elimination System (NPDES) permit and measured at the point at which the flow from the cooling system enters the discharge embayment is 45 °C (113 °F) (SCDHEC 2002). The maximum plume temperature measured at the intake of the FPSF is 32.2 °C (90 °F) (SCDHEC 2002). The discharge canal conveys the water from the discharge embayment toward the main body of the reservoir and toward the FPSF.

The NRC defines "cooling pond" as a humanmade impoundment that does not impede the flow of a navigable system and that is used primarily to remove waste heat from condenser water (NRC 1996). Under this definition, Monticello Reservoir is categorized as a cooling pond. The NRC notes that nuclear power plants with cooling ponds represent a unique subset of closed-cycle systems in that they operate as once-through plants (with large condenser flow rates), but withdraw from relatively small bodies of water created for the plant (NRC 1996). The "natural body of water" (the Broad River/Parr Reservoir) is not relied on for heat dissipation, but is used as a source of makeup water to replace that lost to evaporation from the cooling pond (Monticello Reservoir) and as a receiving stream for discharges from the cooling pond.

V.C. Summer Nuclear Station Quarterly Water Use Reports indicate the theoretical maximum loss of cooling system water to evaporation is 0.6 m³/s (22 cfs) (SCE&G 1998, 1999b). Because cooling water is withdrawn from and discharged back to Monticello Reservoir, the evaporative loss occurs from the reservoir. Make-up water for the evaporative losses is taken from the Broad River/Parr Reservoir. The theoretical maximum evaporative loss represents 14.7 percent of the minimum allowable instantaneous flow of 4.2 m³/s (150 cfs), 9.4 percent of the lowest daily mean flow 6.6 m³/s (235 cfs), and approximately 0.3 percent of the daily mean flow 185 m³/s (6535 cfs) of the Broad River at Alston, South Carolina. However, water potentially used for cooling at the facility is not removed directly from a stream with natural flow, but from the Parr Reservoir, an impounded section of the Broad River. The minimum flow restrictions are Federal Energy Regulatory Commission- (FERC-) mandated as part of the relicensing of the Parr Hydroelectric Project. The restrictions do not directly apply to V.C. Summer. While V.C. Summer has established minimum water surface elevation guidelines for Monticello Reservoir to be considered as part of the cooling system operations, there is no minimum water surface elevation requirement for Monticello Reservoir. Therefore, the timing or quantity of water to be withdrawn from the Parr Reservoir to replenish the Monticello Reservoir is not subject to a regulatory requirement.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

SCE&G uses liquid, gaseous, and solid radioactive waste management systems to collect and treat the radioactive materials that are produced as a by-product of V.C. Summer plant operations. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to maintain levels as low as reasonably achievable (ALARA) before they are released to the environment. The V.C. Summer waste processing systems meet the design objectives of Title 10 Code of Federal Regulations (CFR) Part 50, Appendix I ("Numerical Guides for Design Objective, and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water Cooled Nuclear Power Reactor Effluents"). Radioactive material in the reactor coolant is the primary source of gaseous, liquid, and solid radioactive wastes in light-water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination.

Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. Solid wastes are shipped to a waste processor for volume reduction before disposal or are sent directly to the licensed disposal facility. Spent resins and filters are dewatered and packaged for shipment to licensed offsite processing or disposal facilities (SCE&G 2002b). Currently, solid waste is shipped to Barnwell, South Carolina.

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. V.C. Summer currently operates on an 18-month refueling cycle. The spent fuel assemblies are currently stored onsite in a spent fuel pool in the Auxiliary Building adjacent to the Containment Building. Spent fuel has been stored at V.C. Summer since 1984 with anticipated storage capacity being available until 2018. V.C. Summer does not currently have an independent spent fuel storage installation.

The Offsite Dose Calculation Manual (ODCM) for V.C. Summer describes the methods used for calculating concentration of radioactive material in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from V.C. Summer (SCE&G 1999a). The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with NRC regulations (NRC 1991).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The liquid waste processing system (LWPS) at V.C. Summer collects and processes potentially radioactive liquid wastes for recycle or for release to the environment (SCE&G 2001). Liquid wastes are sampled and analyzed before they are discharged. Based on a laboratory analysis, these wastes are either released under controlled conditions via the penstocks of the FPSF or retained for further processing. The LWPS consists mainly of two subsystems designated as Drain Channel A and Drain Channel B. Drain Channel A typically processes all water that can be recycled, and Drain Channel B typically processes all water that is to be discharged except for secondary system wastes. In addition to the LWPS, very low concentrations of radioactive liquid wastes are also released to Monticello Reservoir in the circulating water discharge for V.C. Summer (SCE&G 1999b).

Drain Channel A processes reactor-grade water that enters the LWPS via equipment leaks and drains, valve leakoff, pump seal leakoffs, tank overflows, and other tritiated and aerated water sources. Deaerated tritiated water inside the Reactor Building from sources such as valve leakoff, which is collected in the reactor coolant drain tank, may be routed directly to the boron recycle waste holdup tanks for processing. Administratively controlled equipment drains are the major contributors of water to Drain Channel A. Valve and pump leakoffs outside the Reactor Building are also collected in the waste holdup tank for processing and recycling. Abnormal liquid sources include leaks that may develop in the reactor coolant and auxiliary systems.

The basic composition of the liquid collected in the waste holdup tank is boric acid and water with some radioactive contamination. Liquid collected in this tank is normally treated by evaporation to remove radioisotopes, boron, and air from the water so that it may be reused in the Reactor Coolant System. The condensate leaving the LWPS waste evaporator may pass through the waste evaporator condensate demineralizer and then enter the waste evaporator condensate tank. When a sufficient quantity of water has collected in the waste evaporator condensate tank, it is normally transferred to the reactor makeup water storage tank for reuse. If the condensate requires further processing, it may be passed through the waste evaporator condensate demineralizer again or, if necessary, returned to the waste holdup tank for additional evaporation. Liquid in the waste holdup tank can also be sent directly to a demineralizer and then to a waste monitoring tank where it is stored prior to discharge.

Drain Channel B collects and processes nonreactor-grade liquid wastes from floor drains, equipment drains containing nonreactor-grade water, laundry and hot shower drains, and other nonreactor-grade sources. Drain Channel B equipment includes a floor drain tank and filter, laundry and hot shower tank and filter, chemical drain tank, waste monitor tank demineralizer and filter, two waste monitor tanks, and a waste evaporator. Non-recyclable reactor coolant leakage enters the floor drain tank from system leaks inside the Reactor Building via the

1 Reactor Building sump, from system leaks in the Auxiliary Building via the floor drains, and from
2 the floor drain tank from the sample room and chemical laboratory. Laundry and hot shower
3 drains are the largest volume source of liquid wastes and normally need no treatment for
4 removal of radioactive material. This water is transferred to a waste monitor tank via the
5 laundry and hot shower filter and discharged if the activity level is below acceptable limits.

6
7 Liquid wastes are released from the waste monitor tanks through the penstocks of the FPSF
8 into Parr Reservoir. The discharge valve is interlocked with two process radiation detection
9 monitors and closes automatically when the concentration of radioactive materials in the liquid
10 discharge exceeds a preset limit.

11
12 The Excess Liquid Waste Processing and Storage Subsystem provides additional waste
13 handling capability to supplement the LWPS. This processing and storage subsystem can
14 accept excess liquid waste from the floor drain tank, laundry and hot shower tank, and waste
15 holdup tank when these tanks are filled to capacity. Also, potentially radioactive wastes are
16 collected from the Hot Machine Shop, Fuel Handling Building drains, and the decontamination
17 pit. In addition, the Turbine Building floor drain system discharge will be directed to this
18 subsystem when radioactive concentration in excess of limits is detected. The subsystem
19 consists of two storage tanks, two process pumps, two redundant demineralizers, and two
20 backflushable filters. Liquid waste from either storage tank is sent to the waste monitor tank
21 prior to discharge.

22
23 The spent resin sluice portion of the LWPS consists of a spent resin storage tank, a spent resin
24 sluice pump, and a spent resin sluice filter. The system is designed to transport spent resin to
25 the spent resin storage tank for treatment. Following treatment, the sluice water is available for
26 subsequent resin sluicing operations.

27
28 The ODCM prescribes the alarm/trip setpoints for the liquid-effluent radiation detection
29 monitors, which are derived from 10 times the effluent concentration limits provided in 10 CFR
30 Part 20, Appendix B, Table 2, Column 2 (SCE&G 1999a). There are two liquid-effluent
31 radiation monitors for the primary radioactive liquid waste discharge pathway at V.C. Summer.
32 The alarm/trip setpoint for each liquid-effluent monitor is based on the concentration of
33 radioactive material in a batch of liquid to be released or in the continuous liquid discharge
34 (SCE&G 1999a).

35
36 During 2001, there were 335 batch releases of liquid effluents with a total volume of
37 8.90×10^7 L (2.35×10^7 gal) of liquid waste released prior to dilution (SCE&G 2002b). In this
38 liquid waste, there was a total fission and activation product activity of 0.0015 TBq (0.04 Ci) and
39 total tritium activity of 18.65 TBq (504 Ci). These volumes and activities are typical of past
40 years. Each drain channel uses one 3.8×10^4 L (10,000 gal) liquid waste-holdup tank. The

Plant and the Environment

1 actual liquid waste generated is reported in the Annual Effluent and Waste Disposal Report for
2 V.C. Summer (SCE&G 2002b). See Section 2.2.7 for a discussion of the calculated doses to
3 the maximally exposed individual as a result of these releases.

4
5 SCE&G does not anticipate any increase in liquid waste releases during the renewal period.
6

7 2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

8
9 The Gaseous Waste Processing System (GWPS) is the primary gaseous waste handling
10 system for V.C. Summer. It is designed to remove fission product gases from the reactor
11 coolant in the volume control tank (SCE&G 2001). The system is also designed to collect
12 gases from the boron recycle and waste evaporators, reactor coolant drain tank, recycle holdup
13 tanks, and reactor vessel. The GWPS is a closed-loop system composed of two waste gas
14 compressors, two catalytic hydrogen recombiners, eight gas decay tanks to accumulate the
15 fission product gases, one gas decay tank drain pump, one gas drain filter, and four gas traps.
16 All of the equipment is located in the Auxiliary Building. The principal source to the GWPS
17 during normal operation is taken from the gas space in the volume control tank.
18

19 During normal power operation, nitrogen gas is continuously circulated around the GWPS loop
20 by one of the two compressors. Hydrogen gas is added to the volume control tank where it is
21 mixed with fission gases, which are stripped from the reactor coolant. The contaminated
22 hydrogen gas is then vented from the tank into the circulating nitrogen stream to transport the
23 fission gases into the GWPS. The resulting nitrogen-hydrogen-fission gas is pumped to the
24 recombiner where oxygen is combined with the hydrogen to produce water vapor. After the
25 water vapor is removed, the resulting gas stream is circulated to the waste gas decay tanks and
26 back to the compressor suction to complete the loop circuit.
27

28 The Auxiliary Building Charcoal Exhaust System continuously exhausts air drawn from building
29 areas with the potential for radioactive contamination. The supply and exhaust ducts are
30 arranged so that air flow is always in the direction of progressively greater potential
31 contamination. Exhaust air from these areas is drawn through the roughing/high-efficiency
32 particulate air (HEPA)/charcoal filter plenums continuously and is routed to the main exhaust
33 fans and plant vent.
34

35 In addition to the GWPS, the Reactor Building can also release radioactive gases intermittently.
36 Radioactive gases are released inside the Reactor Building when primary system components
37 are opened or if leakage from the primary system occurs. The gaseous activity inside the
38 Reactor Building may be purged continuously by a small purge system during normal operation.
39 It may also be released when the larger Reactor Building Purge System is used during cold
40 shutdown. If necessary, the Reactor Building Charcoal Cleanup System can be used to
41 recirculate the Reactor Building atmosphere prior to purging. The Reactor Building purge

1 systems are exhausted to the outside atmosphere through HEPA filters and charcoal
2 absorbers.

3
4 Secondary systems that can also release gaseous wastes include the Turbine Building, the
5 Condenser Air Removal System, and Steam Generator Blowdown. Turbine Building steam
6 leakage may release radioactive gas if primary to secondary leakage occurs. Turbine Building
7 Ventilation System exhausts are not treated prior to release. If primary to secondary leakage
8 occurs, then offgas from the Condenser Air Removal System may contain radioactive gases.
9 When condenser offgas contains any significant amount of radioactive material, it is exhausted
10 through HEPA filters and charcoal adsorbers in the Auxiliary Building Charcoal Exhaust System
11 for particulate and iodine removal. Gaseous releases from Steam Generator Blowdown are
12 infrequent. Radioactive gaseous effluents can also be released from the Oil Incineration
13 Facility when it is operated on an as needed or infrequent basis.

14
15 Radioactive gaseous wastes are monitored at three primary release points at V.C. Summer:
16 Auxiliary Building, Reactor Building (intermittently), and the Turbine Building. These release
17 points are monitored for noble gases, and radioiodines and particulate activity, as appropriate
18 (SCE&G 2001). Two radiation monitors (routine and high-range back-up) provide noble gas
19 monitoring and iodine and particulate sampling for the Auxiliary Building exhaust. The Reactor
20 Building also has two similar radiation monitors. The Turbine Building only has one monitor for
21 gases. The ODCM prescribes alarm/trip setpoints for these effluent monitors and control
22 instrumentation to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR
23 Part 20 for gaseous effluents (SCE&G 1999a). These release points are continuously or
24 intermittently monitored and provide alarms with automatic valve closure when radiation levels
25 exceed a preset level, thus terminating discharge (SCE&G 1999a).

26
27 During 2001, there was a total fission and activation gas activity of 2.08×10^{-3} TBq
28 (5.63×10^{-2} Ci), no iodine activity, a total particulate activity of 6.88×10^{-7} TBq (1.86×10^{-5} Ci),
29 and a total tritium activity of 1.00×10^{-3} TBq (0.27 Ci) released from V.C. Summer
30 (SCE&G 2002b). These releases are typical of past years. The actual gaseous waste
31 generated is reported in the *Annual Effluent and Waste Disposal Report for V.C. Summer*
32 (SCE&G 2002b). See Section 2.2.7 for a discussion of the calculated doses to the maximally
33 exposed individual as a result of these releases.

34
35 SCE&G does not anticipate any increase in gaseous releases during the renewal period.
36

2.1.4.3 Solid Waste Processing

The Solid Waste System at V.C. Summer is designed to package and/or solidify radioactive wastes for shipment to an approved offsite burial facility. Solid wastes consist of evaporator concentrates, chemical laboratory samples, spent resins, used filter cartridges, radioactively contaminated hardware, and compacted wastes such as rags, paper, and clothing.

Liquid wastes contained in the Waste Evaporator Concentrates Tank or Chemical Drain Tank can be transferred into the liner located in the solidification area as needed. When required, radwaste solidification is accomplished using approved vendor-supplied equipment and process control program.

Primary and secondary spent resins are transferred from their respective holdup tanks to either a disposable liner in the solidification area or a liner in the truck bay. The resins may then be either solidified or dewatered for shipment. Filters are of the disposable cartridge type. Storage and disposal of all filters are within either high-integrity containers or U.S. Department of Transportation approved containers depending on the specific activity of the filters. Radioactively contaminated hardware can consist of damaged or used equipment or instruments. Such material is disposed of in the same manner as filter cartridges or compacted waste, depending upon radiation levels.

The solid waste system is normally operated on a batch basis. Radioactive waste is generally stored in the shielded areas of the radwaste area (SCE&G 2001). Storage areas are designed to accommodate the waste generated over a period in excess of a month. Solid wastes from V.C. Summer are either shipped directly to an offsite licensed disposal facility (e.g., spent resins) or consigned to a licensed processing facility for volume-reduction and decontamination activities (e.g., compactible trash). The material that remains after volume reduction is transported by the processing facility to a final disposal facility, depending on the radioactive limits. Lower-level wastes (i.e., miscellaneous solid materials) are disposed of at a licensed facility such as those in Barnwell, South Carolina, or Envirocare in Utah. Higher-level wastes (i.e., spent resins) are typically sent directly to a licensed disposal facility such as Barnwell, South Carolina (SCE&G 2002b).

Disposal and transportation of solid wastes are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There are no releases to the environment from radioactive solid wastes generated at V.C. Summer.

In 2001, V.C. Summer made 12 shipments of solid wastes to Envirocare (Clive, Utah) and two shipments of solid wastes to Barnwell, South Carolina, with a total volume of 11.2 m³ (396 ft³) and a total activity of 2.93 TBq (79.17 Ci) (SCE&G 2002b). These shipments are representative of the shipments made in the past several years and are not expected to change

substantively during the license renewal period. The actual amount of solid waste generated is reported in the *Annual Effluent and Waste Disposal Report for V.C. Summer* (SCE&G 2002b). SCE&G continues to reduce its solid waste volumes and minimize waste generated.

2.1.5 Nonradioactive Waste Systems

Various nonradioactive wastewater management and disposal activities are conducted at V.C. Summer. They include collection, treatment, and disposal of the following (SCDHEC 2002):

- sanitary wastes,
- condensate polisher backwash,
- clarifier blowdown,
- carbon filter backwash,
- gravity filter backwash,
- steam generator blowdown,
- wastewater from various sumps,
- boiler house drains,
- ion exchange regeneration,
- chemical metal cleaning wastes (primarily citric acid), and
- sumps in the chemical feed equipment area, caustic tank area, and "D" battery room.

Subsequent to the appropriate treatment processes the wastewater streams are discharged to Monticello Reservoir and monitored and regulated according to NPDES permit number SC0030856 administered by the South Carolina Department of Health and Environmental Control (SCDHEC) (SCDHEC 2002).

Storm water from the western portions of the V.C. Summer area is discharged to an unnamed tributary of the Broad River that flows into Parr Reservoir. Storm water from the eastern portions of the V.C. Summer area flows into Mayo Creek, which also drains to the Broad River, but enters the river from below the dam.

Four wastewater treatment lagoons are used to process the various types of wastewater. Wastewater potentially containing oil is processed through an oil/water separator and then solids are settled prior to discharge.

Sanitary wastewater is treated in an aeration pond, followed by a stabilization pond. The effluent is chlorinated in a chlorine contact chamber prior to commingling with other wastewater and subsequent discharge.

Plant and the Environment

1 For wastewater resulting from backwash, filtering, and blowdown processes, treatment consists
2 of sedimentation for the reduction of suspended solids content, then the water is discharged.

3
4 For wastewater resulting from ion exchange regeneration and sumps in the chemical feed
5 equipment area, caustic tank area, and "D" battery room, treatment consists of flow equalization
6 and neutralization in a 3.8×10^5 L (100,000 gal) wastewater treatment tank before the effluent is
7 discharged.

8
9 Wastewater containing chemical metal cleaning wastes treatment consists of neutralization and
10 sedimentation prior to discharge.

11
12 Solid wastes are disposed using licensed disposal methods appropriate for the waste type.
13 Paint, oils, and solvent wastes are managed by permit as hazardous wastes and disposed of in
14 accordance with the rules and regulations of the SCDHEC Bureau of Land and Waste
15 Management.

16 17 **2.1.6 Plant Operation and Maintenance**

18
19 Routine maintenance performed on plant systems and components is necessary for safe and
20 reliable operation of a nuclear plant. Maintenance activities conducted at V.C. Summer include
21 inspection, testing, and surveillance to maintain the current licensing basis of the plant and to
22 ensure compliance with environmental and public safety requirements. Certain activities can be
23 performed while the reactor is operating. Others require that the plant be shut down. SCE&G
24 refuels V.C. Summer on an 18-month schedule. Up to 700 additional contract workers are
25 employed for the 30- to 40-day refueling outage.

26
27 SCE&G performed an aging management review and developed an integrated plant
28 assessment for managing the effects of aging on systems, structures, and components in
29 accordance with 10 CFR Part 54. The aging management program is described in Section 2 of
30 the License Renewal Application (SCE&G 2002c). The integrated plant assessment identified
31 the programs and inspections that are managing the effects of aging at V.C. Summer.
32 Previously, SCE&G has performed some major component replacement activities at
33 V.C. Summer (e.g., steam generator replacement), and the integrated plant assessment did not
34 identify any need for additional refurbishment or replacement activities. SCE&G assumes that
35 an additional 60 workers will be needed to perform all the necessary surveillance, monitoring,
36 inspections, testing, trending, and recordkeeping activities during the license renewal period.

37

2.1.7 Power Transmission System

SCE&G built eight transmission lines for the specific purpose of connecting V.C. Summer to the transmission system. Two additional transmission lines were built by Santee Cooper, the co-owner of V.C. Summer, to connect it to the regional grid. A number of these lines share the same corridor and a number of these are tie lines into an existing line. A pre-existing Duke Power Company transmission line crosses the V.C. Summer site, but does not connect to the V.C. Summer switchyard or the SCE&G transmission system.

Originating at V.C. Summer, the SCE&G transmission lines generally run in a southerly direction, with five terminations near V.C. Summer (Parr 1 and 2, Fairfield 1 and 2, and Denny Terrace 1 Tie Line), one near Aiken, South Carolina (Graniteville), and two near Columbia, South Carolina (Pineland and Denny Terrace 2) (Figure 2.4). The Santee Cooper lines run approximately east and west to substations near Blythewood and Newberry, South Carolina, respectively.

Table 2-1 identifies the transmission lines by where each line connects to the electric grid. A discussion of the features of the transmission lines, including voltage, right-of-way width and length, and presence of other lines in the right-of-way, follows and are summarized in Table 2-1.

Table 2-1. V.C. Summer Transmission Line Corridors

Transmission Line or Tie Line	Number of Lines	kV	Length		Width		Area	
			km	(mi)	m	(ft)	ha	(ac)
Parr 1 and 2	2	230	3.7	2.3	70	240	27	67
Fairfield 1 and 2	2	230	1.6	1	50	170	8	21
Denny Terrace 1 Tie Line	1	230	4	2.5	30	100	12	30
Pineland 1	1	230	38	23.5	70	240	277	684
Denny Terrace 2	1	230	40	25	30	100	132	327
Graniteville	1	230	100	62.5	50	170	521	1288
Blythewood	1	230	32	20	30	100	98	242
Newberry	1	230	29	18	30	100	88	218

Source: SCE&G 2002a

Plant and the Environment

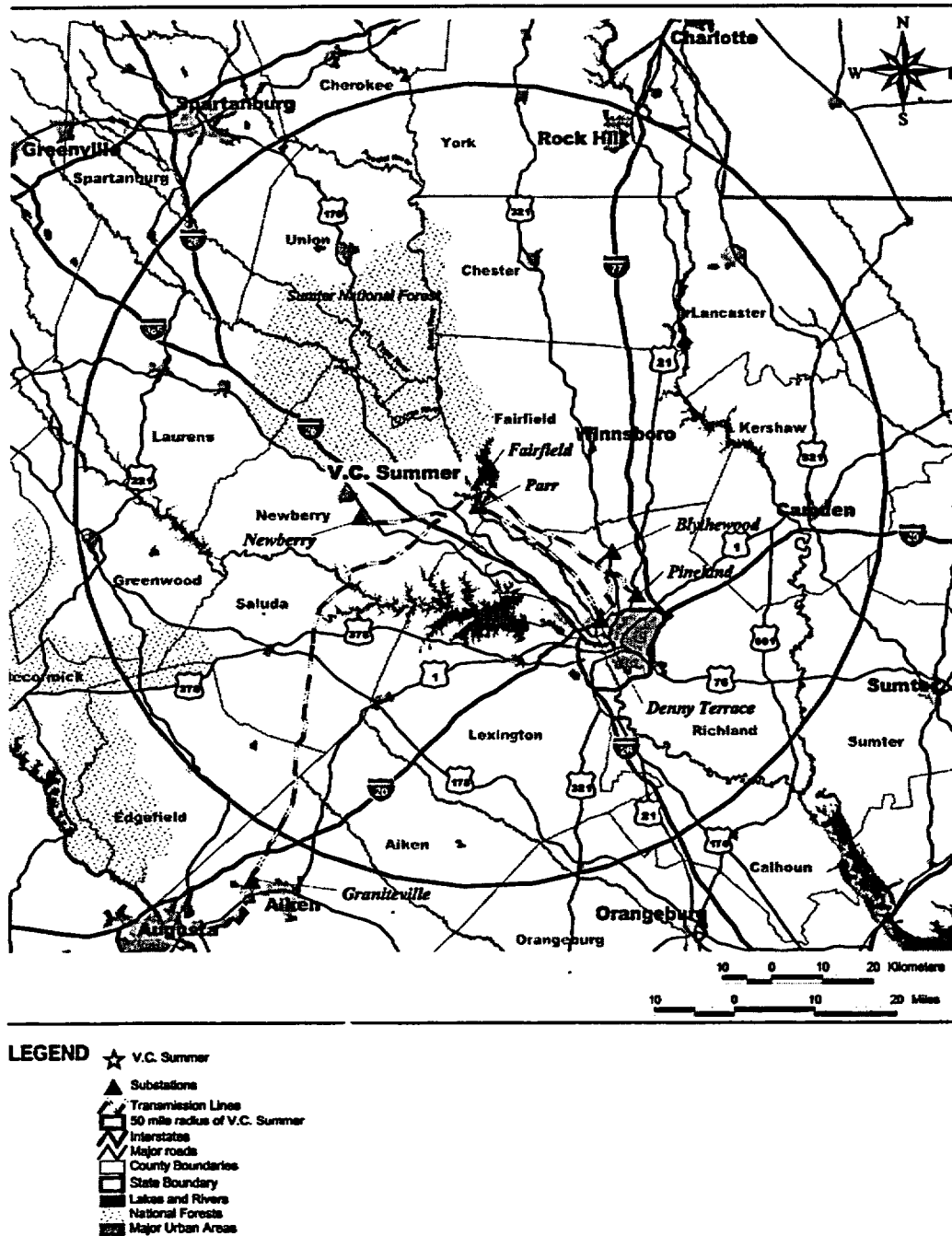


Figure 2-4. V.C. Summer Transmission Lines

- 1 • Summer-Parr No. 1 and No. 2 – These two SCE&G lines, which occupy the same 70-m
2 (240-ft) right-of-way to the Parr Substation, operate at 230 kV. The lines' lengths are each
3 3.7 km (2.3 mi). For approximately 0.8 km (0.5 mi), these lines share the corridor with the
4 Graniteville line and Santee Cooper's Newberry line.
- 5
- 6 • Summer-Fairfield No. 1 and No. 2 – These two 230-kV lines provide power to and from
7 SCE&G's FPSF. The lines are only 1.6 km (1 mi) long and occupy a 50-m (170-ft), SCE&G
8 wholly-owned corridor.
- 9
- 10 • Summer-Denny Terrace No. 1 Tie line – This 4-km (2.5-mi), 230-kV tie line connects
11 Summer Station to the Denny Terrace No. 1 line near Parr, South Carolina, well north of the
12 Denny Terrace Substation. The line was built by SCE&G and occupies a 30-m (100-ft)
13 right-of-way.
- 14
- 15 • Summer-Pineland No. 1 – This SCE&G line provides power at 230 kV to the Pineland
16 Substation 9.6 km (6 mi) northeast of Columbia. The right-of-way width is 70 m (240 ft) for
17 the approximately 29 km (18 mi) that the line shares the corridor with the Denny Terrace
18 No. 2 line and then 30 m (100 ft) for the remaining 8.8 km (5.5 mi). Santee Cooper's
19 Blythewood line parallels this line for approximately 27 km (17 mi).
- 20
- 21 • Summer-Denny Terrace No. 2 – This 230-kV SCE&G line to the Denny Terrace Substation
22 two miles north of Columbia follows the Pineland corridor for approximately 29 km (18 mi)
23 and then continues for approximately 11 km (7 mi) in a 30-m (100-ft) right-of-way.
24 Santee Cooper's Blythewood line parallels this line for 27 km (17 mi).
- 25
- 26 • Summer-Graniteville – This SCE&G line provides 230 kV of power to the Graniteville
27 Substation. The line is 100 km (62.5 mi) long. For the first 0.8 km (0.5 mi), it occupies the
28 same right-of-way as the Newberry and Summer-Parr No. 1 and No. 2 lines. Then for 4 km
29 (2.5 mi) it parallels the Newberry line. For the remaining 96 km (59.5 mi), it is the sole
30 occupant of the corridor. The right-of-way width is 50 m (170 ft) as far as the Broad River
31 and then 30 m (100 ft) to Graniteville.
- 32
- 33 • Summer-Blythewood – The Blythewood line is owned by Santee Cooper. It is a 230-kV line
34 that runs for approximately 32 km (20 mi), sharing the corridor with the Summer-Pineland
35 and the Denny Terrace No. 2 lines for the first 27 km (17 mi). For the remaining 5 km
36 (3 mi), the right-of-way is 30 m (100 ft).
- 37
- 38 • Summer-Newberry – This Santee Cooper line, which is approximately 29 km (18 mi) long,
39 operates at 230 kV and provides power to the Newberry Substation. For the first 0.8 km

Plant and the Environment

(0.5 mi), it shares the corridor with the Summer-Parr No. 1 and No. 2 and the Graniteville lines. For the next 4 km (2.5 mi) it shares the corridor with the Summer-Graniteville line. For the remaining 24 km (15 mi), it occupies the 30-m (100-ft) right-of-way alone.

In total, for the specific purpose of connecting V.C. Summer to the transmission system, SCE&G and Santee Cooper have constructed approximately 250 km (160 mi) of transmission lines (over 190 km [120 mi] of corridor because of co-located lines) that occupy approximately 800 ha (2000 ac) of corridor.

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near V.C. Summer as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts associated with other Federal project activities.

2.2.1 Land Use

The V.C. Summer site covers approximately 909 ha (2245 ac), an area that includes portions of Monticello Reservoir and FPSF. Approximately 348 ha (860 ac) are covered by the waters of Monticello Reservoir. A portion of the property (approximately 150 ha [370 ac]) consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. Some functions, such as the truck equipment and maintenance facility, serve both V.C. Summer and Parr Hydro. Some 50 ha (125 ac) are dedicated to transmission line rights-of-way. However, much of the V.C. Summer property consists of forested areas (approximately 360 ha [890 ac]). The primary terrestrial habitats at V.C. Summer are pine forest, deciduous forest, and mixed pine-hardwood forest (SCANA 2000). The pine forests at V.C. Summer include planted pines and naturally vegetated pines. Most of the deciduous forests at the site are located along stream bottoms and surrounding slopes. Streamside management zones at the site are protected in accordance with best management practices established by the South Carolina Forestry Commission.

The lands at V.C. Summer are designated for industrial development in the Fairfield County Comprehensive Plan (Fairfield County 1997), which states that these lands are intended to encourage industrial growth that provides quality employment opportunities and makes effective use of the county's resources. These are the only industrial lands in western Fairfield County.

The lands surrounding Monticello Reservoir are designated by the Plan for Residential Conservation and Development and Rural Development. Several commercial clusters are also depicted along SC 215 near V.C. Summer on the Comprehensive Land Use and Development Plan. The Fairfield County Comprehensive Plan observes the unfulfilled development potential of Monticello Reservoir and designates it for Resource Preservation. Monticello Reservoir has experienced less development than other lakes in the region because power boating is not permitted, and the water level varies daily by 1.2 m (4 ft) to service Parr Hydro.

2.2.2 Water Use

Monticello Reservoir, a 2630-ha (6500-ac) impoundment, was built in the Frees Creek Valley to serve as the upper pool for the FPSF and the source of make-up cooling water for V.C. Summer. Cooling water is drawn from Monticello Reservoir at a rate of approximately 32 m³/s (1143 cfs), passed through the condensers, and ultimately returned to Monticello Reservoir. The primary consumption of water from the Monticello Reservoir by the nuclear station is only attributable to evaporative loss. V.C. Summer Quarterly Water Use Reports indicate the theoretical maximum loss of cooling system water to evaporation is 0.6 m³/s (22 cfs) (SCE&G 1998, 1999b). Ultimately, these losses are made up from water acquired from the Parr Reservoir on the Broad River. Water is withdrawn from Monticello Reservoir for potable use and other non-cooling related uses at V.C. Summer. This water is treated at the water treatment plant prior to use. For the year 2002, the total rate of water withdrawal from Monticello Reservoir by the water treatment plant was 0.01 m³/s (0.045 cfs).

Pursuant to the Federal Water Pollution Control Act of 1977 (FWPCA), also known as the Clean Water Act, the water quality of the plant effluents is regulated through the NPDES. The SCDHEC is the agency delegated to issue NPDES permits. The current permit (SC0030856) was issued December 2002 and is due to expire April 2007. Any new regulations promulgated by the U.S. Environmental Protection Agency (EPA) and SCDHEC would be included in future permits.

The Broad River was impounded in 1914 for a small, run-of-the-river hydroelectric plant (Parr Hydro). The impoundment is known as Parr Reservoir. In 1977 the surface area of Parr Reservoir was expanded from 750 ha (1850 ac) to 1780 ha (4400 ac) by raising the level of the dam by 2.7 m (9 ft) (SCE&G 1978). This modification was necessary to support the development of the FPSF. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing a headwater pool for Parr Hydro and a tailwater pool for FPSF.

Plant and the Environment

1 The daily cycle of operation at the FPSF transfers up to 416 m³/s (14,700 cfs) of water from
2 Parr Reservoir to Monticello Reservoir and back (NRC 1981). Operations vary, depending on
3 the season and system needs. In summer, FPSF generally pumps water from Parr Reservoir
4 to Monticello Reservoir between the hours of 11 pm and 8 am and generates power (by
5 releasing water) between the hours of 10 am and 11 pm. In winter, FPSF generally pumps
6 water from Parr Reservoir to Monticello Reservoir between 11 pm and 6 am and generates
7 between the hours of 6 am and 1 pm. The level of generation varies from one generator up to
8 the maximum output of eight, depending on demand. Maximum output may not be necessary
9 on all days. Pumping is normally done at maximum capacity. FPSF is normally operated
10 7 days a week.

11
12 As a result of FPSF operations, Parr Reservoir is subject to daily fluctuations in water level of
13 as much as 3 m (10 ft) (NRC 1981), but the daily average is approximately 1.2 m (4 ft)
14 (Dames and Moore 1985a). These water level fluctuations can expose and then re-inundate up
15 to 1030 ha (2550 ac) of Parr Reservoir with each cycle of pumpback and generation (release of
16 water). The amount of water pumped from and returned to Parr Reservoir daily represents as
17 much as 88 percent of its total volume (NRC 1981).

18
19 The annual mean flow of the Broad River is approximately 5.8 x 10⁹ m³/yr (2.1 x 10¹¹ ft³/yr).
20 The Federal Power Commission (FERC's predecessor agency) licensed the Parr Hydroelectric
21 Project in 1974, contingent upon a minimum instantaneous release at the Parr Powerhouse of
22 4.2 m³/s (150 cfs) during most months of the year and a minimum instantaneous release of
23 28 m³/s (1000 cfs) during the March-April-May striped bass (*Morone saxatilis*) spawning period
24 (NRC 1981). For the periods 1896 to 1907 and 1980 to 2000, the lowest daily mean flow of the
25 Broad River at the Alston, South Carolina, gauging station was 6.7 m³/s (235 cfs)
26 (Cooney et al. 2001). The lowest recorded daily mean flow of 4.2 m³/s (149 cfs) was measured
27 at the Richtex Station, approximately 11 km (7 mi) downstream of Parr Reservoir (NRC 1981).

28
29 There are two groundwater removal (dewatering) wells on the site that are used to lower the
30 water table and alleviate problems with water seepage into below-grade portions of buildings.
31 This is the only withdrawal of groundwater associated with V.C. Summer. It is estimated that
32 both wells withdraw less than 1.6 L/s (26 gpm) and both wells discharge to the site storm water
33 system (SCE&G 2002a).

2.2.3 Water Quality

34
35
36
37 Potential environmental issues associated with water quality include three separate areas: the
38 Monticello Reservoir, the Broad River and Parr Reservoir, and groundwater.
39

2.2.3.1 Monticello Reservoir Hydrology and Water Quality

The most complete source of information on the water quality and biotic resources of Monticello Reservoir is a series of reports prepared in support of a FWPCA Section 316(a) Demonstration for V.C. Summer and summarized in a final report (Dames and Moore 1985a) submitted to SCDHEC and the NRC in April 1985. A station-to-station comparison of preoperational (1978 to 1982) and operational (1983 to 1984) water chemistry in Monticello Reservoir showed significant differences in 13 of 27 chemical parameters analyzed (Dames and Moore 1985a). In 10 cases, concentrations of chemicals or measurements were higher in the preoperational phase and in three cases concentrations were higher in the operational phase. None of these differences was related to operations of V.C. Summer.

The highest temperature observed in Monticello Reservoir over the 1983 to 1984 operational phase was 34.2 °C (93.6 °F) at a depth of one foot at Station 14 (the sampling point closest to the discharge canal) in August 1983 (Dames and Moore 1985a). A discernible thermal plume was present on 12 of 24 monthly field surveys at this same location, but survey results were confounded by plant operations (the plant was off-line during four surveys and at 50 percent power or less during three surveys). When plumes were detected, they were observed to a depth of 0.3 to 0.9 m (1 to 3 ft). Below this depth, the influence of the thermal plume was not evident. In more recent years (1995 to 2000), maximum temperatures at a sampling station just outside the mouth of the discharge canal ranged from 35.1 to 39.8 °C (95.2 to 103.7 °F). The maximum discharge temperature established by the NPDES permit and measured at the point at which the flow from the cooling system enters the discharge embayment is 45 °C (113 °F) (SCDHEC 2002). The maximum monthly average plume temperature measured at the intake of the FPSF is 32.2 °C (90 °F) (SCDHEC 2002). Monticello Reservoir is currently rated as one of the least eutrophic reservoirs in South Carolina, and is characterized by low nutrient (total phosphorus and total nitrogen) concentrations (SCDHEC 1998).

Storm water and wastewater discharges to Monticello Reservoir and Mayo Creek are regulated and monitored under NPDES permit number SC0030856 (SCDHEC 2002) administered by the SCDHEC. The range of parameters monitored includes flow, temperature, various metals, pH, total suspended solids, oil and grease, biochemical oxygen demand, fecal coliform, residual chlorine, and ammonia. Two minor violations, one for oil and grease and one for residual chlorine, were noted by SCDHEC over the past five years and promptly investigated and corrective measures were taken.

2.2.3.2 Broad River and Parr Reservoir Hydrology and Water Quality

The 1998 SCDHEC report notes that water quality in the Broad River from the Tyger River to the Parr Shoals dam is suitable for a range of aquatic life, but is experiencing a significantly increasing trend in total phosphorous concentrations (SCDHEC 1998) from upstream (agricultural and municipal) sources. In addition, fecal coliform bacteria levels are occasionally elevated in this stretch of the river.

Temperatures and dissolved oxygen (DO) levels in water leaving Parr Reservoir are monitored at a U.S. Geologic Survey water quality monitoring station just downstream of the Parr Hydro powerhouse. Temperature and DO levels vary seasonally and show an inverse relationship, with high temperatures associated with relatively low DO levels and low temperatures associated with relatively high DO levels. Temperatures in water year 1999-2000 (Oct. 1, 1999, through Sept. 30, 2000) ranged from 3.5 °C (38.3 °F) in February to 31 °C (87.8 °F) in August, with corresponding DO concentrations of 13.1 mg/L and 4.9 mg/L (13.1 ppm and 4.9 ppm) (Cooney et al. 2001).

Currently, Parr Reservoir maintains an intermediate trophic state among reservoirs in South Carolina; its river-like flows and short retention time (approximately four days) produce high DO levels (in most months) and high turbidity in the reservoir. Aquatic life and recreational uses are fully supported in Parr Reservoir, according to SCDHEC (1998), meaning that water quality is adequate to support a balanced indigenous community of organisms, with no restrictions on recreational users.

2.2.3.3 Groundwater Quality

V.C. Summer does not discharge directly to groundwater. However, before construction of the Monticello Reservoir, groundwater flowed toward Frees Creek. After construction and filling of the reservoir, the local groundwater table would have been raised and the flow direction would have reversed, away from the Frees Creek drainage.

Groundwater in the vicinity of the site is highly mineralized, due to prolonged contact with, and dissolution of, rock minerals, and as a result, is generally higher than local surface waters in hardness, dissolved solids, and conductivity (Dames and Moore 1985a). The water of Monticello Reservoir is relatively low in the concentration of common ions, low in hardness, and low in dissolved solids/conductivity (Dames and Moore 1985a).

Groundwater is monitored semi-annually as required by NPDES permit number SC0030856 (SCDHEC 2002) administered by the SCDHEC. The range of parameters monitored include groundwater table elevation, ammonia, pH, specific conductivity, iron, lead, sulfate, nitrate, and total dissolved solids.

2.2.4 Air Quality

V.C. Summer is located approximately 42 km (26 mi) northwest of Columbia, South Carolina, with terrain consisting of rolling hills. The region has a temperate climate and is located midway between the humid eastern and dry western climatic zones. The weather at any time may be typical of either of these zones, or it may represent a combination of the zones. The region has long, hot summers and cool winters. Rapid changes in the weather are common, especially during the winter. Climatological records for Columbia, South Carolina, are generally representative of V.C. Summer. These records indicate that the average maximum temperatures for Columbia range from a low of about 13.9 °C (57.1 °F) in January to a high of about 33.5 °C (92.3 °F) in July. The annualized average maximum temperature is about 23.9 °C (75.1 °F). Average minimum temperatures range from a low of about 2.89 °C (37.2 °F) in January to a high of about 21.8 °C (71.3 °F) in July. The annualized average minimum temperature is about 12.2 °C (54.0 °F).

The average precipitation ranges from a low of about 6.5 cm (2.57 in.) in October to a high of about 14.0 cm (5.50 in.) in July. The average annual precipitation is about 115.0 cm (45.1 in.). The summer rains are largely in the form of local thunderstorms, occurring on an average of 11 days per month during this season. Strong winds and heavy rains are experienced once or twice per year, as effects of passing tropical storms. The average annual snowfall is about 3.1 cm (1.2 in.), most of which falls in the months of January and February. Based on statistics for the 30 years from 1954 through 1983 (Ramsdell and Andrews 1986), on the average, only nine tornadoes are expected to occur in South Carolina during the course of a year. The probability of a tornado striking the site is expected to be about 6×10^{-5} per year.

Wind energy potential is generally rated on a scale of 1 through 7. Areas suitable for wind turbine applications have a rating of 3 or higher. There is little wind energy potential in the Southeast region for existing wind turbine applications (Elliot et al. 1987). Even along coastal areas, existing data from exposed sites indicate at best only class 2 at 50 m (164 ft) above ground. The only places in the Southeast region estimated to have class 3 or higher annual average wind resource are the exposed ridge crests and mountain summits confined to northeastern Georgia and extreme northwestern South Carolina (along the ridges of the Blue Ridge Mountains).

Plant and the Environment

V.C. Summer is located within the Columbia Intrastate Air Quality Control Region (AQCR) (40 CFR 81.108). This AQCR consists of the territorial area encompassed by the boundaries of Fairfield County, Lexington County, Newberry County, and Richland County in the State of South Carolina. The air quality in these regions is designated as better than national standards, in attainment, or unclassified for all criteria pollutants, in 40 CFR 81.341. There are no mandatory Class I Federal areas, in which visibility is an important value designated in 40 CFR Part 81, within 160 km (100 mi) of the V.C. Summer site.

In July 1997, the EPA revised the national standard for ground-level ozone from a 0.12-ppm, 1-hour "peak" standard to a 0.08-ppm, 8-hour "average" standard (62 FR 38856). This new standard is commonly referred to as the 8-hour standard. The District of Columbia Court of Appeals ruled against EPA in October 1999, and later the U.S. Supreme Court upheld the 8-hour standard in February 2001. It is not yet clear when EPA will make the 8-hour ozone nonattainment designations; however, the State is responding proactively. On August 23, 2002, SCDHEC published a "Notice of Drafting" in the State Register for an Early Action Plan for measures to attain the 8-hour standard before any nonattainment designation. The State intends to implement control measures in anticipation of future EPA actions.

Diesel generators, boilers, and other activities and facilities associated with the V.C. Summer site emit various nonradioactive air pollutants to the atmosphere. Air emissions from these sources are subject to the terms, limitations, standards, and schedules of a SCDHEC Conditional Major Air Quality Permit (Air Permit). Emissions are regulated under Air Quality Permit Number CM-1000-0012, which expires July 2004. Equipment with nonrad air emissions at the facility includes

- emergency diesel generator #1 (5100 KkW);
- emergency diesel generator #2 (5100 KkW);
- 112 million Btu/h No. 2 oil auxiliary boiler;
- 750,000 Btu/h waste oil incinerator;
- water treatment clay transfer silo; and
- other insignificant sources, including petroleum product storage, diesel-engine air compressors and water pumps, and maintenance facilities.

The Air Permit includes facility-wide limits on emissions of sulfur dioxide, nitrogen oxides, and carbon monoxide and includes source-specific limitations on particulate matter, opacity, sulfur dioxide, and hours of operation. There are no significant changes proposed for nonrad air emissions from the V.C. Summer site, and there are no significant changes proposed to the limits and conditions of the Air Permit.

2.2.5 Aquatic Resources

Aquatic resources in the vicinity of V.C. Summer are associated with Monticello Reservoir on Frees Creek and with Parr Reservoir on the Broad River. Monticello Reservoir (2630 ha [6,500 ac]) was constructed in 1977 on Frees Creek to serve as the cooling water source for V.C. Summer and as the upper reservoir for the FPSF. Parr Reservoir was established in the early 1900s with the construction of the Parr Hydro facility. In 1977 Parr Reservoir was enlarged from 750 ha (1850 ac) to 1780 ha (4400 ac) for added pumped storage exchange with Monticello Reservoir and as makeup water for evaporative losses from Lake Monticello due to V.C. Summer operations (SCE&G 2002a). Parr Reservoir undergoes daily depth fluctuations due to the operations of the FPSF. The reservoir is shallow, and pumped storage withdrawals, amounting to 88 percent of the reservoir's volume, can drop water levels as much as 3 m (10 ft) daily, exposing up to 1030 ha (2550 ac) of the reservoir's 1780 ha (4400 ac). Average daily water fluctuations are 1.2 m (4 ft).

The aquatic environment of Monticello Reservoir is also dominated by daily fluctuations in surface elevation of up to 1.4 m (4.5 ft) due to pumped storage activities. Monticello Reservoir is deep (average depth of 18 m [59 ft]; maximum depth of 38 m [126 ft]) and has a small watershed of 445 ha (11,000 ac) with little natural surface water flow. Surface water temperatures in the vicinity of V.C. Summer may reach as high as 39.8 °C (103.7 °F) from cooling water releases, with a monthly permitted average of 32.2 °C (90 °F) near the FPSF.

SCE&G monitored water quality and aquatic communities in the Monticello Reservoir, Broad River, and Parr Reservoir from mid-1978 through 1984 to assess the impacts of FPSF and V.C. Summer operations (Dames and Moore 1985a, 1985b). These studies represent the most comprehensive information on the biotic communities of the Broad River in the vicinity of V.C. Summer.

The reservoir is one of the least eutrophic lakes in the state, with low hardness and low phosphorus and nitrogen levels (Haddon 1995, SCE&G 2002a). The small watershed provides limited opportunity for nutrient sources to support aquatic productivity, although daily pumping from the Broad River by the FPSF may provide an additional nutrient supply. The lake supports a smaller shad population compared to some other reservoirs in the region (Christie and Stroud 1996, Nash et al. 1990); this condition may be a reflection of the low productivity of the lake. The near-shore environment is dominated by the daily fluctuations in reservoir surface elevation and may provide little opportunity for establishment of aquatic vegetation.

Monticello Reservoir contains a diverse fish community with 38 reported species. Additionally, the Asiatic clam (*Corbicula* sp.), an introduced species, has become established in the lake.

Plant and the Environment

1 Standing crop of fish in 1984, approximately two years after the plant began operating, was
2 dominated by bluegill (*Lepomis macrochirus*) and gizzard shad (*Dorosoma cepedianum*), with
3 substantial populations of pumpkinseed (*L. gibbosus*) and channel catfish (*Ameiurus punctatus*)
4 (Table 2-2). Based on studies conducted in 1978 to 1984, fish populations in Monticello
5 Reservoir appeared to be unaffected by V.C. Summer operations (Dames and Moore 1985b).
6

7 From 1986 to 1995, the SCDNR conducted cove rotenone studies of Monticello Reservoir fish
8 populations, which yielded higher standing stocks than earlier studies (Table 2-2). Dominant
9 fish in 1986–1987 included gizzard shad, bluegill, channel catfish, and white catfish (*Ameiurus*
10 *catus*). In 1989, blue catfish (*Ictalurus furcatus*) were collected from Monticello Reservoir for
11 the first time. In 1995, white perch (*Morone americana*) were reported from the reservoir. By
12 1996, blue catfish was the most dominant fish and white perch was the sixth most dominant
13 species. Other dominant species included gizzard shad, bluegill, channel catfish, and white
14 catfish. Other recently introduced and newly collected species included the green sunfish
15 (*Lepomis cyanellus*), brook silversides (*Labidesthes sicculus*), and the swallowtail shiner
16 (*Notropis procne*). The introduction of the white perch and blue catfish is of concern to the lake
17 fishery because of their competition for limited forage and predation on other species (SCE&G
18 2002a).
19

20 Fishery investigations (Christie and Stroud 1996, 1997, 1998, 1999, Nash et al. 1990) suggest
21 that introduction of blue catfish and white perch has had a significant effect on the fishery of
22 Lake Monticello. In 1987-1989, catfish comprised 61 percent of the fish caught and white perch
23 were not present (Nash et al. 1990). By 1999 catfish species comprised 82 percent of fish
24 numbers and 88 percent of fish weight harvested. The most harvested species were blue
25 catfish (60,202 fish, 51 percent by weight), channel catfish (44,630 fish, 33.7 percent by
26 weight), white perch (17,205 fish, 3 percent by weight), and bluegill (11,479 fish, 1 percent by
27 weight) (Christie and Stroud 1999).
28

29 In the late 1980s, fish kills were observed in the V.C. Summer discharge bay in the late summer
30 and early fall. Monitoring by SCE&G identified high discharge temperatures combined with
31 Monticello Reservoir drawdowns as the probable cause of the fish kills. At lower reservoir
32 levels, the flow of cooler water along the bottom of the discharge canal into the discharge bay
33 was restricted, and temperatures rose to lethal levels for fish. From 1991 to 1993, SCE&G
34 undertook several measures to resolve this problem, including removing a hump in the
35 discharge canal (1992), limiting drawdown of Monticello Reservoir (1992), and dredging the
36 entire length of the canal (1993). Monitoring in 1994 and 1995 verified that fish kills in the
37 discharge channel had ceased (SCE&G 2002a).
38

39 At the upper end of Monticello Reservoir is a smaller impoundment, known as Monticello
40 Subimpoundment. Although hydraulically connected to the main reservoir by a conduit that
41 passes under SC 99, the water level in this subimpoundment is minimally influenced by pumped

Table 2-2 Standing Stock of Dominant Fishes of Monticello Reservoir

Species	1984 ^a	1987 ^b	1988 ^b	1989 ^b	1995 ^c	1996 ^d
	kg/ha (lb/ac)	kg/ha (lb/ac)	kg/ha (lb/ac)	kg/ha (lb/ha)	kg/ha (lb/ac)	kg/ha (lb/ac)
gizzard shad (<i>Dorosoma cepedianum</i>)	13.69 (12.2)	84.4 (75.3)	37.0 (33.0)	25.2 (22.5)	46.8 (41.8)	103 (91.9)
threadfin shad (<i>Dorosoma petenense</i>)	0.14 (0.12)	16.5 (14.7)	10.6 (9.5)	10.4 (9.3)	1.71 (1.52)	2.8 (2.5)
channel catfish (<i>Ameiurus punctatus</i>)	2.78 (2.5)	62.7 (55.9)	75.9 (67.7)	31.5 (28.1)	36.1 (32.2)	98.7 (88.1)
white catfish (<i>Ameiurus catus</i>)	0.70 (0.62)	25.7 (22.9)	55.6 (49.6)	30.5 (27.2)	0.38 (0.34)	48.3 (43.1)
blue catfish (<i>Ictalurus furcatus</i>)	--	--	--	4.9 (4.4)	7.67 (6.84)	123.7 (110.4)
white perch (<i>Morone americana</i>)	--	--	--	--	0.50 (0.45)	24.6 (21.9)
white bass (<i>Morone chrysops</i>)	present	0.7 (0.62)	0.3 (0.26)	1.0 (0.9)	30.0 (26.8)	0.2 (0.2)
bluegill (<i>Lepomis macrochirus</i>)	14.69 (13.1)	57.3 (51.1)	55.9 (49.6)	70.9 (13.3)	18.5 (16.5)	56.0 (49.9)
pumpkinseed (<i>Lepomis gibbosus</i>)	3.48 (3.1)	3.5 (3.1)	5.49 (4.9)	4.6 (4.1)	0.86 (0.77)	3.1 (2.8)
black crappie (<i>Pomoxis nigromaculatus</i>)	0.03 (0.026)	8.7 (7.8)	6.16 (5.5)	0.3 (0.27)	0.01 (0.01)	0.5 (0.45)
largemouth bass (<i>Micropterus salmoides</i>)	1.04 (0.93)	6.4 (5.7)	6.4 (5.7)	3.9 (3.5)	4.19 (3.74)	6.5 (5.8)
yellow perch (<i>Perca flavescens</i>)	0.59 (0.53)	10.0 (8.9)	14.8 (13.2)	9.7 (8.7)	--	4.4 (3.9)
TOTAL	40.13 (35.8)	306.3 (273.2)	281.2 (250.8)	204.5 (182.5)	154.3 (137.7)	482.3 (430.3)

^a Dames and Moore 1985b^b Nash et al. 1990^c Christie and Stroud 1996^d Christie and Stroud 1997

Plant and the Environment

1 storage operations on the main impoundment. The subimpoundment is managed for recreation
2 by SCE&G and SCDNR. Dominant fish species include gizzard shad, sunfish, crappie, and
3 largemouth bass.

4
5 Monticello Reservoir and the subimpoundment are used for recreational fishing. The
6 recreational fishery of Monticello Reservoir is dominated by catfish and sunfish. A roving creel
7 survey, including interviews with fishermen, was conducted by SCDNR from June 1997 through
8 May 1999 (Christie and Stroud 1999). Anglers expended an estimated 115,973 hours of fishing
9 effort during that time. Fishing occurred from the bank (26 percent of effort), from docks
10 (6 percent of effort), and from boats (68 percent of effort). Catfish were targeted by 51 percent
11 of the total effort, while black crappie and largemouth bass received 15 percent and 5 percent
12 of the effort. Fishing success was 0.9 fish/h, ranging from a high of 3 fish/h in the summer to
13 0.8 fish/h in the fall. Harvest rates were 56.1 fish/ha or 11.9 kg/ha (22.7 fish/ac or 10.8 lbs/ac).
14 Harvest was dominated by blue catfish, channel catfish, and white perch.

15
16 No aquatic Federal- or State-listed endangered or threatened species are known to occur in
17 Monticello Reservoir or in Parr Reservoir in the vicinity of V.C. Summer or in aquatic habitats
18 crossed by the transmission lines. Two Federal-listed and 12 State-listed aquatic species have
19 been reported from the counties of the V.C. Summer site and transmission lines (Table 2-3).
20 One Federal-listed endangered species, the shortnose sturgeon (*Acipenser brevirostrum*),
21 historically occurred in the Broad River in Lexington and Newberry Counties, but has been
22 extirpated from that stretch of the Broad River. Passage of this species up the Broad River is
23 blocked by dams. In South Carolina, the primary factors affecting populations of this species
24 are habitat alteration due to dredging and dam construction, and pollution. In South Carolina, it
25 currently inhabits the Winyah Bay rivers that drain into Lake Marion, the Santee, Cooper, and
26 Savannah rivers, and the ACE (Ashepoo, Combahee, and Edisto Rivers) Basin. In the latter,
27 shortnose sturgeon are typically found at the freshwater-saltwater interface. There are no
28 recorded occurrences of this species in or adjacent to the transmission line corridors associated
29 with V.C. Summer (SCDNR 2001b).

30
31 The Carolina heelsplitter (*Lasmigona decorata*), a freshwater mussel listed as Endangered
32 under the provisions of the Endangered Species Act, was historically found in South Carolina in
33 the Pee Dee River system (Clarke 1985 as cited in USFWS 1993, Keferl and Shelly 1988 as
34 cited in USFWS 1993, Keferl 1991 as cited in USFWS 1993). Before a 1987 USFWS survey,
35 the Carolina heelsplitter had not been recorded in the state since the mid-19th century (Keferl
36 and Shelly 1988 as cited in USFWS 1993, Keferl 1991 as cited in USFWS 1993). The USFWS
37 conducted intensive surveys between 1987 and 1990 and found only two surviving populations
38 of the Carolina heelsplitter in the Pee Dee River system; the Goose Creek and Lynches
39 River/Flat Creek populations (Keferl 1991 as cited in USFWS 1993). During the USFWS
40 surveys, a total of only 12 live individuals were found in Flat Creek (1987–1990) and two
41 individuals were found in the Lynches River (both found in 1990). Because the Carolina

Table 2-3. Aquatic Species Listed or Candidates as Endangered or Threatened by the U.S. Fish and Wildlife Service or the State of South Carolina that Occur or Potentially Occur Within or Near the V.C. Summer Site or the Associated Transmission Line Rights-of-Way

Scientific Name	Common Name	Federal Status ^(a)	State Status ^(a)
Plants			
<i>Myriophyllum laxum</i>	Piedmont watermilfoil	--	SC
<i>Potamogeton confervoides</i>	algae-like pondweed	--	SC
Crustaceans			
<i>Distocambarus youngineri</i>	Saluda crayfish	--	SC
Mollusks			
<i>Elimia catenaria</i>	gravel elimia	--	SC
<i>Elliptio lanceolata</i>	yellow lance	--	SC
<i>Lasmigona decorta</i>	Carolina heelsplitter	E	SC
<i>Pyganodon cataraca</i>	Eastern floater	--	SC
<i>Strophitus undulatus</i>	squawfoot	--	SC
<i>Villosa delumbis</i>	Eastern creekshell	--	SC
Fish			
<i>Acipenser brevirostrum</i>	shortnose sturgeon	E	--
<i>Etheostoma collis</i>	Carolina darter	--	SC
<i>Fundulus diaphanus</i>	banded killifish	--	SC
<i>Notropis chiliticus</i>	redlip shiner	--	SC
<i>Rhinichthys atratulus</i>	blacknose dace	--	SC

(a) E = endangered, SC = South Carolina species of special concern, -- = no listing.

heelsplitter populations have been found only in other tributaries to the Pee Dee River and not in the Broad River system near the V.C. Summer site. There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with V.C. Summer (SCDNR 2001b).

Twelve additional species are listed by the State of South Carolina as species of special concern. Two submerged aquatic plants of shallow water, Piedmont watermilfoil (*Myriophyllum*

Plant and the Environment

1 *laxum*) and algae-like pondweed (*Potamogeton confervoides*), are listed as species of special
2 concern for Lexington and Richland Counties. There are no recorded occurrences of these
3 species in or adjacent to the transmission line corridors associated with V.C. Summer (SCDNR
4 2001b).

5
6 The Saluda crayfish (*Distocambarus youngineri*), a burrowing species, is known from Newberry
7 County at two localities over 40 km (25 mi) west of V.C. Summer. There are no recorded
8 occurrences of this species in or adjacent to the transmission line corridors associated with
9 V.C. Summer (SCDNR 2001b).

10
11 The gravel elimia (*Elimia catenaria*) is an aquatic snail listed as a species of special concern for
12 Richland County. There are no recorded occurrences of this species in or adjacent to the
13 transmission line corridors associated with V.C. Summer (SCDNR 2001b).

14
15 The yellow lance (*Elliptio lanceolata*) is a mussel found in clean sands in flowing water and is
16 listed as a species of special concern for Newberry County. There are no recorded
17 occurrences of this species in or adjacent to the transmission line corridors associated with V.C.
18 Summer (SCDNR 2001b).

19
20 The eastern floater (*Pyganodon cataraca*) is a mussel found in mud, sand, and gravel in ponds,
21 lakes, and streams; it is listed as a species of special concern for Fairfield County. There are no
22 recorded occurrences of this species in or adjacent to the transmission line corridors associated
23 with V.C. Summer (SCDNR 2001b).

24
25 The squawfoot (*Strophitus undulatus*) is a mussel found in mud, sand, or gravel in streams and
26 small rivers; it is listed as a species of special concern in Richland County. There are no
27 recorded occurrences of this species in or adjacent to the transmission line corridors associated
28 with V.C. Summer (SCDNR 2001b).

29
30 The eastern creekshell (*Villosa delumbis*) is a mussel found in muds or soft sand in small rivers
31 and creeks; it is listed as a species of special concern for Fairfield and Richland Counties.
32 There are no recorded occurrences of this species in or adjacent to the transmission line
33 corridors associated with V.C. Summer (SCDNR 2001b).

34
35 The Carolina darter (*Etheostoma collis*) is a small bottom-dwelling fish of warm pools and runs
36 in small streams; it is listed as a species of special concern for Fairfield and Richland Counties.
37 There are no recorded occurrences of this species in or adjacent to the transmission line
38 corridors associated with V.C. Summer (SCDNR 2001b).

1 The banded killifish (*Fundulus diaphanus*) is a small topwater fish of quiet shallow backwaters
2 of lakes, ponds, rivers, and estuaries; it is listed as a species of special concern for Richland
3 County. There are no recorded occurrences of this species in or adjacent to the transmission
4 line corridors associated with V.C. Summer (SCDNR 2001b).

5
6 The redlip shiner (*Notropis chiliticus*) is a small minnow of pools and runs in small streams; it is
7 listed as a species of special concern for Richland County. There are no recorded occurrences
8 of this species in or adjacent to the transmission line corridors associated with V.C. Summer
9 (SCDNR 2001b).

10
11 The blacknose dace (*Rhinichthys atratulus*) is a small minnow found in small streams with clear
12 water and a gravel bottom; it is listed as a species of special concern for Richland County.
13 There are no recorded occurrences of this species in or adjacent to the transmission line
14 corridors associated with V.C. Summer (SCDNR 2001b).

15 16 2.2.6 Terrestrial Resources

17
18 The V.C. Summer site covers approximately 909 ha (2245 ac), an area that includes portions of
19 Monticello Reservoir and FPSF. Approximately 348 ha (860 ac) are covered by the waters of
20 Monticello Reservoir. A significant portion of the property (approximately 150 ha [370 ac])
21 consists of generation and maintenance facilities, laydown areas, parking lots, roads, and
22 mowed grass. Some 50 ha (125 ac) are dedicated to transmission line rights-of-way. However,
23 much of the V.C. Summer property consists of forested areas (approximately 360 ha [890 ac]).
24 The primary terrestrial habitats at V.C. Summer are pine forest, deciduous forest, and mixed
25 pine-hardwood forest (SCE&G 2002a). The pine forests at V.C. Summer include planted pines
26 and naturally vegetated pines. Most of the deciduous forests at the site are located along
27 stream bottoms and surrounding slopes.

28
29 Forested areas within the 909-ha (2245-ac) V.C. Summer site are managed by SCANA
30 Services' Forestry Operations group, but timber is not routinely harvested. Parr Reservoir
31 provides some limited freshwater marsh habitat in shallow backwaters, around low-lying
32 islands, and in an area east of the FPSF tailrace that was used in the 1970s for the disposal of
33 dredge spoil. These marshes and adjacent shallows are used by migrating dabbling ducks,
34 including mallard (*Anas platyrhynchos*), black duck (*A. rubripes*), and teal (*A. discors* and *A.*
35 *crecca*). Monticello Reservoir and its subimpoundment also provide resting areas for wintering
36 waterfowl and provide year-round habitat for nonmigratory Canada geese (*Branta canadensis*).
37 Terrestrial wildlife species found in the forested portions of the V.C. Summer property are those
38 typically found in the Piedmont forests of South Carolina.

Plant and the Environment

1 No areas designated by the U.S. Fish and Wildlife Service as critical habitat for endangered
2 species exist at V.C. Summer or adjacent to associated transmission lines. In addition, the
3 transmission corridors do not cross any State or Federal parks, wildlife refuges, or wildlife
4 management areas. Table 2-4 lists the protected species and their status. SCE&G conducted
5 a survey of threatened and endangered species at V.C. Summer and associated transmission
6 lines (SCE&G 2002e).

7
8 Six bald eagle (*Haliaeetus leucocephalus*) nesting sites occur within an 8-km (5-mi) radius of
9 V.C. Summer (SCDNR 2001a). Four of these six nests are believed to be active nesting sites,
10 while the status of two nests is unknown (SCDNR 2001b). There are four bald eagle nesting
11 sites on Parr Reservoir. Three (one active, two unknown status) are in roughly the same area
12 (within 0.8 km [0.5 mi] of one another), on the western shore of the reservoir, approximately
13 3 km (2 mi) west of V.C. Summer. The fourth is on the Heller's Creek arm of Parr Reservoir,
14 approximately 6.5 km (4 mi) northwest of V.C. Summer. There is a single bald eagle nesting
15 site on the eastern shore of Monticello Reservoir, approximately 5.5 km (3.5 mi) north of
16 V.C. Summer. There is also a nesting site approximately 2 km (2 mi) east of Monticello
17 Reservoir (6.5 km [4 mi] northeast of V.C. Summer) on a tributary of the Little River. One active
18 bald eagle nest in Saluda County is approximately 0.8 km (0.5 mi) west of the Summer-
19 Graniteville transmission line, and one bald eagle nest in Richland County is located
20 approximately 1.4 km (0.9 mi) south of the Summer-Denny Terrace transmission line
21 (SCDNR 2001b). The current status of the Richland County nest is unknown, but the nest was
22 viable as recently as 1995 (SCDNR 2001b). Bald eagles are generally associated with lakes,
23 rivers, and coastal areas (USACE 2002). The bald eagle is Federal-listed as threatened and
24 State-listed as endangered. Bald eagles are commonly observed foraging around Monticello
25 Reservoir, the FPSF tailrace canal, Parr Reservoir, and on the Broad River downstream of Parr
26 Shoals dam.

27
28 The wood stork (*Mycteria americana*), State- and Federal-listed as endangered, is known to
29 occur in Aiken County. Although they do not nest in Aiken County, wood storks from the
30 Birdsville Colony (near Millen, Georgia) forage in shallow wetlands on the Department of
31 Energy's Savannah River Site and in specially constructed ponds on the National Audubon
32 Society's Silver Bluff Sanctuary, near Jackson, South Carolina (DOE 1997; NAS undated). No
33 transmission corridors associated with V.C. Summer cross or approach the Savannah River
34 Site or the Silver Bluff Sanctuary.

35
36 The red-cockaded woodpecker (*Picoides borealis*), State- and Federal-listed as endangered, is
37 known to occur in Aiken and Richland Counties (SCDNR 2002). Active nest cavities of this
38 cooperative breeder occur in open, mature pine stands with sparse midstory vegetation
39 (USFWS 2002). Suitable habitat for this species does not occur at V.C. Summer, and there are
40 no known active or abandoned cavity trees adjacent to V.C. Summer-associated transmission
41 line corridors (SCDNR 2001b).

Table 2-4. Terrestrial Species Listed or Candidates for Listing as Endangered or Threatened by the U.S. Fish and Wildlife Service or the State of South Carolina that Occur or Potentially Occur Within or Near the V.C. Summer Site or the Associated Transmission Line Rights-of-Way

Scientific Name	Common Name	Federal Status ^(a)	State Status ^(a)
Birds			
<i>Haliaeetus leucocephalus</i>	bald eagle	T	E
<i>Mycteria americana</i>	wood stork	E	E
<i>Picoides borealis</i>	red-cockaded woodpecker	E	E
Plants			
<i>Amphianthus pusillus</i>	pool sprite	T	T
<i>Aster georgianus</i>	Georgia aster	C	--
<i>Echinacea laevigata</i>	smooth coneflower	E	E
<i>Lysimachia asperulifolia</i>	rough-leaved loosestrife	E	E
<i>Oxypolis canbyi</i>	Canby's dropwort	E	E
<i>Ptilimnium nodosum</i>	harperella	E	E
<i>Trillium reliquum</i>	relict trillium	E	E
Amphibians			
<i>Hyla andersonii</i>	pine barrens treefrog	--	T
<i>Plethodon websteri</i>	Webster's salamander	--	E
Mammals			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	--	E
Reptiles			
<i>Gopherus polyphemus</i>	gopher tortoise	--	E
(a) E = endangered, T = threatened, C = candidate for Federal listing, -- = no listing.			

Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is State-listed as endangered. This bat is found in forested areas, especially in pine flatwoods and pine-oak woodlands. It roosts in

Plant and the Environment

1 hollow trees, under bark, in old cabins and barns, and in wells and culverts (Brown 1997). The
2 species has been recorded in Aiken and Richland Counties (SCDNR 2002), but there are no
3 recorded occurrences in or adjacent to the transmission line corridors associated with
4 V.C. Summer (SCDNR 2001b).

5
6 The gopher tortoise (*Gopherus polyphemus*) is State-listed as endangered and is known to
7 occur in Aiken County (SCDNR 2002). The gopher tortoise inhabits sandy, well-drained areas
8 where adequate vegetation for foraging exists (Martoff et al. 1980). The gopher tortoise has
9 not been recorded north of Aiken County, and no burrows have been recorded in or adjacent to
10 the transmission line corridors associated with V.C. Summer (SCDNR 2001b). The species'
11 burrows, which are readily visible, have not been observed at V.C. Summer. The gopher
12 tortoise is generally not found in areas of Piedmont soils, which characterize most of the
13 transmission corridors associated with V.C. Summer.

14
15 The pine barrens treefrog (*Hyla andersonii*) is State-listed as threatened and is known to occur
16 in Richland County (SCDNR 2002). This species inhabits trees in swamps adjacent to sandhill
17 habitats (Martoff et al. 1980). There are no recorded occurrences of this species in or adjacent
18 to the transmission line corridors associated with V.C. Summer (SCDNR 2001b).

19
20 Webster's salamander (*Plethodon websteri*) is State-listed as endangered. It has been
21 recorded in Saluda and Edgefield Counties (SCDNR 2002), which represent the eastern extent
22 of its range. Webster's salamander inhabits moist, mixed hardwood forests on steep north-
23 facing slopes with rock outcrops (Martoff et al. 1980). There are no recorded occurrences of
24 this species in or adjacent to the transmission line corridors associated with V.C. Summer
25 (SCDNR 2001b).

26
27 The pool sprite (*Amphianthus pusillus*) , also known as little amphianthus, is State- and
28 Federal-listed as threatened. This aquatic plant occurs in small (usually less than one square
29 meter) shallow pools on the crests and flattened slopes of granite outcrops (USFWS 2002).
30 These pools completely dry out in summer droughts. Within South Carolina, the pool sprite is
31 known from three counties (USFWS 2002; SCDNR 2002), one of which (Saluda) is crossed by
32 the transmission lines associated with V.C. Summer. Only one occurrence of this plant is
33 known from Saluda County (USFWS 2002), but there are no recorded occurrences in or
34 adjacent to the V.C. Summer-associated transmission line corridors (SCDNR 2001b).
35 The Georgia aster (*Aster georgianus*), a candidate for Federal listing, is found in dry, open
36 woodlands and disturbed areas, such as roadsides and utility rights-of-way that are regularly
37 mowed. Populations have been found in Edgefield, Fairfield, and Richland Counties
38 (SCDNR 2002). There are no recorded occurrences of this species in or adjacent to the
39 V.C. Summer-associated transmission corridors (SCDNR 2001b).

1 The smooth coneflower (*Echinacea laevigata*), State- and Federal-listed as endangered, is
2 known to occur in Aiken and Richland Counties (SCDNR 2002). Habitat for this perennial herb
3 is open woods, cedar barrens, roadsides, clear cuts, limestone bluffs, and transmission line
4 corridors. Fire or other disturbance, such as well-timed mowing or clearing, is essential to
5 maintaining the open habitat required for this species (USFWS 2002). There are no recorded
6 occurrences of this species in or adjacent to the transmission line corridors associated with
7 V.C. Summer (SCDNR 2001b).

8
9 The rough-leaved loosestrife (*Lysimachia asperulifolia*) is State- and Federal-listed as
10 endangered. Habitat for this perennial herb consists of Carolina bays and the ecotones
11 between longleaf pine (*Pinus palustris*) uplands and pond pine (*P. serotina*) pocosins. The only
12 known location of the rough-leaved loosestrife within South Carolina is at Fort Jackson in
13 Richland County (USFWS 2002); there are no recorded occurrences of this species in or
14 adjacent to the transmission line corridors associated with V.C. Summer (SCDNR 2001b).

15
16 Canby's dropwort (*Oxypolis canbyi*) is State- and Federal-listed as endangered. This perennial
17 plant is known to occur in 11 counties within South Carolina, one of which (Richland) is crossed
18 by V.C. Summer transmission lines (SCDNR 2002). This coastal plain species grows in wet
19 meadows, wet pineland savannas, ditches, sloughs, and along the edges of cypress-pine
20 (*Callitris* sp.) ponds (USFWS 2002). There are no recorded occurrences of this species in or
21 adjacent to the transmission line corridors associated with V.C. Summer (SCDNR 2001b).

22
23 Harperella (*Ptilimnium nodosum*) is State- and Federal-listed as endangered. Typical habitat
24 for this annual herb is rocky or gravel shoals, margins of swift-flowing streams, and edges of
25 intermittent pineland ponds (USFWS 2002). Harperella is known in South Carolina from Aiken
26 and Saluda Counties (SCDNR 2002). There is one recorded population of harperella
27 approximately 0.8 km (0.5 mi) west of the Summer-Graniteville transmission line corridor in
28 Saluda County. The most recent observation of this population in the SCDNR database was
29 from 1985 (SCDNR 2001b). There are no recorded occurrences of this species in or adjacent
30 to the V.C. Summer-associated transmission corridors (SCDNR 2001b).

31
32 Relict trillium (*Trillium reliquum*) is State- and Federal-listed as endangered. Habitat for this
33 perennial herb is mature, moist, undisturbed hardwood forests (USFWS 2002). Relict trillium is
34 known from Aiken and Edgefield Counties (SCDNR 2002). There are no recorded occurrences
35 of this species in or adjacent to the transmission line corridors associated with V.C. Summer
36 (SCDNR 2001b).

2.2.7 Radiological Impacts

SCE&G conducts an annual radiological environmental monitoring program (REMP) in and around the V.C. Summer site. This program was initiated before plant operation in 1982 (SCE&G 2002d). Through this program, radiological impacts to workers, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are to

- provide representative measurements of radiation and radioactive materials in the exposure pathways and of the radionuclides that have the highest potential for radiation exposures to members of the public and
- supplement the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and the modeling of the environmental exposure pathways.

Radiological releases are summarized in two annual reports: *SCE&G Radiological Environmental Monitoring Report* (SCE&G 2002d) and *SCE&G Annual Effluent and Waste Disposal Report* (SCE&G 2002b). The limits for all radiological releases are specified in the V.C. Summer ODCM (SCE&G 1999), and these limits are designed to meet Federal standards and requirements. The REMP includes monitoring of the aquatic environment (fish, invertebrates, and shoreline sediment), atmospheric environment (airborne radioiodine, gross beta, and gamma), terrestrial environment (vegetation), and direct radiation.

SCE&G's review of historical data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of V.C. Summer were a small fraction of the limits specified in the SCE&G ODCM (SCE&G 1999a) to meet EPA radiation standards in 40 CFR Part 190 as required by 10 CFR 20.1301(d). For 2001 (the most recent year that data were available), dose estimates were calculated based on actual liquid and gaseous effluent release data (SCE&G 2002a). Dose estimates were performed by SCE&G using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM.

An assessment of doses to the maximally exposed individual from gaseous and liquid effluents was performed by SCE&G for locations representing the maximum dose. In all cases, doses were well below the technical specification limits as defined in the ODCM (SCE&G 2002d). A

breakdown of the maximum dose to an individual located at the V.C. Summer boundary from liquid and gaseous effluents released during 2001 are summarized as follows:

- Total body dose from liquid effluents at the site discharge was 3.96×10^{-5} mSv (3.96×10^{-3} mrem), which is about 0.13 percent of the 0.03 mSv (3 mrem) dose limit specified in 10 CFR Part 50, Appendix I. The critical organ dose due to the liquid effluents at the site discharge was 4.71×10^{-5} mSv (4.71×10^{-3} mrem). This dose was about 0.05 percent of the 0.10 mSv (10 mrem) dose limit (SCE&G 2002b).
- The air dose due to noble gases in gaseous effluents was 9.93×10^{-7} mSv (9.93×10^{-5} mrad) gamma (0.001 percent of the 0.10 mGy [10 mrad] gamma dose limit) and 3.56×10^{-7} mGy (3.56×10^{-5} mrad) beta (0.0002 percent of the 0.20 mGy [20 mrad] beta dose limit) (SCE&G 2002b).
- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days was 1.52×10^{-6} mSv (1.52×10^{-4} mrem), which is 0.001 percent of the 0.15 mSv (15 mrem) dose limit (SCE&G 2002b).

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from V.C. Summer operations during the renewal period and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the *V.C. Summer Environmental Report* (SCE&G 2002a) and information obtained from meetings with local and regional agencies during a site visit to Fairfield County and the surrounding area from December 10–12, 2002. The following information describes the housing, public services, land use, demographics, and economy of the communities near V.C. Summer.

2.2.8.1 Housing

SCE&G employs a permanent workforce of approximately 600 employees at V.C. Summer and an additional 130 to 140 long-term contract employees who provide security, maintenance, engineering, and janitorial support; this is within the range of 600 to 800 personnel per reactor unit estimated in the Generic Environmental Impact Statement (GEIS) (NRC 1996). Approximately 95 percent of the permanent employees live in Lexington, Richland, Fairfield, and Newberry Counties. The remaining 4 percent are distributed across 11 South Carolina counties. About 10 percent of the employees live in Fairfield County, and 48 of these (81 percent) live in Winnsboro or Jenkinsville. Table 2-5 summarizes the information for the

Table 2-5. V.C. Summer Employee Residence Information by County

County	Number of Personnel	Percent of Total
Fairfield	59	10
Lexington	210	34
Newberry	126	20
Richland	197	32
Other Counties	29	4
TOTAL	621	100
Source: SCE&G 2002a		

permanent workforce. Given the predominance of regular employees living in the Central Midlands Region and the absence of the likelihood of significant socioeconomic effects in other counties, the focus of this analysis is Fairfield, Lexington, Newberry, and Richland Counties.

V.C. Summer is on an 18-month refueling cycle. During refueling outages, which typically last for 30 to 40 days, the number of workers on site increases substantially. In three recent outages, V.C. Summer brought in 613 (refueling-10), 591 (refueling-11), and 791 (refueling-12) contractors, an average of 665 additional workers per outage. Most of these temporary workers are assumed to be located in the same geographic areas as the permanent SCE&G staff. This falls within the GEIS range of 200 to 900 additional workers per reactor outage (SCE&G 2002a).

Table 2-6 provides the number of housing units and housing unit vacancies for the four Central Midlands Counties for 1990 and 2000, derived from U.S. Census Bureau information. Each of these counties has a comprehensive plan that addresses housing needs and provides policies for guiding housing choices. Fairfield County accounted for just 1.7 percent of the Central Midlands Region's new housing units in 2001, compared to 56.5 percent in Richland, 38.2 percent in Lexington, and 3.6 percent in Newberry County (CMCOG 2001). These figures do not include mobile homes, which constitute a growing segment of the affordable housing supply in South Carolina. The Census Bureau reported that 29.3 percent of all housing units in Fairfield County in 2000 were mobile homes (this includes manufactured housing), and these structures provided 24.4 percent of the total housing units in Newberry County compared to 23.1 percent in Lexington County, just 6.6 percent in Richland County, and 20 percent for South Carolina (USCB 2000). Fairfield County has the smallest housing stock in the Central Midlands Region while Richland County has the largest. The Lexington County housing stock grew the fastest, by nearly 35 percent between 1990 and 2000, but it also had the largest change in vacancy rates. The vacancy rate in Fairfield County in 2000 was 15.5 percent but nearly half of

these (724 homes) are actually seasonal and vacation homes (USCB 2000). The vacancy rate for the four Central Midlands counties in 2000 was 8.8 percent and represents nearly 22,000 homes.

2.2.8.2 Public Services

Public services include water supply, education, and transportation.

- **Water Supply**

Table 2-7 summarizes the daily water consumption and areas served by each water system in Fairfield County, the county most impacted by the relicensing of V.C. Summer. Fairfield County has five public water systems, serving approximately 51 percent of the population. Less than two percent receive water from private residential water systems. The remaining 47 percent rely on individual wells (Fairfield County 1997). Only the town of Winnsboro draws water from a surface supply. The source is a reservoir west of Winnsboro that is part of the Jackson Mill Creek watershed. The reservoir contains approximately 600 million gallons of water (Fairfield County 1997). The remaining four public systems draw from groundwater sources, which have a relatively low yield in the area. However, each of the systems is currently operating below capacity, with room for additional growth and development (Fairfield County 1997). The county has been working to expand water service along major transportation corridors and there has been some discussion of establishing a sewer authority, but the focus of these efforts would likely be the areas along U.S. 21 between Interstate 77 and Lake Wateree and SC 269 south of Winnsboro. Development in western Fairfield County tends to be low-density, single-family residential and served by septic systems that require lots to be an acre or more.

The major public providers of water in Lexington County include Columbia, West Columbia, the Lexington County Joint Municipal Water and Sewer Commission, Cayce, Lexington, Batesburg-Leesville, Chapin, Pelion, Swansea, the Gilbert-Summit Rural Water District, Gaston Water District, and the Bull Swamp Water District. The remainder are private systems. Nonpublic providers include AAA Utilities, Inc., Carolina Water Service, and Heater Utilities, Inc. Lexington County has ample capacity for additional growth.

Constraints in Newberry County will be mitigated by the construction of additional water treatment facilities as the need arises (Newberry County 1998). While water is available at the interstate interchanges, the supply is not sufficient for industrial or large-scale

Plant and the Environment

Table 2-6. Housing Units and Housing Units Vacant (Available) by County during 1990 and 2000

		1990	2000	Approximate Percentage Change 1990–2000
Fairfield County				
Housing Units		8730	10,383	18.9
Occupied Units		7467	8774	17.5
Vacant Units		1263	1609	27.4
Newberry County				
Housing Units		14,445	16,805	16.3
Occupied Units		12,314	14,026	13.9
Vacant Units		2141	2779	29.8
Lexington County				
Housing Units		67,510	90,978	34.8
Occupied Units		61,592	83,240	35.1
Vacant Units		5918	7738	30.6
Richland County				
Housing Units		109,563	129,793	18.5
Occupied Units		101,588	120,101	18.2
Vacant Units		7975	9692	21.5
Source: U.S. Census Bureau (USCB) 2000 and CMCOG 2003a				

Table 2-7. Fairfield County Public and Private Water Suppliers and Capacities

Water Supplier	Average Daily Use m³/day (MGD)	Maximum Daily Capacity m³/day (MGD)
Community Systems		
Town of Winnsboro ^b	6738 (1.78)	11,735 (3.1)
Town of Ridgeway ^b	549 (0.145)	3785 (1.0)
Jenkinsville Water District ^b	477 (0.126)	651 (0.172)
Mid-County Water District	276 (0.073)	916 (0.242)
1 ^b Mid-County Water District	246 (0.065)	378 (0.100)
2 ^b Mitford Water District ^b	303 (0.080)	1514 (0.400)
Private Residential Systems		
Royal Hills Subdivision ^a	7.6 (0.002)	45 (0.012)
Chappel Mobile Home Park ^b	not available	95 (0.025)
Coley's Mobile Home Park ^b	not available	7.9 (0.03)
Fairview Manor ^a	not available	15.8 (0.06)
Lambright Care ^a	not available	not available
Industrial Systems		
V.C. Summer ^b	7.3 (0.0278)	342 (1.296)

a. Fairfield County 1997.

b. SCDHEC 1998.

residential development. The Water and Sewer Authority will make the investment to install water tanks or larger lines only when the demand requires it (Newberry County 1998).

Plant and the Environment

1 Water service is available to Richland County through public and private water systems.
2 The major public system is operated exclusively by the city of Columbia which has primary
3 water lines extending into four major planning areas. Water service is provided as far west
4 as Chapin and Lake Murray and north to the town of Blythewood. Water service in the
5 northeast extends very close to the Kershaw County line. Southeast of the city, water lines
6 reach to the McEntire Air National Guard Base and the Hopkins area. Columbia's position
7 has been to delay further water extension into unserved, sparsely populated areas until a
8 sufficient customer base has formed. Outside of Columbia's service area, water supply
9 depends on private wells.

10 • Education

11
12 The Central Midlands Region includes 11 school districts and 170 public schools with
13 enrollment totaling more than 107,000 students. There are also 75 private schools and
14 nine colleges and universities (CCEDA 2002). Fairfield County will be the focus of this
15 analysis as it is the school district most directly and fiscally impacted by the relicensing
16 of V.C. Summer.
17

18
19 The Fairfield County School District operates eight schools serving 3600 students. The
20 high school is located in Winnsboro, as is the middle (grades 6 to 8) school. There is
21 also an intermediate (grades 4 to 6) school, one elementary, and one primary school
22 (grades K to 6) in Winnsboro. There are also two schools providing pre-K through 6th
23 grade in Blair and Ridgeway. The operating budget for the Fairfield County School
24 District in 2002 was \$29.5 million of which approximately \$11.4 million is derived from
25 V.C. Summer taxes. Per pupil expenditures for the Fairfield County School District are
26 the highest in the Central Midlands at \$8062 in 1999. This compares with \$5189 to
27 \$6117 for Lexington schools, \$5989 for Newberry, and \$6035 to \$6552 for Richland
28 schools and \$5556 for South Carolina (CCEDA 2002).
29

30 • Transportation

31
32 The Central Midlands Region has a transportation network of trucking and railroad
33 terminals and interstate highway access to nine regional airports, three international
34 airports, and three international seaports, giving the area access to both domestic and
35 international markets (CCEDA 2002).
36

37 Fairfield County operates a basic public transportation system that operates along
38 established routes but can deviate up to 3.2 km (2 mi) off the route, and does pass
39 close to V.C. Summer along SC 215. The primary means of personal transportation for
40 commuting is private vehicles. Approximately 14 percent of the households in Fairfield
41 County do not have a vehicle (USCB 2000). Road access to V.C. Summer is via

SC 311 (Ollie Bradham Boulevard), a two-lane paved road (see Figure 2-3). SC 311 intersects with SC 215 approximately 2.4 km (1.5 mi) east of V.C. Summer. SC 215 has a north-south orientation and is used by employees traveling from the Richland and Fairfield Counties areas. Additionally, employees traveling from the Richland and Lexington Counties areas may use U.S. 176 north to SC 213, which intersects with SC 215 3.2 to 4.8 km (2 to 3 mi) south of V.C. Summer.

Employees coming from the west and Newberry County area may use several secondary roads such as SC 773 or SC 202 to intersect with U.S. 176 and head south to intersect with SC 213. Traffic counts for each of these highways/roads are shown in Table 2-8 (SCE&G 2002a). Two projects appear on the Long-Range Rural System Upgrades map in the vicinity of V.C. Summer: improvements to SC 213 between SC 215 and SC 176 and for the "Peak Bypass."

Railroad access to V.C. Summer is provided with a spur from the Norfolk Southern line along the east side of Broad River that runs through Columbia and Spartanburg. There is a municipal airport south of Winnsboro and another in Newberry County while

Table 2-8 Traffic Counts for Roads in the Vicinity of V.C. Summer

Route No.	Route Location	Est. AADT ^a (total of both directions)	AADT Year
U.S. 176	SC 34 to SC 219	900	2000
U.S. 176	SC 219 to Richland County Line	1450	2000
SC 213	Newberry County line to SC 215	2300	2000
SC 213	U.S. 176 to Fairfield County line	1750	2000
SC 215	Richland County line to SC 213	1500	2000
SC 215	SC 213 to Chester County line	1250	2000
SC 202	Interstate 26 to U.S. 176	1100	2000
SC 202	U.S. 76 to Interstate 26	1850	2000
SC 773	U.S. 76 to U.S. 176	2700	2000

^a = annual average daily traffic volume. Source: SCE&G 2002a.

Plant and the Environment

Columbia Metropolitan Airport provides the entire region with commercial and freight service.

2.2.8.3 Offsite Land Use

Fairfield County

Fairfield County contains approximately 177,414 ha (438,400 ac). Developed or urban land composes just 2 percent of the county. The largest land use category is forest, accounting for 87 percent of the total acreage. This includes public, commercial, and noncommercial forests, as well as farm woodlands. Nonforested land, including all urban or developed land, accounts for the remaining 13 percent. The surface waters of Wateree Lake and Monticello Reservoir, along with the Broad and Catawba Rivers, compose 4 percent of the county (Fairfield County 1997). Roughly 3 percent of the forested land in the county is government owned, primarily in the Sumter National Forest, located in the northwestern part of the county. Privately owned forest land in the county is dominated by corporations, individuals, and the forest products industry. Only 6 percent of the forested land is owned by farmers, reflecting the continued decline in farming in Fairfield County since the Depression era (Fairfield County 1997). Table 2-9 provides more information about these land use patterns.

Most of the growth in Fairfield County has occurred between Winnsboro and Wateree Lake, along the Interstate 77 corridor, and suburbanization is close to Richland County. Elsewhere, development is characteristically sparse and rural, characterizing the county's agricultural past (Fairfield County 1997). The dominant form of residential land use is single-family detached housing and includes a growing number of mobile homes and other manufactured structures. Residential development is found in both isolated and cluster patterns along most county roads (Fairfield County 1997). In the 20 years that V.C. Summer has operated, Fairfield County has experienced minimal population growth: the increase from 1990 to 2000 was only 0.5 percent. The county's economic base continues to be manufacturing, followed by government, industry, and services. Land use trends tend to be evolving simultaneously with the nationwide movement away from agricultural production and toward commerce built on the processing/production of goods and the distribution of services. The Fairfield County Comprehensive Plan was prepared in 1997 and provides policies that promote orderly development while protecting natural resources and prime farmland. The Plan also contains eight policies that promote the location and retention of appropriate industries.

Table 2-9. Land Use in Fairfield County, 1997

	ha (ac)	% County
Total Area	177,424 (438,400)	
Forested Land (by ownership)	155,240 (383,607)	0.87
Public		
National Forest	4678 (11,560)	0.03
Municipal, County, State	193 (478)	0.001
Private		
Forest Industries	52,860 (130,622)	0.30
Farms (farmers)	11,747 (29,027)	0.06
Corporations and Individuals	85,761 (211,920)	0.48
Nonforested Land	22,184 (54,818)	0.13
Developed (urban)	2974 (7350)	0.01
Water	6239 (15,416)	0.04
Other	12,971 (32,052)	0.07
Source: Fairfield County, 1997.		

Lexington County

Lexington County contains over 110,000 parcels located in a 1813-km² (700-mi²) area (Lexington County 1999). Farmland represents 21 percent of the land, as the county is a relatively strong agricultural center. However, Lexington County is encouraging the growth of residential areas by promoting the quality of the school systems and the accessibility of resources. Overall, Lexington County has no specific growth control regulations or ordinances; however, it does have a blend of zoning styles, unrelated to growth control, that encourages a quality type of expansion characterized by a reduction in land allocations that are random and sporadic. According to the Lexington County Land Use Plan (Lexington County 1999), land will continue to be available for development for a variety of uses for several decades.

Plant and the Environment

Newberry County

Newberry County has a total land area of 1678 km² (648 mi²). According to the Comprehensive Plan for Newberry County (Newberry County 1998), the land is characterized by a mixture of rural and urban uses including agricultural, residential, commercial, industrial, public and semiprivate uses and vacant land. The Comprehensive Plan study was limited to the areas around the municipalities, the lake shores of Lake Greenwood and Lake Murray, the U.S. 76 corridor between the town of Little Mountain and the city of Newberry, and portions of SC 773, SC 219, SC 34, and SC 121. The unincorporated portions of the county that fall outside the defined study area do not have land use regulations but may eventually need them for future development (Newberry County 1998). Residential development is generally characterized by low- to medium-density, single-family development. There are a number of vacant lots inside and outside of the study area. Most of these are located along the lake shores, where most of the neighborhood subdivisions have occurred (Newberry County 1998). There are very few multifamily units in the unincorporated areas of the county. The option most selected for affordable housing is the manufactured home. The number of manufactured homes has increased dramatically since 1980. Most are located on individual lots and, more recently, in subdivisions (Newberry County 1998). Unlike a municipality where there is dense commercial development in a downtown or some other commercial district, Newberry County's commercial development is much less dense. In most cases, the commercial development is limited to stores located at the intersections of major roads. The remainder of commercial development exists in areas that serve local residents (Newberry County 1998). Agriculture is represented by 200 or more ha (500 ac) scattered throughout the Comprehensive Plan study area, an area comprised mostly of incorporated and developed portions of the county. Generally, there is ample land available for future development in the county; however, the exact locations of growth will be guided by two major constraints: natural features and infrastructure. The study area is crisscrossed with streams and rivers, so there will be areas where topography and flood plain characteristics will constrain development.

Richland County

Richland County occupies roughly 1937 km² (748 mi²) of land area. Approximately 38 percent of the unincorporated portion of the county is developed, while the remaining 62 percent of the unincorporated land in the county is undeveloped. The unincorporated portions of the county were divided into four separate planning areas and two subareas to facilitate planning (Richland County 1999). A recently prepared comprehensive plan (Richland County 1999) noted that zoning controls were not established in Richland County until September 7, 1977. The absence of zoning controls and restrictions produced an environment where existing development patterns have been a mixture of many types of residential, commercial, and industrial uses. The plan noted further that rural open spaces and prime farmlands are being converted to residential and other suburban uses. The plan concluded that, in order to protect

significant agricultural lands, natural areas, and open space corridors, Richland County will ultimately have to develop specific zoning and growth management tools for directing future development to sustainable areas. As yet, growth control measures have not been developed or adopted.

2.2.8.4 Visual Aesthetics and Noise

V.C. Summer is situated in an undulating wooded area that is primarily rural in character. Residential low-density development typifies this part of Fairfield County. V.C. Summer is visible from certain vantage points along the shore of Monticello Reservoir and SC 215. Several transmission lines can be seen when crossing roads in the area. Noise is generally not an issue because the actual facilities are within an exclusion and buffer zone and front the reservoir.

2.2.8.5 Demography

Population was estimated from V.C. Summer out to 80 km (50 mi) in 16-km (10-mi) concentric rings. In accordance with NRC Guidance, SCE&G used the most recent decennial U.S. Census Bureau census data (USCB 2000) and geographic information system software (ArcView®) to determine demographic characteristics in the V.C. Summer vicinity. Table 2-10 shows population growth rates and projections in the Central Midlands Region from 1980 to 2040.

- Resident Population Within 80 km (50 mi)

All or parts of 21 South Carolina counties and the city of Columbia (State capital), are located within 80 km (50 mi) of V.C. Summer. A small portion of one North Carolina county (Union) also lies within the 80-km (50-mi) radius. In 2000, an estimated 1.03 million people live within 80 km (50 mi) of V.C. Summer, which equates to a population density of 131 persons per square mile. Table 2-11 presents the population distribution within 80 km (50 mi) of V.C. Summer in 10-year increments between 1990 and 2010.

Applying the GEIS proximity measures, V.C. Summer is classified as Category 3 (having one or more cities with 100,000 or more persons and less than 73 persons/km² [190 persons/mi²] within 80 km [50 mi]). According to the GEIS sparseness and proximity matrix, V.C. Summer ranks of sparseness Category 3 and proximity Category 3 result in the conclusion that V.C. Summer is located in a medium population area.

Plant and the Environment

Table 2-10. Population Growth in the Central Midlands Region of South Carolina 1980 to 2040

Year	Fairfield County		Lexington County		Richland County		Newberry County	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1980	20,700 ^a	0.4	140,353 ^a	5.8	269,735 ^a	1.5	31,242 ^a	0.7
1990	22,295 ^a	0.8	167,611 ^a	1.9	285,720 ^a	5.9	33,172 ^a	0.6
2000	23,454 ^a	0.5	216,014 ^a	2.9	320,677 ^a	1.2	36,108 ^a	0.9
2010	24,200 ^b	0.5	244,600 ^b	1.7	329,000 ^b	0.7	36,400 ^b	0.5
2020	25,300 ^b	0.5	280,400 ^b	1.5	350,100 ^b	0.6	38,100 ^b	0.5
2030	26,474 ^b	0.5	321,473 ^b	1.5	377,575 ^b	0.6	40,304 ^b	0.6
2040	27,565 ^b	0.4	359,133 ^b	1.2	400,258 ^b	0.6	42,091 ^b	0.4

a. USCB 2000. b. CMCOG 1999.

Table 2-11. Resident Population Within 80 km (50 mi) of V.C. Summer

	0 to 16 km (0 to 10 mi)	16 to 32 km (10 to 20 mi)	32 to 48 km (20 to 30 mi)	48 to 64 km (30 to 40 mi)	64 to 80 km (40 to 50 mi)	Total
Total 1990	9720	101,479	353,400	160,349	268,826	893,774
Total 2000	10,574	127,716	397,546	189,377	307,117	1,032,330
Total 2010 (est.)	11,247	151,154	437,851	215,455	340,649	1,156,356

Source: CMCOG 2003b

The largest population centers within the 16-km (10-mi) area are the communities of Jenkinsville (948 people in 2000) in Fairfield County and Peak in Newberry County. These areas have not experienced growth relative to other areas that lie outside the 16-km (10-mi) ring, but some new residential development has occurred along SC 215 on the shore of Monticello Reservoir. In fact, the Monticello-Salem area of Fairfield County, where V.C. Summer is located, lost about 10 percent of its population (approximately 240 people) between 1970 and 1990, and currently has a population of about 2200. Fairfield County had a lower population in 2000 (23,454) than it did at the turn of the 20th Century in 1900 (29,425), and it has experienced the slowest growth compared to the three other counties (USCB 2000).

Winnsboro is 24 km (15 mi) west of V.C. Summer and has a population of 16,000. The Fairfield County Comprehensive Plan projects that most of the housing and population growth will occur in and around Winnsboro and Ridgeway. These areas of Fairfield County increased in population by nearly 10 percent or about 1700 people between 1980 and 1990 (Fairfield County 1997). The area between Winnsboro, the Broad River, and U.S. 321 is projected to grow up to 8 percent between 2000 and 2010 (CMCOG 2002).

Areas 32 to 48 km (20 to 30 mi) from V.C. Summer include eastern Newberry County, northern Lexington County, including the rapidly growing Irmo area, and Columbia, the State capitol in Richland County. These are the most rapidly growing areas within the 80-km (48-mi) radius of V.C. Summer where population gains of the 1990s are projected to continue at similar rates during the next 10 years (CMCOG 2002). There were 163 residential building permits issued in 2001 in Newberry County, in contrast to 1724 in Lexington County, and 2550 in Richland County. By comparison, just 78 residential building permits were issued in Fairfield County (CMCOG 2002). The Columbia metropolitan statistical area (Lexington and Richland Counties) grew by 8.4 percent during the 1990s, and is projected to grow by 10.7 percent between 2000 and 2010 (CCEDA 2002).

Population and growth rates 64 to 80 km (38 to 48 mi) away from V.C. Summer tend to diminish with distance. This is particularly true to the north and east.

Table 2-12 lists the age distribution of Fairfield County reported by the 2000 census and compares it to South Carolina's population for the same year. Fairfield County is essentially consistent with South Carolina for each age bracket.

Table 2-12. Age Distribution of Population in Fairfield County

Fairfield County			South Carolina	
Age Group	Number	Percentage	Number	Percentage
Under 4	1580	6.7	264,679	6.6
5 to 17	4548	19.4	744,962	18.5
18 to 44	8539	36.4	1,593,806	39.6
45 to 64	5693	24.3	923,232	23.2
65 and over	3094	13.2	485,333	12.1
Total	23,454	100.00	4,012,012	100.00
Source: CMC0G 2003b				

- Transient Population**

The area within the first 16 km (10 mi) of V.C. Summer is characterized as rural, wooded, and low-density residential. There is no concentration of industrial or commercial facilities or uses within this area, and none are anticipated based upon the land uses denoted in the Comprehensive Plans for Fairfield and Newberry Counties. Transient employment is most likely to be out of this zone rather than into it, with the exception of V.C. Summer.

Monticello Reservoir and the private wooded lands that predominate are within the 16-km (10-mi) area. A small part of the Sumter National Forest is also within this area. The reservoir offers recreational opportunities, including camping and fishing, and day-time activities such as picnic tables, ball fields, and a playground. There are five public boat ramps, and boating is limited to nongasoline powered craft. Deer hunting is very popular in this area of Fairfield County. Private lands are leased specifically for this purpose by various sports clubs because the county is among the most-densely forested in South Carolina.^(a)

Peak daily and annual transient population numbers are not available for these lake and hunting activities. The Rock Around the Clock Festival is held in late September in Winnsboro to celebrate the nation's oldest continually running municipal clock and attracts between 5000 and 12,000 people. The Pig in the Ridge Barbeque is held in

(a) Personal communication between Daniel Pava, Los Alamos National Laboratory, Los Alamos, New Mexico, and Mark Talbert, Clemson Agricultural Extension Service, Winnsboro, South Carolina. December 10, 2001.

Ridgeway in November and attracts several thousand. V.C. Summer refuels on an 18-month cycle and the worker population increases substantially during these 30- to 40-day outages. An average of 665 additional workers have been brought in during the past three refueling outages.

- **Migrant Labor**

Migrant farm workers are individuals whose employment requires travel to tend or harvest agricultural crops. Migrant workers are typically members of minority or low-income populations. Because migrant workers travel and can temporarily spend a significant amount of time in an area without being actual residents, they may be unavailable for census takers to count. If this occurs, migrant workers would be under-represented in U.S. Census Bureau minority and low-income population counts. There is a growing Hispanic presence in the Central Midlands living near work opportunities such as the poultry processing plants in Newberry and Columbia Farms in Lexington County.^(a) While Hispanics are increasingly represented in Fairfield County, there has been an exceptional increase in Newberry County as indicated by the 2000 census that shows 4.2 percent of the population as Hispanic, which is a nine-fold increase since 1990 (United Way of the Central Midlands 2002).

In 1997, Fairfield County had 172 individual farms averaging 108 ha (271 ac) and 51 full-time farms. Hay and turkeys are the major products, and the county ranks 38th of 46 in agricultural cash receipts—about \$13.5 million in 2001. Timber harvesting is big in Fairfield County where the 1999 delivered value of timber was \$32.2 million, placing the county third out of 46 in the state (South Carolina Agricultural Statistics Service 2002 and USDA 1997). The Clemson Agricultural Extension Service estimates that tree harvesting has increased considerably during the past 20 years while the labor to accomplish this has decreased considerably. Approximately 200 people, mostly local African Americans, are employed seasonally, and crews of migrant workers from Mexico plant trees and spray them. There are no migrant worker camps within Fairfield County.^(b)

Given the expected small number of migrant workers, and the fact that they are not concentrated in Fairfield County, the staff concludes that migrant workers would not

(a) Personal communication between Daniel Pava, Los Alamos National Laboratory, Los Alamos, New Mexico, and Cary Smith, United Way of the Central Midlands, Columbia, South Carolina.

(b) Personal communication between Daniel Pava, Los Alamos National Laboratory, Los Alamos, New Mexico, and Mark Talbert, Clemson Agricultural Extension Service, Winnsboro, South Carolina. December 10, 2001.

Plant and the Environment

materially change the population characteristics of any particular census tract within the county.

2.2.8.6 Economy and Taxes

The communities potentially impacted socioeconomically by relicensing V.C. Summer are located in the four Central Midlands counties: Fairfield, Lexington, Newberry, and Richland. Fairfield County would experience the largest impacts of relicensing because the station is located there, and because economic conditions including the county's tax base are much more affected by V.C. Summer than are the other three counties. Table 2-13 summarizes and compares the unemployment, family poverty level, and median household income for each of the four counties and compares these figures with the State of South Carolina.

Fairfield County has the highest unemployment and poverty rates and the lowest median household income when compared to the three other counties and South Carolina. There are 61 percent more families in poverty in Fairfield County than in the state, and the contrast is higher when compared to the three other counties and particularly Lexington and Richland where family poverty is below the state levels. Both Newberry and Fairfield Counties also have a median household income that is lower than the state; however, the median household income in Fairfield County is projected to rise 24 percent over the next 10 years. Fairfield County unemployment has lowered over time: it was close to 10 percent in 1997. The staff concludes that Fairfield County economic trends should be more closely analyzed regarding the relicensing of V.C. Summer because of these factors.

Table 2-13. Unemployment, Poverty Level, and Median Household Income Comparison

	Percent Unemployed in Civilian Labor Force	Percent Families Below Poverty Level	Median Household Income in Dollars
Fairfield	6.9	17.2	30,376
Lexington	2.6	6.4	44,659
Newberry	4.7	13.6	32,867
Richland	4.3	10.1	39,961
South Carolina	5.9	10.7	37,082

Source: USCB 2000; Fairfield County Chamber of Commerce 2002

The Central Midlands Region, composed of Richland, Lexington, Newberry, and Fairfield Counties, is a varied mixture of rural and metropolitan areas with a total population of almost 600,000 (596,253) and an average annual growth rate of 1.7 percent (USCB 1991, 2000). Newberry and Fairfield Counties are rural. Richland and Lexington Counties encompass the metropolitan area of Columbia, the State capital, and comprise 90 percent of the Central Midland Region's population. From 1990 to 2000, South Carolina's average annual population growth rate was 1.5 percent, while Richland, Lexington, Newberry, and Fairfield Counties increased by 1.2, 2.9, 0.9, and 0.5 percent, respectively (USCB 1991, 2000). Between 2000 and 2040, Richland, Newberry, Lexington, and Fairfield Counties are projected to grow at average annual rates of 0.6, 0.4, 1.7, and 0.4 percent, respectively (USCB 2000, TtNUS 2002). In 2000, South Carolina reported a population of approximately 4.0 million people (USCB 2000). By the year 2040, South Carolina is projected to have 5.6 million people, growing at an average annual rate of 1.0 percent (USCB 2000, TtNUS 2002).

Fairfield and Newberry Counties were settled by Scotch-Irish, English, and German immigrants in the mid-18th century. In the 19th century, large-scale cotton farming replaced small farms, and the introduction of the railroad made this a leading area for the cotton market. In recent years, emphasis has been on the manufacturing, trade, and government sectors. More specifically, manufacturing is the number one sector for Fairfield and Newberry Counties (34.2 percent and 41.3 percent, respectively). Trade (28 percent) and government services (29.7 percent) are the largest sectors for Lexington and Richland Counties (CCEDA 1998). Although agriculture played a more significant role in the past, it is no longer a dominant force in the regional economy.

Columbia, the State capital, is located in Richland County. Nineteen Fortune 500 companies and 41 company headquarters can be found in Columbia. Columbia's top employers in the public sector include Federal, State, and local government, Fort Jackson, and the University of South Carolina. Top employers in the private sector include SCE&G, Richland Memorial Hospital, Blue Cross and Blue Shield of South Carolina, Computer Sciences Corporation (formerly Policy Management Systems), and Bell South (Realty World America 2002). The major private employers in Fairfield County include V.C. Summer, Uniroyal Goodrich, Standard Products, Isola USA, Fuji Coplan, Plastech Engineered Products, Salant, Wal-Mart, Lang Mekra, and Gividi USA. These 11 companies employed approximately 2835 people in 2002. Mack Truck, which employed 1300 workers during peak operations in the late 1990s, recently shut down its Fairfield County operations (CCEDA 2002). Government employs about 1030, and 250 work at the hospital. Since nearly 11,000 residents in Fairfield County are in the civilian labor force, and employees commute to these major employers from outside the county, it can be surmised that most county residents work in other pursuits and smaller businesses. For example, nearly 1200 list retail trade as a household occupation in the 2000 census. Private wage and salary workers compose about 78 percent of the labor pool, government

Plant and the Environment

accounts for about 18 percent, and those who are self-employed another 5 percent. This is nearly consistent with the state as a whole, where 78 percent are private wage and salary workers, 16 percent government workers, and 6 percent are self-employed (USCB 2000). Table 2-14 lists the major employers in Fairfield County.

Most of the retail and service establishments in Fairfield County are located in the incorporated areas of Winnsboro and Ridgeway where the population is sufficiently concentrated to support business activities. Most of the industrial plants are located in or near Winnsboro, and newer

Table 2-14. Major Employers in Fairfield County, South Carolina

Employer	Product	Number of Employees
Fairfield County Schools	government	700
V.C. Summer	power plant	625
Ben Arnold-Sunbelt Beverage Co.	bottler	372
Uniroyal Goodrich Tire Co.	tire cords	317
Standard Products Co.	automotive trim	302
Fairfield Memorial Hospital	medical services	250
Isola USA	printed circuit boards	238
Fairfield County	government	235
Fuji Copian Corp.	typewriter cassettes	209
Plastech Engineered Products Co.	molded automotive plastics	200
Salant Corporation	textiles and clothing	200
Wal-Mart	retail	170
Lang Mekra	truck mirrors	138
Town of Winnsboro	government	96
Gividi USA	fiberglass computer parts	64

Source: CCEDA 2002, Fairfield County Chamber of Commerce 2002

development occurs at the Walter Brown Industrial Park near Interstate 77 (Fairfield County 1997). While the trend is toward diversification in the manufacturing base, major employment in Fairfield County continues to be in the government, services, and retail sectors. An example of this is the October 2002 announcement that Infinity Health Foods will move into a previously occupied manufacturing facility on SC 321 and will employ up to 100 people over the next five years (CCEDA 2002). V.C. Summer has been and will continue to be a major employer located in Fairfield County, provided that it is relicensed and continues operations.

V.C. Summer pays annual property taxes to Fairfield County. These taxes fund Fairfield County operations, including the Fairfield County Public Schools. The county's operating budget includes the coroner, assessor, auditor, sheriff, detention center, road maintenance, solid waste, emergency management, social services, veterans affairs, and recreation facilities. For the years 1995 to 2000, V.C. Summer property taxes provided between about 41 percent and 50 percent of Fairfield County's total property tax revenue and approximately the same percentage of Fairfield County's total operating budget. The trend has been downward during this time. Residential property taxes have increased modestly during this time as well. Other sources of revenue include various fees and fines, State aid, inventory taxes, and motor carrier taxes (Johnson 2002).

Schools in South Carolina are funded primarily with the property tax. The Fairfield County School District derived \$11.4 million from taxes paid by V.C. Summer in 2002. This equates to almost 40 percent of the district's \$29.5 million budget. Table 2-15 compares V.C. Summer's tax payments to Fairfield County tax revenue and operating budgets.

The South Carolina Legislature is studying the issue of electric power industry deregulation. The effects of deregulation are not yet fully known but could affect tax payments by utilities to the counties. Any changes to V.C. Summer tax rates due to deregulation would, however, be independent of license renewal.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known and potential historic and archaeological resources at V.C. Summer and the immediate surrounding area.

2.2.9.1 Cultural Background

The area around V.C. Summer is rich in prehistoric and historic Native American and historic Euro-American resources. Recent literature provided adequate background information for the area. Consequently, only a brief summary is provided here. Prehistoric period overviews for

Plant and the Environment

Table 2-15. Fairfield County Property Tax Revenues, Property Taxes Paid by V.C. Summer, and Fairfield County Operating Budget 1995 to 2000

Year	Total Fairfield County Property Tax Revenues ^a (excluding debt)	Property Tax Paid by V.C. Summer	Percent of Total Property Taxes	Operating Budget for Fairfield County ^a (excluding debt)
1995	23,338,821	11,671,000	50	23,096,221
1996	24,472,690	12,324,000	50	24,387,997
1997	25,256,855	12,629,000	50	25,234,991
1998	26,730,639	12,943,000	48	26,795,321
1999	27,772,061	12,529,000	45	27,508,743
2000	29,604,792	12,272,000	41	29,540,322

a. SCE&G 2002a.

South Carolina are provided by U.S. National Park Service (2003) and South Carolina Indians (2002). Historic period overviews for South Carolina are provided by Edgar (1998) and Milling (1969).

Prehistoric Period

The prehistoric Native American occupation of the region around V.C. Summer includes four general periods: Paleoindian period (about 10,000 to 8000 BC), the Archaic period (about 8000 to 1000 BC), the Woodland period (about 1000 BC to 900 AD), and the Mississippian and late prehistoric period (about 900 to 1500 AD). This late prehistoric period is a transitional period in which initial contacts were made with Europeans and cultural changes associated with subsequent European settlement of the area took place.

The prehistoric periods were marked by initial reliance on big game hunting for subsistence, followed by increased use of smaller game animals and plant foods in the Archaic period. Major environmental changes in the Archaic period led to an increasingly more sedentary lifestyle, primarily in riverine settings. Late in the Archaic period, more sedentary villages and an increased reliance on cultivated crops became the norm. The Woodland and Mississippian periods were characterized by larger base camps in the river valleys, with subsistence based on agriculture, hunting and gathering, and intergroup trade. The late prehistoric period is primarily identified by the introduction of European trade goods.

Native American Historic Period

At least 29 distinct groups of Indians lived in South Carolina, each having a separate dialect, many of these dialects being distinct languages. The common language families were Algonquian, Iroquoian, Muskogean, Siouan, and Yuchi. The Eno and Shakori Indians, now extinct tribes, lived in the area of present-day Fairfield County. The Catawba, Pee Dee, Chicora, Edisto, Santee, and Chicora-Waccamaw tribes are all still present in South Carolina as are many descendants of the Cherokee. By 1750, the smaller Indian tribes throughout South Carolina disappeared, probably merging with larger groups, such as the Catawba and Cherokee of South Carolina or the Creeks of Georgia. In 1830, the Indian Removal Act was passed by the United States government. In 1838, the Cherokee Indians were forced to leave their eastern homeland and travel to Indian Territory in Oklahoma. In 1993, the Catawba Tribe received its Federal recognition status. Today, the Catawba Tribe is the only Federally recognized tribe in the State of South Carolina and numbers 1200 individuals living in the vicinity of Rock Hill, South Carolina.

Euro-American Historic Period

South Carolina is one of the 13 original colonies. The Spanish and French explorers arrived in the area in the 16th century and found the land inhabited by many small tribes of Native Americans, the largest were the Cherokees and the Catawbas. The first European settlements failed. In 1670, an English settlement was established on the coast near present-day Charleston. The colony was divided in 1710 into South Carolina and North Carolina. Settlers from the British Isles, France, and other parts of Europe built plantations throughout the coastal low country. African slaves were brought into the colony in large numbers to provide labor for the plantations, and by 1720 they formed the majority of the population. The port city of Charleston became an important center of commerce and culture. The interior was slowly settled by small farmers and traders, who pushed the dwindling tribes to the west.

South Carolina was one of the richest colonies in America by the time of the American Revolution. More Revolutionary War battles were fought in South Carolina than any other state. South Carolina ratified the United States Constitution on May 23, 1788, becoming the eighth state to enter the Union.

Early settlement of Fairfield County in the mid 1700s brought cotton to the county, and it remained the main crop until depletion of the soil and the industry was brought to a halt in the 1920s. Granite deposits in the county led to the early development of quarrying. In December 1832, Winnsboro was incorporated as a town.

Plant and the Environment

2.2.9.2 Historic and Archaeological Resources at V.C. Summer

Historic and archaeological site file searches were conducted at the South Carolina Master File in the South Carolina Department of Archives and History to identify cultural resources that might be present at V.C. Summer. In addition, record searches were conducted for nearby locations to gain perspective on the types of historic resources that may be present in the previously undeveloped and unsurveyed portions of V.C. Summer.

The Final Environmental Statement (AEC 1973) for the construction of V.C. Summer listed three historic sites in the vicinity. At that time, it was determined that none of the sites were "endangered" by V.C. Summer. Additionally, four archaeological sites were discovered within or near the boundary of the site and a recommendation was made by Dr. Robert L. Stephenson, State Archaeologist, that the area be surveyed and that two of the known sites be excavated (AEC 1973).

In 1972, SCE&G funded an archaeological survey that was conducted by a team from the University of South Carolina Institute of Archaeology and Anthropology. The archaeological survey was conducted to assess the nature and distribution of the sites present and to assess the effect of the Parr Hydroelectric Project on historic and archaeological resources. The Parr Hydroelectric Project included (1) elevation of the Parr Reservoir Dam, raising the level of the Parr Reservoir, (2) construction of a series of dams on Frees Creek to create the upper reservoir for a new pumped-storage facility and supply cooling water for V.C. Summer, and (3) construction of the FPSF and V.C. Summer.

The Institute of Archaeology and Anthropology team identified 27 additional sites and performed the excavation of two others. Approximately five sites were covered by water when Monticello Reservoir was filled in 1978 and are now inaccessible; the remaining sites lie along the banks of Monticello and Parr Reservoirs. Periods represented included the Early Archaic, Middle Archaic, Woodland, Mississippian, and Early Historic (SCE&G 2002a).

Since the publication of the 1973 Final Environmental Statement, 41 sites have been added to the National Register of Historic Places (NRHP) for Fairfield County. Ten of these sites fall within a 9.6-km (6-mi) radius of V.C. Summer. Twenty-eight sites have been added to the NRHP for Newberry County. Four of these sites fall within a 9.6-km (6-mi) radius of V.C. Summer. No sites listed on the National Register of Historic Places fall within a 1.6-km (1-mi) radius of V.C. Summer.

There are two other historic sites within a 9.6-km (6-mi) radius of V.C. Summer that are not listed on the National Register of Historic Places but are protected by SCE&G. One is the Mayo family cemetery, which is in a wooded area approximately 4.0 km (2.5 mi) south of V.C. Summer on land that is owned by SCE&G but is not part of V.C. Summer property. This

1 small family plot contains headstones dating back to 1895. The other historic site,
2 approximately 2.4 km (1.5 mi) southwest of V.C. Summer, is a large monument erected in 1943
3 by the Daughters of the American Revolution marking the grave of General John Pearson, a
4 Fairfield County native who served with distinction in the Revolutionary War. This monument is
5 in a wooded area on land that is not part of V.C. Summer property, but is maintained as a buffer
6 zone around the site. SCE&G's Forestry Operations group is familiar with these sites, which
7 are marked on their timber inventory and land cover maps, and takes appropriate measures to
8 protect them when conducting forest management activities in the vicinity of either historic site
9 (SCE&G 2002a).

11 2.2.10 Related Federal Project Activities and Consultations

13 The staff reviewed the possibility that activities of other Federal agencies might impact the
14 renewal of the operating license for V.C. Summer. Any such activities could result in
15 cumulative environmental impacts and the possible need for the Federal agency to become a
16 cooperating agency for preparation of this supplemental environmental impact statement
17 (SEIS).

19 The Federal Power Commission (which became FERC) issued a license (Project Number 1894)
20 to SCE&G on June 30, 1974, for the Parr Hydroelectric Project, which consisted of a set of
21 related actions (elevation of Parr Shoals Dam, enlargement of Parr Reservoir, construction of
22 FPSF, impoundment of Frees Creek for Monticello Reservoir). The Federal Power Commission
23 prepared an environmental impact statement for this major Federal license that evaluated
24 potential environmental impacts of this action, including the inundation of 3784 ha (9350 ac) of
25 land (eliminating farmland, timber, wildlife habitat, and 25 homes) and enhanced recreational
26 opportunities provided by the public recreational facilities at the expanded Parr Reservoir and
27 new Monticello Reservoir. The Federal Power Commission concluded that the loss of 3784 ha
28 (9350 ac) of farmland and wildlife habitat was significant (Federal Power Commission 1974),
29 but that, with prudent evaluation and selection of construction methods and project operation,
30 no serious cumulative adverse environmental impacts were foreseen. FPSF began commercial
31 operation in 1978, four years before V.C. Summer. The FERC license for the Parr
32 Hydroelectric Project, including FPSF, expires on June 30, 2020. Under current rules, SCE&G
33 will have to file a notice of intent with FERC by the year 2015 declaring whether or not it intends
34 to seek a new license for the hydroelectric project. At least two years before the current FERC
35 license expires (i.e., prior to June 30, 2018), SCE&G will have to file an application for a new
36 license.

38 Federal activities within the 80-km (50-mi) radius of V.C. Summer include the Sumter National
39 Forest managed by the U.S. Department of Agriculture, the Congaree Swamp National
40 Monument managed by the U.S. Department of Interior, and the Army's 20,800-ha (52,000-ac)

Plant and the Environment

1 Fort Jackson southeast of Columbia. The 8800-ha (22,000-ac) Congaree Swamp hosted
2 nearly 110,000 visitors in FY2001. Fort Jackson employs 3900 civilians and is the largest and
3 most active Initial Entry Training Center in the United States Army, training 19,000 each year.
4 Fort Jackson has added several new schools and training institutions, including the Soldier
5 Support Institute, the Chaplains Center and School, and the U.S. Department of Defense
6 Polygraph Institute. Shaw Air Force Base is located in Sumter, South Carolina, outside of the
7 Central Midlands Region but also within the 80-km (50-mi) area.

8
9 The staff determined that there were no Federal projects or activities in the vicinity of
10 V.C. Summer that would result in cumulative impacts or would make it desirable for another
11 Federal agency to become a cooperating agency for preparing this SEIS.

12
13 The NRC is required under Section 102(c) of the National Environmental Policy Act of 1969
14 (NEPA 1969) to consult with and obtain the comments of any Federal agency that has
15 jurisdiction by law or special expertise with respect to any environmental impact involved in the
16 subject matter of the SEIS. NRC is consulting with the U.S. Fish and Wildlife Service and the
17 South Carolina State Historic Preservation Office. Consultation correspondence is included in
18 Appendix E.

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3.0 Environmental Impacts of Refurbishment

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

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

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

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

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

Environmental Impacts of Refurbishment

Table 3-1. Category 1 Issues for Refurbishment Evaluation

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

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

Category 1 and Category 2 issues related to refurbishment that are not applicable to the Virgil C. Summer Nuclear Station (V.C. Summer) because they are related to plant design features or site characteristics not found at V.C. Summer are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. South Carolina Electric and Gas (SCE&G) indicated that it performed its integrated plant assessment, the evaluation of structures and components pursuant to 10 CFR 54.21, to identify activities that are necessary to continue operation of V.C. Summer during the requested 20-year period of extended operation. In its Environmental Report (ER), SCE&G stated that it completed major modifications (e.g., steam generator replacement) that were necessary for the operation of V.C. Summer during its initial licensing term (SCE&G 2002).

Table 3-2. Category 2 Issues for Refurbishment Evaluation

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

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the applicant's ER and the staff's environmental impact statement.

SCE&G stated that, as a result of its integrated plant assessment, it has not identified the need to undertake major refurbishment or replacement activities for important structures, systems, or components during the license renewal period. Routine maintenance and inspection activities are within the bounds of normal plant component replacement and inspections; therefore, SCE&G is not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (AEC 1973).

In addition, the SCE&G evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support

Environmental Impacts of Refurbishment

1 the continued operation of V.C. Summer beyond the end of the existing operating license.
2 Therefore, refurbishment is not considered in this draft supplemental environmental impact
3 statement.
4
5

6 3.1 References

7
8 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental
9 Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10
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12 Renewal of Operating Licenses for Nuclear Power Plants."

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26 *for License Renewal of Nuclear Plants Main Report*. "Section 6.3 – Transportation, Table 9.1
27 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final
28 Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.
29
30

4.0 Environmental Impacts of Operation

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

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

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

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to the Virgil C. Summer Nuclear Station (V.C. Summer). Section 4.1 addresses issues applicable to the V.C. Summer cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses new information that was raised during the scoping period.

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

Environmental Impacts of Operation

The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.8. Finally, Section 4.9 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to V.C. Summer because they are related to plant design features or site characteristics not found at V.C. Summer are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to V.C. Summer cooling system operation during the renewal term are listed in Table 4-1. South Carolina Electric and Gas (SCE&G) stated in its Environmental Report (ER) (SCE&G 2002a) that it is not aware of any new and significant information associated with the renewal of the V.C. Summer operating license (OL). The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

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

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1; 4.4.3
Altered thermal stratification of lakes	4.2.1.2.3; 4.4.3
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.3
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.3
Eutrophication	4.2.1.2.3; 4.4.3
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2; 4.4.3
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2; 4.4.3
Discharge of other metals in wastewater	4.2.1.2.4; 4.4.2.2
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.2.2; 4.4.1.2; 4.4.3; 4.6.1.1
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.2.2.1.10; 4.2.2.2; 4.4.3
Cold shock	4.2.2.1.5; 4.2.2.1.10; 4.2.2.2; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.2.2.2; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.2.2.2; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.2.2.2; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.2.2.2; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.2.2.2; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.2.2.2; 4.4.3
Stimulation of nuisance organisms (e.g., shipworms)	4.2.2.1.11; 4.2.2.2; 4.4.3
TERRESTRIAL RESOURCES	
Cooling pond impacts on terrestrial resources	4.4.4
HUMAN HEALTH	
Noise	4.3.7

Environmental Impacts of Operation

- 1 • Altered thermal stratification of lakes. Based on information in the GEIS, the
2 Commission found that

3
4 Generally, lake stratification has not been found to be a problem at operating
5 nuclear power plants and is not expected to be a problem during the license
6 renewal term.
7

8 The staff has not identified any significant new information during its independent review of
9 the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring
10 programs and evaluation of other available information. Therefore, the staff concludes that
11 there are no impacts of altered thermal stratification of lakes during the renewal term
12 beyond those discussed in the GEIS.
13

- 14 • Temperature effects on sediment transport capacity. Based on information in the GEIS,
15 the Commission found that

16
17
18 These effects have not been found to be a problem at operating nuclear
19 power plants and are not expected to be a problem during the license renewal
20 term.
21

22 The staff has not identified any significant new information during its independent review of
23 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
24 available information. Therefore, the staff concludes that there are no impacts of
25 temperature effects on sediment transport capacity during the renewal term beyond those
26 discussed in the GEIS.
27

- 28 • Scouring caused by discharged cooling water. Based on information in the GEIS, the
29 Commission found that

30
31
32 Scouring has not been found to be a problem at most operating nuclear power
33 plants and has caused only localized effects at a few plants. It is not expected
34 to be a problem during the license renewal term.
35

36 The staff has not identified any significant new information during its independent review of
37 the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring
38 programs and evaluation of other available information. Therefore, the staff concludes that
39 there are no impacts of scouring caused by discharged cooling water during the renewal
40 term beyond those discussed in the GEIS.
41

- Eutrophication. Based on information in the GEIS, the Commission found that

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring programs and evaluation of other available information including plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information including the National Pollutant Discharge Elimination System (NPDES) permit for V.C. Summer (SCDHEC 2002), or discussion with the NPDES compliance office. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information including the NPDES permit for V.C. Summer (SCDHEC 2002) or discussion with the NPDES compliance office. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

Environmental Impacts of Operation

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

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

8
9 The staff has not identified any significant new information during its independent review of
10 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
11 available information, including the NPDES permit for V.C. Summer (SCDHEC 2002) or
12 discussion with the NPDES compliance office. Therefore, the staff concludes that there are
13 no impacts of discharges of other metals in wastewater during the renewal term beyond
14 those discussed in the GEIS.

- 15
16 • Water use conflicts (plants with once-through cooling systems). Based on information in
17 the GEIS, the Commission found that

18
19
20 These conflicts have not been found to be a problem at operating nuclear
21 power plants with once-through heat dissipation systems.

22
23 The staff has not identified any significant new information during its independent review of
24 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
25 available information. Therefore, the staff concludes that there are no impacts of water use
26 conflicts for plants with once-through cooling systems during the renewal term beyond those
27 discussed in the GEIS.

- 28
29 • Accumulation of contaminants in sediments or biota. Based on information in the GEIS,
30 the Commission found that

31
32
33 Accumulation of contaminants has been a concern at a few nuclear power
34 plants but has been satisfactorily mitigated by replacing copper alloy
35 condenser tubes with those of another metal. It is not expected to be a
36 problem during the license renewal term.

37
38 The staff has not identified any significant new information during its independent review of
39 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of available
40 information. Therefore, the staff concludes that there are no impacts of accumulation of
41 contaminants in sediments or biota during the renewal term beyond those discussed in the
42 GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring programs and evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that

Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

Environmental Impacts of Operation

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

3
4
5 Thermal discharge may have localized effects but is not expected to effect the
6 larger geographical distribution of aquatic organisms.

7
8 The staff has not identified any significant new information during its independent review of
9 the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring
10 programs and evaluation of other available information. Therefore, the staff concludes that
11 there are no impacts on distribution of aquatic organisms during the renewal term beyond
12 those discussed in the GEIS.

- 13
14 • Premature emergence of aquatic insects. Based on information in the GEIS, the
15 Commission found that

16
17
18 Premature emergence has been found to be a localized effect at some
19 operating nuclear power plants but has not been a problem and is not
20 expected to be a problem during the license renewal term.

21
22 The staff has not identified any significant new information during its independent review of
23 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
24 available information. Therefore, the staff concludes that there are no impacts of premature
25 emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- 26
27 • Gas supersaturation (gas bubble disease). Based on information in the GEIS, the
28 Commission found that

29
30
31 Gas supersaturation was a concern at a small number of operating nuclear
32 power plants with once-through cooling systems but has been satisfactorily
33 mitigated. It has not been found to be a problem at operating nuclear power
34 plants with cooling towers or cooling ponds and is not expected to be a
35 problem during the license renewal term.

36
37 The staff has not identified any significant new information during its independent review of
38 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
39 available information. Therefore, the staff concludes that there are no impacts of gas
40 supersaturation during the renewal term beyond those discussed in the GEIS.
41

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, and staff review of monitoring programs and evaluation of other available information. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of

Environmental Impacts of Operation

stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Cooling pond impacts on terrestrial resources. Based on information in the GEIS, the Commission found that

Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of cooling ponds on terrestrial resources during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that

Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to V.C. Summer are discussed in the section that follows and are listed in Table 4-2. Although the SCE&G ER identified only microbial organisms (public health) as an applicable Category 2 issue, the staff determined that all the Category 2 issues pertaining to plants with cooling ponds are applicable to V.C. Summer.

4.1.1 Water Use Conflicts (Make-up Water from a Small River)

Water use conflicts has been determined to be a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts may be a problem at some plants because consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (NRC 1996).

V.C. Summer operates as a once-through cooling plant that withdraws from and discharges to a cooling pond, Monticello Reservoir. This issue applies because Monticello Reservoir receives its make-up water from the Broad River, which has an annual mean flow of approximately

Table 4-2. Category 2 Issues Applicable to the Operation of the V.C. Summer Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(II) Subparagraph	SEIS ^a Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	4.2.1.3, 4.2.2.2, 4.4.2.1	A	4.1.1
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2; 4.3.3	B	4.1.2
Impingement of fish and shellfish	4.2.2.1.3; 4.3.3	B	4.1.3
Heat shock	4.2.2.1.4; 4.3.3	B	4.1.4
HUMAN HEALTH			
Microbial organisms (public health)(plants using lakes or canals or cooling towers that discharge into a small river)	4.3.6	G	4.1.5
^a = Supplemental Environmental Impact Statement			

$6 \times 10^9 \text{ m}^3/\text{yr}$ ($2.1 \times 10^{11} \text{ ft}^3/\text{yr}$) ($185 \text{ m}^3/\text{s}$ [6,535 cfs]) (Cooney et al. 2001). Monticello Reservoir was built to supply cooling water to the station and to provide an upper reservoir for the Fairfield Pumped Storage Facility (FPSF), located on Parr Reservoir. Parr Reservoir was created (1913-1914) by impounding the Broad River approximately 42 km (26 mi) upstream of the confluence of the Broad and Saluda Rivers.

The Federal Power Commission (Federal Energy Regulatory Commission's predecessor agency) licensed the Parr Hydroelectric Project in 1974, contingent upon a minimum instantaneous release at the Parr Powerhouse of $4.2 \text{ m}^3/\text{s}$ (150 cfs) during most months of the year and a minimum instantaneous release of $28 \text{ m}^3/\text{s}$ (1000 cfs) during the March-April-May striped bass (*Morone saxatilis*) spawning period (NRC 1981). For the periods 1896 to 1907 and 1980 to 2000, the lowest daily mean flow of the Broad River at the Alston, South Carolina, gauging station was $6.6 \text{ m}^3/\text{s}$ (235 cfs) (Cooney et al. 2001). The lowest recorded daily mean flow of $4.2 \text{ m}^3/\text{s}$ (149 cfs) was measured at the Richtex Station, approximately 11.3 km (7.0 mi) downstream of Parr Reservoir (NRC 1981).

Environmental Impacts of Operation

1 The 1981 *Final Environmental Statement* indicated that approximately 0.37 m³/s (13 cfs) of the
2 33 m³/s (1180 cfs) of water withdrawn from Monticello Reservoir for condenser cooling would
3 be lost to evaporation. This water loss was to be made up by pumping back from Parr
4 Reservoir. The projected evaporative loss of 0.37 m³/s (13 cfs) from condenser cooling
5 represented approximately 9 percent of the minimum allowable instantaneous flow of 4.2 m³/s
6 (150 cfs), 5.5 percent of the lowest daily mean flow (6.6 m³/s [235 cfs]), and approximately
7 0.2 percent of the annual mean flow (185 m³/s [6535 cfs]) of the Broad River at Alston, South
8 Carolina. The daily cycle of operation at the FSPF transfers up to 11,736 ha-ft (29,000 ac-ft) of
9 water (equivalent to 416 m³/s [14,700 cfs]) from Parr Reservoir to Monticello Reservoir and
10 back on a daily basis.

11
12 Based on a higher (theoretical maximum) cooling water withdrawal rate of 37 m³/s (1308 cfs),
13 V.C. Summer Quarterly Water Use Reports indicate that 0.62 m³/s (22 cfs) is lost to
14 evaporation (SCE&G 1998, 1999). This loss represents 14.7 percent of the minimum allowable
15 instantaneous flow of 4.2 m³/s (150 cfs), 9.4 percent of the lowest daily mean flow (6.6 m³/s
16 [235 cfs]), and approximately 0.3 percent of the annual mean flow (185 m³/s [6535 cfs]) of the
17 Broad River at Alston, South Carolina. Under normal circumstances, evaporative losses from
18 Monticello Reservoir represent less than one percent reduction in Broad River flows. Any
19 impacts to riparian ecological communities in Parr Reservoir would be small.

20
21 Severe drought conditions were experienced throughout the summer of 2002. However, no
22 situations were encountered where make-up water for the evaporative losses due to
23 V.C. Summer operations affected the flow conditions in the Broad River so as to impinge upon
24 any of the Federal Energy Regulatory Commission- (FERC-) mandated flow restrictions. A
25 discussion with the FERC oversight staff member of the Parr Hydropower facility confirmed that
26 the operation of V.C. Summer causes no discernable impacts to maintaining minimum flow
27 conditions in the Broad River. There is no concern on the part of the FERC concerning this
28 issue.^(a)

29
30 The staff has reviewed the available information, including the rate of evaporative water loss
31 associated with V.C. Summer operations, maintenance of minimum flow conditions on the
32 Broad River, and information concerning past operations. Based on this evaluation, any
33 impacts from V.C. Summer on the Broad River flow conditions or in stream and riparian
34 communities in Parr Reservoir or the Broad River over the license renewal term would be
35 SMALL and would not warrant mitigation.

(a) Statement provided via telephone conversation with Mr. John Lyon (FERC) 20 February 2003.

4.1.2 Entrainment of Fish and Shellfish in Early Life Stages

For plants with once-through cooling systems, entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal. Entrainment of fish and shellfish in early life stages at V.C. Summer has been investigated as part of the 316(b) demonstration for the SCDHEC NPDES permit (SCDHEC 2002). Entrainment sampling of V.C. Summer intake waters for ichthyoplankton (fish eggs and larvae) took place between October 1983 through September 1984 (Dames and Moore 1985a). No other specific entrainment studies have been conducted at the site. The current NPDES permit for V.C. Summer (No. SC003085) states that the V.C. Summer cooling water intake structure(s) reflect the best technology available for minimizing adverse environmental impact. Therefore, the South Carolina Department of Health and Environmental Control (SCDHEC) has not required further sampling. From 1987 through 1998, South Carolina Department of Natural Resources (SCDNR) conducted other general fisheries studies; these have been summarized in Section 2.2 of the draft supplemental environmental impact statement (SEIS).

Entrainment studies, including ichthyoplankton studies were conducted in 1983-1984 (Dames and Moore 1985a), prior to the introduction of white perch (*Morone americana*) to the reservoir. Gizzard shad (*Dorosoma cepedianum*) larvae were the most abundant organisms collected, representing 87 percent to 93 percent of the ichthyoplankton samples. Other larvae collected included white bass (*Morone chrysops*), yellow perch (*Perca flavescens*), crappie (*Pomoxis nigromaculatus*), and sunfish. Catfish juveniles were not collected. Larval fish densities were greatest at the surface at the sampling location nearest to the intakes to V.C. Summer. Total mean densities for this sampling location were 53.9/100 m³ at the surface. Mean densities at mid-depth were 11.8/100 m³ at this sampling location; and ranged up to 18.34 at the reference station at the upper end of the lake. At the sampling location closest to the intakes to V.C. Summer, white bass represented approximately 5 percent of the sample. Other species collected at this sampling location include minnows, suckers, perch, and sunfish. The composition of these samples reflects the overall composition of the fish stocks in Monticello Reservoir (Table 2-2) at the time of sampling (Dames and Moore 1985a).

Since the 1983-1984 study, the fish composition of the Monticello Reservoir has changed, with recently introduced blue catfish (*Ictalurus furcatus*) becoming the dominant fish, and white bass becoming abundant (Table 2-2). Currently, the fish most vulnerable to entrainment in early life stages, due to a combination of both life history and abundance in the lake, include gizzard shad, white perch, and yellow perch. In addition, very small and weak-swimming fry of benthic nesting fish, such as sunfish and crappie are also vulnerable to entrainment, although less so than the gizzard shad, white perch, and yellow perch. Based on the ratio of abundance in the plankton in 1983-1984 and standing stocks in 1984, ichthyoplankton abundances for 1996 fish

Environmental Impacts of Operation

1 stock levels would have been on the order of 126/100 m³ for gizzard shad, 1.7/100 m³ for yellow
2 perch, 0.7/100 m³ for white bass, and 0.2/100 m³ for bluegill (*Lepomis macrochirus*). If the
3 plankton/stock ratio of its close relative, the white bass were assumed, white perch abundance
4 in the ichthyoplankton would have been on the order of 90/100 m³, second only to gizzard shad.
5 These numbers represent a balance between the introduction of larval fish into the plankton
6 (due in part to fish reproduction in Monticello and introduction of ichthyoplankton from Parr
7 Reservoir by pumped storage) and fish mortality (due in part to entrainment). At a 32 m³/sec
8 (1,143 cfs) cooling water withdrawal rate, V.C. Summer is capable of daily pumping 1.5 percent
9 of Monticello Reservoir's surface waters per day (assuming an epilimnion of 7 m [23 ft]), waters
10 where ichthyoplankton would be expected to be most abundant. Combined with pumped
11 storage operations of 420 m³/sec (160,000 cfs) over a 12-hour discharge cycle, V.C. Summer
12 plus FPSF pump the equivalent of 10 percent of Monticello Reservoir's surface waters per day.
13 Even with the large volumes of surface water pumped by both facilities, and related potential
14 fish entrainment, Monticello Reservoir maintains sustainable populations of a variety of fish, and
15 a sustainable fishery, as described in Section 2.2. Changes in fish communities since 1985
16 have coincided with the introduction of new species, including the white perch and blue catfish,
17 which are effective predators and competitors with other species. While entrainment of fish and
18 shellfish in early life stages from V.C. Summer operations would continue during the renewal
19 period, the potential impacts on fish populations in Monticello Reservoir would be small. Under
20 natural conditions, only a very small percentage of juvenile fish survive predation, competition,
21 and other mortality to become adult, reproducing fish.

22
23 Molluscan species such as freshwater clams, which incubate eggs internally but release larvae
24 that continue their life as fish parasites, may briefly be vulnerable to entrainment in short time
25 periods before they reach their hosts. The Asiatic clam (*Corbicula* sp.) releases free-living
26 (free-floating) larvae which also may be vulnerable to entrainment. While euplanktonic
27 crustaceans, such as copepods and cladocerans, are vulnerable to entrainment, benthic
28 crustaceans such as amphipods and crayfish brood their eggs and young prior to release to
29 independent living. However, individuals of these crustaceans may be entrained if they are
30 swept into the intake canals. No mollusks or crustaceans of economic importance as fisheries
31 resources are present in Monticello Reservoir.

32
33 Monticello Reservoir has maintained a diverse fish community and sustainable fishery
34 throughout the period of operations of V.C. Summer and PFSF (Christie and Stroud 1996,
35 1997, 1998, 1999, Dames and Moore 1985b, Nash, et al. 1990). Information on
36 ichthyoplankton from V.C. Summer's 316(b) demonstration (Dames and Moore 1985a) has
37 been incorporated into the NPDES permit, and SCDHEC has determined that further mitigative
38 efforts are not warranted at this time (SCDHEC 2002). NPDES permits are renewed every
39 five years. The most recent NPDES permit (see Appendix E), which expires on April 30, 2007,
40 does not require that SCE&G conduct entrainment studies of the aquatic organisms in the

station's cooling-water flow (SCDHEC 2002). No Federal- or State-listed threatened or endangered fish, mollusks, or crustaceans are present in the Monticello Reservoir; therefore, there will be no impacts on any listed species due to entrainment at V.C. Summer during the renewal period.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the SCDHEC, the scoping process, and other public sources. Using this information, the staff evaluated the potential impacts due to entrainment of early life stages of fish and shellfish by continued operation and maintenance of V.C. Summer. The staff considered the cumulative impacts of past, current, and foreseeable future actions at the site regardless of what agency (Federal or non-Federal) or person undertakes such other actions. It is the staff's conclusion that the potential impacts due to entrainment of fish and shellfish in early life stages during the renewal term are SMALL.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of V.C. Summer. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at V.C. Summer (e.g., placement of the intake structure) provide mitigation for all impacts related to entrainment, and no new mitigation measures are warranted.

4.1.3 Impingement of Fish and Shellfish

For plants with once-through cooling systems, impingement of fish and shellfish on debris screens of cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring site-specific assessment before license renewal. Impingement was monitored and impingement impacts were evaluated at V.C. Summer from October 1983 through September 1984 as part of V.C. Summer's 316(b) demonstration (Dames and Moore 1985a). No other specific impingement studies have been conducted. The current NPDES permit for V.C. Summer (No. SC003085) states that the V.C. Summer cooling water intake structure(s) reflect the best technology available for minimizing adverse environmental impact. Therefore, the SCDHEC has not required further sampling. There have been other general fisheries studies conducted in the mid 1990s; these are summarized in Section 2.2.

Fish present in Monticello Reservoir that are potentially most vulnerable to impingement are those that inhabit the water column: threadfin shad, gizzard shad, white perch, and white bass. Benthic species may also be swept into the intake structures and become impinged on the screens. As part of the 316b demonstration, fish were collected from the traveling screens twice monthly. A total of 5140 fish were collected, and yearly impingement was estimated to be 85,000 fish weighing 515 kg. This represented about one half of one percent of the estimated

Environmental Impacts of Operation

standing stock at the time the studies were conducted. The highest number of fish were impinged during January, and cold shock was implicated in the high numbers, as shad are particularly affected by cold temperatures. The fish collected from the screens represented 17 species belonging to 6 families (Table 4-3). The most impinged fish were gizzard shad (83 percent) and members of the perch family (7.6 percent). Members of the sunfish family represented 4.8 percent of the fish sampled (Dames and Moore 1985a).

The study confirmed that any impact of operational water withdrawal by V.C. Summer will be primarily on gizzard shad (83 percent of impinged fish). During the one-year study, V.C. Summer was estimated to impinge about 16 kg of an estimated total standing crop of 37,700 kg in the reservoir (Dames and Moore 1985a). Gizzard shad was an abundant species in the reservoir and the species has high reproductive and growth rates. Thus, SCE&G (2002a) concluded in the ER that V.C. Summer operations will have a negligible impact on the identified species.

During the period from 1985 through 1999, fish populations in Monticello Reservoir have changed as the result of the introduction of the white perch and blue catfish, two species that are effective predators and competitors with other species already inhabiting the reservoir.

Table 4-3 Species Comprising More than One Percent of Impingement Samples: Results of 316(b) Impingement Studies, V.C. Summer (Dames and Moore 1985a)

Species	% Total Catch by Occurrence	% Total Catch by Weight
gizzard shad	82.6	54.8
yellow perch	7.6	8.1
white catfish	2.4	17.6
bluegill	1.5	2.1
channel catfish	1.3	4.7
black crappie	1.3	2.5
pumpkinseed	1.1	1.1
threadfin shad	0.8	0.6
warmouth	0.6	2.8
white bass	0.3	5.2
white crappie	0.3	3.3

Blue catfish and white perch have become dominant members of the fish community. These changes are expected to be reflected in the impingement mortality during the renewal period. During the period 1986 to 1999, fish standing stocks do not appear to have declined as a result of V.C. Summer operations, and introductions of blue catfish and white perch are coincident with higher standing stocks of these species (Christie and Stroud 1996, 1997, 1998, 1999, Nash, et al. 1990) (See Section 2.2). These data support a conclusion that Monticello Reservoir maintains a diverse fish community and a sustainable recreational fishery despite any losses of fish due to impingement mortality from V.C. Summer operations, including cumulative effects from the FPSF, and that standing stocks will continue to be influenced by introduction of new species and stabilization of fish populations subsequent to those introductions.

All species of mollusks and macro crustaceans in Monticello Reservoir are benthic as adults and are not normally vulnerable to impingement. However, individuals living in the areas of the intake, upon death or accident, may be swept into the intake screens.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the SCDHEC, the scoping process, and other public sources. Using this information, the staff evaluated the potential impacts due to impingement of fish and shellfish by continued operation and maintenance of V.C. Summer. The staff considered the cumulative impacts of past, current, and foreseeable future actions at the site. It is the staff's conclusion that the potential impacts due to impingement of fish and shellfish during the renewal term are SMALL.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of V.C. Summer. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at V.C. Summer (e.g., the operational design of the intake screens) provide mitigation for all impacts related to impingement, and no new mitigation measures are warranted.

4.1.4 Heat Shock

For plants with cooling ponds or reservoirs, including V.C. Summer, heat shock is considered a Category 2 issue, requiring a site-specific assessment before license renewal. The staff independently reviewed the V.C. Summer ER (SCE&G 2002a), visited the site, and reviewed the applicant's NPDES permit (SC0030856, effective February 1, 2003, to April 30, 2007). The staff also independently reviewed monitoring reports for the circulating cooling water discharge, the cooling water bay, and the cooling water canal.

Environmental Impacts of Operation

1 Heat shock to fish from thermal discharges has been investigated by SCE&G. In the
2 Monticello Reservoir, the major factor of plant operations affecting heat-related deaths of fish is
3 the temperature of water in the cooling water bay and the cooling water canal (SCE&G 2002a).
4 The current NPDES permit limits the daily maximum discharge temperature to 45 °C (113 °F)
5 and monthly average plume temperature to 32 °C (90 °F). As discussed in Section 2.2.5, in the
6 late 1980s, periodic fish kills were observed in the discharge bay during the summer. Thermal
7 effects from combined operations of V.C. Summer and drawdown of the reservoir for pumped
8 storage operations were the suspected cause of mortality of fish congregating in this area.
9 These thermal effects were mitigated by dredging in the discharge canal in 1993. Subsequent
10 monitoring demonstrated that the modifications were successful in reducing the temperature
11 regimes and eliminating the conditions believed responsible for the fish kills. No further fish
12 kills have been observed (SCE&G 1994, 1996).

13
14 The staff has reviewed the available information and, based on the conditions of the NPDES
15 permit, the operating history of V.C. Summer, the staff's site visit, the scoping process, and
16 other public sources, the staff concludes that the potential impacts of discharging heated water
17 from V.C. Summer to Monticello Reservoir are SMALL. When preparing this SEIS, the staff
18 considered the potential impacts to aquatic resources due to heat shock for an additional 20
19 years of operation and maintenance of V.C. Summer, mitigation measures, and the cumulative
20 impacts of operations of the FPSF. Based on assessments to date, the staff expects that the
21 measures in place at V.C. Summer will provide mitigation for all impacts related to heat shock,
22 and no new mitigation measures are warranted.

23 24 4.1.5 Microbial Organisms (Public Health)

25
26 For plants discharging cooling water to cooling ponds, lakes, canals, or small rivers with annual
27 average flow rates less than $9 \times 10^{10} \text{ m}^3/\text{yr}$ ($3.15 \times 10^{12} \text{ ft}^3/\text{yr}$), the effects of microbial organisms
28 on human health are listed as a Category 2 issue and require plant-specific evaluation before
29 license renewal. This issue is applicable to V.C. Summer because the station uses a cooling
30 pond (Monticello Reservoir) that discharges to Parr Reservoir, which is part of the Broad River.
31 The Broad River has an average annual flow of $6 \times 10^9 \text{ m}^3/\text{yr}$ ($2.1 \times 10^{11} \text{ ft}^3/\text{yr}$) and is
32 categorized as a small river in the GEIS (NRC 1996).

33
34 The Category 2 designation is based on the potential for public health impacts associated with
35 the enhancement of thermophilic organisms such as *Naegleria fowleri*, a pathogenic amoeba,
36 that could not be determined generically. The Nuclear Regulatory Commission (NRC) noted
37 that impacts of nuclear plant cooling towers and thermal discharges are considered to be of
38 small significance if they do not enhance the presence of microorganisms that are detrimental
39 to water quality and public health (NRC 1996). The assessment criteria relate to thermal
40 discharge temperature, thermal characteristics, thermal conditions for the enhancement of

1 these microorganisms, and impact to public health. Thermophilic bacteria generally occur at
2 temperatures of 25 °C to 80 °C (77 °F to 176 °F), with maximum growth at 50 °C to 60 °C (122
3 °F to 140 °F) (SCE&G 2002a).

4
5 SCE&G monitors water temperature at an "uplake" location, near the water intake, and at a
6 location near the discharge canal. The maximum temperature observed by SCE&G during the
7 years 1995 to 2000 was 39.8 °C (103.7 °F), which occurred in July 1999 (SCE&G 2000).
8 Maximum temperatures for the other years ranged from 35.1 °C to 38.4 °C (95.2 °F to
9 101.2 °F). All of these maximum temperatures were observed in July and August at the
10 surface. Temperatures at 1 m (3 ft) or deeper in the vicinity of the discharge canal were
11 generally 2 °C to 5 °C (3.0 °F to 9.0 °F) lower during the summer months. Maximum
12 temperatures in Monticello Reservoir outside of the discharge canal are below the optimal
13 temperature range for growth and reproduction of thermophilic organisms.

14
15 In addition to reactor cooling water discharges, V.C. Summer releases turbine building closed-
16 cycle cooling water system discharges to Monticello Reservoir. V.C. Summer adds a bromine
17 compound to the open side of this cooling system during normal operations. The bromine
18 compound is used to eliminate microorganisms that would be a potential human health
19 problem. Another factor that affects the survival and growth of thermophilic organisms in
20 Monticello Reservoir is the disinfection of V.C. Summer sewage treatment plant effluents. This
21 treatment reduces the potential for introducing or enhancing existing populations of these
22 organisms in the discharge canal or the reservoir.

23
24 There is public access to Monticello Reservoir, including recreational fishing, boating, and
25 waterfowl hunting. Some subsistence fishing may also occur along the eastern shore, where all
26 the lakeshore residences are located. Public use of the reservoir creates the potential for
27 human exposure to thermophilic organisms. However, given the thermal characteristics of
28 Monticello Reservoir in the vicinity of the discharge outfall and the disinfection of nonreactor
29 cooling tower water and sewage effluents, these organisms would not be expected to pose a
30 threat to recreational or subsistence users of the reservoir or downstream users.

31
32 SCE&G wrote the SCDHEC requesting information on any studies the agency might have
33 conducted concerning thermophilic microorganisms in Monticello Reservoir and any concerns
34 the agency might have relative to these organisms (SCE&G 2002a). SCDHEC's response
35 indicated that public health hazards from thermophilic organisms are largely theoretical and do
36 not represent a significant health threat to offsite users of Monticello Reservoir's waters.

37
38 Based on its review of the above information, the staff concludes that the potential impacts to
39 public health from microbial organisms resulting from operation of V.C. Summer's cooling water

Environmental Impacts of Operation

1 discharge system to the aquatic environment on or in the vicinity of the site area are SMALL,
2 and additional mitigation is not warranted.

3 4 4.2 Transmission Lines

5
6 SCE&G built eight transmission lines for the specific purpose of connecting V.C. Summer to the
7 transmission system. Two additional transmission lines were built by Santee Cooper, co-owner
8 of V.C. Summer, to connect the station to the regional grid.

9
10 In total, for the specific purpose of connecting V.C. Summer to the transmission system,
11 SCE&G and Santee Cooper have constructed approximately 250 km (160 mi) of transmission
12 lines (over 190 km [120 mi] of corridor) that occupy approximately 800 ha (2000 ac) of corridor.
13 The corridors pass through land that is primarily rolling hills covered in forests or farmland. The
14 areas are mostly remote, with low population densities. The longer lines cross numerous State
15 and U.S. highways, including Interstate 26 and Interstate 20.

16
17 The transmission corridors are maintained by mowing, trimming of undesirable vegetation from
18 the sides of the corridors, and by use of nonrestricted-use herbicides. Under normal
19 circumstances, the mowing and herbicide schedule follows a three-year cycle. Trees are side-
20 trimmed every 10 years by helicopters carrying hydraulically operated saws. Aerial patrols of
21 transmission corridors are conducted four times a year by SCE&G and twice a year by Santee
22 Cooper. Dead and diseased trees at the edges of corridors are removed if they could fall and
23 strike the transmission lines or support structures.

24
25 Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to
26 transmission lines from V.C. Summer are listed in Table 4-4. SCE&G stated in its ER that it is
27 not aware of any new and significant information associated with the renewal of the
28 V.C. Summer OL. The staff has not identified any significant new information during its
29 independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping
30 process, or staff evaluation of other available information. Therefore, the staff concludes that
31 there are no impacts related to these issues beyond those discussed in the GEIS. For all of
32 those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-
33 specific mitigation is not likely to be sufficiently beneficial to be warranted.

34
35 A brief description of the staff's review and GEIS conclusions, as codified in Table B-1, for each
36 of these issues follows.

Table 4-4. Category 1 Issues Applicable to the V.C. Summer Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Flood plains and wetlands on power line right-of-way	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line right-of-way	4.5.3

- Power line right-of-way management (cutting and herbicide application). Based on information in the GEIS, the Commission found that

The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, consultation with the U.S. Fish and Wildlife Service and the SCDNR, or staff evaluation of other information. Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that

Impacts are expected to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, consultation with the U.S. Fish and Wildlife Service and SCDNR, or staff evaluation of other information. Therefore, the

Environmental Impacts of Operation

1 staff concludes that there are no impacts of bird collisions with power lines during the
2 renewal term beyond those discussed in the GEIS.

- 3
4 • Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops,
5 honeybees, wildlife, livestock). Based on information in the GEIS, the Commission
6 found that

7
8 No significant impacts of electromagnetic fields on terrestrial flora and fauna
9 have been identified. Such effects are not expected to be a problem during the
10 license renewal term.

11
12 The staff has not identified any significant new information during its independent review of
13 the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
14 information. Therefore, the staff concludes that there are no impacts of electromagnetic
15 fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- 16
17 • Flood plains and wetlands on power line right-of-way. Based on information in the
18 GEIS, the Commission found that

19
20 Periodic vegetation control is necessary in forested wetlands underneath power
21 lines and can be achieved with minimal damage to the wetland. No significant
22 impact is expected at any nuclear power plant during the license renewal term.

23
24 The staff has not identified any significant new information during its independent review of
25 the SCE&G ER, the staff's site visit, the scoping process, consultation with the U.S. Fish
26 and Wildlife Service and SCDNR, or staff evaluation of other information. Therefore, the
27 staff concludes that there are no impacts of power line rights-of-way on flood plains and
28 wetlands during the renewal term beyond those discussed in the GEIS.

- 29
30 • Air quality effects of transmission lines. Based on information in the GEIS, the
31 Commission found that

32
33 Production of ozone and oxides of nitrogen is insignificant and does not
34 contribute measurably to ambient levels of these gases.

35
36 The staff has not identified any significant new information during its independent review
37 of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other
38 information. Therefore, the staff concludes that there are no air quality impacts of
39 transmission lines during the renewal term beyond those discussed in the GEIS.

40

- Onsite land use. Based on the information in the GEIS, the Commission found that

Onsite land use changes required during ... the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.

The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other information. Therefore, the staff concludes that there are no onsite land-use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right-of-way (land use). Based on information in the GEIS, the Commission found that

Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other information. Therefore, the staff concludes that there are no impacts of power line rights-of-way on land use during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue related to transmission lines, and another issue related to transmission lines is being treated as a Category 2 issue. These issues are listed in Table 4-5 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-5. Category 2 and Uncategorized Issues Applicable to the V.C. Summer Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
HUMAN HEALTH			
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	NA	4.2.2

Environmental Impacts of Operation

4.2.1 Electromagnetic Fields—Acute Effects

In the GEIS (NRC 1996), the staff found that, without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) criteria (IEEE 1997), it was not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents.

SCE&G built eight transmission lines for the specific purpose of connecting V.C. Summer to the transmission system (NRC 1981, Section 3.2.7). Two additional transmission lines were built by Santee Cooper, co-owner of V.C. Summer, to connect the station to the regional grid. A total of 10 transmission lines connect V.C. Summer to the transmission system. SCE&G and Santee Cooper have constructed approximately 257 km (160 mi) of transmission lines (193 km [120 mi] of corridor) that occupy approximately 800 ha (2000 ac) of corridor. SCE&G and Santee Cooper designed and constructed all V.C. Summer transmission lines in accordance with the NESC and industry guidance that was in effect when the lines were built (SCE&G 2002a).

To support its conclusion that the transmission lines at V.C. Summer are in compliance with the NESC 5-mA, electric-field-induced current limit, SCE&G conducted a computer-model-based analysis evaluating the conformance of the transmission lines at V.C. Summer with the NESC requirement that transmission lines be designed to limit the steady-state current due to electrostatic effects to 5 mA in a tractor-trailer parked under the lines (SCE&G 2002a). SCE&G calculated electric field strength and induced current for both Santee Cooper- and SCE&G-owned lines using a computer code called AC/DCLINE, produced by the Electric Power Research Institute (EPRI 1991). The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included the limiting case configuration for each line, that line sag be determined at 48.9 °C (120 °F) conductor temperature, and the maximum vehicle size under the lines is a tractor-trailer.

The analysis determined that none of the transmission lines has the capacity to induce as much as 5 mA in a tractor-trailer parked beneath the lines. Therefore, V.C. Summer transmission line designs conform to the NESC provisions for preventing electric shock from induced or steady-state current.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, and other public sources. Using this information, the staff evaluated the potential impacts for electric shock resulting from operation of V.C. Summer and associated transmission lines. The staff considered the cumulative impacts of past, current, and foreseeable future actions at the site regardless of what agency (Federal or non-Federal) or person undertakes such other actions. It is the staff's preliminary conclusion that the potential impacts for electric shock during the renewal term are SMALL.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of V.C. Summer. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at V.C. Summer (e.g., transmission lines are in compliance with the NESC) provide mitigation for all impacts related to acute effects of electromagnetic fields, and no new mitigation measures are warranted.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of 60-Hz electromagnetic fields from power lines were not designated as either Category 1 or Category 2, and will not be until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy. A recent report (NIEHS 1999) contains the following conclusion:

The NIEHS concludes that ELF-EMF [extremely low frequency-electromagnetic field] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

Environmental Impacts of Operation

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The staff considers the GEIS finding of "not applicable" still appropriate and will continue to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to V.C. Summer in regard to radiological impacts are listed in Table 4-6. SCE&G stated in its ER (SCE&G 2002a) that it is not aware of any new and significant information associated with the renewal of the V.C. Summer OL. No new and significant information on these issues has been identified by the staff during its independent review of the V.C. Summer ER, the staff's site visit, the scoping process, discussions with other agencies, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

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

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that

Radiation doses to the public will continue at current levels associated with normal operations.

The staff has not identified any new and significant information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

Table 4-6. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that

Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.

The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to radiological impacts of routine operations.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Term

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-7. SCE&G stated in its ER (SCE&G 2002a) that it was not aware of any new and significant information associated with the renewal of the V.C. Summer OL. The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other information. Therefore, the staff

Table 4-7. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

Environmental Impacts of Operation

concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

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

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that

Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that

Only impacts of small significance are expected.

The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that

No significant impacts are expected during the license renewal term.

The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that

No significant impacts are expected during the license renewal term.

The staff has not identified any significant new information during its independent review of the SCE&G ER (SCE&G 2002a), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-8 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and environmental justice, which was not addressed in the GEIS. These issues are discussed in Sections 4.4.1 through 4.4.6.

Table 4-8. Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SOCIOECONOMICS			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services, transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental justice	Not addressed ^(a)	Not addressed ^(a)	4.4.6
(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice is to be addressed in the licensee's ER and the staff's environmental impact statement.			

Environmental Impacts of Operation

4.4.1 Housing Impacts During Operations

Housing impacts is a Category 2 issue (10 CFR 51, Subpart A, Appendix B, Table B-1). In determining housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS Section C.1.4 [NRC 1996]). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS Table C.1), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

SCE&G used 2000 census data from the U.S. Census Bureau website (USCB 2000) and geographic information system software (ArcView®) to determine demographic characteristics in the V.C. Summer vicinity. As derived from Census Bureau information, an estimated 136,842 people live within 32 km (20 mi) of V.C. Summer. Applying the GEIS sparseness measures, V.C. Summer has a population density of 109 persons per square mile within 32 km (20 mi) and falls into a less sparse category, Category 3 (having 60 to 120 persons per square mile).

As derived from Census Bureau information, an estimated 1.02 million people live within 80 km (50 mi) of V.C. Summer. This equates to a population density of 131 persons per square mile within 50 miles. Applying the GEIS proximity measures, V.C. Summer is classified as Category 3 (having one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 mi). According to the GEIS sparseness and proximity matrix, the V.C. Summer ranks of sparseness Category 3 and proximity Category 3 result in the conclusion that V.C. Summer is located in a medium-population area.

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. However, SCE&G does not plan to perform refurbishment and concluded that there would be no refurbishment-related impacts to area housing. Accordingly, the following discussion focuses on impacts of continued operations on local housing availability. The maximum impact to area housing is calculated using the following assumptions: (1) all direct and indirect jobs would be filled by in-migrating residents; (2) the residential distribution of new residents would be similar to current worker distribution; and (3) each new job created (direct and indirect) represents one housing unit. As described in Section 3.4 of the SCE&G ER (SCE&G 2002a), approximately 90 percent of V.C. Summer employees reside in Fairfield, Lexington, Newberry, and Richland Counties. Therefore, the focus of the housing impact analysis is on these areas.

10 CFR Part 51, Subpart A, Appendix B, Table B-1 states that impacts on housing availability are expected to be of small significance at plants located in a medium-population area where growth-control measures are not in effect. This conclusion is supported by the following site-specific housing analysis. The GEIS assumes that an additional staff of 60 permanent workers per unit might be needed during the license renewal period to perform routine maintenance and other activities, and Section 3.4 of the SCE&G ER (SCE&G 2002a) conservatively estimates that 60 additional employees during the license renewal period could generate demand for 237 housing units (60 direct and 177 indirect jobs). If it is assumed that 90 percent of the 237 new workers would locate in these four counties, consistent with current employee trends, then approximately 213 housing units would be required in Fairfield, Lexington, Newberry, and Richland Counties. The V.C. Summer site is located in a medium-population area and neither Fairfield nor the adjacent Central Midlands Counties are subject to growth-control measures that would limit housing development. There are ample housing options to absorb this increase in all four counties as detailed in Table 2-5 with nearly 248,000 units and almost 22,000 vacant units in 2000.

Based on the NRC criteria, the SCE&G ER (SCE&G 2002a) expects housing impacts to be SMALL during continued operations at V.C. Summer. SMALL impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion is required to meet new demand (NRC 1996).

The staff reviewed the available information relative to housing impacts and SCE&G's conclusions. Based on this review and because the bounding number of new housing units needed is a very small percentage of the available units, the staff concludes that the impact on housing during the license renewal period would be SMALL, and additional mitigation is not warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to the level of demand, and thus there is no need to add capital facilities. Impacts are considered MODERATE if overtaxing service capabilities occurs during periods of peak demand. Impacts are considered LARGE if existing levels of service (e.g., water or sewer services) are substantially degraded and additional capacity is needed to meet ongoing demands for services. The GEIS indicates that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies (NRC 1996).

Environmental Impacts of Operation

1 Analysis of impacts on the public water supply system considered plant demand and plant-
2 related population growth. Section 2.2.2 describes the V.C. Summer permitted withdrawal rate
3 and actual use of water. V.C. Summer does not use water from a municipal system and is
4 planning no major refurbishment, so plant demand would not change beyond current demands
5 (SCE&G 2002a).

6
7 The NRC considers both plant demand and plant-related population growth demands on local
8 water resources. The impact to the local water supply systems from plant-related population
9 growth can be determined by calculating the amount of water that would be required by these
10 individuals. The average American uses between 190 and 300 L (50 and 80 gal) per day for
11 personal use (Fetter 1980).

12
13 In Section 3.4 of the SCE&G ER (SCE&G 2002a), the applicant uses a conservative estimate of
14 60 additional employees during the license renewal period who could generate a total of
15 237 new jobs, which could result in a population increase of 640 in the area [237 jobs multiplied
16 by 2.7, which is the average number of persons per household in the area (CMCOG 1999)].
17 Using this consumption rate, the plant-related population increase could require an additional
18 192,000 L/d (51,200 gal/d) (640 people multiplied by 300 L/d [80 gal/d]) in an area where the
19 public water supply capacity is more than 570 million L/d (150 million gal/d). If it is assumed
20 that this increase is distributed across the four potentially affected counties, consistent with
21 current employee trends, the increase in water demand would not create shortages in capacity
22 of the water supply systems in these communities.

23
24 The staff has reviewed the available information and the SCE&G analysis discussed above.
25 Because the increase in water use is such a small percentage of the available capacity in the
26 region, the staff concludes that the impact of the increase in water use is SMALL, requiring no
27 additional mitigation.

28 29 4.4.3 Offsite Land Use During Operations

30
31 Offsite land use during the license renewal term is a Category 2 issue (10 CFR 51, Subpart A,
32 Appendix B, Table B-1). Table B-1 of 10 CFR 51 Subpart A, Appendix B notes that "significant
33 changes in land use may be associated with population and tax revenue changes resulting from
34 license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

SMALL - Little new development and minimal changes to an area's land-use pattern.

MODERATE - Considerable new development and some changes to the land-use pattern.

LARGE - Large-scale new development and major changes in the land-use pattern.

SCE&G has identified a maximum of 60 additional employees during the license renewal term plus an additional 177 indirect jobs (total 237) in the region (SCE&G 2002a). In Section 3.7.5 of the GEIS (NRC 1996), the staff found that if plant-related population growth is less than 5 percent of the study area's total population, then offsite land use changes would be small. This is especially pertinent if the study area has established patterns of residential and commercial development, a population density of at least 23 persons/km² (60 persons/mi²), and at least one urban area with a population of 100,000 or more within 80 km (50 mi). In the case of V.C. Summer, population growth will be less than 5 percent of the four-county area's total population, each county in the area has established patterns of residential and commercial development guided by comprehensive plans, there is a population density of 131 persons per square mile within a 50-mi radius, and there is one urban area (Columbia) with a population of 116,278 in the city and a metropolitan area population of 536,691 (USCB 2000). Consequently, the staff concludes that population changes resulting from license renewal are likely to result in SMALL offsite land use impacts.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. In Section 4.7.4.1 of the GEIS, the staff states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. In Section 4.7.2.1 of the GEIS, the staff states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be MODERATE. If the tax payments are projected to be a dominant

Environmental Impacts of Operation

1 source of the community's total revenue, new tax-driven land uses would be LARGE
2 (NRC 1996a).

3
4 Fairfield County is the only local jurisdiction that taxes V.C. Summer directly. V.C. Summer tax
5 payments to Fairfield County represented approximately 47 percent of total annual property tax
6 revenues and 47 percent of the County's annual operating budget between 1995 and 2000.
7 Continued operation of V.C. Summer over the license renewal term would be important to
8 maintaining the current level of development and public services, but would not result in
9 changes to local land-use and development patterns or result in additional costs for public
10 services. V.C. Summer has been, and would probably continue to be, the dominant source of
11 tax revenue for Fairfield County. However, despite having this income source since the early
12 1980s, Fairfield County has not experienced large land-use changes, especially on the west
13 side near V.C. Summer. The V.C. Summer environs have remained largely rural, county
14 population growth rates after V.C. Summer construction have been minimal, and county
15 planners are not projecting large changes (Stowers 2000).

16
17 SCE&G does not anticipate major refurbishment or construction during the license renewal
18 period and therefore does not anticipate any increase in the assessed value of V.C. Summer
19 due to refurbishment-related improvements nor any related tax-increase-driven changes to
20 offsite land-use and development patterns. If the OL for V.C. Summer was not renewed and
21 the station was decommissioned, then impacts to the tax base of the surrounding communities
22 and their economic structures could be significant, as discussed in Section 8.4.7 of the GEIS
23 (NRC 1996). However, based on the information presented above, the staff concludes that tax-
24 related land-use impacts related to renewing the OL for V.C. Summer are likely to be SMALL.

25 26 4.4.4 Public Services: Transportation Impacts During Operations

27
28 On October 4, 1999, 10 CFR 51.53(c)(3)(ii)(J) and 10 CFR Part 51, Subpart A, Appendix B,
29 Table B-1 were revised to clearly state that "Public Services: Transportation Impacts During
30 Operations" is a Category 2 issue (see NRC 1999 for more discussion of this clarification). The
31 issue is treated as such in this SEIS for V.C. Summer.

32
33 As described previously, no major refurbishment is planned and no refurbishment impacts to
34 local transportation are therefore anticipated. The V.C. Summer workforce includes
35 approximately 600 SCE&G and between 130 and 140 contract employees. On an 18-month
36 cycle, 600 to 800 additional workers join the permanent workforce during refueling outages.
37 The SCE&G projection of 60 additional employees associated with license renewal for
38 V.C. Summer represents a conservative estimate that would result in no more than a
39 10 percent increase in the current number of permanent employees and an even smaller

percentage of employees present onsite during a typical refueling outage. This increase in employees and consequent trips generated by renewing the OL would not impact the roadway system that serves V.C. Summer. The area surrounding the station is essentially rural, low-density residential and there is adequate roadway network capacity even though these are rural roads. Roadway improvements are proposed in the vicinity of V.C. Summer to SC 213 and the Peak Bypass and are shown on the Long-Range Rural System Upgrades Map maintained by the Central Midlands Council of Governments.

The staff has reviewed the SCE&G ER (SCE&G 2002a) and other information made available during interviews with local officials and observation of the transportation conditions around V.C. Summer and concludes that impacts of V.C. Summer license renewal on transportation would be SMALL and mitigation would not be warranted.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act of 1966 (NHPA), as amended, requires Federal agencies to take into account the effects of their undertakings on historic properties. The historic preservation review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation at 36 CFR Part 800. Renewal of an OL could potentially affect historic properties that may be located at the site. Therefore, in accordance with the NHPA, the NRC must make a reasonable effort to identify historic properties in the areas of potential effects. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Officer (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

In January 2001, SCE&G wrote to the South Carolina SHPO requesting comments on the V.C. Summer license renewal process. In this letter, SCE&G determined that the continued operation of V.C. Summer will have no impact on historic properties (SCE&G 2001). In a response dated January 29, 2001, the South Carolina SHPO stated that license renewal for the continuing operation of plants such as this one typically has no effect on historic properties (SHPO 2001). NRC has initiated consultation with the South Carolina SHPO pursuant to Section 10 of the NHPA.

Major refurbishment of V.C. Summer is not required during the license renewal period, so there will be no need to use currently undeveloped portions of the site for operations during the renewal period. Operation of V.C. Summer, as planned under the application for license renewal, would protect undiscovered historic or archaeological resources on the site because

Environmental Impacts of Operation

1 the undeveloped natural landscape and vegetation would remain undisturbed, and access to
2 the site would remain restricted.

3
4 SCE&G established a land use and shoreline management plan. The purpose of this plan is to
5 help maintain and conserve the area's natural and human-made resources as well as assist in
6 providing a balance between recreational use and development and environmental preservation
7 and control. This management plan addresses environmental policies including the exclusion
8 zone, public access, public fishing, and boating and hunting, as well as shoreline activities.
9 Erosion control measures are identified as well as restrictions on the removal of under brushing
10 (SCE&G 2002b).

11
12 SCE&G operating procedures take into account the inadvertent discovery of historic and
13 archaeological remains at V.C. Summer. However, care should be taken during normal
14 operational and maintenance conditions to ensure that historic properties are not inadvertently
15 impacted. These activities may include not only operation of V.C. Summer itself, but also land
16 management-related actions such as recreation, wildlife habitat enhancement, or
17 maintaining/upgrading V.C. Summer access roads through the site and on transmission line
18 rights-of-way.

19
20 Based on the staff's cultural resources analysis and consultation, on SCE&G conclusions that
21 major refurbishment activities will not be undertaken related to the license renewal of
22 V.C. Summer, and on the fact that operation will continue within the bounds of station
23 operations as evaluated in the *Final Environmental Statement* (AEC 1973), the staff concludes
24 that the potential impacts on historic and archaeological resources are SMALL, and no
25 additional mitigation is warranted.

26 27 4.4.6 Environmental Justice

28
29 Environmental justice refers to a Federal policy that requires that Federal agencies identify and
30 address, as appropriate, disproportionately high and adverse human health or environmental
31 effects of its actions on minority^(a) or low-income populations. The memorandum accompanying
32 Executive Order 12898 (59 *Federal Register* 7629) directs Federal executive agencies to
33 consider environmental justice under the National Environmental Policy Act of 1969. The
34 Council on Environmental Quality has provided guidance for addressing environmental justice
35 (CEQ 1997). Although the Executive Order is not mandatory for independent agencies, the

(a) The NRC Guidance for performing environmental justice reviews defines "minority" as American Indian or Alaskan Native, Asian or Pacific Islander, Black not of Hispanic Origin, or Hispanic (NRC 2001).

1 NRC has voluntarily committed to undertake environmental justice reviews. Specific guidance
2 is provided in NRC Office of Nuclear Reactor Regulation Office Instruction LIC-203, *Procedural*
3 *Guidance for Preparing Environmental Assessments and Considering Environmental Issues*
4 (NRC 2001).

5
6 The staff examined the geographic distribution of minority and low-income populations within
7 80 km (50 mi) of V.C. Summer, using the 2000 Census (USCB 2000) for low-income and
8 minority populations. The radius within 80 km (50 mi) of V.C. Summer encompassed 21 South
9 Carolina counties and a small portion of one county in North Carolina. The analysis was
10 supplemented with interviews with local governments and social service agencies in Fairfield
11 County and the Central Midlands Region.

12
13 For the purpose of the staff's review, a minority population is defined to exist if the percentage
14 of each minority and aggregated minority category within the census block groups potentially
15 affected by the license renewal of V.C. Summer exceeds the corresponding percentage of
16 minorities in the entire State of South Carolina by 20 percent; or if the corresponding
17 percentage of minorities within the census block group is at least 50 percent. A low-income
18 population is defined to exist if the percentage of low-income population within a census block
19 group^(a) exceeds the corresponding percentage of low-income population in the entire State of
20 South Carolina by 20 percent, or if the corresponding percentage of low-income population
21 within a census block group is at least 50 percent.

22
23 The Census Bureau data characterize South Carolina as 0.3 percent American Indian or
24 Alaskan Native; 0.9 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander;
25 29.5 percent Black races; 1.0 percent all other single minorities; 1.0 percent multi-racial;
26 32.8 percent aggregate of minority races; and 2.4 percent Hispanic ethnicity (USCB 2000).
27 Census Bureau data characterize North Carolina as 1.2 percent American Indian or Alaskan
28 Native; 1.4 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 21.6 percent
29 Black races; 2.3 percent all other single minorities; 1.3 percent multi-racial; 27.9 percent
30 aggregate of minority races; and 4.7 percent Hispanic ethnicity (USCB 2000).

31
(a) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the Census Bureau collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with Census Bureau guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (USCB 2001).

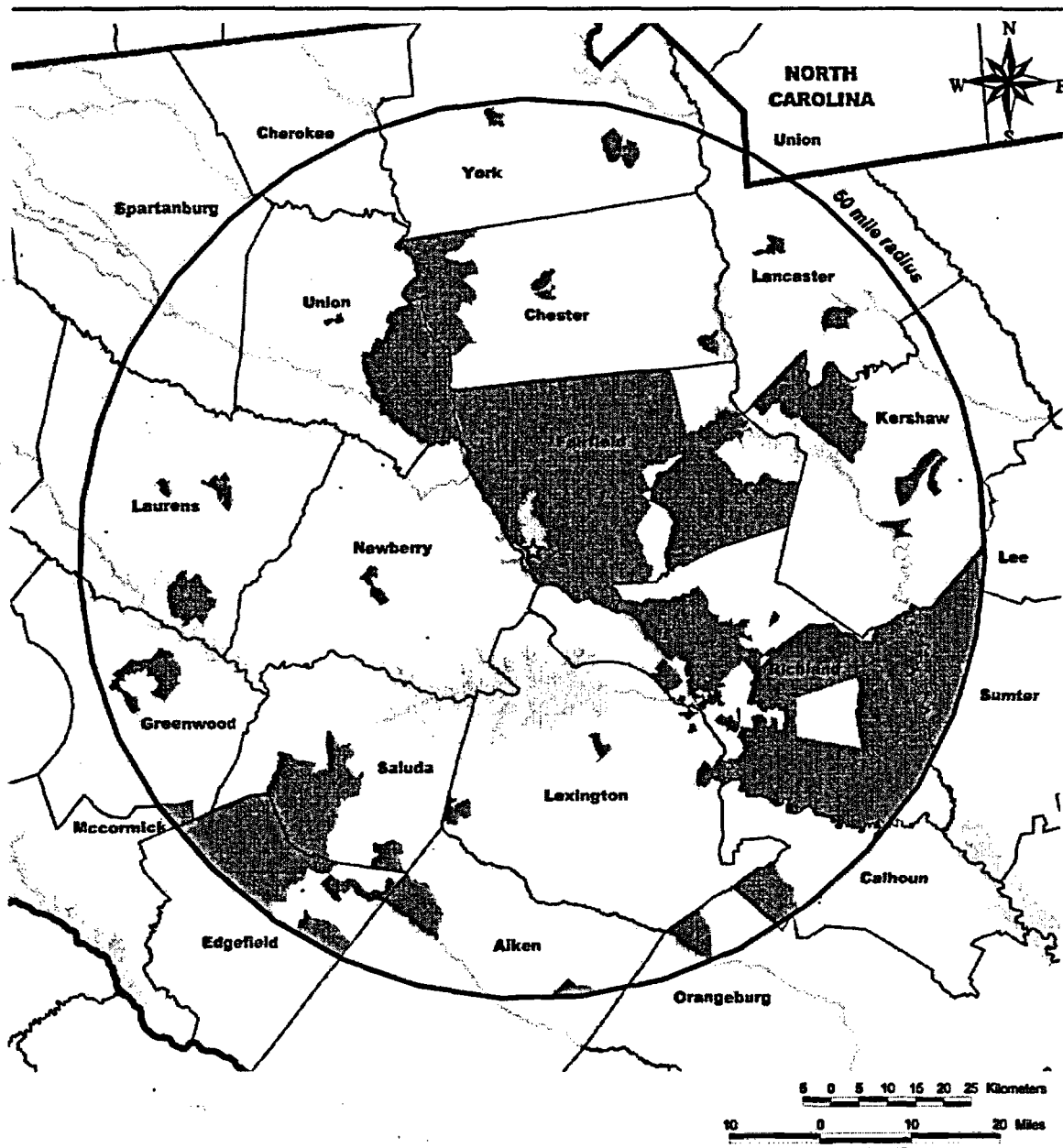
Environmental Impacts of Operation

1 The SCE&G ER (SCE&G 2002a) reported that aggregate minority populations exist in
2 230 block groups based on the more than 20 percent criterion. Figure 4-1 displays the location
3 of these minority block groups distributed among the counties in the geographic area. The
4 African American minority population exists in 209 block groups based on the more than
5 20 percent criterion. Based on the more than 20 percent criterion, American Indian or Alaskan
6 Native minority populations exist in a single block group in York County. The Catawba Indian
7 Nation has tribal lands (approximately 283 ha [700 ac]) in the Rock Hill, South Carolina, area
8 (EDA 2000). Total tribal membership is believed to be around 3000, with approximately half of
9 this number living in York County and Lancaster County (EDA 2000; EPA 2001). Based on the
10 more than 20 percent criterion, Hispanic ethnicity minority populations exist in two block groups
11 that are in Saluda County and Greenwood County. Based on the more than 20 percent
12 criterion, the Asian minority population exists in a single block group in Richland County. No
13 Native Hawaiian or other Pacific Islander, other single minorities, or multi-racial minorities exist
14 in the geographic area based on the more-than-20-percent or the exceeds-50-percent criteria.

15
16 The Census Bureau had not yet released 2000 census data for low-income households when
17 the SCE&G ER (SCE&G 2002a) was prepared. Therefore, SCE&G used 1990 census data
18 from the Census Bureau website (USCB 1991) in reporting the percentage of the total
19 households within the States of North Carolina and South Carolina that are deemed low-income
20 households and in identifying low-income households within 80 km (50 mi) of V.C. Summer.
21 The 2000 census data for low-income households has since been made available by the
22 Census Bureau, and subsequently, the staff assessed this matter using the more recent data.

23
24 NRC guidance defines low-income using Census Bureau statistical poverty thresholds (NRC
25 2001, Appendix D). The low-income household numbers for each census tract were divided by
26 the total households for that census tract to obtain the percentage of low-income households
27 per census tract. Census Bureau data (USCB 1991) characterize 15.8 percent of South
28 Carolina and 14.0 percent of North Carolina households as low income. Based on the more-
29 than-20-percent criterion, 15 1990-census tracts contained a low-income population. Eleven of
30 these tracts were found in Richland County, two in York County, and one each in Lexington and
31 Sumter Counties. Figure 4-2 displays the locations of low-income household tracts among the
32 counties in the geographic area.

33
34 With the locations of minority and low-income populations identified, the staff proceeded to
35 evaluate whether any of the environmental impacts of the proposed action could affect these
36



LEGEND
 ☆ V.C. Summer
 ■ Aggregate of Minority Races Populations

Figure 4-1. Geographic Distribution of Minority Populations within 80 km (50 mi) of V.C. Summer

Environmental Impacts of Operation

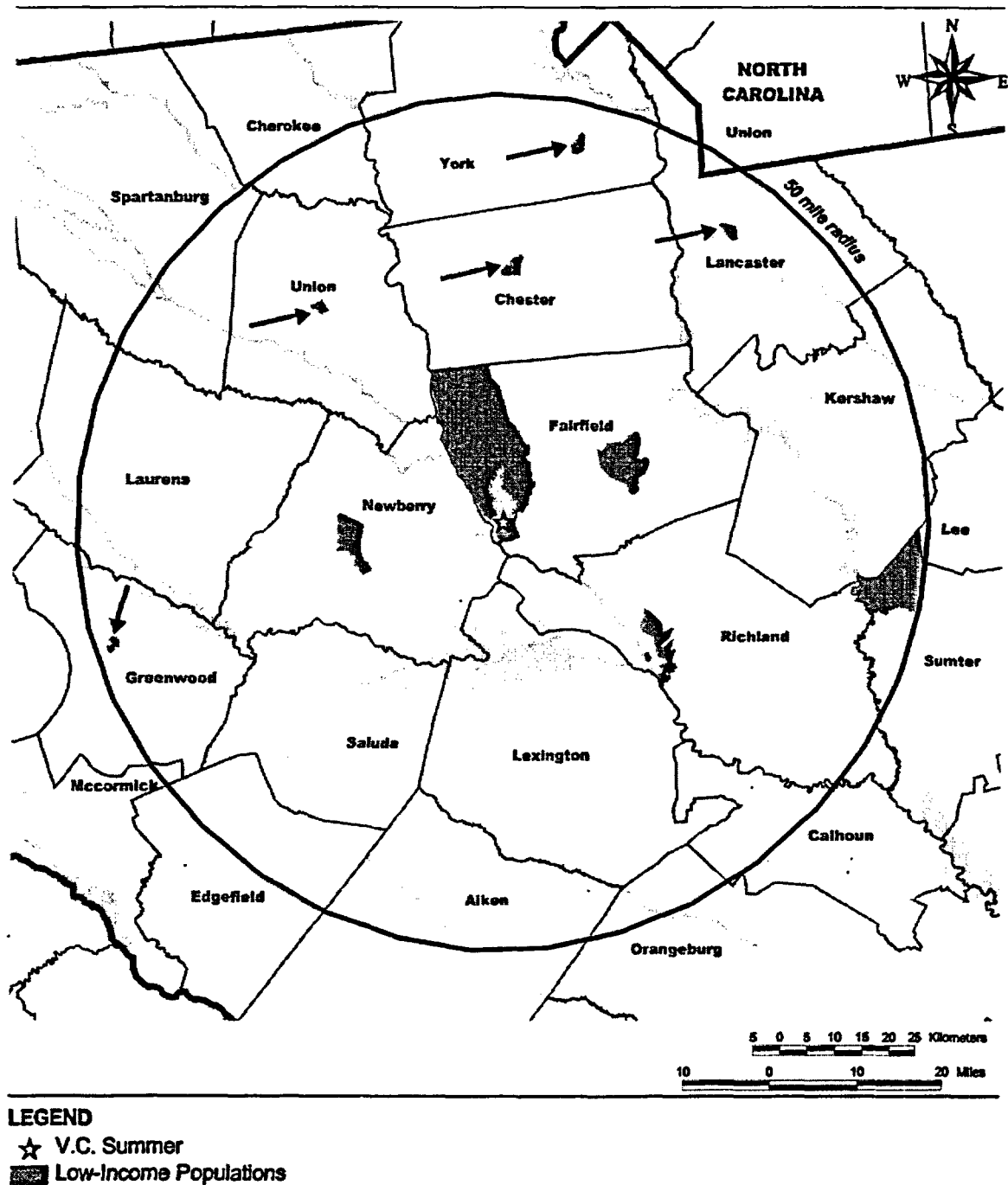


Figure 4-2. Locations of Low-income Populations within 80 km (50 mi) of V.C. Summer

populations in a disproportionately high and adverse manner. Based on staff guidance (NRC 2001), air, land, and water resources within about 80 km (50 mi) of V.C. Summer were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population.

The pathways through which the environmental impacts associated with V.C. Summer license renewal can affect human populations are discussed throughout this SEIS. The staff evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing through which the populations could be disproportionately high and adversely affected. In addition, the staff did not identify any location-dependent disproportionately high and adverse impacts affecting these minority and low-income populations. The staff concludes that offsite impacts from V.C. Summer to minority and low-income populations would be SMALL, and no special mitigation is warranted.

It is evident from staff consultations with local officials and research that Fairfield and Newberry Counties demonstrate many of the hallmarks of communities likely to be impacted by environmental justice issues. There are many indicators that this is a valid observation that can be supported by the reports of local social service agencies (United Way of the Central Midlands 2002). It can also be concluded that the presence of V.C. Summer may counteract and mitigate some of these socioeconomic issues and concerns.

4.5 Groundwater Use and Quality

The single Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that is applicable to V.C. Summer groundwater use and quality is listed in Table 4-9. SCE&G stated in its ER that it is not aware of any new and significant information associated with the renewal of the V.C. Summer OL (SCE&G 2002a). The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS. For this issue, the GEIS concluded that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, 10 CFR 51, follows.

Environmental Impacts of Operation

Table 4-9. Category 1 Issue Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
GROUNDWATER USE AND QUALITY	
Groundwater-use conflicts (potable and service water; plants that use <100 gpm).	4.8.1.1

- Groundwater-use conflicts (potable and service water; plants that use <100 gpm).
Based on information in the GEIS, the Commission found that

Plants using less than 100 gpm are not expected to cause any groundwater-use conflicts.

The V.C. Summer groundwater use is less than 100 gpm. The staff has not identified any significant new information during its independent review of the SCE&G ER, the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no groundwater-use conflicts during the renewal term beyond those discussed in the GEIS.

Category 2 issues related to groundwater use and quality during the renewal term that are applicable to V.C. Summer are discussed in the sections that follow. These issues, which require plant-specific analysis, are listed in Table 4-10.

4.5.1 Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds that Withdraw Make-up Water from a Small River)

The issue of groundwater use conflicts applies to V.C. Summer because it withdraws from and discharges to a cooling pond, Monticello Reservoir, which receives its make-up water from Parr Reservoir on the Broad River. The Broad River is considered a small river, based on an average flow of $5.9 \times 10^9 \text{ m}^3/\text{yr}$ ($2.1 \times 10^{11} \text{ ft}^3/\text{yr}$).

Daily mean flow in the Broad River in the vicinity of V.C. Summer (at Alston, South Carolina, 1.9 km [1.2 mi] downstream of the Parr Shoals dam) ranged from $6.65 \text{ m}^3/\text{s}$ (235 to 130,000 cfs) over the period of record, with an annual average of $185.05 \text{ m}^3/\text{s}$ (6535 cfs). According to

Table 4-10. Category 2 Issues Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
GROUND-WATER USE AND QUALITY			
Groundwater-use conflicts (plants using cooling towers or cooling ponds that withdraw make-up water from a small river)	4.8.1.3 4.4.2.1	A	4.5.1
Groundwater quality degradation (cooling ponds at inland sites)	4.8.3	D	4.5.2

the *Final Environmental Statements* for construction (AEC 1973) and operation (NRC 1981) of Summer Station, the lowest recorded daily mean flow at a gauging station in the vicinity of V.C. Summer was 4.22 m³/s (149 cfs) at Richtex, South Carolina, 11.26 km (7 mi) downstream of the Parr Shoals dam. This U.S. Geological Survey station was taken out of service in 1983. Monticello Reservoir water lost to evaporation is replaced with water from Parr Reservoir as part of the normal operation of the FPSF. Water is cycled between the reservoirs daily. The V.C. Summer water use reports for 1998 and 1999 indicate that evaporative losses as high as 0.62 m³/s (22 cfs) are associated with V.C. Summer operations (SCE&G 1998, 1999). This loss represents approximately 1.7 percent of the cooling water removed from the reservoir (37.04 m³/s [1308 cfs]) and approximately 0.3 percent of the average annual natural stream flow of 185.05 m³/s (6535 cfs). The potential evaporative loss represents 14.8 percent of the lowest recorded daily mean stream flow of 4.22 m³/s (149 cfs) reported in the *Final Environmental Statement* (NRC 1981).

Water used for cooling at the facility is not removed from a stream with natural flow, but from Parr Reservoir, an impounded section of the Broad River. The flow is regulated to maintain a minimum downstream release of 4.25 m³/s (150 cfs) (NRC 1981). The site is located within the Piedmont Physiographic Province of South Carolina. Rivers in the South Carolina Piedmont typically are high-energy, shallow, rocky-bottomed streams that tend not to develop extensive alluvial flood plains. The Broad River is typical of the area. With the construction of Parr Reservoir, the upstream river flood plain was inundated. The surrounding area is characterized by a surficial water table aquifer in saprolitic soils and shallow fractures in rocks (SCE&G 2002a). With the construction of Parr Reservoir, the water in the surficial aquifer adjacent to the reservoir rose. Water flow within saprolitic soil is typically very slow due to the relatively

Environmental Impacts of Operation

impermeable natural soils, and the flow direction follows the surface topography within drainage basins toward discharge points along the stream valleys. These soils release water slowly back to reservoir during extreme low-level periods. The fact that Broad River water is pumped (via FPSF) to Monticello Reservoir for condenser cooling has had no significant impact on the alluvial aquifer in the vicinity of the site during periods of low natural stream flow. The water in Parr Reservoir itself and the surrounding surficial aquifer distributes any loss in reservoir water level in such a way as to be considered insignificant to the alluvial aquifer. Impacts of V.C. Summer operation on the alluvial aquifer over the license renewal term would likewise be SMALL and would not warrant mitigation.

The staff has reviewed the available information including the discharge history of the Broad River, maintenance of minimum flow conditions on the Broad River, the physiographic and hydrogeologic setting, and the demands placed on the Broad River during low-flow conditions to compensate for evaporative losses. Based on this evaluation, any impacts from V.C. Summer on the Broad River flow conditions or associated, sparsely-distributed alluvial groundwater that would affect instream and riparian communities in Parr Reservoir or the Broad River over the license renewal term would be SMALL and would not warrant mitigation.

4.5.2 Groundwater Quality Degradation (Cooling Ponds at Inland Sites)

The issue of groundwater degradation applies to V.C. Summer because the station uses a cooling pond. V.C. Summer employs a once-through cooling system, but withdraws from and discharges to a cooling pond, Monticello Reservoir. Monticello Reservoir provides once-through cooling water to V.C. Summer and acts as the upper reservoir for the FPSF. Parr Reservoir, created by the damming of the Broad River, serves as the lower reservoir for the FPSF. Make-up water for Monticello Reservoir is supplied from Parr Reservoir. As part of FPSF operations, water is released from Monticello Reservoir through FPSF and discharged to Parr Reservoir during the day. Water is then pumped at night from Parr Reservoir to Monticello Reservoir to maintain the level of the upper reservoir. Over time, the water quality of Monticello Reservoir due to the constant cycling and mixing of water is basically that of the Broad River (NRC 1981).

Water quality monitoring data indicate that Monticello Reservoir waters are relatively low in concentrations of common ions, low in hardness, and low in dissolved solids/conductivity (Dames and Moore 1985). Groundwater in the vicinity of the site is highly mineralized, due to prolonged contact with, and solution of, rock minerals, and as a result is generally higher than local surface waters in hardness, dissolved solids, and conductivity (Dames and Moore 1985, Table 2.2.2; SCE&G 2002a). There is no indication that evaporative losses associated with operation of V.C. Summer have increased concentrations of common ions, minerals, or solids

in Monticello Reservoir water, and no indication that groundwater quality in the area has been affected by this cooling pond. Therefore, there appears to have been little or no negative impact on groundwater quality as a result of the operation of V.C. Summer. Impacts of continued operation would be SMALL and would not warrant mitigation.

The staff has reviewed the available information including the physiographic and hydrogeologic setting and the water quality of Monticello Reservoir and the regional groundwater. Based on this evaluation, overall groundwater quality is likely to be improved by the presence of Monticello Reservoir and any negative impacts from V.C. Summer on the groundwater in the vicinity of the Station over the license renewal term would be SMALL and would not warrant mitigation.

4.6 Threatened or Endangered Species

Threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-11.

This issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of the nuclear plant during the license renewal term. The presence of threatened or endangered species in the vicinity of V.C. Summer is discussed in Sections 2.2.5 and 2.2.6.

4.6.1 Aquatic Species

No Federal-listed threatened or endangered aquatic species or their habitats are known to occur at the V.C. Summer site, including Monticello/Parr Reservoir system or in streams that are crossed by a V.C. Summer transmission line corridor (SCE&G 2002a).

Aquatic species that may have historically inhabited the Broad River include the shortnose sturgeon (*Acipenser brevirostrum*), a Federal-listed endangered species of fish, and a mussel, the Carolina heelsplitter (*Lasmigona decorata*). The shortnose sturgeon is currently not known from the Broad River; the nearest documented populations are in Lakes Marion and Moultrie in the Santee Cooper system. The upstream migration of this species is prevented by dams. Although the Carolina heelsplitter is known from several creeks in the western portion of Edgewood County, this mussel is not known from the watersheds of creeks in the north-eastern portion of the county that is crossed by a V.C. Summer transmission line corridor.

Environmental Impacts of Operation

Table 4-11. Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

The staff has prepared an assessment evaluating the potential impacts on aquatic threatened or endangered species resulting from the operation of V.C. Summer for an additional 20 years during the renewal period. The staff concluded that V.C. Summer license renewal will have no effect on the shortnose sturgeon or the Carolina heelsplitter. In a letter dated June 26, 2003, the staff transmitted its biological assessment to the USFWS and requested concurrence on its determination. The letter to USFWS and the staff's biological assessment are included in Appendix E to this SEIS.

The staff has reviewed the V.C. Summer ER (SCE&G 2002a), visited the site, reviewed the current NPDES permit (SC003856, issued 9/29/97) and related operational and biological information, and consulted with the USFWS. The staff concludes that license renewal will not impact Federal-listed aquatic threatened or endangered species or their critical habitat. During the course of its evaluation, the staff considered whether further mitigation for continued operation of V.C. Summer was warranted. Based on this evaluation, the staff determined that mitigation in place at V.C. Summer is appropriate and no additional mitigation is warranted.

4.6.2 Terrestrial Species

There are 10 Federal-listed or candidate terrestrial species that are known to occur in the vicinity of V.C. Summer or in counties crossed by the transmission lines (see Section 2.2.6). However, of these species, the bald eagle (*Haliaeetus leucocephalus*) is the only terrestrial species known to occur at V.C. Summer or along its transmission line corridors. There have been no reports of collisions or electrocutions of bald eagles along the transmission lines. SCE&G and Santee Cooper participate with the U.S. Department of Agriculture-Natural Resources Conservation Service, SCDNR, and other organizations in a wildlife management program for transmission line corridors. The "Power for Wildlife" program is designed to help landowners whose property is crossed by transmission lines convert transmission corridors into productive habitat for wildlife. In addition, SCE&G's procedures require that it follow the

USFWS habitat management guidelines for the bald eagle in the Southeast Region (USFWS 1987) and submit a raptor incident report in the event that an electrocuted eagle is found.

The staff has prepared an assessment evaluating the potential impacts on terrestrial threatened, endangered, or candidate species resulting from the operation of V.C. Summer for an additional 20 years during the renewal period. The staff concluded that V.C. Summer license renewal will have no effect on the wood stork, red-cockaded woodpecker, pool sprite, Georgia aster, smooth coneflower, rough-leaved loosestrife, Canby's dropwort, harperella, or relict trillium. The license renewal may affect, but is not likely to adversely affect, the bald eagle. In a letter dated June 26, 2003, the staff transmitted its biological assessment to the USFWS and requested concurrence on its determination. The letter to USFWS and the staff's biological assessment are included in Appendix E to this SEIS.

The staff has reviewed the information provided by the applicant, met with the SCDNR, and has consulted with the U.S. Fish and Wildlife Service. Based on the site visit, review of the ER, other reports, and consultation with the U.S. Fish and Wildlife Service and the SCDNR, it is the staff's preliminary conclusion that the impacts on terrestrial endangered, threatened, or candidate species of an additional 20 years of operation and maintenance of V.C. Summer and its associated transmission lines would be SMALL, and further mitigation is not warranted.

4.7 Evaluation of Potential New and Significant Information on Impacts of Operations During the Renewal Term

The staff has not identified significant new information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation during the renewal term. The staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and has conducted its own independent review, including public scoping meetings, to identify issues with significant new information. Processes for identification and evaluation of new information are described in Section 1.2.2, License Renewal Evaluation Process.

4.8 Evaluation of Cumulative Impacts of Operations During the Renewal Term

The staff considered potential cumulative impacts during the evaluation of information applicable to each of the potential impacts identified within the GEIS. The impacts of the

Environmental Impacts of Operation

proposed license renewal are combined with other past, present, and reasonably foreseeable actions to determine whether cumulative impacts exist. For the purposes of this analysis, past actions were those related to the resources at the time of the plant licensing and construction. Current actions are the operation of the power plant and future actions are considered to be those that are reasonably foreseeable through the end of plant operation. Therefore, the analysis considers potential impacts through the end of the current license term, as well as the 20-year renewal license term. The geographical area over which past, present, and future actions that could contribute to cumulative impacts depends on the type of action considered, and is described below for each impact area.

4.8.1 Cumulative Impacts Resulting from Operation of the Plant Cooling System

For the purposes of this analysis, the geographic area considered is the Broad River. As described in Section 4.1, the staff found no new and significant information indicating that the conclusions regarding any of the cooling system-related Category 1 issues as related to V.C. Summer are inconsistent with the conclusions in the GEIS. Additionally, the staff has determined that none of the cooling system-related Category 2 issues were likely to have greater than a SMALL impact on local water quality or aquatic resources.

Cumulative impacts to the Broad River involve water use conflicts. As described in Section 2.1.3, V.C. Summer utilizes the Monticello Reservoir as a source of cooling water for its condenser. Monticello Reservoir is connected hydrologically to the Broad River by the Parr Reservoir and the Fairfield Pumping Station. Even through severe drought conditions, operations at V.C. Summer did not exceed any Federal Energy Regulatory Commission-mandated flow restrictions. There are no known or planned activities on the Broad River that could potentially produce additional water conflicts. Therefore, the cumulative impact is SMALL and no mitigation measures are warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

The continued operation of the V.C. Summer electrical transmission facilities was evaluated to determine if there is the potential for interactions with other past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources such as wildlife populations, and the size and distribution of habitat areas; aquatic resources such as wetlands and floodplains; and both the acute and chronic effects of electromagnetic fields. For the purposes of this analysis, the geographic area that encompasses the past, present and

foreseeable future actions that could contribute to adverse cumulative effects is the area within 50 miles of the V.C. Summer site, as depicted in Figure 2-1.

As described in Section 4.2, the staff found no new and significant information indicating that the conclusions regarding any of the transmission line-related Category 1 issues related to V.C. Summer are inconsistent with the conclusions in the GEIS. For the category 2 issue related to electromagnetic fields-acute effects (electric shock), the impact is small and the uncategorized issue of chronic effects is still considered "not applicable." There are no known or planned activities within the 80-km (50-mi) radius area of consideration that could potentially produce additional impacts associated with transmission lines. Therefore, the cumulative impact is SMALL and no mitigation measures are warranted.

4.8.3 Cumulative Radiological Impacts

The radiological exposure limits for protection of the public and for occupational exposures have been developed assuming long-term exposures, and therefore incorporate cumulative impacts. As described in Section 2.2.7, the public and occupational doses resulting from V.C. Summer are well below regulatory limits, and as described in Section 4.3, the impacts of these exposures are SMALL. For the purposes of this analysis, the geographical area is the area included within a 80-km (50-mi) radius of the V.C. Summer site (Figure 2-1). The NRC would regulate any reasonably foreseeable future actions in the vicinity of V.C. Summer that could contribute to cumulative radiological impacts.

Therefore, the staff has determined that the cumulative radiological impacts of continued operation of V.C. Summer will be SMALL, and that additional mitigation is not warranted.

4.8.4 Cumulative Socioeconomic Impacts

Much of the analyses of socioeconomic impacts presented in Section 4.4 of this SEIS already incorporate cumulative impact analysis because the metrics used for quantification only make sense when placed in the total or cumulative context. For instance, the impact of the total number of additional housing units that may be needed can only be evaluated with respect to the total number that will be available in the impacted area. Therefore, the geographical area of the cumulative analysis varies depending on the particular impact considered, and may depend on specific boundaries, such as taxation jurisdictions or may be distance related, as in the case of Environmental Justice.

Environmental Impacts of Operation

1 The continued operation of V.C. Summer is not likely to add to any cumulative socioeconomic
2 impacts beyond those already evaluated in Sections 4.4. In other words, the impacts of issues
3 such as transportation or offsite land-use are likely to be non-detectable beyond the regions
4 previously evaluated and will quickly decrease with increasing distance from the site. The staff
5 has determined that the impacts on housing, public utilities, public services, and environmental
6 justice would all be SMALL. The staff has determined that the impact on off-site land-use is
7 SMALL because, even though V.C. Summer provides greater than 10% of the property tax
8 revenue for the Fairfield County School District, there are no refurbishment actions planned at
9 V.C. Summer. There are no reasonably foreseeable scenarios that would alter these
10 conclusions in regard to cumulative impacts.

11
12 Related to historic resources, there are no structures eligible for the inclusion in the National
13 Register of Historic Places on the V.C. Summer site or along the transmission lines. The staff
14 has concluded that the impacts of license renewal would be SMALL. There is no reason to
15 believe that the continued operation and maintenance of the V.C. Summer site and
16 transmission line rights-of-way would impact any properties beyond the site or right-of-way
17 boundaries, and therefore the contribution to a cumulative impact on historic resources would
18 be negligible.

19
20 Based on these considerations, the staff concludes that continued operation of V.C. Summer is
21 not likely to make a detectable contribution to the cumulative effects associated with any of the
22 socioeconomic issues discussed in Section 4.4, and therefore, the cumulative impacts will be
23 SMALL and no additional mitigation measures are warranted.

24 25 4.8.5 Cumulative Impacts on Groundwater Use and Quality

26
27 There are no known or planned projects that would require withdrawal of groundwater that, if
28 implemented in addition to license renewal, would potentially cause an adverse impact on
29 groundwater. The V.C. Summer groundwater use is less than 100 gpm. The current impact on
30 the alluvial aquifer due to plant operations and current groundwater withdrawals are small as
31 discussed in Section 4.5. Therefore the cumulative impact is SMALL and no mitigation
32 measures are warranted.

33 34 4.8.6 Cumulative Impacts on Threatened or Endangered Species

35
36 The geographic area considered in the analysis of cumulative impacts to threatened or
37 endangered species includes V.C. Summer project area and the associated transmission line
38 right-of-way. As discussed in Sections 2.2.5 and 2.2.6, there are several threatened or

1 endangered species that occur within this area. However, the staff determined in Section 4.6
2 that continued operation of V.C. Summer would have no effect or is not likely to adversely effect
3 any of these species. Therefore, the continued operation of V.C. Summer will not contribute to
4 a regional cumulative impact to these species, regardless of whether or not other actions occur
5 that could have adverse impacts.

6
7 Therefore, the staff has determined that the cumulative impacts to threatened or endangered
8 species due to continued operation at the V.C. Summer site and associated transmission line
9 will be SMALL, and that additional mitigation measures would not be warranted.

10 11 **4.9 Summary of Impacts of Operations During the** 12 **Renewal Term**

13
14 Neither SCE&G nor the staff is aware of information that is both new and significant related to
15 any of the applicable Category 1 issues associated with the V.C. Summer operation during the
16 renewal term. Consequently, the staff concludes that the environmental impacts associated
17 with these issues are bounded by the impacts described in the GEIS. For each of these issues,
18 the GEIS concluded that the impacts would be SMALL and that additional plant-specific
19 mitigation is not likely to be sufficiently beneficial to warrant implementation.

20
21 Plant-specific environmental evaluations were conducted for 14 Category 2 issues applicable to
22 V.C. Summer operation during the renewal term and for chronic effects of electromagnetic
23 fields and environmental justice. For all issues, the staff concluded that the potential
24 environmental impact of renewal term operations of V.C. Summer would be of SMALL
25 significance in the context of the standards set forth in the GEIS and that additional mitigation
26 would not be warranted.

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Environmental Impacts of Operation

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5.0 Environmental Impacts of Postulated Accidents

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

This chapter describes the environmental impacts from postulated accidents that might occur during the license renewal term.

5.1 Postulated Plant Accidents

Two classes of accidents are evaluated in the GEIS. These are design-basis accidents (DBAs) and severe accidents, as discussed below.

(1) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and Addendum 1.

Postulated Accidents

5.1.1 Design-Basis Accidents

To receive U.S. Nuclear Regulatory Commission (NRC) approval to operate a nuclear power facility, an applicant for an initial operating license (OL) must submit a Safety Analysis Report (SAR) as part of its application. The SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

The DBAs are evaluated by both the licensee and the NRC staff to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in 10 CFR Part 50 and 10 CFR Part 100.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the OL. The results of these evaluations are found in license documentation such as the applicant's Final Safety Analysis Report (FSAR), the staff's Safety Evaluation Report (SER), and the Final Environmental Statement (FES). The licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirement that aging management programs be in effect for license renewal and the requirement that the consequences of any DBA remain below specified acceptable levels at all times during plant operation, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal period. Accordingly, the design of the plant relative to DBAs during the period of extended operation is considered to remain acceptable and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, design-basis events are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal.

This issue, applicable to the Virgil C. Summer Nuclear Station (V.C. Summer) is listed in Table 5-1.

Table 5-1. Category 1 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
POSTULATED ACCIDENTS	
Design-basis accidents (DBAs)	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that

The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.

South Carolina Electric and Gas Company (SCE&G) stated in its Environmental Report (ER) (SCE&G 2002) that it is not aware of any new and significant information associated with the renewal of the V.C. Summer OL. The staff has not identified any significant new information during its independent review of the ER. (SCE&G 2002), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to design basis accidents beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

Severe accidents initiated by external phenomena such as tornadoes, floods, earthquakes, fires, and sabotage have not traditionally been discussed in quantitative terms in FESs and were not specifically considered for the V.C. Summer site in the GEIS (NRC 1996). However, in the GEIS, the staff did evaluate existing impact assessments performed by the NRC and by the industry for 44 nuclear plants in the United States. As set forth in the GEIS, the staff concluded that the risk from sabotage and beyond design basis earthquakes at existing nuclear power plants is SMALL. Additionally, the staff concluded that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents.

Postulated Accidents

Based on information in the GEIS, the Commission found that

The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

Therefore, the Commission has designated mitigation of severe accidents as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue, applicable to V.C. Summer, is listed in Table 5-2.

Table 5-2. Category 2 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
POSTULATED ACCIDENTS			
Severe Accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	L	5.2

The staff has not identified any significant new information with regard to the consequences from severe accidents during its independent review of the ER (SCE&G 2002), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for V.C. Summer. The results of its review are discussed in Section 5.2.

5.2 Severe Accident Mitigation Alternatives (SAMAs)

10 CFR 51.53(c)(3)(ii)(L) requires that license renewal (LR) applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for V.C. Summer; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for V.C. Summer conducted by SCE&G and described in the ER (SCE&G 2002) and of the NRC's review of that evaluation. The details of the review are described in the NRC staff evaluation that was prepared by the staff with contract assistance from Information Systems Laboratories, Inc. The entire evaluation is presented in Appendix G.

The SAMA evaluation for V.C. Summer was a multi-step process. In the first step, SCE&G quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic risk assessment (PRA) and other risk models.

The second step was the examination of the major risk contributors to identify areas where plant improvements might have the greatest chance to reduce risk. Then, possible ways of reducing those risks were identified. Common ways of reducing risk are changes to components, systems, procedures, and training. SCE&G identified 268 potential SAMAs. Using a set of screening criteria, the number of SAMAs warranting further consideration was reduced to 32. Of these remaining SAMAs, 20 were screened from further analysis because, based on plant-specific PRA insights, they did not provide a significant safety benefit, or because the cost of implementation would be greater than the benefits associated with implementing the SAMA.

In the third step, the benefits and costs for the 12 remaining candidate SAMAs were estimated. Estimates were made of how much each proposed SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997). The costs of implementing the proposed SAMAs were also estimated.

Finally in the fourth step, the costs and benefits of each of the 12 final SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the costs (a positive cost-benefit). In the final analysis, none of these 268 SAMAs were determined to be cost-beneficial for V.C. Summer.

Each of these four steps is discussed in more detail in the sections that follow.

5.2.2 Estimate of Risk

SCE&G submitted an assessment of SAMAs for V.C. Summer as part of the ER (SCE&G 2002). This assessment was based on the most recent V. C. Summer Probabilistic Risk Analysis (PRA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2), and insights from the

Postulated Accidents

V. C. Summer Individual Plant Examination (IPE) (SCE&G 1993) and Individual Plant Examination of External Events (IPEEE) (SCE&G 1995). The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 5.6×10^{-5} per year, and the baseline large early release frequency (LERF) is approximately 7.0×10^{-7} per year. The CDF and LERF are based on the risk assessment for internally-initiated events. The CDF represents a sizeable change from the original IPE CDF value of 2.0×10^{-4} per year. SCE&G did not include the contribution of risk from external events within the V. C. Summer risk estimates, but in response to a request for additional information, SCE&G applied a factor of two multiplier to the estimated internal events benefits to account for additional benefits in external events. The breakdown of CDF by initiating event/accident class is summarized in Table 5-3. Transients and loss of offsite power events are the dominant contributors to the CDF.

Table 5-3. V. C. Summer Core Damage Frequency

Initiating Event/Accident Class	CDF (Per Year)	Contribution to CDF (%)
Loss of Offsite Power (LOOP)	3.9×10^{-5}	70
Transients	7.5×10^{-6}	13
Special Initiators	4.4×10^{-6}	8
Loss-of-Coolant Accident (LOCA)	1.7×10^{-6}	3
Steam Generator Tube Rupture (SGTR)	1.7×10^{-7}	<1
Interfacing Systems LOCA (ISLOCA)	1.8×10^{-7}	<1
Others	2.6×10^{-6}	5
Total CDF (from internal events)	5.6×10^{-5}	100

SCE&G estimated the dose from all postulated accidents to the population within 80 km (50 mi) of the V.C. Summer site to be approximately 0.01 person-Sv (1.0 person-rem). The breakdown of the population dose by containment release mode is summarized in Table 5-4. Bypass events (SGTR, interfacing system LOCA) dominate the population dose.

SCE&G's determination of offsite risk at V. C. Summer is based on the following three major elements of analysis:

- the Level 1 and 2 risk models that form the bases for the 1993 IPE and 1995 IPEEE submittals (SCE&G 1993 and SCE&G 1995),
- the major modifications to the IPE model that have been incorporated in the V. C. Summer PRA, and

- the MACCS2 analysis performed to translate fission product release frequencies from the Level 2 PRA model into offsite consequence measures.

Table 5-4. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem* Per Year)	Contribution (%)
SGTR	0.27	27
Interfacing Systems LOCAs	0.63	63
Containment isolation failure	0.05	5
Early containment failure	0	0
Late containment failure	0.05	5
Total	1.0	100

*One person-Rem = 0.01 person-Sv

The staff has reviewed SCE&G's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for the candidate SAMAs. Specifically, the staff concludes that the Level 1 and Level 2 PRA models are of sufficient quality, SCE&G's consideration of external events is acceptable, and the methods, assumptions, and analyses applied in the estimation of offsite consequences are reasonable and acceptable for the purposes of SAMA evaluation. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses provided by SCE&G.

5.2.3 Potential Plant Improvements

Once the most risk significant parts of the plant design and operation were identified, SCE&G searched for ways to reduce those risks. To identify potential plant improvements, SCE&G's process consisted of the following elements:

- review of plant-specific improvements identified in the V.C. Summer IPE and IPEEE and subsequent PRA revisions
- review of SAMA analyses submitted in support of original licensing and license renewal activities for other operating nuclear power plants
- review of other NRC and industry documentation discussing potential plant improvements, e.g., NUREG-1560.

SCE&G identified 268 potential risk-reducing improvements to plant components, systems, procedures, and training (SAMAs).

Postulated Accidents

1 All but 69 of these SAMAs were removed from further consideration because: (1) the SAMA
2 was not applicable at V.C. Summer due to design differences, (2) the SAMA had already been
3 implemented at V.C. Summer, (3) the SAMA was sufficiently similar to another SAMA such that
4 they could be combined, or (4) the SAMA would not provide a significant safety benefit. A
5 preliminary cost estimate was prepared for each of the remaining 69 SAMAs.

6
7 The preliminary cost estimate of each of these 69 remaining SAMAs was compared to the
8 maximum attainable benefit (MAB) of 1.2 million dollars. The MAB is the dollar value of the
9 benefit that would be achieved if the plant risk and population dose from postulated accidents
10 could be reduced to zero. If the cost of a SAMA exceeded the MAB, it could not be cost-
11 beneficial because no single SAMA could eliminate all the risk. Using this comparison, 37 of
12 the candidate SAMAs were eliminated from further consideration, leaving 32 candidate SAMAs
13 for further evaluation in Phase 2. Of these remaining SAMAs, 20 were screened from further
14 analysis because, based on plant-specific PRA insights, they did not provide a significant safety
15 benefit, or because the cost of implementation would be greater than the benefits associated
16 with implementing the SAMA. This culminated in identification of 12 candidate SAMAs.

17
18 The staff questioned SCE&G about lower cost alternatives to several of the SAMAs evaluated,
19 including the use of: (1) portable battery chargers to supply power to the steam generator
20 instrument panels, (2) a cross-tie to the existing non-safety station batteries, (3) a direct-drive
21 diesel emergency feedwater pump, and (4) an automatic safety injection pump trip on low
22 refueling water storage tank (RWST) level as an alternative to an automatic swap to
23 recirculation (NRC 2003a). In response, SCE&G provided estimated benefits and
24 implementation costs for each alternative (SCE&G 2003a). These are discussed further in
25 Appendix G.

26
27 The staff concludes that SCE&G used a systematic and comprehensive process for identifying
28 potential plant improvements for V. C. Summer, and that the set of potential plant
29 improvements identified by SCE&G is reasonably comprehensive and therefore acceptable.
30 This search included reviewing insights from the IPE and IPEEE, and plant improvements
31 considered in previous SAMA analyses. While explicit treatment of external events in the
32 SAMA identification process was limited, the staff recognizes that the absence of external event
33 vulnerabilities reasonably justifies examining primarily the internal events risk results for this
34 purpose.

35 36 5.2.4 Risk Reduction Potential of Plant Improvements

37
38 SCE&G evaluated the risk-reduction potential of the 12 Phase 2 SAMAs applicable to V. C.
39 Summer, as well as several additional SAMAs suggested by the staff. In response to a staff
40 request, SCE&G further examined several SAMAs including those closest to being cost
41 beneficial to determine the extent to which the SAMAs might reduce external event risk

(SCE&G 2003b). The SAMAs considered include: Phase 2 SAMA 3, Phase 2 SAMA 10, use of portable 120V DC generator to supply power to steam generator level instrumentation, installation of direct-drive diesel emergency feedwater pump, and use of the fire service water for make-up to steam generators. This assessment included consideration of both seismic and fire risk.

Based on this assessment, SCE&G concluded that although some credit may be taken for these SAMAs in external events, the benefit is more limited than in the internal events analysis. For example, power recovery in fire events may create additional difficulties not present for the initiators addressed in the internal events model. Also, the low cost alternatives would not be required to meet the rigors of a seismically-qualified component, and therefore, may not be useable following a seismic event. Nevertheless, SCE&G conservatively increased the benefit for these SAMAs by a factor of two to account for external events. In addition, the estimated benefit for all SAMAs was increased by 15% to account for the resolution of peer review comments.

The staff has reviewed SCE&G's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and, for the above reasons, are generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on SCE&G's risk reduction estimates.

5.2.5 Cost Impacts of Candidate Plant Improvements

SCE&G estimated the costs of implementing the 12 SAMAs which were not initially screened out. The cost estimates conservatively did not include the cost of replacement power during any extended outages that might be needed to implement the modifications. Estimates that were taken from prior SAMA analyses were not adjusted to present-day dollars. For many of the SAMAs considered, the cost estimates were significantly greater than the benefits calculated such that a detailed evaluation was not necessary and a specific dollar value was not reported.

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates (presented in Table F.6-1 of Appendix F to the ER) to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. A majority of the SAMAs were eliminated from further consideration on the basis that the expected implementation cost would be much greater than the estimated risk reduction benefit.

Postulated Accidents

1 The staff notes that the cost to implement a direct-drive diesel EFW pump at another plant was
2 estimated to be about \$200K. However, SCE&G estimated the cost of the modification at
3 V. C. Summer to be about \$800K based on the following: \$200K for design, \$200K for
4 evaluations, \$100K for materials, \$200K for implementation, \$30K for training, and \$80K for
5 documentation and closeout (SCE&G 2003c). To verify the validity of the \$800K cost, the staff
6 reviewed the costs for similar modifications evaluated in other plants' SAMA analyses. These
7 costs ranged from \$300K to \$2M.

8
9 Although SCE&G's cost estimate is significantly greater than \$200K, it does not appear to be
10 unreasonable relative to the cost estimates for similar modifications. The staff concludes that
11 the cost estimates provided by SCE&G are sufficient and appropriate for use in the SAMA
12 evaluation.

13 14 5.2.6 Cost-Benefit Comparison

15
16 The methodology used by SCE&G was based primarily on NRC's guidance for performing cost-
17 benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*
18 (NRC 1997d). The staff reviewed the SCE&G SAMA analysis and questioned the treatment of
19 uncertainties associated with the calculated CDF. SCE&G revisited the cost-benefit analyses
20 for the 12 Phase 2 SAMAs and found SAMAs 3 and 10 potentially cost beneficial (SCE&G
21 2003a). SAMA 3 was further evaluated and SCE&G estimated the total benefit to be
22 approximately \$24K and the cost of implementation to be approximately \$150K to \$170K.
23 Accordingly, this SAMA is not cost-beneficial. Similarly, SAMA 10 was evaluated further.
24 SCE&G noted that this SAMA would require modification to controls in the main control room.
25 Costs associated with this aspect were not considered in the original cost estimate provided,
26 nor were costs associated with the engineering analysis needed to support the modification.
27 When these additional costs factors are included, the implementation costs would be
28 substantially greater than \$50K. The total benefit for this SAMA was estimated to be
29 approximately \$48K, accordingly, this SAMA is not cost-beneficial.

30
31 The staff questioned SCE&G about lower cost alternatives to several of the SAMAs evaluated,
32 including the use of: (1) portable 120V DC generator to supply power to the steam generator
33 instrument panels, (2) a cross-tie to the existing non-safety station batteries, (3) a direct-drive
34 diesel emergency feedwater pump, and (4) an automatic safety injection pump trip on low
35 RWST level as an alternative to an automatic swap to recirculation (NRC 2003a). SCE&G
36 provided estimated benefits and implementation costs for each alternative. Based on these
37 estimates, none of these alternatives appear cost beneficial.

38
39 The staff concludes that the costs of all of the SAMAs assessed would be higher than the
40 associated benefits. This conclusion is supported by sensitivity analysis and upheld despite a

number of additional uncertainties and non-quantifiable factors in the calculations, summarized as follows:

- Uncertainty in the internal events CDF was not initially included in the calculations, which employed best-estimate values to determine the benefits. Even upon considering benefits at the 95th percentile value, no SAMAs were judged to be cost-beneficial.
- External events were similarly not included in the V. C. Summer risk profile. However, given that the expected external events contribution to CDF is calculated in a conservative fashion and is expected to be on the same order of magnitude as the internal events contribution to CDF, a factor of two increase in the estimated internal events benefits to account for the external events should be conservative
- Risk reduction and cost estimates are reasonable, and generally conservative. As such, uncertainty in the costs of any of the contemplated SAMAs would not likely have the effect of making them cost beneficial.

Based on its review of the SCE&G SAMA analysis, as set forth above, the staff finds that none of the candidate SAMAs are cost-beneficial. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

5.2.7 Conclusions

SCE&G compiled a list of 268 SAMA candidates using the SAMA analyses as submitted in support of licensing activities for other nuclear power plants, NRC and industry documents discussing potential plant improvements, and the plant-specific insights from the V. C. Summer IPE, IPEEE, and current PRA model. A qualitative screening removed SAMA candidates that (1) were not applicable at V. C. Summer due to design differences, (2) had already been implemented at V. C. Summer, (3) were sufficiently similar to another SAMA such that they could be combined, or (4) did not provide a significant safety benefit. A total of 199 SAMA candidates were eliminated based on the above criteria, leaving 69 SAMA candidates for further evaluation.

Using guidance in NUREG/BR-0184 (NRC 1997d), the current PRA model, and a Level 3 analysis developed specifically for SAMA evaluation, a maximum attainable benefit of about \$1.2M was calculated, representing the total present dollar value equivalent associated with completely eliminating severe accidents at V. C. Summer. Thirty-seven of the 69 SAMAs were eliminated from further evaluation because their implementation costs were greater than this maximum attainable benefit. An additional 20 SAMAs were eliminated because, based on plant-specific PRA insights, they did not provide a significant safety benefit, or because the cost of implementation would be greater than the benefits associated with implementing the SAMA.

Postulated Accidents

1 For the remaining 12 SAMA candidates and several additional alternatives identified by the
2 staff, more detailed conceptual designs and cost estimates were developed. The cost-benefit
3 analyses showed that none of the candidate SAMAs were cost-beneficial.

4
5 The staff reviewed the SCE&G analysis and concluded that the methods used and the
6 implementation of those methods were sound. The treatment of SAMA benefits and costs, the
7 generally large negative net benefits, and the small baseline risks support the general
8 conclusion that the SAMA evaluations performed by SCE&G are reasonable and sufficient for
9 the license renewal submittal. The unavailability of a seismic and fire PRA model precluded a
10 quantitative evaluation of SAMAs specifically aimed at reducing risk of these initiators; however,
11 improvements have been realized as a result of the IPEEE process at V. C. Summer that would
12 minimize the likelihood of identifying further cost-beneficial enhancements in these areas. To
13 assess the potential impact of uncertainties in the analysis or the inclusion of additional benefits
14 in external events, SCE&G applied a factor of two multiplier to the estimated benefits based on
15 internally-initiated events, and confirmed that even when considering the increase in the
16 benefits, none of the SAMAs become cost beneficial.

17
18 Based on its review of the SCE&G SAMA assessment, and as explained above, the staff finds
19 that none of the candidate SAMAs are cost beneficial. This is based on conservative treatment
20 of costs and benefits. This conclusion is consistent with the low residual level of risk indicated in
21 the V. C. Summer PRA and the fact that V. C. Summer has already implemented plant
22 improvements identified from the IPE and IPEEE processes.

23 24 5.3 References

25
26 South Carolina Electric & Gas Company (SCE&G). 1993. Letter from John L. Skolds (SCE&G)
27 to Nuclear Regulatory Commission Document Control Desk. "Virgil C. Summer Nuclear Station
28 (VCSNS) Docket No. 50-395 Operating License No. NPF-12 Transmittal of IPE Report; Generic
29 Letter 88-20, LTR 880020," June 18, 1993.

30
31 South Carolina Electric & Gas Company (SCE&G). 1995. Letter from Gary J. Taylor (SCE&G)
32 to Nuclear Regulatory Commission Document Control Desk. "Virgil C. Summer Nuclear Station
33 Docket No. 50-395 Operating License No. NPF-12 Transmittal of IPEEE Report; Generic Letter
34 88-20, Supplement 4, (LTR 880020-4)," June 30, 1995.

35
36 South Carolina Electric & Gas Company (SCE&G). 2002. *Applicant's Environmental*
37 *Report—Operating License Renewal Stage, Virgil C. Summer Nuclear Station*. South Carolina
38 Electric & Gas Company, Columbia, South Carolina. August 2002.

1 U.S. Nuclear Regulatory Commission (NRC). 1988. Generic Letter 88-20, "Individual Plant
2 Examination for Severe Accident Vulnerabilities," November 23, 1988.

3
4 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for*
5 *License Renewal of Nuclear Plants*. NUREG-1437. Office of Nuclear Regulatory Research.
6 Washington, D.C.
7

6.0 Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

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

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

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to the Virgil C. Summer Nuclear Station (V.C. Summer). The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in

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

10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The GEIS also addresses the impacts from radon-222 and technetium-99. There are no Category 2 issues for the uranium fuel cycle and solid waste management.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to V.C. Summer from the uranium fuel cycle and solid waste management are listed in Table 6-1.

Table 6-1. Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and HLW)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (spent fuel and HLW disposal)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste (LLW) storage and disposal	6.1; 6.2.2.2; 6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6; 6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
Onsite spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

South Carolina Electric and Gas Company (SCE&G) stated in its Environmental Report (ER) (SCE&G 2002) that it is not aware of any new and significant information associated with the renewal of the V.C. Summer operating license (OL). The staff has not identified any significant new information on these issues during its independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of these issues follows:

- Offsite radiological impacts (individual effects from other than the disposal of spent fuel and HLW). Based on information in the GEIS, the Commission found that

Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part [10 CFR 51.51(b)]. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

The staff has not identified any new and significant information on this issue during its independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (individual effects from other than the disposal of spent fuel and HLW) of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). Based on information in the GEIS, the Commission found that

The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem [148 person Sv], or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of

Fuel Cycle

1 cancer fatalities from the fuel cycle, but this result assumes that even tiny doses
2 have some statistical adverse health effect which will not ever be mitigated (for
3 example no cancer cure in the next thousand years), and that these doses
4 projected over thousands of years are meaningful. However, these assumptions
5 are questionable. In particular, science cannot rule out the possibility that there
6 will be no cancer fatalities from these tiny doses. For perspective, the doses are
7 very small fractions of regulatory limits and even smaller fractions of natural
8 background exposure to the same populations.

9
10 Nevertheless, despite all the uncertainty, some judgement as to the regulatory
11 NEPA [National Environmental Policy Act] implications of these matters should
12 be made and it makes no sense to repeat the same judgement in every case.
13 Even taking the uncertainties into account, the Commission concludes that these
14 impacts are acceptable in that these impacts would not be sufficiently large to
15 require the NEPA conclusion, for any plant, that the option of extended operation
16 under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission
17 has not assigned a single level of significance for the collective effects of the fuel
18 cycle, this issue is considered Category 1.

19
20 The staff has not identified any new and significant information on this issue during its
21 independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping
22 process, or its evaluation of other available information. Therefore, the staff concludes that
23 there are no offsite radiological impacts (collective effects) from the uranium fuel cycle
24 during the renewal term beyond those discussed in the GEIS.

- 25
26 • Offsite radiological impacts (spent fuel and HLW disposal). Based on information in the
27 GEIS, the Commission found that

28
29 For the high level waste and spent fuel disposal component of the fuel cycle,
30 there are no current regulatory limits for offsite releases of radionuclides for the
31 current candidate repository site. However, if we assume that limits are
32 developed along the lines of the 1995 National Academy of Sciences (NAS)
33 report, "Technical Bases for Yucca Mountain Standards," and that in accordance
34 with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository
35 can and likely will be developed at some site which will comply with such limits,
36 peak doses to virtually all individuals will be 100 millirem [1 mSv] per year or
37 less. However, while the Commission has reasonable confidence that these
38 assumptions will prove correct, there is considerable uncertainty since the limits
39 are yet to be developed, no repository application has been completed or
40 reviewed, and uncertainty is inherent in the models used to evaluate possible

1 pathways to the human environment. The NAS report indicated that 100 millirem
2 [1 mSv] per year should be considered as a starting point for limits for individual
3 doses, but notes that some measure of consensus exists among national and
4 international bodies that the limits should be a fraction of the 100 millirem [1
5 mSv] per year. The lifetime individual risk from 100 millirem [1 mSv] annual dose
6 limit is about 3×10^{-3} .

7
8 Estimating cumulative doses to populations over thousands of years is more
9 problematic. The likelihood and consequences of events that could seriously
10 compromise the integrity of a deep geologic repository were evaluated by the
11 U.S. Department of Energy in the *Final Environmental Impact Statement:*
12 *Management of Commercially Generated Radioactive Waste*, October 1980
13 [DOE 1980]. The evaluation estimated the 70-year whole-body dose
14 commitment to the maximum individual and to the regional population resulting
15 from several modes of breaching a reference repository in the year of closure,
16 after 1000 years, after 100,000 years, and after 100,000,000 years.
17 Subsequently, the NRC and other federal agencies have expended considerable
18 effort to develop models for the design and for the licensing of a high level waste
19 repository, especially for the candidate repository at Yucca Mountain. More
20 meaningful estimates of doses to population may be possible in the future as
21 more is understood about the performance of the proposed Yucca Mountain
22 repository. Such estimates would involve very great uncertainty, especially with
23 respect to cumulative population doses over thousands of years. The standard
24 proposed by the NAS is a limit on maximum individual dose. The relationship of
25 potential new regulatory requirements, based on the NAS report, and cumulative
26 population impacts has not been determined, although the report articulates the
27 view that protection of individuals will adequately protect the population for a
28 repository at Yucca Mountain. However, the EPA's [U.S. Environmental
29 Protection Agency] generic repository standards in 40 CFR Part 191 generally
30 provide an indication of the order of magnitude of cumulative risk to population
31 that could result from the licensing of a Yucca Mountain repository, assuming the
32 ultimate standards will be within the range of standards now under consideration.
33 The standards in 40 CFR Part 191 protect the population by imposing
34 "containment requirements" that limit the cumulative amount of radioactive
35 material released over 10,000 years. Reporting performance standards that will
36 be required by EPA are expected to result in releases and associated health
37 consequences in the range between 10 and 100 premature cancer deaths with
38 an upper limit of 1000 premature cancer deaths worldwide for a 100,000 metric
39 tonne (MTHM) repository.
40

Fuel Cycle

1 Nevertheless, despite all the uncertainty, some judgement as to the regulatory
2 NEPA implications of these matters should be made and it makes no sense to
3 repeat the same judgement in every case. Even taking the uncertainties into
4 account, the Commission concludes that these impacts are acceptable in that
5 these impacts would not be sufficiently large to require the NEPA conclusion, for
6 any plant, that the option of extended operation under 10 CFR Part 54 should be
7 eliminated. Accordingly, while the Commission has not assigned a single level of
8 significance for the impacts of spent fuel and high level waste disposal, this issue
9 is considered Category 1.

10
11 Since the GEIS was originally issued in 1996, the EPA has published radiation protection
12 standards for Yucca Mountain, Nevada, at 40 CFR Part 197, "Public Health and
13 Environmental Radiation Protection Standards for Yucca Mountain, Nevada," on June 13,
14 2001 (66 FR 32132). The Energy Policy Act of 1992 (42 USC 10101 et seq.) directs that
15 the U.S. Nuclear Regulatory Commission (NRC) adopt these standards into its regulations
16 for reviewing and licensing the repository. NRC published its regulations at 10 CFR Part 63,
17 "Disposal of High-Level Radioactive Wastes in Geologic Repository at Yucca Mountain,
18 Nevada" on November 2, 2001 (66 FR 55792). These standards include the following:
19 (1) 0.15 mSv/year (15 mrem/year) dose limit for members of the public during the storage
20 period prior to repository closure, (2) 0.15 mSv/year (15 mrem/year) dose limit for the
21 reasonably maximally exposed individual for 10,000 years following disposal,
22 (3) 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed
23 individual as a result of a human intrusion at or before 10,000 years after disposal, and
24 (4) a groundwater protection standard that states for 10,000 years of undisturbed
25 performance after disposal, radioactivity in a representative volume of groundwater will not
26 exceed (a) 0.19 Bq/L (5 pCi/L) for radium-226 and radium-228, (b) 0.56 Bq/L (15 pCi/L) for
27 gross alpha activity, and (c) 0.04 mSv/year (4 mrem/year) to the whole body or any organ
28 (from combined beta and photon-emitting radionuclides, assuming consumption of 2 L/d of
29 the affected water).

30
31 On February 15, 2002, subsequent to receipt of a recommendation by the Secretary,
32 U.S. Department of Energy, the President recommended the Yucca Mountain site for the
33 development of a repository for the geologic disposal of spent nuclear fuel and HLW. The
34 U.S. Congress approved this recommendation on July 9, 2002, in House Joint
35 Resolution 87. On July 23, 2002, the President signed into law House Joint Resolution 87.
36 This development does not represent new and significant information with respect to the
37 offsite radiological impacts related to spent fuel and HLW disposal during the renewal term.

38
39 The staff has not identified any new and significant information on this issue during its
40 independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping

process, or staff evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and HLW disposal during the renewal term beyond those discussed in the GEIS.

- Nonradiological impacts of the uranium fuel cycle. Based on information in the GEIS, the Commission found that

The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

The staff has not identified any new and significant information on this issue during its independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Low-level waste storage and disposal. Based on information in the GEIS, the Commission found that

The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The staff has not identified any new and significant information on this issue during its independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of LLW storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Mixed waste storage and disposal. Based on information in the GEIS, the Commission found that

Fuel Cycle

1 The comprehensive regulatory controls and the facilities and procedures that are
2 in place ensure proper handling and storage, as well as negligible doses and
3 exposure to toxic materials for the public and the environment at all plants.
4 License renewal will not increase the small, continuing risk to human health and
5 the environment posed by mixed waste at all plants. The radiological and
6 nonradiological environmental impacts of long-term disposal of mixed waste from
7 any individual plant at licensed sites are small. In addition, the Commission
8 concludes that there is reasonable assurance that sufficient mixed waste
9 disposal capacity will be made available when needed for facilities to be
10 decommissioned consistent with NRC decommissioning requirements.

11
12 The staff has not identified any new and significant information on this issue during its
13 independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping
14 process, or its evaluation of other available information. Therefore, the staff concludes that
15 there are no impacts of mixed waste storage and disposal associated with the renewal term
16 beyond those discussed in the GEIS.

- 17
18 • Onsite spent fuel. Based on information in the GEIS, the Commission found that

19
20 The expected increase in the volume of spent fuel from an additional 20 years of
21 operation can be safely accommodated on site with small environmental effects
22 through dry or pool storage at all plants if a permanent repository or monitored
23 retrievable storage is not available.

24
25 The staff has not identified any new and significant information on this issue during its
26 independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping
27 process, or its evaluation of other available information. Therefore, the staff concludes that
28 there are no impacts of onsite spent fuel associated with license renewal beyond those
29 discussed in the GEIS.

- 30
31 • Nonradiological waste. Based on information in the GEIS, the Commission found that

32
33 No changes to generating systems are anticipated for license renewal. Facilities
34 and procedures are in place to ensure continued proper handling and disposal at
35 all plants.

36
37 The staff has not identified any new and significant information on this issue during its
38 independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping
39 process, or its evaluation of other available information. Therefore, the staff concludes that

there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

- Transportation. Based on information contained in the GEIS, the Commission found that

The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada, are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4—Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.

V.C. Summer meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any new and significant information on this issue during its independent review of the V.C. Summer ER (SCE&G 2002), its site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

6.2 References

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

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

10 CFR Part 63. Code of Federal Regulations, Title 10, *Energy*, Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR Part 191. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

Fuel Cycle

1 40 CFR Part 197. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 197,
2 "Public Health and Environmental Radiation Protection Standards for Management and
3 Disposal for Yucca Mountain, Nevada."

4
5 66 FR 32132, "Public Health and Environmental Radiation Protection Standards for Yucca
6 Mountain, Nevada. *Federal Register* Vol. 66, No. 114. June 13, 2001.

7
8 66 FR 55792, "Disposal of High-Level Radioactive Wastes in a Proposed Geological Repository
9 at Yucca Mountain, Nevada." *Federal Register* Vol. 66, No. 213. November 2, 2001.

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11 Energy Policy Act of 1992. 42 USC 10101, et seq.

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13 South Carolina Electric and Gas Company (SCE&G). 2002. *Virgil C. Summer Nuclear Station*
14 *License Renewal Application*. "Appendix E, Environmental Report." Docket Number 50/395;
15 License Number NPF-12. Jenkinsville, South Carolina.

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17 National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards*.
18 Washington, D.C.

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

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22 U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement:*
23 *Management of Commercially Generated Radioactive Waste*. DOE/EIS-0046F.
24 Washington, D.C.

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26 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement*
27 *for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2. Washington, D.C.

28
29 U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement*
30 *for License Renewal of Nuclear Plants, Main Report*. "Section 6.3 – Transportation, Table 9.1,
31 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final
32 Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

7.0 Environmental Impacts of Decommissioning

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

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

Category 2 issues are those that do not meet one or more of the criteria for Category 1 and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B that are applicable to decommissioning of the Virgil C. Summer Nuclear Station (V.C. Summer) following the renewal term are listed in Table 7-1. South Carolina Electric and Gas (SCE&G) stated in its Environmental Report (ER) (SCE&G 2002) that it is aware of no new and significant information regarding the environmental impacts of V.C. Summer license renewal. The staff has not identified any significant new information on these issues during its independent

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

Environmental Impacts of Decommissioning

Table 7-1. Category 1 Issues Applicable to the Decommissioning of V.C. Summer Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1		GEIS Section
DECOMMISSIONING		
Radiation Doses		7.3.1; 7.4
Waste Management		7.3.2; 7.4
Air Quality		7.3.3; 7.4
Water Quality		7.3.4; 7.4
Ecological Resources		7.3.5; 7.4
Socioeconomic Impacts		7.3.7; 7.4

review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of the issues follows.

- Radiation doses. Based on information in the GEIS, the Commission found that

Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem [0.01 person-Sv] caused by buildup of long-lived radionuclides during the license renewal term.

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no radiation doses associated with decommissioning following license renewal beyond those discussed in the GEIS.

- Waste management. Based on information in the GEIS, the Commission found that

Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Air quality. Based on information in the GEIS, the Commission found that

Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on air quality during decommissioning beyond those discussed in the GEIS.

- Water quality. Based on information in the GEIS, the Commission found that

The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on water quality during decommissioning beyond those discussed in the GEIS.

- Ecological resources. Based on information in the GEIS, the Commission found that

Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

Environmental Impacts of Decommissioning

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on ecological resources during decommissioning beyond those discussed in the GEIS.

- Socioeconomic impacts. Based on information in the GEIS, the Commission found that

Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

The staff has not identified any new and significant information on this issue during its independent review of the SCE&G ER (SCE&G 2002), the staff's site visit, the scoping process, or staff evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on the socioeconomic impacts of decommissioning beyond those discussed in the GEIS.

7.1 References

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

South Carolina Electric and Gas Company (SCE&G). 2002. *Virgil C. Summer Nuclear Station License Renewal Application*. "Appendix E, Environmental Report." Docket Number 50/395; License Number NPF-12. Jenkinsville, South Carolina.

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

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

8.0 Environmental Impacts of Alternatives to License Renewal

This chapter examines the potential environmental impacts associated with denying the renewal of an operating license (OL) (i.e., the no-action alternative); the potential environmental impacts from electric generation sources other than the Virgil C. Summer Nuclear Station (V.C. Summer); the possibility of purchasing electric power from other sources to replace power generated by V.C. Summer and the associated environmental impacts; the potential environmental impacts from a combination of generation and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by V.C. Summer. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC) three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)^(a) with the additional impact category of environmental justice.

8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act of 1969 (NEPA) specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS) [10 CFR Part 51, Subpart A, Appendix A(4)]. For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the V.C. Summer OL, and

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

Alternatives

1 South Carolina Electric and Gas Company (SCE&G) would then decommission V.C. Summer
2 when plant operations cease.

3
4 SCE&G will be required to comply with NRC decommissioning requirements whether or not the
5 OL is renewed. If the V.C. Summer OL is renewed, decommissioning activities may be
6 postponed for up to an additional 20 years. If the OL is not renewed, SCE&G would conduct
7 decommissioning activities according to the requirements in 10 CFR 50.82.

8
9 The environmental impacts associated with decommissioning under both license renewal and
10 the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the
11 GEIS, Chapter 7 of this supplemental environmental impact statement (SEIS), and
12 Supplement 1 to the *Final Generic Environmental Impact Statement on Decommissioning of*
13 *Nuclear Facilities*, NUREG-0586 (NRC 2002). The impacts of decommissioning after 60 years
14 of operation are not expected to be significantly different from those occurring after 40 years of
15 operation.

16
17 The environmental impacts of the no-action alternative are summarized in Table 8-1 and are
18 discussed in the following paragraphs. Implementation of the no-action alternative would also
19 have certain positive impacts in that adverse environmental impacts associated with current
20 operation of V.C. Summer (e.g., solid waste impacts and adverse impacts on aquatic life) would
21 be eliminated.

22
23 The no-action alternative is a conceptual alternative resulting in a net reduction in power
24 production, but with no environmental impacts assumed for replacement power. In actual
25 practice, the power lost by not renewing the V.C. Summer OL would likely be replaced by
26 (1) demand-side management (DSM) and energy conservation, (2) power purchased from other
27 electricity providers, (3) generating alternatives other than V.C. Summer, or (4) some
28 combination of these options. This replacement power would produce additional environmental
29 impacts as discussed in Section 8.2 of this report.

30 • Land Use

31
32
33 Temporary changes in onsite land use could occur during decommissioning. Temporary
34 changes may include addition or expansion of staging and laydown areas or construction of
35 temporary buildings and parking areas. No offsite land-use changes are expected as a
36 result of decommissioning. Following decommissioning, the V.C. Summer site would likely
37 be retained by SCE&G for other corporate purposes. Eventual sale or transfer of land
38 occupied by V.C. Summer, however, could result in changes to land use. Notwithstanding
39 this possibility, the impacts of the no-action alternative on land use are considered SMALL.

40

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comment
Land Use	SMALL	Onsite impacts expected to be temporary. No offsite impacts expected.
Ecology	SMALL	Impacts to ecology are expected to be temporary and largely mitigatable using best management practices.
Water Use and Quality	SMALL	Water use will decrease. Water quality unlikely to be adversely affected unless onsite disposal of demolition debris is utilized.
Air Quality	SMALL	Greatest impact is likely to be from fugitive dust; Impact can be mitigated by good management practices.
Waste	SMALL	Low-level radioactive waste will be disposed of in licensed facilities. A permanent disposal facility for high-level waste is not currently available.
Human Health	SMALL	Radiological doses to workers and members of the public are expected to be within regulatory limits and comparable to, or lower than, doses from operating plants. Occupational injuries are possible, but injury rates at nuclear power plants are below the U.S. average industrial rate.
Socioeconomics	SMALL to LARGE	Decrease in employment in Fairfield County and surrounding counties and tax revenues in Fairfield County.
Aesthetics	SMALL	Positive impact from eventual removal of buildings and structures. Some noise impact during decommissioning operations.
Historic and Archaeological Resources	SMALL	Minimal impact on land used during plant operations. Land occupied by V.C. Summer would likely be retained by SCE&G for other corporate purposes.
Environmental Justice	SMALL to MODERATE	Some loss of employment opportunities and social programs is expected.

• **Ecology**

At V.C. Summer, impacts on aquatic ecology could result from removal or the filling of the intake structures discharge canal. Impacts to aquatic ecology would likely be short-term and could be mitigated. The aquatic environment is expected to recover naturally. Impacts on terrestrial ecology could occur as a result of land disturbance for additional laydown yards, stockpiles, and support facilities. Land disturbance is expected to be minimal and to result in relatively short-term impacts that can be mitigated using best management

Alternatives

practices (dust suppression and erosion control). The land is expected to recover naturally. Overall, the ecological impacts associated with decommissioning are considered SMALL.

• Water Use and Quality

Cessation of plant operations would result in a reduction in water use because reactor cooling will no longer be required. As plant staff size decreases, the demand for potable water is expected to also decrease. Overall, water use and quality impacts of decommissioning are considered SMALL.

• Air Quality

Decommissioning activities that can adversely affect air quality include dismantlement of systems and equipment, demolition of buildings and structures, and the operation of internal combustion engines. The most likely adverse impact would be the generation of fugitive dust. Best management practices, such as seeding and wetting, could be used to minimize the generation of fugitive dust. Overall, air quality impacts associated with decommissioning activities are considered SMALL.

• Waste

Decommissioning activities would result in the generation of radioactive and nonradioactive waste. The volume of low-level radioactive waste (LLW) could vary greatly depending on the type and size of the plant, the decommissioning option chosen, and the waste treatment and volume reduction procedures used. LLW must be disposed of in a facility licensed by NRC or a state with authority delegated by NRC. Recent advances in volume reduction and waste processing have significantly reduced waste volumes.

A permanent repository for high-level waste is not currently available. The NRC has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in its spent fuel pool or at either onsite or offsite independent spent fuel storage installations [10 CFR 51.23(a)]. Overall, waste impacts associated with decommissioning activities are considered SMALL.

• Human Health

Radiological doses to occupational workers during decommissioning activities are estimated to average approximately 5 percent of the dose limits in 10 CFR Part 20, and to be similar

to, or lower than, the doses experienced by workers in operating nuclear power plants. Collective doses to members of the public and to the maximally exposed individual as a result of decommissioning activities are estimated to be well below the limits in 10 CFR Part 20, and to be similar to, or lower than, the doses received from operating nuclear power plants. Occupational injuries to workers engaged in decommissioning activities are possible. However, historical injury and fatality rates at nuclear power plants have been lower than the average U.S. industrial rates. Overall, the human health impacts associated with decommissioning activities are considered SMALL.

• **Socioeconomics**

If V.C. Summer ceased operation at the end of its current OL, there would be a decrease in employment and tax revenues associated with the closure. Employment (primary and secondary) impacts and impacts on population would occur over a wide area. Employees working at V.C. Summer reside in a number of South Carolina counties; however, approximately 96 percent of employees live in Fairfield, Lexington, Newberry, and Richland Counties (SCE&G 2002). The no-action alternative would result in the loss of plant payrolls 20 years earlier than if the OL were renewed.

Tax-related impacts would occur in Fairfield County and, to a much lesser extent, to other surrounding counties. Property tax payments made by SCE&G to Fairfield County for V.C. Summer constitute about 41 percent to 50 percent of the county's total property tax revenues (SCE&G 2002). The no-action alternative would result in the loss of the taxes attributable to V.C. Summer. There could also be an adverse impact on housing values and the local nearby economy if V.C. Summer were to cease operations.

Both Chapter 7 of the GEIS and Supplement 1 to NUREG-0586 (NRC 2002) note that socioeconomic impacts would be expected as a result of the decision to close a nuclear power plant, and that the direction and extent of the overall impacts would depend on the state of the economy, the net change in workforce at the plant, and the changes in local government tax receipts. The socioeconomic impacts of decommissioning activities themselves are expected to be SMALL. Appendix J of Supplement 1 to NUREG-0586 (NRC 2002) shows that the overall socioeconomic impact of plant closure plus decommissioning could be greater than SMALL.

The staff has concluded that when the property tax revenue from a nuclear power plant comprises over 20 percent of the tax revenue of a local jurisdiction, the socioeconomic impacts associated with the loss of the plant's tax revenue as a result of plant closure is considered LARGE. The property taxes that SCE&G pays for V.C. Summer comprises

Alternatives

more than 40 percent of total revenue of Fairfield County; consequently, the socioeconomic impacts resulting from loss of this revenue are considered **LARGE**.

SCE&G employees working at V.C. Summer currently contribute time and money toward community involvement, including school, churches, charities, and other civic activities. It is likely that, with a reduced presence in the community following decommissioning, community involvement efforts by SCE&G and its employees in the region would be less.

- **Aesthetics**

Decommissioning would result in the eventual dismantlement of buildings and structures at the site resulting in a positive aesthetic impact. Noise would be generated during decommissioning operations that might be detectable offsite; however, the impact is unlikely to be of moderate or large significance. Overall, the aesthetic impacts associated with decommissioning are considered **SMALL**.

- **Historic and Archaeological Resources**

The amount of undisturbed land needed to support the decommissioning process will be relatively small. Activities conducted within operational areas are not expected to have a detectable effect on important cultural resources because these areas have been impacted during the operating life of the plant. Minimal disturbance of land outside the licensee's operational area for decommissioning activities is expected. Historic and archaeological resources on undisturbed portions of the site are not expected to be adversely affected. Following decommissioning, the site would likely be retained by SCE&G for other corporate purposes. Eventual sale or transfer of the site, however, could result in adverse impacts to cultural resources if the land-use pattern changes dramatically. Notwithstanding this possibility, the impacts of the no-action alternative on historic and archaeological resources are considered **SMALL**.

- **Environmental Justice**

Current operations at V.C. Summer have no disproportionate impacts on the minority and low-income populations of Fairfield County and surrounding counties. It is evident from staff research and consultations with local officials that Fairfield and Newberry Counties have benefitted from V.C. Summer in ways that contra-act and mitigate negative socioeconomic trends. Closure of V.C. Summer would result in decreased employment opportunities and tax revenues in Fairfield County and surrounding counties, with possible negative and

disproportionate impacts on minority or low-income populations. Therefore, because V.C. Summer is located at the expanding boundary of the Columbia Metro Area with many employment opportunities, the environmental justice impacts under the no-action alternative are considered SMALL to MODERATE.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by V.C. Summer, assuming that the OL is not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- coal-fired power generation at the V.C. Summer site and at an alternate South Carolina/greenfield site^(a) (Section 8.2.1),
- natural gas-fired power generation at the V.C. Summer site and at an alternate South Carolina/greenfield site (Section 8.2.2), and
- nuclear power generation at the V.C. Summer site and at an alternate South Carolina/greenfield site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at V.C. Summer is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for V.C. Summer are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year the Energy Information Administration (EIA), a component of the U.S. Department of Energy, issues an Annual Energy Outlook. The latest report, *Annual Energy Outlook 2002*, was issued in December 2001 (DOE/EIA 2001a). In this report, EIA projects that combined-cycle^(b) or combustion turbine technology fueled by natural gas is likely to account for approximately 88 percent of new electric generating capacity between the years 2000 and 2020. Both technologies are designed primarily to supply peak and intermediate capacity, but combined-

(a) A greenfield site is assumed to be an undeveloped site with no previous construction.

(b) In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

Alternatives

1 cycle technology can also be used to meet baseload^(a) requirements. Coal-fired plants are
2 projected by EIA to account for approximately 9 percent of new capacity during this period.
3 Coal-fired plants are generally used to meet baseload requirements. Renewable energy
4 sources, primarily wind, geothermal, and municipal solid waste units, are projected by EIA to
5 account for the remaining 3 percent of capacity additions. EIA's projections are based on the
6 assumption that providers of new generating capacity will seek to minimize cost while meeting
7 applicable environmental requirements. Combined-cycle plants are projected by EIA to have
8 the lowest generation cost in 2005 and 2020, followed by coal-fired plants and then wind
9 generation (DOE/EIA 2001a).

10
11 EIA projects that oil-fired plants will account for very little of new generation capacity in the
12 United States during the 2000 to 2020 time period because of higher fuel costs and lower
13 efficiencies (DOE/EIA 2001a).

14
15 EIA also projects that new nuclear power plants will not account for any new generation
16 capacity in the United States during the 2000 to 2020 time period because natural gas and
17 coal-fired plants are projected to be more economical (DOE/EIA 2001a). In spite of this
18 projection, a new nuclear plant alternative for replacing power generated by V.C. Summer is
19 considered in Section 8.2.3. Since 1997, the NRC has certified three new standard designs for
20 nuclear power plants under the procedures in 10 CFR Part 52 Subpart B. These designs are
21 the U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the System 80+
22 Design (10 CFR Part 52, Appendix B), and the AP600 Design (10 CFR Part 52, Appendix C).
23 The submission to the NRC of these three applications for certification indicates continuing
24 interest in the possibility of licensing new nuclear power plants. In addition, the staff expects to
25 receive up to three early site permit applications under 10 CFR Part 52 Subpart A in 2003,
26 further indicating continued interest in building and operating nuclear power facilities. NRC has
27 established a New Reactor Licensing Project Office to prepare for and manage future reactor
28 and site licensing applications (NRC 2001).

29
30 V.C. Summer has a maximum net electrical output of 966 MW(e). For the coal and natural gas
31 alternatives, SCE&G assumes two standard units in its Environmental Report (ER)
32 (SCE&G 2002), each a maximum 408-MW(e) net electrical output. This approach is followed in
33 this SEIS, although it results in some environmental impacts that are roughly 16 percent lower
34 than if full replacement capacity were constructed. Although customized unit sizes can be built,
35 use of standardized sizes is more economical. In addition, using three 408-MW(e) units for the

(a) A baseload plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for baseload generation; i.e., these units generally run near full load.

analysis would overestimate environmental impacts and tend to make the fossil alternatives less attractive.

For purposes of analysis, SCE&G identified Cope Station near Bamberg, South Carolina, as the location for the coal-fired alternative (SCE&G 2002). Cope Station is the site of a new state-of-the-art coal-fired unit. Similarly, for purposes of analysis, SCE&G identified the V.C. Summer site as the location for the gas-fired alternative. This SEIS has been prepared taking account of these preferred and potential sites, but the analyses were not limited to these particular sites.

8.2.1 Coal-Fired Power Generation

The coal-fired alternative is analyzed for both V.C. Summer and an alternate site in South Carolina. As discussed in Section 8.2, the staff assumed construction of two 408-MW(e) units. Co-location with an existing coal-fired unit would preclude the need to construct additional transmission lines and other facilities needed to support coal-fired units.

Coal and lime or limestone for a coal-fired plant sited at V.C. Summer most likely would be delivered via the existing rail line. Lime^(a) or limestone is used in the scrubbing process for control of sulfur dioxide (SO₂) emissions. Rail delivery also would be the most likely option for delivering coal and lime/limestone to an alternative site for the coal-fired plant. A coal slurry pipeline is also a technically feasible delivery option; however, the associated cost and environmental impacts make a slurry pipeline an unlikely transportation alternative. Construction at an alternative site could necessitate the construction of a new transmission line to connect to existing lines and a rail spur to the plant.

The coal-fired plant would consume approximately 2.4 million MT (2.60 million tons) per year of pulverized bituminous coal with an ash content of approximately 8.8 percent (SCE&G 2002). SCE&G assumes a heat rate of 3.0 J of fuel /J of electricity (10,200 Btu/kWh) and a capacity factor^(b) of 0.85 in its ER (SCE&G 2002). After combustion, 99.9 percent of the ash (approximately 209,000 MT/yr [230,000 tons/yr]) would be collected and disposed of at the plant site. In addition, approximately 154,000 MT (170,000 tons) of scrubber sludge would be disposed of at the plant site based on annual lime usage of approximately 86,000 MT (95,000 tons).

-
- (a) In a typical wet scrubber, lime (calcium hydroxide) or limestone (calcium carbonate) is injected as a slurry into the hot effluent combustion gases to remove entrained sulfur dioxide. The lime-based scrubbing solution reacts with sulfur dioxide to form calcium sulfite which precipitates and is removed in sludge form.
 - (b) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Alternatives

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the SCE&G ER (SCE&G 2002). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

8.2.1.1 Once-Through Cooling System

For purposes of this SEIS, the staff assumed that a coal-fired plant located at V.C. Summer would use the existing once-through cooling system. The staff also assumed that a greenfield site would use a once-through cooling system. In Section 8.2.1.2 of this SEIS, the staff discusses the environmental impact differences between closed-cycle and once-through cooling systems.

The overall impacts of the coal-fired generating system are discussed in the following sections and summarized in Table 8-2. The extent of impacts at an alternate South Carolina/greenfield site would depend on the location of the particular site selected.

- **Land Use**

The V.C. Summer site is approximately 909 ha (2245 ac). Construction of the power block and coal storage area would impact some land area and associated terrestrial habitat. The existing facilities and infrastructure at V.C. Summer would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the coal-fired replacement plant alternative would use the cooling system, switchyard, offices, rail spur, and transmission line rights-of-way.

The coal-fired generation alternative would necessitate converting some of the unused land at V.C. Summer to coal storage and ash scrubber sludge disposal. SCE&G estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 85 ha (210 ac) (SCE&G 2002). There is sufficient space at V.C. Summer to accommodate the coal-fired plant (about 560 ha [1390 ac] based on estimates in the GEIS [NRC 1996]) and the waste disposal area. After closure, the waste site would be re-vegetated and the land would become available for other uses. Additional land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be affected for mining the coal and disposing of the waste to support a 1000-MW(e) coal plant during its operational life (NRC 1996). Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for V.C. Summer.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	Use of existing infrastructure. Uses about 560 ha (1390 ac) for plant, waste disposal of coal ash and scrubber sludge over 40-year plant life. Additional offsite land impacts for coal and limestone mining.	SMALL to LARGE	Uses approximately 860 ha (1390 ac), for plant, offices, parking and waste disposal; additional land impacts for coal and limestone mining; possible impacts for transmission line and rail spur. Degree of impact dependent on whether alternative site is disturbed: SMALL to MODERATE impact to previously developed site; LARGE impact to greenfield site.
Ecology	SMALL to MODERATE	Uses mainly previously disturbed areas at current V.C. Summer site, plus rail corridor. However, some additional areas at the site will be affected.	SMALL to LARGE	Impact depends whether site is previously developed (SMALL to MODERATE) or greenfield (MODERATE to LARGE). Factors to consider include location and ecology of site, surface water body used for intake and discharge, and transmission line and/or rail spur route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality	SMALL	Once-through cooling would use existing intake structures; surface water use should remain the same as current uses for V.C. Summer.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Groundwater Use and Quality	SMALL	Groundwater not used, remaining the same as currently for V.C. Summer.	SMALL	Groundwater use similar to impacts at V.C. Summer; impacts depend on groundwater use and availability.

Alternatives

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Air Quality	MODERATE	Sulfur oxides • 5669 MT/yr (6249 tons/yr) Nitrogen oxides • 582 MT/yr (642 tons/yr) Particulates • 102 MT/yr (113 tons/yr) of total suspended particulates which would include 24 MT/yr (26 tons/yr) of PM ₁₀ . Carbon monoxide • 582 MT/yr (642 tons/yr) Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials—mainly uranium and thorium.	MODERATE	Potentially same impacts as the V.C. Summer site, although pollution-control standards may vary.
Waste	MODERATE	Total waste volume would be approximately 363,000 MT/yr (400,000 tons/yr) of ash and scrubber sludge requiring approximately 85 ha (210 ac) for disposal during the 40-year life of the plant.	MODERATE	Air Quality
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.	SMALL	

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to LARGE	<p>During construction, impacts would be SMALL to MODERATE. Up to 2500 additional workers during the peak period of the 5-year construction period, followed by reduction from current V.C. Summer work force of 740 to 70. Tax base preserved. Impacts during operation would be SMALL to MODERATE.</p> <p>Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts during operation would be SMALL due to decreased work force.</p> <p>For rail transportation of coal and lime/limestone, the impact is considered SMALL to MODERATE.</p>	SMALL to LARGE	<p>Construction impacts depend on location, but could be LARGE if plant is located in a rural area. Fairfield County would experience loss of tax base and employment with potentially LARGE impacts. Impacts during operation at alternative site would be SMALL to LARGE, depending upon the economy at the alternate site.</p> <p>Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts during operation would be SMALL.</p> <p>For rail transportation of coal and lime/limestone, the impact is considered SMALL to MODERATE. For barge transportation, the impact is considered SMALL.</p>
Aesthetics	SMALL to MODERATE	<p>Two coal-fired power plant units and exhaust stack would be visible in daylight hours from offsite. Outside lighting at the plant would also be visible at night. Rail transportation of coal and lime/limestone would also have a MODERATE impact. Mechanical sources of noise would be audible offsite. These impacts are SMALL to MODERATE.</p>	SMALL to LARGE	<p>Impact would depend on the site selected and the surrounding land features and could be LARGE if a greenfield site is selected. If needed, a new transmission line or rail spur would add to aesthetic impact. Rail transportation of coal and lime/limestone would be SMALL to MODERATE, depending on the characteristics of the alternative site.</p>

Alternatives

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Historic and Archeological Resources	SMALL to MODERATE	Some construction would affect previously developed parts of V.C. Summer; cultural resource inventory should minimize any impacts on undeveloped lands. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources even at a developed site.	SMALL to MODERATE	Alternate location would necessitate cultural resource studies. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 600 operating jobs (permanent and contractor) at V.C. Summer could reduce employment prospects for minority and low-income populations. Dependent, to some extent, on the economic growth of Columbia and surrounding area.	SMALL to LARGE	Impacts at alternate site will vary depending on population distribution and makeup. Could be SMALL to LARGE. Fairfield County would lose significant revenue, which could have MODERATE to LARGE impacts on minority and low-income populations in terms of services the County could provide with the smaller property tax and employment base.

The GEIS states that approximately 405 ha (1000 ac) would be affected for mining the uranium and processing it during the operating life of a 1000-MW(e) nuclear power plant (NRC 1996).

The impact of a coal-fired generating unit on land use at V.C. Summer is best characterized as SMALL to MODERATE. The impact would definitely be greater than the OL renewal alternative.

In the GEIS, the staff estimated that a 1000-MW(e) coal-fired plant would require approximately 700 ha (1700 ac) (NRC 1996). Construction of a 816-MW(e) coal-fired

generation alternative at an alternative site could impact proportionately less land (about 560 ha [1390 ac]). The degree to which the land use would be impacted depends on whether the alternative site is a greenfield site or a previously developed industrial site (such as Cope Station). Additional land could be needed for a transmission line and a rail spur to the plant site. Depending on transmission line and rail line routing requirements, this alternative would result in SMALL to LARGE land-use impacts.

- Ecology

Locating a coal-fired plant at V.C. Summer would alter ecological resources because of the need to convert approximately 85 ha (210 ac) (SCE&G 2002) for ash and scrubber sludge disposal. In addition, construction of the power block and coal storage area would impact about 475 ha (1190 ac) and associated habitat. Some of this area would have been previously disturbed. Operation of the coal-fired plant would use the existing cooling system, which would have adverse impacts to aquatic resources. In summary, because the coal-fired alternative is developed on a mainly previously disturbed area, is at an existing industrial site, and makes maximum use of existing facilities, it is expected that the ecological impacts would be SMALL to MODERATE, but still greater than renewal of the V.C. Summer OL.

At an alternate site, the coal-fired generation alternative would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Once-through cooling water withdrawal and discharge could have adverse aquatic resource impacts. If needed, construction and maintenance of the transmission line and a rail spur would have ecological impacts. Overall, the ecological impacts at an alternate site would be SMALL to MODERATE (previously developed site) or MODERATE to LARGE (greenfield site).

- Water Use and Quality

Surface water. The coal-fired generation alternative at V.C. Summer is assumed to use the existing once-through system, which would minimize incremental water-use and quality impacts. Thus surface-water impacts are expected to remain SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

For a coal-fired plant located at an alternate site, the impact on the surface water would depend on the volume of water needed for make-up water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface

Alternatives

body of water would be regulated by the State of South Carolina. The impacts would be SMALL to MODERATE.

Groundwater. The staff assumed that the two groundwater removal wells would continue to be used to alleviate water seepage into the below-grade portions of coal-fired plant buildings located at V.C. Summer. Groundwater withdrawals would be equal to or less than the no-action and license renewal alternatives. Hence, impacts are considered SMALL. Use of groundwater for a coal-fired plant located at an alternative site is a possibility. Groundwater withdrawals at an alternative site would likely require a permit from the State of South Carolina. The impacts are considered SMALL.

• Air Quality

The air-quality impacts of coal-fired generation vary considerably from those of nuclear generation due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

V.C. Summer is located within the Columbia Intrastate Air Quality Control Region (40 CFR 81.108). The air quality in this region is designated as better than national standards, in attainment, or unclassified for all criteria pollutants, in 40 CFR 81.341. However, on August 23, 2002, the South Carolina Department of Health and Environmental Control (SCDHEC) published a "Notice of Drafting" in the State Register for an Early Action Plan for measures to attain the 8-hour standard prior to any non-attainment designation. The State intends to implement control measures in anticipation of future U.S. Environmental Protection Agency (EPA) actions.

A new coal-fired generating plant located in V.C. Summer would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60 Subpart Da. The standards establish limits for particulate matter and opacity (40 CFR 60.42a), SO₂ (40 CFR 60.43a), and NO_x (40 CFR 60.44a).

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51 Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. The air quality in this region is designated as better than national standards, in attainment, or unclassified for all criteria pollutants, in 40 CFR 81.341.

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from human-made air pollution. EPA issued a new regional haze rule on July 1, 1999, cited in the *Federal Register* (FR) as 64 FR 35714 (EPA 1999). The rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a coal-fired plant were located close to a mandatory Class I Federal area, additional air pollution control requirements could be imposed.

South Carolina has only one area (Cape Romaine Wildlife Area) designated in 40 CFR 81.426 as a mandatory Class I Federal area in which visibility is an important value. This Class I Federal area is not within 80 km (50 mi) of V.C. Summer.

In 1998, the EPA issued a rule requiring 22 eastern states, including South Carolina, to revise their state implementation plans to reduce NO_x emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone. The total amount of NO_x that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 to September 30) is set out at 40 CFR 51.121(e). For South Carolina, the amount is 111,656 MT (123,105 tons). Any new coal-fired plant sited in South Carolina would be subject to this limitation.

Impacts for particular pollutants are as follows:

Sulfur oxides emissions. SCE&G states in its ER that an alternative coal-fired plant located at Cope Station would use dry scrubber-calcium hydroxide for flue gas desulfurization (SCE&G 2002).

A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of SO₂ and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO₂ emissions and imposes controls on SO₂ emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO₂ that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO₂ emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchase or reduce SO₂ emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net

Alternatives

1 regional SO₂ emissions, although it might do so locally. Regardless, SO₂ emissions
2 would be greater for the coal alternative than the OL renewal alternative.

3
4 SCE&G estimates that by using the best technology to minimize SO_x emissions, the
5 total annual stack emissions would be approximately 5669 MT (6249 tons) of SO_x
6 (SCE&G 2002).

7
8 Nitrogen oxides emissions. Section 407 of the Clean Air Act establishes technology-based
9 emission limitations for NO_x emissions. The market-based allowance system used for SO₂
10 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to
11 the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This
12 regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge
13 of any gases that contain nitrogen oxides (expressed as NO₂) in excess of 200 ng/J of
14 gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

15
16 SCE&G estimates that by using NO_x burners with overfire air and selective catalytic
17 reduction the total annual NO_x emissions for a new coal-fired power plant would be
18 approximately 582 MT (642 tons) (SCE&G 2002). This level of NO_x emissions would be
19 greater than the OL renewal alternative.

20
21 Particulate emissions. SCE&G estimates that the total annual stack emissions would
22 include 102 MT (113 tons) of filterable total suspended particulates (particulates that range
23 in size from less than 0.1 µm up to approximately 45 µm). The 102 MT (113 tons) would
24 include 24 MT (26 tons) of PM₁₀ (particulate matter having an aerodynamic diameter less
25 than or equal to 10 µm). Fabric filters or electrostatic precipitators would be used for
26 control. In addition, coal-handling equipment would introduce fugitive particulate emissions.
27 Particulate emissions would be greater under the coal alternative than the OL renewal
28 alternative.

29
30 During the construction of a coal-fired plant, fugitive dust would be generated. In addition,
31 exhaust emissions would come from vehicles and motorized equipment used during the
32 construction process.

33
34 Carbon monoxide emissions. SCE&G estimates that the total carbon monoxide emissions
35 would be approximately 582 MT (642 tons) per year (SCE&G 2002). This level of emissions
36 is greater than the OL renewal alternative.

37
38 Hazardous air pollutants including mercury. In December 2000, EPA issued regulatory
39 findings on emissions of hazardous air pollutants from electric utility steam generating units
40 (65 FR 79825 [EPA 2000a]). The EPA determined that coal- and oil-fired electric utility

steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000a). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000a). Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the Clean Air Act for which emission standards for hazardous air pollutants will be issued (EPA 2000a).

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant released roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Summary. The GEIS analysis did not quantify emissions from coal-fired power plants, but implied that air-quality impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts (NRC 1996). Adverse human health effects such as cancer and emphysema have been associated with the products of coal combustion. The appropriate characterization of air impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Siting a coal-fired generation plant at a site other than V.C. Summer would not significantly change the air-quality impacts identified in this section, although it could result in installing more or less stringent pollution-control equipment to meet applicable local requirements. Therefore, the impacts would be MODERATE.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates spent selective catalytic reduction catalyst, additional ash, and scrubber sludge. Two 408-MW(e) coal-fired plants would generate approximately 363,000 MT

Alternatives

(400,000 tons) of this waste annually for 40 years. The waste would be disposed of onsite, accounting for approximately 85 ha (210 ac) of land area over the 40-year plant life. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would also be generated during construction activities.

In May 2000, the EPA issued a Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels (EPA 2000b). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 percent to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (4) EPA identified gaps in state oversight of coal combustion wastes. Accordingly, the EPA announced its intention to issue regulations for disposal of coal combustion waste under subtitle D of the Resource Conservation and Recovery Act of 1976 (RCRA) (42 USC 6901).

For these reasons, the appropriate characterization of impacts from waste generated from burning coal is MODERATE; the impacts would be clearly noticeable, but would not destabilize any important resource.

Siting the facility at a site other than V.C. Summer would not alter waste generation, although other sites might have more constraints on disposal locations. Therefore, the impacts would be MODERATE.

• Human Health

Coal-fired power generation introduces worker risks from fuel and limestone mining and worker and public risks from fuel and lime/limestone transportation and inhalation of stack-emissions. Emission impacts can be widespread and health risks difficult to quantify. The coal alternative also introduces the risk of coal pile fires and attendant inhalation risks.

The staff stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but did not identify the significance

of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As previously discussed, the EPA has recently concluded that certain segments of the United States population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal are characterized as SMALL.

- **Socioeconomics**

Construction and operation. Construction of the coal-fired alternative would take approximately five years. The staff assumed that construction would take place while V.C. Summer continues operation and would be completed by the time V.C. Summer permanently ceases operations. The work force would be expected to vary between 1200 and 2500 workers during the five-year construction period (NRC 1996). These workers would be in addition to the approximately 740 workers employed at V.C. Summer. During construction of the new coal-fired plant, communities near V.C. Summer would experience demands on housing and public services that could have SMALL to MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from outside the immediate area of the site, including Columbia, South Carolina. After construction, the communities would be impacted by the loss of the construction jobs.

If the coal-fired replacement plant were constructed at V.C. Summer and the nuclear unit were decommissioned, there would be a loss of approximately 670 permanent and contract employees, as SCE&G estimates that the completed coal-fired plant would employ approximately 70 workers (SCE&G 2002). There would be a commensurate reduction in demand on socioeconomic resources and contribution to the regional economy. The coal-fired plants would provide a new tax base to offset the loss of tax base associated with decommissioning of the nuclear unit. For all of these reasons, the appropriate characterization of nontransportation socioeconomic impacts for a coal-fired plant constructed at V.C. Summer would be SMALL to MODERATE; the socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area. The impacts could be mitigated by the site's proximity to the Columbia metropolitan area and might be additionally

Alternatives

1 offset if economic growth in Columbia and surrounding areas continued as it has during the
2 last decade.

3
4 Construction of a replacement coal-fired power plant at an alternate site would relocate
5 some socioeconomic impacts, but would not eliminate them. Fairfield County would
6 experience the brunt of V.C. Summer operational job loss and would lose a significant tax
7 base. These losses could have potentially LARGE socioeconomic impacts to the County,
8 particularly over the short to intermediate term (from 5 to 10 years following plant closure),
9 Communities around the new site would have to absorb the impacts of a large, temporary
10 work force (up to 2500 workers at the peak of construction) and a permanent work force of
11 approximately 70 workers. The staff stated in the GEIS that socioeconomic impacts at a
12 rural site would be larger than at an urban site because more of the peak construction work
13 force would need to move to the area to work. Alternative sites would need to be analyzed
14 on a case-by-case basis. Socioeconomic impacts at or near an urban, previously
15 developed industrial area would be SMALL. Socioeconomic impacts at a rural site would be
16 MODERATE to LARGE, depending on the relative location of the site to towns and cities
17 that might be able to accommodate such impacts.

18
19 Transportation. During the five-year construction period of replacement coal-fired units, up
20 to 2500 construction workers would be working at the site in addition to the 740 workers at
21 V.C. Summer. The addition of these workers could place significant traffic loads on existing
22 highways near V.C. Summer. Such impacts would be MODERATE to LARGE.

23
24 For transportation related to commuting of plant operating personnel, the impacts are
25 considered SMALL. The maximum number of plant operating personnel would be
26 approximately 70. The current V.C. Summer work force is approximately 740. Therefore,
27 traffic impacts associated with plant personnel commuting to a coal-fired plant would be
28 expected to be SMALL compared to the current impacts from V.C. Summer operations.

29
30 Coal and lime/limestone would likely be delivered to V.C. Summer by trains. Each train
31 would have approximately 115 open-top rail cars, each holding about 90 MT (100 tons) of
32 coal. Additional cars would be needed for lime/limestone delivery. In all, approximately
33 224 trains per year would deliver the coal and lime/limestone for the two units. An average
34 of roughly nine train trips per week would be needed to transport the coal and
35 lime/limestone. For each full train delivery, an empty train would return. On several days
36 per week, there would be two to three trains per day using the rail spur to V.C. Summer.
37 Socioeconomic impacts associated with rail transportation, such as delays at rail crossings,
38 would likely be SMALL to MODERATE.

Transportation-related impacts associated with commuting construction workers at an alternate site are site dependent, but could be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would also be site dependent, but can be characterized as SMALL due to a smaller work force.

At an alternate site, coal and lime/limestone delivery would likely be by rail, although barge delivery would be feasible at a coastal location. Impacts of rail transportation would be SMALL in a rural area and MODERATE in a more crowded suburban area. Barge delivery of coal and lime/limestone would likely have SMALL socioeconomic impacts.

- **Aesthetics**

The two coal-fired power plant units would be visible in daylight hours from offsite. The exhaust stack would be about 160 m (525 ft) high. The stack would be visible for several miles in every direction during daylight hours. The units and associated stacks would also be visible at night because of outside lighting. Visual impacts could be mitigated by landscaping and color selection for buildings that are consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding or directional lighting.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime delivery, use of outside loudspeakers, and the commuting of plant employees. The incremental noise impacts of a coal-fired plant compared to existing V.C. Summer operations are considered to be SMALL to MODERATE.

At an alternate site, there would be an aesthetic impact from the buildings and exhaust stacks. This impact could be LARGE if a greenfield site is used. There would also be an aesthetic impact if construction of a new transmission line and/or rail spur were needed. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. In a more suburban location, the impacts are considered MODERATE. This is due to the frequency of train transport, the fact that many people are likely to be within hearing distance of the rail route, and the impacts of noise on residents in the vicinity of the facility and the rail line. At a more rural location, the impacts could be SMALL. Noise and light from the plant would be detectable offsite. Overall, the

Alternatives

aesthetic impacts associated with locating at an alternative site can be categorized as SMALL to LARGE, depending on the characteristics of the alternative site.

• Historic and Archaeological Resources

At the V.C. Summer site or an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the V.C. Summer site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts need to be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, impacts would vary between SMALL to MODERATE, depending on what historic and archaeological resources are present, and whether mitigation is necessary.

• Environmental Justice

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the V.C. Summer site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations to the extent housing frequented by these populations could come into increased demand. Closure of V.C. Summer would result in a decrease in employment of approximately 600 permanent and contract employees at the site. Resulting economic conditions could reduce employment prospects for minority or low-income populations. Overall, impacts would be SMALL to MODERATE, and may be mitigated by the economic vitality/expansion of the Columbia metropolitan and surrounding area.

Impacts at other sites would depend upon the site chosen and the nearby population distribution. If a replacement coal-fired plant were constructed at an alternative site, Fairfield County would experience a loss of tax revenue that could affect their ability to provide services and programs. Fairfield County and surrounding counties would also lose

670 jobs. These impacts would be MODERATE to LARGE. Impacts at the alternative site would vary between SMALL and LARGE, depending on population makeup and distribution and the economy.

8.2.1.2 Closed-Cycle Cooling System

This section discusses the environmental impacts of constructing a coal-fired generation system at an alternate location site using a closed-cycle cooling system with cooling towers. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a coal-fired plant using the once-through cooling system. However, there are some environmental impact differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

8.2.2 Natural Gas-Fired Power Generation

The environmental impacts of the natural gas-fired alternative are examined in this section for both the V.C. Summer site and an alternate site. For the V.C. Summer site, the staff assumed that the plant would use the existing once-through cooling system.

V.C. Summer is not served by natural gas pipelines. A dedicated, 0.6-m- (2-ft-) diameter pipeline would have to be constructed to V.C. Summer from Aiken, South Carolina, a distance of about 113 km (70 mi). The pipeline right-of-way would require 298 ha (737 ac).^(a)

The staff assumed that a replacement natural gas-fired plant would use combined-cycle technology (SCE&G 2002). In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

If a new natural gas-fired plant were built at an alternate site from V.C. Summer, a new transmission line may be needed to connect to existing lines. In addition, construction or upgrade of a natural gas pipeline from the plant to a supply point where an adequate and reliable supply of gas would be available also may be required.

The following additional assumptions are made for the natural gas-fired plants (SCE&G 2002):

- two 408-MW(e) net electrical units would be needed, each consisting of a 135-MW combustion turbine and a 138-MW heat recovery boiler,

(a) Calculated as follows: 70 mi x 100 ft easement = 298 ha or 737 ac.

Alternatives

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Site with Closed-Cycle Cooling System

Impact Category	Change in Impacts from Closed-Cycle Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial biota from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.
Socioeconomics	No change.
Aesthetics	Introduction of cooling towers and associated plume. Natural draft towers could be up to 158 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high and also have an associated noise impact.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

- natural gas with an average heating value of 37 MJ/m³ (1037 Btu/ft³) will be the primary fuel, and
- natural gas consumption will be 1.4 billion m³/yr (50 billion ft³/yr).

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.2 are from the SCE&G ER (SCE&G 2002). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only

20 years, the impact of operating the natural gas-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a natural gas-fired plant).

8.2.2.1 Once-Through Cooling System

The overall impacts of the natural gas-generating system are discussed in the following sections and summarized in Table 8-4. The extent of impacts at an alternate site will depend on the location of the particular site selected.

Table 8-4. Summary of Environmental Impacts of Natural Gas-Fired Generation at V.C. Summer and an Alternate Greenfield Site Using Once-Through Cooling

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	45 ha (110 ac) of previously disturbed land needed for plant site. Additional impact of up to approximately 295 ha (729 ac) for construction of an underground gas pipeline. Maximum use of existing infrastructure at the site.	SMALL to LARGE	SMALL if infrastructure is in place, 45 ha (110 ac) for powerblock, offices, roads, and parking areas. MODERATE if additional land needed for transmission line and/or natural gas pipeline. LARGE if greenfield site and transmission lines required.
Ecology	SMALL to LARGE	Uses some undeveloped areas at V.C. Summer site, plus gas pipeline.	SMALL to LARGE	Impact depends on greenfield or previously developed site. Also impact depends on biota of the site, surface water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality	SMALL	Uses existing once-through cooling system.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body.
Groundwater Use and Quality	SMALL	Groundwater not used, remaining the same as currently for V.C. Summer.	SMALL	Groundwater use similar to impacts at V.C. Summer; impacts depend on groundwater use and availability.

Alternatives

Table 8-4. Summary of Environmental Impacts of Natural Gas-Fired Generation at V.C. Summer and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Air Quality	MODERATE	Sulfur oxides • 80 MT/yr (88 tons/yr) Nitrogen oxides • 301 MT/yr (332 tons/yr) Carbon monoxide • 395 MT/yr (435 tons/yr) PM ₁₀ particulates • 118 MT/yr (130 tons/yr) Some hazardous air pollutants. Small amount of ash produced.	MODERATE	Same emissions as V.C. Summer site.
Waste	SMALL	Small amount of ash produced.	SMALL	Small amount of ash produced.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE. Up to 1200 additional workers during the peak of the three-year construction period, followed by reduction from current V.C. Summer work force of 740 to 150; tax base preserved. Impacts during operation would be SMALL to MODERATE, due to loss of employment in Fairfield County and surrounding counties, which may be offset by proximity to Columbia economy. Transportation impacts associated with construction workers would be SMALL to MODERATE.	SMALL to LARGE	Impact depends on site characteristics. During construction, impacts on receiving county could be SMALL to MODERATE. Up to 1200 additional workers during the peak of the three-year construction period. Fairfield County would experience loss of V.C. Summer tax base. Fairfield County and surrounding counties would experience loss of employment with potentially MODERATE to LARGE associated impacts. Transportation impacts associated with construction workers would be SMALL to LARGE.
Aesthetics	SMALL	Some visibility of structures offsite.	SMALL to LARGE	Impact would depend on the site selected and the surrounding land features. SMALL if previously developed site and site disturbance minimal. MODERATE to LARGE if a greenfield site is selected.

Table 8-4. Summary of Environmental Impacts of Natural Gas-Fired Generation at V.C. Summer and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Historic and Archeological Resources	SMALL to MODERATE	Some construction would affect previously developed parts of V.C. Summer; cultural resource inventory should minimize any impacts on undeveloped lands. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources even at a developed site. Any potential impacts can likely be effectively managed.	SMALL to MODERATE	Alternate location would necessitate cultural resource studies. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 590 operating jobs at V.C. Summer could reduce employment prospects for minority and low-income populations. Proximity to Columbia may mitigate impacts.	SMALL to LARGE	Impacts at alternate site vary depending on population distribution and makeup at site could be SMALL to LARGE. Fairfield County would lose significant revenue, which could have MODERATE to LARGE impacts on minority and low-income populations. Proximity to Columbia may mitigate impacts.

• Land Use

For siting at V.C. Summer, existing facilities and infrastructure would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the natural gas-fired replacement plant alternative would use the once-through cooling system, switchyard, offices, and transmission line right(s)-of-way. Much of the land that would be used has been previously disturbed. In the GEIS, staff estimated that 45 ha (110 ac) are needed for a natural gas-fired plant site (NRC 1996). At V.C. Summer, this much previously disturbed land is available within the boundaries of the plant site (SCE&G 2002). There would be an additional impact of up to approximately 295 ha (729 ac) for construction of a natural gas pipeline to the V.C. Summer site (SCE&G 2002). SCE&G states that it would apply best management practices during

Alternatives

1 construction of the pipeline such as minimizing soil loss and constructing the pipeline along
2 existing utility corridors, if possible (SCE&G 2002). Land-use impacts at V.C. Summer
3 would be SMALL to MODERATE and depend on the extent to which ecological damage
4 could be minimized in the construction of the natural gas pipeline.

5
6 For construction at an alternate site, the staff assumed that 45 ha (110 ac) would be needed
7 for the plant and associated infrastructure (NRC 1996). A previously developed site with
8 substantial infrastructure in place (e.g., gas line and transmission line), would be
9 characterized as having SMALL impacts. For any new natural gas plant, additional land
10 could be impacted for construction of a transmission line and/or natural gas pipeline to
11 serve the plant, in which case the impacts could be MODERATE. Land use impacts at a
12 greenfield site could be considered LARGE.

13
14 Offsite of V.C. Summer or alternative site, additional land would be required for natural gas
15 wells and collection stations. NRC staff estimated in the GEIS that approximately 1500 ha
16 (3600 ac) would be needed for a 1000-MW(e) plant. A replacement gas-fired plant for
17 V.C. Summer would be 816 MW(e) and would affect proportionately less land. Partially
18 offsetting these offsite land requirements would be the elimination of the need for mining the
19 uranium and processing it during the operating life of a 1000-MW(e) nuclear power plant.
20 The staff estimated in the GEIS (NRC 1996) that approximately 400 ha (1000 ac) would be
21 affected for mining the uranium and processing it during the operating life of a 1000-MW(e)
22 nuclear power plant. Because the two assumed replacement units for V.C. Summer would
23 generate 408 MW(e) each, the land needed for gas wells and collection stations (and the
24 land not needed for nuclear fuel) would be proportionately lower. Overall, land-use impacts
25 would be MODERATE to LARGE.

26 • Ecology

27
28
29 At the V.C. Summer site, there would be ecological, land-related impacts for siting of the
30 gas-fired plant; however the impacts would be SMALL considering the smaller footprint of
31 the new facility (compared to the existing nuclear facilities) and the fact that the land at the
32 site is previously disturbed. There would be ecological impacts associated with bringing a
33 new gas pipeline to V.C. Summer. Impacts would include losses of less mobile animals
34 such as mice, which are common throughout the area. Aquatic impacts could include
35 habitat disturbance at stream crossings, removal of shading vegetation, and erosion and
36 sedimentation. Habitat of State- or Federal-listed mussel species might be affected. Noise
37 and movement from workers would also disturb wildlife. SCE&G expects the impacts to be
38 minor and temporary (SCE&G 2002). Overall, the ecological impacts are considered
39 SMALL to LARGE.
40

Ecological impacts at an alternate site would depend on the nature of the land converted for the plant and the possible need for a new transmission line and/or gas pipeline. At a greenfield site, construction of a transmission line and a gas pipeline to serve the plant could be expected to have ecological impacts. Whether these impacts are temporary or permanent and the extent to which ecological resources are impacted is highly dependent on the location of the alternative site. Ecological impacts resulting from plant siting and utility easements could include impacts on threatened or endangered species. There could be wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Once-through cooling water withdrawal and discharge could have aquatic resource impacts. Aquatic impacts could include habitat disturbance at stream crossings, removal of shading vegetation, and erosion and sedimentation. Habitat of State- or Federal-listed mussel species might be affected. Hence, at a greenfield site the ecological impacts are expected to be MODERATE to LARGE. If the alternative site selected already has been developed, then the terrestrial ecological impacts would be SMALL if the required infrastructure is already in place. Aquatic impacts would be SMALL to MODERATE, depending on the site location and aquatic habitats affected. Overall, the ecological impacts at an alternative site are considered SMALL to LARGE, depending on the characteristics of the site selected.

• Water Use and Quality

Surface water. The gas-fired plant sited at V.C. Summer is assumed to use the existing once-through cooling system. Each of the gas-fired units would include a heat-recovery boiler from which steam would turn an electric generator. Steam would be condensed and circulated back to the boiler for reuse. Overall, water use and quality impacts at V.C. Summer are considered SMALL as operation impacts are minimized by use of the existing intake/discharge system. Water quality impacts from sedimentation during construction of a natural gas-fired plant is characterized by the staff in the GEIS as SMALL (NRC 1996). The staff also notes that operational water quality impacts would be similar to, or less than, those from other generating technologies.

For alternative sites, the impacts on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State of South Carolina. Water use and quality impacts at an alternative site are considered SMALL to MODERATE, depending on the characteristics of the alternative site.

Groundwater. The staff assumed that the two groundwater removal wells would continue to be used to alleviate water seepage into the below-grade portions of buildings located at V.C. Summer. Groundwater withdrawals would be equal to the no-action and license

Alternatives

renewal alternatives. Hence, impacts are considered SMALL. Use of groundwater for a natural gas-fired plant located at an alternative site is a possibility. Groundwater withdrawals at an alternative site would likely require a permit from the State of South Carolina. For alternate greenfield sites, the impact to groundwater would depend on the site characteristics, including the amount of groundwater available. Overall, the impacts are considered SMALL.

• Air Quality

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative. Hence, it would be subject to the same air quality regulations as a coal-fired plant.

A new gas-fired generating plant located at V.C. Summer would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. A new combined-cycle natural gas power plant would also be subject to the new source performance standards for such units at 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO₂, and NO_x. Obtaining air permits for construction of a combined-cycle plant would potentially require emission offsets from other generating facilities.

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from human-made air pollution. EPA has various regulatory requirements for visibility protection in 40 CFR Part 51 Subpart P, including a specific requirement for review of any new major stationary source in an area designated attainment or unclassified under the Clean Air Act. EPA issued a new regional haze rule in 1999 (64 FR 35714; July 1, 1999 [EPA 1999]). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a natural gas-fired plant were located close to a mandatory Class I Federal area, additional air pollution control requirements could be imposed. South Carolina has only one area (Cape Romaine Wildlife Area) designated in 40 CFR 81.426 as a mandatory Class I Federal area in which visibility is an important value. This Class I Federal area is not within 80 km (50 mi) of V.C. Summer.

In 1998, the EPA issued a rule requiring 22 eastern states, including South Carolina, to revise their state implementation plans to reduce NO_x emissions. Nitrogen oxide emissions

contribute to violations of the national ambient air quality standard for ozone. The total amount of NO_x that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 to September 30) is set out at 40 CFR 51.121(e). For South Carolina, the amount is 111,656 MT (123,105 tons).

SCE&G projects the following emissions for the natural gas-fired alternative (SCE&G 2002):

Sulfur oxides - 80 MT/yr (88 tons/yr)
 Nitrogen oxides - 301 MT/yr (332 tons/yr)
 Carbon monoxide - 395 MT/yr (435 tons/yr)
 PM₁₀ particulates - 118 MT/yr (130 tons/yr)

A natural gas-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). Natural gas-fired power plants were found by the EPA to emit arsenic, formaldehyde, and nickel (EPA 2000a). Unlike coal and oil-fired plants, the EPA did not determine that emissions of hazardous air pollutants from natural gas-fired power plants should be regulated under Section 112 of the Clean Air Act.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. These would be similar to the coal-fired alternative, but smaller due to the smaller construction work force.

The preceding emissions would likely be the same at V.C. Summer or at an alternate site. Impacts from the above emissions would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural gas-generating plant sited at V.C. Summer or at an alternate site is considered MODERATE.

- **Waste**

There will be small amounts of solid-waste products (i.e., ash) from burning natural gas. In the GEIS, the staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation at a gas-fired plant would be largely limited to typical office wastes. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be

Alternatives

generated during construction activities. Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at V.C. Summer or at an alternate site.

In the winter it may become necessary for a replacement baseload natural-gas fired plant to operate on fuel oil due to lack of gas supply. Oil combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. The amount of ash and sludge generated would depend on the type and quantity of fuel oil combusted, Number 2 fuel oil doesn't produce any appreciable ash, while the heavier Number 6 fuel oil does. Overall, the waste impacts associated with fuel oil combustion at a combined-cycle plant are expected to be SMALL because the amount of oil combusted is expected to be relatively small. When natural gas is available, fuel oil is generally not price competitive with gas.

- **Human Health**

In the GEIS, the staff identified cancer and emphysema as potential health risks from gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. NO_x emissions from a gas-fired plant in South Carolina would be regulated by SCDHEC. Human health effects are not expected to be detectable or would be sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural gas-fired alternative sited at V.C. Summer or at an alternate site are considered SMALL.

- **Socioeconomics**

Construction and Operation. Construction of a natural gas-fired plant would take approximately three years. Peak employment would be approximately 1200 workers (NRC 1996). The staff assumed that construction would take place while V.C. Summer continues operation and would be completed by the time it permanently ceases operations. During construction, the communities surrounding the V.C. Summer site would experience demands on housing and public services that could have SMALL to MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from cities such as Columbia. After construction, the communities would be impacted by the loss of jobs. The current V.C. Summer work force (740 permanent and contract workers) would decline through a decommissioning period to a minimal maintenance size. Approximately 150 workers would be needed to operate the natural gas-fired plant (a loss of about 590 jobs). The new natural gas-fired plant partially would replace the nuclear tax base in Fairfield and surrounding counties. The impacts could be SMALL to MODERATE and may be moderated by Fairfield County's proximity to Columbia.

Siting at an alternative site would result in the loss of the V.C. Summer tax base and associated employment in Fairfield and surrounding counties with potentially MODERATE to LARGE socioeconomic impacts. Socioeconomic impacts from locating the facilities at an alternative site would depend on the characteristics of the site. Impacts of construction could range between SMALL to MODERATE. Impacts during plant operation would be SMALL (smaller work force), and the tax impacts could be SMALL to LARGE, depending on the relative proportion of taxes paid by the plant to total county taxes. In the GEIS (NRC 1996), the staff concluded that socioeconomic impacts from constructing a natural gas-fired plant would not be very noticeable and that the small operational work force would have the lowest socioeconomic impacts of any nonrenewable technology. Compared to the coal-fired and nuclear alternatives, socioeconomic impacts would be mitigated by the smaller construction work force, the shorter construction time frame, and the smaller operations work force.

Overall socioeconomic impacts resulting from construction of a natural gas-fired plant at V.C. Summer would be SMALL to MODERATE, and may be offset by the continued growth of the economy in the Columbia and surrounding area. For construction at an alternate site, socioeconomic impacts would be SMALL to LARGE, depending on the characteristics of the alternative site.

Transportation. Transportation impacts associated with construction and operating personnel commuting to the V.C. Summer site would be SMALL to MODERATE. The impacts can be classified as SMALL to LARGE for siting at an alternative site and would be dependent on the characteristics of the alternative site, including transportation infrastructure.

- **Aesthetics**

The turbine buildings and exhaust stacks would be visible during daylight hours from offsite creating incremental visual impacts to those from existing V.C. Summer facilities. The gas pipeline compressors would also be visible. Noise and light from the plant would be detectable offsite. At V.C. Summer, these impacts would result in a SMALL aesthetic impact.

At an alternate site, the buildings and stacks could be visible offsite. Aesthetic impacts could be mitigated if the plant were located in an industrial area adjacent to other power plants or industrial facilities. Overall, the aesthetic impacts associated with an alternate site are categorized as SMALL. The impacts would be greater if a new transmission line is needed and could be considered MODERATE. The impacts could be LARGE if a greenfield site is developed.

Alternatives

• Historic and Archaeological

At both V.C. Summer and an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at V.C. Summer or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, or other rights-of-way). Historic and archaeological resource impacts need to be evaluated on a site-specific basis. The impacts can generally be effectively managed, and as such, impacts would vary between SMALL to MODERATE, depending on what historic and archaeological resources are present, and whether mitigation is necessary.

• Environmental Justice

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural gas-fired plant were built at the V.C. Summer site. Some impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations. Closure of V.C. Summer would result in a decrease in employment of approximately 590 permanent and contract operating employees. Resulting economic conditions could reduce employment prospects for minority or low-income populations in Fairfield County. The impacts could be offset by projected economic growth and the ability of affected workers to commute to other jobs in Columbia or eastern Fairfield County. Overall, impacts are expected to be SMALL to MODERATE.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution. Minority and low-income populations at the alternative site could benefit from the plant's relocation through improved job prospects and the increased tax base that could enable more services to be provided. These impacts could be SMALL to LARGE. However, if a replacement natural gas-fired plant were constructed at an alternative site, Fairfield County would experience a significant loss of property tax revenue, as well as jobs, which would affect the County's ability to provide services and

1 programs. Impacts to minority and low-income populations in Fairfield County could be
2 MODERATE to LARGE, again potentially offset by other economic growth in the area
3 not related to V.C. Summer.

4 5 **8.2.2.2 Closed-Cycle Cooling System**

6
7 This section discusses the environmental impacts of constructing a natural gas-fired generation
8 system at an alternate location using closed-cycle cooling. The impacts (SMALL, MODERATE,
9 or LARGE) of this option are the same as the impacts for a natural gas-fired plant using the
10 once-through system. However, there are minor environmental impact differences between the
11 closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental
12 differences.

13 14 **8.2.3 Nuclear Power Generation**

15
16 Since 1997, the NRC has certified three new standard designs for nuclear power plants under
17 10 CFR Part 52 Subpart B. These designs are the 1300-MW U.S. Advanced Boiling Water
18 Reactor (10 CFR Part 52 Appendix A), the 1300-MW System 80+ Design (10 CFR Part 52
19 Appendix B), and the 600-MW AP600 Design (10 CFR Part 52 Appendix C). All of these plants
20 are light-water reactors. Although no applications for a construction permit or a combined
21 license based on these certified designs have been submitted to NRC, the submission of the
22 design certification applications indicates continuing interest in the possibility of licensing new
23 nuclear power plants. In addition, recent escalation in prices of natural gas and electricity have
24 made new nuclear power plant construction more attractive from a cost standpoint.
25 Consequently, construction of a new nuclear power plant at the V.C. Summer site using the
26 existing once-through cooling system and at an alternate site, using both closed- and open-
27 cycle cooling, are considered in this section. The staff assumed that the new nuclear plant
28 would have a 40-year lifetime.

29
30 NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3
31 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would
32 be associated with a replacement nuclear power plant built to one of the certified designs, sited
33 at V.C. Summer or an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e)
34 reactor and would need to be adjusted to reflect replacement of V.C. Summer, which has a
35 capacity of 966 MW(e). The environmental impacts associated with transporting fuel and waste
36 to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of
37 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear
38 power plants in Table B-1 of 10 CFR Part 51 Subpart A, Appendix B, is also relevant, although
39 not directly applicable, for consideration of environmental impacts associated with the operation
40 of a replacement nuclear power plant. Additional environmental impact information for a

Alternatives

Table 8-5. Summary of Environmental Impacts of Natural Gas-Fired Generation at an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Closed-Cycle Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial biota from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated. Decrease water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.
Socioeconomics	No change.
Aesthetics	Introduction of cooling towers and associated plume. Possible noise impact from operation of cooling towers.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

replacement nuclear power plant using once-through cooling is presented in Section 8.2.3.1 and using closed-cycle cooling in Section 8.2.3.2.

8.2.3.1 Once-Through Cooling System

The overall impacts of the nuclear generating system are discussed in the following sections. The impacts are summarized in Table 8-6. The extent of impacts at an alternate site will depend on the location of the particular site selected.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling

		V.C. Summer Site		Alternate Greenfield Site	
Impact Category		Impact	Comments	Impact	Comments
Land Use		MODERATE	Requires approximately 200 ha (500 ac) for the plant.	MODERATE to LARGE	Requires approximately 200 ha (500 ac) for the plant. Possible additional land if a new transmission line needed.
Ecology		SMALL to MODERATE	Uses undeveloped areas at current V.C. Summer site. Potential habitat loss and fragmentation, and reduced productivity and biological diversity.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality		SMALL	Uses existing once-through cooling system.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Groundwater Use and Quality		SMALL	Groundwater not used, remaining the same as currently for V.C. Summer.	SMALL	Groundwater use similar to impacts at V.C. Summer; impacts depend on groundwater use and availability.
Air Quality		SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as V.C. Summer site.
Waste		SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as V.C. Summer site.
Human Health		SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	Same impacts as V.C. Summer site

Alternatives

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to LARGE	During construction, impacts would be SMALL to MODERATE. Up to 2500 workers during peak period of the five-year construction period. Operating work force assumed to be similar to V.C. Summer, base preserved. Impacts during operation would be SMALL. Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel would be SMALL.	SMALL to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Fairfield County would experience loss of tax base and employment, potentially offset by economic growth of Columbia area. Operation impacts at an alternate site would be SMALL to MODERATE. Transportation impacts of construction workers could be MODERATE to LARGE. Transportation impacts of commuting plant personnel could be SMALL to MODERATE.
Aesthetics	SMALL	No exhaust stacks or cooling towers would be needed. Daytime visual impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	SMALL to LARGE	Impact would depend on the site selected and the surrounding land features. SMALL if previously developed site or adjacent to existing industrial area. LARGE if a greenfield site is selected. New transmission lines would add to the impact and would be MODERATE depending on the alternate site's characteristics.
Historic and Archeological Resources	SMALL to MODERATE	Some construction would affect previously developed parts of V.C. Summer; cultural resource inventory should minimize any impacts on undeveloped lands. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources even at a developed site.	SMALL to MODERATE	Alternate location would necessitate cultural resource studies. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the V.C. Summer Site and an Alternate Greenfield Site Using Once-Through Cooling (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction.	SMALL to LARGE	Impacts will vary depending on population distribution and makeup at the site. Impacts to minority and low-income residents of Fairfield County associated with closure of V.C. Summer - MODERATE to LARGE. Impacts to receiving county is site-specific and could range from SMALL to LARGE.

• **Land Use**

The existing facilities and infrastructure at the V.C. Summer site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing once-through cooling system, switchyard, offices, and transmission line right-of-way. Much of the land that would be used has been previously disturbed. A replacement nuclear power plant at the V.C. Summer site would alter approximately 200 ha (500 ac) of land, which likely would be previously disturbed. V.C. Summer would continue to operate as the new nuclear power facilities are being constructed.

There would be no net change in land needed for uranium mining because land needed for the new nuclear plant would offset land needed to supply uranium for fuel for the existing V.C. Summer reactor

The impact of a replacement nuclear generating plant on land use at the existing V.C. Summer site is best characterized as MODERATE. The impact would be greater than the OL renewal alternative.

Land-use requirements at an alternative site would be approximately 200 ha (500 ac) plus the possible need for a new transmission line (NRC 1996). In addition, it might be necessary to construct a rail spur to an alternative site to deliver equipment during construction. Depending on new transmission line routing, siting a new nuclear plant at an alternative site could result in MODERATE to LARGE land-use impacts, and probably would be LARGE for a previously undisturbed greenfield site.

Alternatives

• Ecology

Locating a replacement nuclear power plant at the V.C. Summer site would alter ecological resources because of the need to convert roughly 200 ha (500 ac) of land to industrial use. Potential habitat loss and fragmentation and reduced productivity and biological diversity could result. Most of this land, however, has been previously disturbed. Siting at V.C. Summer would have a SMALL to MODERATE ecological impact that would be greater than renewal of the V.C. Summer OL.

At an alternate site, there would be construction impacts and new incremental operational impacts. The impacts would be greatest at an alternate greenfield site. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Once-through cooling water withdrawal and discharge could have adverse aquatic resource impacts. If needed, construction and maintenance of the transmission line would have ecological impacts. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE.

• Water Use and Quality

Surface water. The staff assumed that a replacement nuclear power plant at V.C. Summer would use the existing once-through cooling system, which would minimize incremental water-use and quality impacts. Surface-water impacts are expected to remain SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

For alternate sites, the impact on the surface water would depend on the volume of water needed for makeup water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State of South Carolina. The impacts would be SMALL to MODERATE.

Groundwater. No groundwater is currently used for operation of V.C. Summer. Two groundwater removal wells may be used to alleviate water seepage into the below-grade portions of the new nuclear plant buildings located at V.C. Summer. It is unlikely that groundwater would be used for an alternative nuclear power plant sited at V.C. Summer. The impacts are considered SMALL.

A nuclear power plant sited at an alternate site may use groundwater. Groundwater withdrawal at an alternative site would likely require a permit. The impacts would depend on availability and how water is withdrawn, but overall are considered SMALL.

- **Air Quality**

Construction of a new nuclear plant sited at V.C. Summer or an alternate site would result in fugitive emissions during the construction. Exhaust emissions would also come from vehicles and motorized equipment used during the construction. An operating nuclear plant would have minor air emissions associated with diesel generators. Emissions would be regulated by the SCDHEC. Overall, emissions and associated impacts are considered SMALL.

- **Waste**

The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts are considered SMALL.

Siting the replacement nuclear power plant at a site other than V.C. Summer would not alter waste generation. Therefore, the impacts would be SMALL.

- **Human Health**

Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts are considered SMALL.

Siting the replacement nuclear power plant at a site other than V.C. Summer would not alter human health impacts. Therefore, the impacts would be SMALL.

- **Socioeconomics**

Construction and Operation. The construction period and the peak work force associated with new nuclear power plant construction are currently unquantified (NRC 1996). In the absence of quantified data, a construction period of five years and a peak work force of 2500 is assumed. The staff assumed that construction would take place while the existing nuclear unit continues operation and would be completed by the time V.C. Summer permanently ceases operations. During construction, the communities surrounding the

Alternatives

1 V.C. Summer site would experience demands on housing and public services that could
2 have SMALL to MODERATE impacts. These impacts would be tempered by construction
3 workers commuting to the site from outside Fairfield County. After construction, the
4 communities would be impacted by the loss of the construction jobs.

5
6 The replacement nuclear unit is assumed to have an operating work force comparable to
7 the 740 permanent and contract workers currently working at V.C. Summer. The
8 replacement nuclear unit would provide a new tax base to offset the loss of tax base
9 associated with decommissioning of V.C. Summer. For all of these reasons, the
10 appropriate characterization of nontransportation socioeconomic impacts for replacement
11 nuclear units constructed at V.C. Summer would be SMALL to MODERATE; the
12 socioeconomic impacts would be noticeable, but would be unlikely to destabilize the area.

13
14 Socioeconomic impacts at alternate sites would need to be analyzed on a case-by-case
15 basis. In the GEIS (NRC 1996), the staff noted that socioeconomic impacts at a rural site
16 would be larger than at an urban site because more of the peak construction work force
17 would need to move to the area to work. Construction of a replacement nuclear power plant
18 at an alternate site would relocate some socioeconomic impacts, but would not eliminate
19 them. The communities around the V.C. Summer site would still experience the impact of
20 operational job loss and loss of tax base, and the communities around the new site would
21 have to absorb the impacts of a large, temporary work force (up to 2500 workers at the
22 peak of construction) and a permanent work force of approximately 740 workers. For
23 Fairfield County, the socioeconomic impacts could be LARGE. The impacts to the county at
24 the alternate location could be SMALL to LARGE depending on the degree of economic
25 development, the proportion of the county's property tax base represented by the new plant,
26 etc.

27
28 Transportation. During the five-year construction period, up to 2500 construction workers
29 would be working at the V.C. Summer site in addition to the 740 workers already employed
30 there. The addition of the construction workers could place significant traffic loads on
31 existing highways, particularly those leading to the V.C. Summer site. Such impacts would
32 be MODERATE to LARGE. Transportation impacts related to commuting of plant operating
33 personnel would be similar to current impacts associated with operation of V.C. Summer
34 and are considered SMALL.

35
36 Transportation-related impacts associated with commuting construction workers at an
37 alternate site are site dependent, but could be MODERATE to LARGE. Transportation
38 impacts related to commuting of plant operating personnel would also be site
39 dependent, but can be characterized as SMALL to MODERATE.

1 • **Aesthetics**

2
3 The containment buildings for a replacement nuclear power plant sited at V.C. Summer and
4 other associated buildings would likely be visible in daylight hours primarily from the
5 Monticello Reservoir along SC 215. Visual impacts could be mitigated by landscaping and
6 selecting a color for buildings that is consistent with the environment. The replacement
7 nuclear units would also likely be visible at night because of outside lighting. Visual impact
8 at night could be mitigated by reduced use of lighting and appropriate use of shielding. No
9 exhaust stacks would be needed.

10
11 Noise from operation of a replacement nuclear plant potentially could be heard offsite under
12 calm wind conditions or when the wind is blowing in the direction of the listener. Mitigation,
13 such as reduced or no use of outside loudspeakers, can be employed to reduce noise levels
14 and maintain the impact of noise to SMALL.

15
16 At an alternate site, there would be an aesthetic impact from the buildings. There would
17 also be a significant aesthetic impact if a new transmission line is needed. Noise and light
18 from the plant would be detectable offsite. The impact of noise and light would be mitigated
19 if the plant is located in an industrial area adjacent to other power plants, or industrial
20 facilities, in which case the impact is SMALL. The impact could be MODERATE if a
21 transmission line needs to be built to the alternative site. The impacts could be LARGE if a
22 greenfield site is selected.

23
24 • **Historic and Archaeological Resources**

25
26 At both V.C. Summer and an alternate site, a cultural resource inventory would likely be
27 needed for any onsite property that has not been previously surveyed. Other lands, if any,
28 that are acquired to support the plant would also likely need an inventory of field cultural
29 resources, identification and recording of existing historic and archaeological resources, and
30 possible mitigation of adverse effects from subsequent ground-disturbing actions related to
31 physical expansion of the plant site.

32
33 Before construction at V.C. Summer or another site, studies would likely be needed to
34 identify, evaluate, and address mitigation of the potential impacts of new plant construction
35 on cultural resources. The studies would likely be needed for all areas of potential
36 disturbance at the proposed plant site and along associated corridors where new
37 construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-
38 way). Historic and archaeological resource impacts need to be evaluated on a site-specific
39 basis. The impacts can generally be effectively managed, and as such, impacts would vary

Alternatives

between SMALL to MODERATE, depending on what historic and archaeologic resources are present, and whether mitigation is necessary.

• Environmental Justice

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at the V.C. Summer site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations. However, this is expected to be mitigated by V.C. Summer's proximity to Columbia. After completion of construction, it is possible that the local government's ability to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for the minority and low-income populations. However, Fairfield County's economic health should be improved as the tax base of the older nuclear unit is replaced by the new, higher-valued (i.e., less depreciated) plant. Hence, the ability of the County to provide social services should improve because of the higher tax base, assuming assessment rates remain stable. Overall, impacts are expected to be SMALL.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution. If a replacement nuclear plant were constructed at an alternate site, Fairfield County would experience a significant loss of property tax revenue, which could affect the county's ability to provide services and programs. Impacts to minority and low-income populations in Fairfield County could be MODERATE to LARGE but potentially offset by economic growth in Columbia. Impacts to the receiving county could be SMALL to LARGE and depend on the relative increase to the tax base resulting from the new plant's construction.

8.2.3.2 Closed-Cycle Cooling System

This section discusses the environmental impacts of constructing a nuclear power plant at an alternate location site using closed-cycle cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a nuclear power plant using the once-through system. However, there are environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant at an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Closed-Cycle Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial ecology from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation.
Groundwater Use and Quality	No change.
Air Quality	No change.
Waste	No change.
Human Health	No change.
Socioeconomics	No change.
Aesthetics	Introduction of cooling towers and associated plume. Natural draft towers could be up to 158 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high and also have an associated noise impact.
Historic and Archaeological Resources	No change.
Environmental Justice	No change.

Alternatives

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the V.C. Summer OL. SCE&G stated that power did not need to be purchased from out-of-state importers (SCE&G 2002).

Imported power from Canada or Mexico is unlikely to be available for replacement of V.C. Summer capacity. In Canada, 62 percent of the country's electrical generation capacity is derived from renewable energy sources, principally hydropower (DOE/EIA 2002). Canada has plans to continue developing hydroelectric power, but the plans generally do not include large-scale projects (DOE/EIA 2002). Canada's nuclear generation is projected to increase by 1.7 percent by 2020, but its share of power generation in Canada is projected to decrease from 14 percent currently to 13 percent by 2020 (DOE/EIA 2001b). EIA projects that total gross United States imports of electricity from Canada and Mexico will gradually increase from 46.5 billion kWh in year 2000 to 68.7 billion kWh in year 2005 and then gradually decrease to 28.6 billion kWh in year 2020 (DOE/EIA 2002). Consequently, it is unlikely that electricity imported from Canada or Mexico would be able to replace V.C. Summer capacity.

If power to replace V.C. Summer capacity were to be purchased from sources within the United States or a foreign country, the generating technology would likely be one of those described in this SEIS and in the GEIS (probably coal, natural gas, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the purchased electrical power alternative to renewal of the V.C. Summer OL. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or another country.

8.2.5 Other Alternatives

Other generation technologies considered by NRC are discussed in the following paragraphs.

8.2.5.1 Oil-Fired Generation

EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States during the 2000 to 2020 period because of higher fuel costs and lower efficiencies (DOE/EIA 2001a). Oil-fired operation is more expensive than nuclear or coal-fired operation. Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. In Section 8.3.11 of the GEIS, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 50 ha (120 ac). Additionally,

operation of oil-fired plants would have environmental impacts (such as impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

8.2.5.2 Wind Power

Most of South Carolina is in a wind power Class 1 region (average wind speeds at 10-m [30-ft] elevation of 0 to 4.4 m/s [9.8 mph]). Class 1 has the lowest potential for wind energy generation (DOE 2001a). Wind turbines are economical in wind power Classes 4 through 7 (average wind speeds of 5.6 to 9.4 m/s [12.5 to 21.1 mph] [DOE 2001a]). Consequently, the staff concludes that locating a wind-energy facility on or near the V.C. Summer site would not be economically feasible given the current state of wind energy generation technology.

8.2.5.3 Solar Power

Solar technologies use the sun's energy and light to provide heating and cooling, light, hot water, and electricity for homes, businesses, and industry. Solar power technologies, photovoltaic and thermal, currently cannot compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent (NRC 1996). Energy storage requirements limit the use of solar-energy systems as baseload electricity supply.

There are substantial impacts to natural resources (wildlife habitat, land use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high—14,000 ha (35,000 ac) per 1000 MW(e) for photovoltaic and approximately 5700 ha (14,000 ac) per 1000 MW(e) for solar thermal systems. Neither type of solar electric system would fit at the V.C. Summer site, and both would have large environmental impacts at a greenfield site.

The V.C. Summer site receives approximately 4 to 5 kWh of solar radiation per square meter per day, compared to 7 to 8 kWh of solar radiation per square meter per day in areas of the western United States, such as California, which are most promising for solar technologies (DOE/EIA 2000a). Because of the natural resource impacts (land and ecological), the area's relatively low rate of solar radiation, and high cost, solar power is not deemed a feasible baseload alternative to renewal of the V.C. Summer OL. Some solar power may substitute for electric power in rooftop and building applications. Implementation of non-rooftop solar generation on a scale large enough to replace V.C. Summer would likely result in LARGE environmental impacts.

Alternatives

8.2.5.4 Hydropower

South Carolina has an estimated 480 MW of undeveloped hydroelectric resources (INEEL 1997). This amount is less than the amount needed to replace the 966-MW(e) capacity of V.C. Summer. As stated in Section 8.3.4 of the GEIS, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern about flooding, destruction of natural habitat, and alteration of natural river courses.

In the GEIS (NRC 1996), the staff estimated that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac) per 1000 MW(e). Replacement of V.C. Summer generating capacity would require flooding nearly this amount of land. Due to the relatively low amount of undeveloped hydropower resource in South Carolina and the large land use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace V.C. Summer, the staff concludes that local hydropower is not a feasible alternative to V.C. Summer OL renewal on its own. Any attempts to site hydroelectric facilities large enough to replace V.C. Summer would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal technology is not widely used as baseload generation due to the limited geographical availability of the resource and immature status of the technology (NRC 1996). As illustrated by Figure 8.4 in the GEIS, geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. There is no feasible eastern location for geothermal capacity to serve as an alternative to renewal of the V.C. Summer OL. The staff concludes that geothermal energy is not a feasible alternative to renewal of the V.C. Summer OL.

8.2.5.6 Wood Waste

A wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 percent to 80 percent and with 20 percent to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Like coal-fired

plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Fairfield County is roughly 177,414 ha (438,400 ac) and developed or urban land comprises just two percent of the County. The largest land use category is forest, accounting for 87 percent of the total acreage. This includes public, commercial, and noncommercial forests, as well as farm woodlands. Timber harvesting is a major agricultural sector in Fairfield County where the 1999 delivered value of timber was \$32.2 million, placing the county third out of 46 in the state. The Clemson Agricultural Extension Service in Winnsboro estimates that tree harvesting has increased considerably during the past 20 years while the labor needed has decreased considerably.

However, due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to renewing the V.C. Summer OL.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate the waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2001). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001c). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Growth in the municipal waste combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive waste disposal alternative such as landfills; (2) the 1994 Supreme Court decision (*C&A Carbone, Inc. v. Town of Clarkstown*), which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that might have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (DOE/EIA 2002).

Alternatives

1 Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash
2 residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the
3 unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small
4 particles that rise from the furnace during the combustion process. Fly ash is generally
5 removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001b).
6

7 Currently there are approximately 102 waste-to-energy plants operating in the United States.
8 These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e)
9 per plant (Integrated Waste Services Association 2001). The staff concludes that generating
10 electricity from municipal solid waste would not be a feasible alternative to replace the
11 966 MW(e) of V.C. Summer and, consequently, would not be a feasible alternative to renewal
12 of the V.C. Summer OL.
13

14 8.2.5.8 Other Biomass-Derived Fuels

15
16 In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling
17 electric generators, including burning crops, converting crops to a liquid fuel such as ethanol,
18 and gasifying crops (including wood waste). In the GEIS, the staff states that none of these
19 technologies has progressed to the point of being competitive on a large scale or of being
20 reliable enough to replace a baseload plant such as V.C. Summer. For these reasons, such
21 fuels do not offer a feasible alternative to renewal of the V.C. Summer OL.
22

23 8.2.5.9 Fuel Cells

24
25 Fuel cells work without combustion and its environmental side effects. Power is produced
26 electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and
27 separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide.
28 Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam
29 under pressure. Phosphoric acid fuel cells are generally considered first-generation
30 technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity
31 and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give
32 the second-generation fuel cells the capability to generate steam for cogeneration and
33 combined-cycle operations.
34

35 The U.S. Department of Energy projects that two second-generation fuel cell technologies
36 using molten carbonate and solid oxide technology, respectively, will be commercially available
37 in sizes up to 2 MW at a cost of \$1000 to \$1500 per kW of installed capacity (DOE 2001b). For
38 comparison, the installed capacity cost for a natural gas-fired combined-cycle plant is on the
39 order of \$500 to \$600 per kW (NWPPC 2000). As market acceptance and manufacturing
40 capacity increase, natural-gas-fueled fuel cell plants in the 50- to 100-MW range are projected

to become available (DOE 2001b). Presently, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Fuels cells are, consequently, not a feasible alternative to renewal of the V.C. Summer OL.

8.2.5.10 Delayed Retirement

SCE&G has no current plans to retire any existing generating units. For this reason, delayed retirement of other SCE&G generating units would not be a feasible alternative to renewal of the V.C. Summer OL.

8.2.5.11 Utility-Sponsored Conservation

SCE&G has developed residential, commercial, and industrial programs to reduce both the peak demands and daily energy consumption. These programs are commonly referred to as DSM. SCE&G currently operates the following DSM programs: standby generator program, interruptible service program, and real time pricing (SCE&G 2002). SCE&G stated that DSM programs and activities have been scaling back and that the trend is expected to continue (SCE&G 2002). However, SCE&G will continue their DSM.

Historic and projected reduction in generation needs as a result of DSM programs have been credited in SCE&G's planning to meet projected customer demand. Because these DSM savings are a part of the long-range plan for meeting projected demand, they are not available offsets for V.C. Summer. Therefore, the conservation option is not considered a reasonable replacement for the OL renewal alternatives.

8.2.6 Combination of Alternatives

Although individual alternatives to renewing the V.C. Summer OL might not be sufficient on their own to replace the capacity of this unit due to the small size or cost, it is conceivable that a combination of alternatives might be cost-effective.

As discussed in Section 8.2, V.C. Summer has a net electrical rating of 966 MW(e). For the coal and natural gas alternatives, SCE&G assumes in its ER two standard 408-MW(e) units as potential replacements for V.C. Summer (SCE&G 2002). This approach is followed in this SEIS, although it results in some environmental impacts that are roughly 16 percent lower than if full replacement capacity were constructed.

There are many possible combinations of alternatives to replace that power. Table 8-8 contains a summary of the environmental impacts of an assumed combination of alternatives consisting

Alternatives

Table 8-8. Summary of Environmental Impacts for an Assumed Combination of Generating and Acquisition Alternatives

		V.C. Summer Site	Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	Nine ha (23 ac) for powerblock, offices, roads, and parking areas. Additional impact of up to approximately 295 ha (729 ac) for construction of an underground gas pipeline.	SMALL to LARGE	23 ha (34 ac) for powerblock, offices, roads, and parking areas. Additional impact for construction and/or upgrade of an underground gas pipeline and transmission lines.
Ecology	SMALL to LARGE	Uses some undeveloped areas at current V.C. Summer site, plus land for a new gas pipeline.	SMALL to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity. Greenfield site increases impact.
Water Use and Quality	SMALL	Uses existing once-through cooling system.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body.
Groundwater Use and Quality	SMALL	Groundwater not used, remaining the same as currently for V.C. Summer.	SMALL	Groundwater use similar to impacts at V.C. Summer; impacts depend on groundwater use and availability.
Air Quality	MODERATE	<u>Natural Gas-Fired Units</u> Some hazardous air pollutants Sulfur oxides • 40 MT/yr (44 tons/yr) Nitrogen oxides • 151 MT/yr (166 tons/yr) Carbon monoxide • 197 MT/yr (217 tons/yr) PM ₁₀ particulates • 59 MT/yr (65 tons/yr) Some hazardous air pollutants.	MODERATE	Same as siting at V.C. Summer.

Table 8-8. Summary of Environmental Impacts for an Assumed Combination of Generating and Acquisition Alternatives (continued)

		V.C. Summer Site	Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Waste	SMALL	Small amount of ash produced.	SMALL	Same as siting at V.C. Summer.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.
Socioeconomics	SMALL to MODERATE	<p>During construction, impacts would be SMALL to MODERATE. Up to 1200 additional workers during the peak of the three-year construction period, followed by reduction from current V.C. Summer work force of 740 to 75; tax base preserved. Impacts during operation would be SMALL to MODERATE due to loss of employment to Fairfield County.</p> <p>Transportation impacts associated with construction workers would be SMALL to MODERATE. Transportation impacts during operation would be SMALL due to smaller work force.</p>	SMALL to LARGE	<p>Construction impacts depend on location, but could be significant if location is in a more rural area than V.C. Summer. Fairfield County would experience loss of tax base and employment, potentially offset by potential economic growth in Columbia area. Impacts during operation at an alternate site would be SMALL to MODERATE depending on economy at alternate site and relative impact of plant to tax base.</p> <p>Transportation impacts associated with construction workers would be SMALL to LARGE and dependent on population density at alternate site. Transportation impacts during operation would be SMALL due to smaller work force.</p>
Aesthetics	SMALL	Some visibility of structure offsite.	SMALL to LARGE	SMALL if alternate site previously developed. MODERATE impact from plant, stack, cooling tower plume, and new transmission lines. LARGE if greenfield site.

Alternatives

Table 8-8. Summary of Environmental Impacts for an Assumed Combination of Generating and Acquisition Alternatives (continued)

V.C. Summer Site			Alternate Greenfield Site	
Impact Category	Impact	Comments	Impact	Comments
Historic and Archeological Resources	SMALL to MODERATE	Some construction would affect previously developed parts of V.C. Summer; cultural resource inventory should minimize any impacts on undeveloped lands. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources even at a developed site.	SMALL to MODERATE	Alternate location would necessitate cultural resource studies. Studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on undeveloped sites on cultural resources.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 595 operating jobs at V.C. Summer could reduce employment prospects for minority and low-income populations. Impacts could be offset by projected economic growth and the ability of affected workers to commute to other jobs.	SMALL to LARGE	Impacts at alternate site vary depending on population distribution and makeup at site. Fairfield County would lose significant revenue, which could have MODERATE to LARGE impacts to minority and low-income populations. Impacts to receiving county could be SMALL to MODERATE.

of one 408-MW(e) combined-cycle, natural gas-fired unit at V.C. Summer using the existing once-through cooling system, and at an alternate location using a once-through cooling system. Purchase from other power generators could account for 204 MW(e) of power, and 204 MW(e) could be gained from additional DSM measures. The impacts associated with the combined-cycle, natural gas-fired units are based on the impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new gas-fired plant would result in increased emissions and environmental impacts. The environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or another country as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-8. The staff concludes that it is very unlikely that the environmental impacts of any

reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of the V.C. Summer OL.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, license renewal, are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned). The alternative actions, i.e., no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear, discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

The no-action alternative would require the replacement of electrical generating capacity by (1) DSM and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than V.C. Summer, or (4) some combination of these options and would result in the decommissioning of V.C. Summer. For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance and aesthetics impacts resulting from construction of any new facility would be greater than the impacts of continued operation of V.C. Summer. The impacts of purchased electrical power (imported power) would still occur, but would occur elsewhere. Alternative technologies are not considered feasible at this time and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the V.C. Summer OL.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

8.4 References

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

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

Alternatives

1 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental
2 Protection Regulations for Domestic Licensing and Related Functions."

3
4 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits;
5 Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

6
7 40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51,
8 "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

9
10 40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60,
11 "Standards of Performance for New Stationary Sources."

12
13 40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81,
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37 [2000-4.pdf](http://www.nwcouncil.org/library/2000/2000-4.pdf) on May 27, 2003.

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39 Resource Conservation and Recovery Act (RCRA) of 1976. 42 USC 6901, et seq.
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2 *License Renewal Application*. "Appendix E, Environmental Report." Docket Number 50/395;
3 License Number NPF-12. Jenkinsville, South Carolina.

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5 U.S. Department of Energy (DOE). 2001a. "U.S. Wind Energy Resource Map." Available
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8 U.S. Department of Energy (DOE). 2001b. "Advanced Fuel Cells." Available online:
9 http://www.fe.doe.gov/coal_power/fuelcells/index.shtml (Accessed March 27, 2002).

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11 U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2000. "Energy
12 Consumption and Renewable Energy Development Potential on Indian Lands."
13 SR/CNEAF/2000-01, Washington, D.C.

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15 U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2001a. "Annual
16 Energy Outlook 2002 With Projections to 2020." DOE/EIA-0383(2002). Washington, D.C.

17
18 U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2001b.
19 "Renewable Energy 2000: Issues and Trends." DOE/EIA-0628(2000). Washington, D.C.

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21 U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2002.
22 "International Energy Outlook 2002." DOE/EIA-0484(2002). Washington, D.C.

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24 U.S. Environmental Protection Agency (EPA). 1998. "Revision of Standards of Performance
25 for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units; Revisions
26 to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam
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30 U.S. Environmental Protection Agency (EPA). 1999. "Regional Haze Regulations, Final Rule"
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33 U.S. Environmental Protection Agency (EPA). 2000a. "Regulatory Finding on the Emissions of
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37 U.S. Environmental Protection Agency (EPA). 2000b. "Notice of Regulatory Determination on
38 Wastes for the Combustion of Fossil Fuels." *Federal Register*. Vol. 65, No. 99, pp.
39 33213-33237. Washington, D.C. (May 22, 2000) (65 FR 33213).

Alternatives

1 U.S. Environmental Protection Agency (EPA). 2001. "Municipal Solid Waste Disposal."
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5 *for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.

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8 *for License Renewal of Nuclear Plants: Main Report* "Section 6.3--Transportation, Table 9.1
9 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final
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16 *Statement on Decommissioning of Nuclear Facilities—Supplement 1 Regarding*
17 *Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1. Washington D.C.

9.0 Summary and Conclusions

1 By letter dated August 6, 2002, South Carolina Electric and Gas Company (SCE&G) submitted
2 an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating
3 license (OL) for the Virgil C. Summer Nuclear Station (V.C. Summer) for an additional 20-year
4 period (SCE&G 2002a). If the OL is renewed, State regulatory agencies and SCE&G will
5 ultimately decide whether the plant will continue to operate based on factors such as the need
6 for power or other matters within the State's jurisdiction or the purview of the owners. If the OL
7 is not renewed, then the plant must be shut down at or before the expiration of the current OL,
8 which expires on August 6, 2022.

9
10 Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321) directs
11 that an environmental impact statement (EIS) is required for major Federal actions that
12 significantly affect the quality of the human environment. The NRC has implemented Section
13 102 of NEPA in 10 CFR Part 51. Part 51 identifies licensing and regulatory actions that require
14 an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a
15 supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS
16 prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact*
17 *Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2
18 (NRC 1996; 1999).^(a)

19
20 Upon acceptance of the SCE&G application, the NRC began the environmental review process
21 described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct
22 scoping in the *Federal Register* (67 FR 65612 [NRC 2002]) on October 25, 2002. The staff
23 visited the V.C. Summer site in December 2002 and held public scoping meetings on
24 December 11, 2002, in Jenkinsville, South Carolina (NRC 2002). The staff reviewed the
25 SCE&G Environmental Report (SCE&G 2002b) and compared it to the GEIS, consulted with
26 other agencies, and conducted an independent review of the issues following the guidance set
27 forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews*
28 *for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff
29 also considered the public comments received during the scoping process for preparation of
30 this draft supplemental environmental impact statement (SEIS) for V.C. Summer. The public
31 comments received during the scoping process that were considered to be within the scope of
32 the environmental review are provided in Appendix A, Part 1, of this SEIS.

33
34 The staff will hold two public meetings in Jenkinsville, South Carolina, in August 2003, to
35 describe the preliminary results of the NRC environmental review and to answer questions to

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

Summary and Conclusions

1 provide members of the public with information to assist them in formulating their comments.
2 When the comment period ends, the staff will consider and disposition all of the comments
3 received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.
4

5 This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the
6 environmental effects of the proposed action, the environmental impacts of alternatives to the
7 proposed action, and mitigation measures available for reducing or avoiding adverse effects.
8 It also includes the staff's preliminary recommendation regarding the proposed action.
9

10 The NRC has adopted the following statement of purpose and need for license renewal from
11 the GEIS:
12

13 The purpose and need for the proposed action (renewal of an operating license) is to
14 provide an option that allows for power generation capability beyond the term of a
15 current nuclear power plant operating license to meet future system generating needs,
16 as such needs may be determined by State, utility, and, where authorized, Federal
17 (other than NRC) decisionmakers.
18

19 The goal of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is
20 to determine
21

22 ... whether or not the adverse environmental impacts of license renewal are so great
23 that preserving the option of license renewal for energy planning decisionmakers would
24 be unreasonable.
25

26 Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that
27 there are factors, in addition to license renewal, that will ultimately determine whether an
28 existing nuclear power plant continues to operate beyond the period of the current OL.
29

30 NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of
31 SEISs prepared at the license renewal stage:
32

33 The supplemental environmental impact statement for license renewal is not required to
34 include discussion of need for power or the economic costs and economic benefits of
35 the proposed action or of alternatives to the proposed action except insofar as such
36 benefits and costs are either essential for a determination regarding the inclusion of an
37 alternative in the range of alternatives considered or relevant to mitigation. In addition,
38 the supplemental environmental impact statement prepared at the license renewal stage
39 need not discuss other issues not related to the environmental effects of the proposed
40 action and the alternatives, or any aspect of the storage of spent fuel for the facility

1 within the scope of the generic determination in § 51.23(a) and in accordance with §
2 51.23(b).^(a)

3
4 The GEIS contains the results of a systematic evaluation of the consequences of renewing an
5 OL and operating a nuclear power plant for an additional 20 years. It evaluates
6 92 environmental issues using the NRC's three-level standard of significance—SMALL,
7 MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines.
8 The following definitions of the three significance levels are set forth in the footnotes to
9 Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

10
11 **SMALL** - Environmental effects are not detectable or are so minor that they will neither
12 destabilize nor noticeably alter any important attribute of the resource.

13
14 **MODERATE** - Environmental effects are sufficient to alter noticeably, but not to
15 destabilize, important attributes of the resource.

16
17 **LARGE** - Environmental effects are clearly noticeable and are sufficient to destabilize
18 important attributes of the resource.

19
20 For 69 of the 92 issues considered in the GEIS, the staff analysis in the GEIS shows the
21 following:

- 22
23 (1) The environmental impacts associated with the issue have been determined to apply either
24 to all plants or, for some issues, to plants having a specific type of cooling system or other
25 specified plant or site characteristic.
26
27 (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the
28 impacts (except for collective off site radiological impacts from the fuel cycle and from high-
29 level waste [HLW] and spent fuel disposal).
30
31 (3) Mitigation of adverse impacts associated with the issue has been considered in the analysis,
32 and it has been determined that additional plant-specific mitigation measures are likely not
33 to be sufficiently beneficial to warrant implementation.
34

(a) The title of 10 CFR 51.23 is "Temporary storage of spent fuel after cessation of reactor operations—generic determination of no significant environmental impact."

Summary and Conclusions

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

5
6 Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2
7 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues,
8 environmental justice and chronic effects of electromagnetic fields, were not categorized.
9 Environmental justice was not evaluated on a generic basis and must also be addressed in a
10 plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic
11 fields was not conclusive at the time the GEIS was prepared.

12
13 This draft SEIS documents the staff's consideration of all 92 environmental issues identified in
14 the GEIS. The staff considered the environmental impacts associated with alternatives to
15 license renewal and compared the environmental impacts of license renewal and the alterna-
16 tives. The alternatives to license renewal that were considered include the no-action alternative
17 (not renewing the OL for V.C. Summer) and alternative methods of power generation. These
18 alternatives were evaluated assuming that the replacement power generation plant is located at
19 either the V.C. Summer site or some other unspecified greenfield location.
20

21 9.1 Environmental Impacts of the Proposed Action— 22 License Renewal

23
24 SCE&G and the staff have established independent processes for identifying and evaluating the
25 significance of any new information on the environmental impacts of license renewal. Neither
26 SCE&G nor the staff has identified information that is both new and significant related to
27 Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither
28 the scoping process, SCE&G, nor the staff has identified any new issue applicable to
29 V.C. Summer that has a significant environmental impact. Therefore, the staff relies upon the
30 conclusions of the GEIS for all Category 1 issues that are applicable to V.C. Summer.

31
32 SCE&G's license renewal application presents an analysis of the Category 2 issues that are
33 applicable to V.C. Summer, plus environmental justice and chronic effects from electromagnetic
34 fields. The staff has reviewed the SCE&G analysis for each issue and has conducted an
35 independent review of each issue. Three Category 2 issues are not applicable because they
36 are related to plant design features or site characteristics not found at V.C. Summer. Four
37 Category 2 issues are not discussed in this draft SEIS because they are specifically related to
38 refurbishment. SCE&G (SCE&G 2002b) has stated that its evaluation of structures and
39 components, as required by 10 CFR 54.21, did not identify any major plant refurbishment

activities or modifications as necessary to support the continued operation of V.C. Summer, for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement Related to the Virgil C. Summer Nuclear Station Unit 1* (AEC 1973).

Fifteen Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 15 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for V.C. Summer, and the plant improvements already made, the staff concludes that none of the candidate SAMAs are cost-beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

Summary and Conclusions

1 The adverse impacts of continued operation identified are considered to be of SMALL
2 significance, and none warrant implementation of additional mitigation measures. The adverse
3 impacts of likely alternatives if V.C. Summer ceases operation at or before the expiration of the
4 current OL will not be smaller than those associated with continued operation of this unit and
5 they may be greater for some impact categories in some locations.
6

7 9.1.2 Irreversible or Irretrievable Resource Commitments

8
9 The commitment of resources related to construction and operation of V.C. Summer during the
10 current license period was made when the plant was built. The resource commitments to be
11 considered in this draft SEIS are associated with continued operation of the plant for an
12 additional 20 years. These resources include materials and equipment required for plant
13 maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent
14 offsite storage space for the spent fuel assemblies.
15

16 The most significant resource commitments related to operation during the renewal term are
17 the fuel and the permanent storage space. V.C. Summer replaces approximately one-third of
18 the fuel assemblies in each of the two units during every refueling outage, which occurs on an
19 18-month cycle.
20

21 The likely power generation alternatives if V.C. Summer ceases operation on or before the
22 expiration of the current OL will require a commitment of resources for construction of the
23 replacement plants as well as for fuel to run the plants.
24

25 9.1.3 Short-Term Use Versus Long-Term Productivity

26
27 An initial balance between short-term use and long-term productivity of the environment at the
28 V.C. Summer site was set when the plant was approved and construction began. That balance
29 is now well established. Renewal of the OL for V.C. Summer and continued operation of the
30 plant will not alter the existing balance, but may postpone the availability of the site for other
31 uses. Denial of the application to renew the OL will lead to shutdown of the plant and will alter
32 the balance in a manner that depends on subsequent uses of the site. For example, the
33 environmental consequences of turning the V.C. Summer site into a park or an industrial facility
34 are quite different.
35

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the OL for V.C. Summer. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at V.C. Summer. Chapters 4 through 7 discuss environmental issues associated with renewal of the OL. Environmental issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OL), the no-action alternative (denial of the application), alternatives involving nuclear or coal- or gas-fired generation of power at the V.C. Summer site and an unspecified "greenfield site," and a combination of alternatives are compared in Table 9-1. Continued use of a once-through cooling system for V.C. Summer is assumed for the V.C. Summer site alternatives.

Table 9-1 shows that the significance of the environmental effects of the proposed action are SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

9.3 Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996; 1999), (2) the Environmental Report submitted by SCE&G (SCE&G 2002b), (3) consultation with Federal, State, and local agencies, (4) the staff's own independent review, and (5) the staff's consideration of public comments received during the scoping process, the preliminary recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for V.C. Summer are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using Once-Through Cooling

Impact Category	Proposed Action— License Renewal	No-Action Alternative— Denial of Renewal	Coal-Fired Generation	Natural Gas-Fired Generation	New Nuclear Generation	Combination of Alternatives
			Greenfield Site ^(a)	Greenfield Site ^(a)	Greenfield Site ^(a)	Greenfield Site ^(a)
Land Use	SMALL	SMALL	SMALL to LARGE	SMALL to LARGE	MODERATE to LARGE	SMALL to LARGE
Ecology	SMALL	SMALL	SMALL to LARGE	SMALL to LARGE	MODERATE to LARGE	SMALL to LARGE
Water Use and Quality	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL	MODERATE
Waste	SMALL	SMALL	MODERATE	SMALL	SMALL	SMALL
Human Health ^(b)	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE
Aesthetics	SMALL	SMALL	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE
Historic and Archaeo- logical Resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Environmental Justice	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE

(a) A greenfield site is assumed, for the purpose of bounding potential impacts, to be an undeveloped site with no previous construction.

(b) Excludes collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which single significance levels were not assigned. See Chapter 6 for details.

9.4 References

- 10 CFR 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."
- 10 CFR 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plant."
- National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.
- South Carolina Electric and Gas Company (SCE&G). 2002a. License Renewal Application, V.C. Summer Nuclear Station. Jenkinsville, South Carolina.
- South Carolina Electric and Gas Company (SCE&G). 2002b. *Virgil C. Summer Nuclear Station License Renewal Application*. "Appendix E, Environmental Report." Docket Number 50/395; License Number NPF-12. Jenkinsville, South Carolina.
- U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to the Virgil C. Summer Nuclear Station Unit 1, South Carolina Electric and Gas Company*. Docket No. 50-935. Directorate of Licensing, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report*, "Section 6.3—Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*. NUREG-1555, Supplement 1, Washington, D.C.
- U.S. Nuclear Regulatory Commission. 2002. "Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 67, No. 207, pp. 65612-65613. Washington, D.C.

Appendix A

Comments Received on the Environmental Review

Part I - Comments Received During Scoping

On October 25, 2002, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (67 Federal Register 65612), to notify the public of the staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, to support the renewal application for the Virgil C. Summer Nuclear Station (V.C. Summer) operating license and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality (CEQ) guidelines, and 10 CFR Part 51. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, State, Tribal, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than January 6, 2003.

The scoping process included two public scoping meetings, which were held at the White Hall A.M.E. Church in Jenkinsville, South Carolina, on December 11, 2002. Approximately 20 members of the public attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process and the NEPA process. After the NRC's prepared statements, the meetings were open for public comments. Attendees provided either oral or written statements that were recorded and transcribed by a certified court reporter. The meeting transcripts are an attachment to the Scoping Meeting Summary dated January 14, 2003.

At the conclusion of the scoping period, the NRC staff and its contractor reviewed the transcripts and all written material to identify individual comments. All comments and suggestions received orally during the scoping meetings or in writing were considered. Each set of comments from a given commenter was given a unique identifier (Commenter ID number), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Several commenters submitted comments through multiple sources (e.g., afternoon and evening scoping meetings).

Table A.1 identifies the individuals who provided comments and the Commenter ID number associated with each person's set(s) of comments. The individuals are listed in the order in which they spoke at the public meeting.

Appendix A

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenters			Comment Source and
ID	Commenter	Affiliation (If Stated)	ADAMS Accession Number
SU-A	Pearson		Afternoon Public Meeting ^(a)
SU-B	Marcharia	Fairfield County Council	Afternoon Public Meeting
SU-C	Bursey		Afternoon Public Meeting
SU-D	Coleman	Representative	Afternoon Public Meeting
SU-E	Robinson	Fairfield County Council	Afternoon Public Meeting
SU-F	Wilder	Fairfield County Schools	Afternoon Public Meeting
SU-G	Murphy	Fairfield County Council	Afternoon Public Meeting
SU-H	Harmon	Pomaria-Garmany Elementary School	Afternoon Public Meeting
SU-I	Byrne	V.C. Summer Nuclear Station	Afternoon Public Meeting
SU-J	Summer	SCANA Services	Afternoon Public Meeting
SU-K	White	South Carolina Public Service Commission	Afternoon Public Meeting
SU-L	Bowlers	Irma/Chapin Recreation Commission	Afternoon Public Meeting
SU-M	Vickers	Fairfield County Chamber of Commerce	Afternoon Public Meeting
SU-N	Cannon	Pastor	Evening Public Meeting ^(b)
SU-O	Pearson		Evening Public Meeting
SU-P	Sprott	Fairfield County School System	Evening Public Meeting
SU-Q	Byrne	V.C. Summer Nuclear Station	Evening Public Meeting
SU-R	Summer	South Carolina	Evening Public Meeting
SU-S	White	South Carolina Public Service Commission	Evening Public Meeting
SU-T	Rabb		Evening Public Meeting
SU-U	Caldwell		Evening Public Meeting
SU-V	Spratt	United States House of Representatives	Letter, December 11, 2002 (ML023540416)

(a) The afternoon transcript can be found under accession number ML030030808.

(b) The evening transcript can be found under accession number ML030030848.

Comments were consolidated and categorized according to the topic within the proposed supplement to the GEIS or according to the general topic if outside the scope of the GEIS. Comments with similar specific objectives were combined to capture the common essential issues that had been raised in the source comments. Once comments were grouped according to subject area, the staff and contractor determined the appropriate action for the comment. The staff made a determination on each comment that it was one of the following:

- A comment that was actually a question and introduced no new information
- A comment that was either related to support for or opposition to license renewal in general (or specifically, V.C. Summer) or that made a general statement about the licensing renewal process. It may have made only a general statement regarding Category 1 and/or Category 2 issues. In addition, it provided no new information and did not pertain to 10 CFR Part 54.

- A comment about a Category 1 issue that
 - provided new information that required evaluation during the review
 - provided no new information.
- A comment about a Category 2 issue that
 - provided information that required evaluation during the review
 - provided no such information.
- A comment regarding alternatives to the proposed action
- A comment that raised an environmental issue that was not addressed in the GEIS
- A comment outside the scope of license renewal, which includes comments regarding the need for power
- A comment outside the scope of the environmental review on safety issues pertaining to 10 CFR Part 54.

Each comment applicable to this environmental review is summarized in this section. This information, which was extracted from the V.C. Summer Scoping Summary Report, is provided for the convenience of those interested in the scoping comments applicable to this environmental review. As part of its ongoing review, the staff has clarified some of the responses included in the Scoping Report. The comments that are general or outside the scope of the environmental review for V.C. Summer are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report. The ADAMS accession number for the summary report is ML030520583. This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) <http://www.nrc.gov/reading-rm.html>.

The following pages summarize the comments and suggestions received as part of the scoping process that are applicable to this environmental review and discuss the disposition of the comments and suggestions. The parenthetical alpha-numeric identifier after each comment refers to the comment set (Commenter ID) and the comment number.

Comments in this section are grouped in the following categories:

1. Comments Concerning Socioeconomic Issues

Appendix A

2. Comments Concerning Air Quality Issues
3. Comments Concerning Human Health Issues
4. Comments Concerning Terrestrial Resource Issues
5. Comments Concerning Threatened and Endangered Species Issues
6. Comments Concerning Water Resources Issues
7. Comments Concerning Uranium Fuel Cycle and Waste Management Issues

Part I. Comments Received During Scoping

1. Comments Concerning Socioeconomic Issues

Comment: We also provide jobs for about 625 SCE&G employees and in excess of 100 long-term contract employees. (SU-I-5)

Comment: We also are the largest employer in the county now. (SU-Q-7)

Comment: Summer Station's operations provide jobs for nearly a thousand people. (SU-V-3)

Response: *The comments are noted. Information regarding impacts resulting from employment of plant workers during the 20-year renewal term is discussed in Chapter 4 of this SEIS.*

Comment: SCE&G is a wonderful partner for our county. Because they came online, we now have some of the finest school facilities in the state. We also are able to offer, because of their tax dollars, services to the people of this county that otherwise we could not afford because our people cannot pay taxes to provide those services. (SU-E-3)

Comment: As far as an economic development impact on this county, this to me is a very clean lake that they have provided. We then have people who are able to fish in this lake, and we now have people who are selling property around this lake, which to us is an economic development tool. And these people are coming in and building homes, which add to our tax base. (SU-E-6)

Comment: ...that the plant has been a very vital part of the tax base in our county. (SU-F-2)

Comment: So if the plant were not to be licensed and, in my personal opinion, the industry was not here to replace the plant that not relicensed, it would be devastating on the county. And for the county to have a \$16 million impact from one plant, that's a big impact into our economic base on the county level. (SU-F-3)

1 **Comment:** The school district is fortunate that the V.C. Nuclear Summer Plant is the largest
 2 tax base in the county. We get in excess 11 million dollars per year in taxes from the plant.
 3 (SU-F-4)

4
 5 **Comment:** The benefits of the taxes that's been b[r]ought in, over \$17 million to the county.
 6 Where would we be if it wasn't for V.C. Summer? (SU-G-3)

7
 8 **Comment:** We're also the largest taxpayer in the county. You've heard a lot about that. We
 9 pay about 17-1/2 million dollars in taxes and represent about 67 percent of the tax base.
 10 (SU-I-6)

11
 12 **Comment:** Aside from being the largest employer, we're also the largest taxpayer. Prior to
 13 Mack's closing, we were 67 percent of the tax base. ... V.C. Summer pays about 17-1/2 million
 14 dollars a year in property taxes to the county. (SU-Q-8)

15
 16 **Comment:** There is a big tax check that keeps our schools going. (SU-T-5)

17
 18 **Comment:** There are many things I could touch on that SCE&G has done in this community
 19 but just to give you an overall picture of how they became our neighbors and how good they are
 20 and the things that they have done. My husband had a vision many years ago for a fire
 21 department. ... And so SCE&G said, No problem, we will come up with the building. ... Then
 22 came EMS, which is a vital part of the community, very much needed, through SCE&G.
 23 (SU-T-3)

24
 25 **Comment:** Then they became customers of the Jenkinsville Water Company, very good
 26 customers, for that we appreciate. They keep us going, they keep the post office going,
 27 because we're a small community. We're just thankful for the things that they have done.
 28 (SU-T-4)

29
 30 **Comment:** SCANA owned companies pay more than 17.5 million in taxes to Fairfield County,
 31 money that helps support vital public services and provides for a better quality of life. (SU-V-4)

32
 33 **Response:** *The comments are noted. Public services, offsite land use, taxes, and education*
 34 *are discussed in Chapters 2 and 4 of this SEIS.*

35 36 **2. Comments Concerning Air Quality Issues**

37
 38 **Comment:** ...want to make certain that SCE&G continue to follow guidelines to ensure that we
 39 are subjected to clean air and a safe environment. (SU-F-1)

Appendix A

1 **Comment:** Reliable operation of the Summer Station, a non-greenhouse gas emitter,
2 precludes the requirement to use greenhouse gas from any generation and is economical for
3 our customers. (SU-K-4)
4

5 **Comment:** Reliable operation of Summer Station, a non-greenhouse gas emitter, precludes
6 the requirement to use greenhouse gas from any generation and is economical for our
7 customers. (SU-S-5)
8

9 **Response:** *The comments are noted. Air emissions are regulated through the U.S.*
10 *Environmental Protection Agency and the State of South Carolina. Issues associated with air*
11 *quality are discussed in Chapters 2 and 4 of this SEIS. The impacts resulting from the use of*
12 *fossil fuel to generate electricity are discussed in Chapter 8 of this SEIS. The comments*
13 *provide no new information and, therefore, will not be evaluated further.*
14

15 **3. Comments Concerning Human Health Issues**

16

17 **Comment:** I've had constituencies ask me over the last 15 years -- there appears to be a
18 substantial increase in different types of cancer, particularly with our senior citizens. What can
19 you say to assure the community that this plant has no direct impact in regards to these
20 questions? (SU-B-3)
21

22 **Comment:** ...does your agency also check environmentally any of the medical records to see
23 whether or not these perceptions of increase of different types of cancers, ... do you also check
24 whether or not there is an increase of health risk to citizens in the area? (SU-B-4)
25

26 **Comment:** I did get asked the question about the perception of cancer. Fairfield County leads
27 the state in terms of diabetes, ... and the perception that the environment might complicate
28 these conditions. So I'm just raising this because we do need an independent study. That's
29 why I asked for a medical explanation. Have DHEC or other folks, the agency for this area, and
30 just for the public safety to make sure that these conditions and perceptions, that they are not
31 found, they're not authentic, and I think that will go a long ways to some uncertainties. (SU-B-6)
32

33 **Comment:** As far as health issues, we have a lot of health issues in Fairfield County, and a lot
34 of contributory things that have been done. We're unique in different things. We have a fault
35 line that runs right through here. We also have a great deposit of granite in the county that lets
36 off radon gas and all these other things that's not attributed to the Summer plant. (SU-G-2)
37

38 **Response:** *The comments are noted. The NRC's regulatory limits for radiological protection*
39 *are set to protect workers and the public from the harmful effects of radiation. The limits are*
40 *based on the recommendations of standards-setting organizations. Radiation standards reflect*

1 extensive study by national and international organizations (International Commission on
2 Radiological Protection [ICRP], National Council on Radiation Protection and Measurements,
3 and National Academy of Sciences) and are conservative to ensure that the public and workers
4 at nuclear power plants are protected. The NRC radiation exposure standards are presented in
5 10 CFR Part 20, "Standards for Protection Against Radiation," and are based on the
6 recommendations in ICRP 26 and 30. Emissions and effluents that are below the limits set by
7 the NRC are not considered to pose any significant risk to public health or safety. V.C. Summer
8 monitors its radiological emissions and effluents to ensure that any radioactive releases are
9 within allowable limits. SCE&G reports the results of its monitoring program on an annual basis
10 in two documents that are available to the public and are provided to the NRC. These reports
11 are (1) Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, and
12 (2) Radiological Environmental Monitoring Report, Virgil C. Summer Nuclear Station.

13
14 The NRC does review the annual amounts of radiological emissions and effluents released into
15 the environment by V.C. Summer and has found them to be well within the acceptable limits. In
16 the past, the State of South Carolina independently monitored the environment around
17 V.C. Summer for radioactive contamination and their results were consistent with those
18 reported by SCE&G. To ensure that the exposure limits to the public are met, NRC sets limits
19 on radiological effluents, requires monitoring of effluents and foodstuffs. SCE&G monitors its
20 effluents and calculates potential offsite doses caused by radioactive liquid and gaseous
21 effluents. These calculations are performed to demonstrate the licensee's compliance with its
22 technical specifications and the NRC regulations. Based on the information provided by
23 SCE&G, radiological emissions and effluents from the station have been well below the limits
24 set by the NRC and, therefore, pose no significant risk to public health or safety.

25
26 Numerous scientifically designed, peer-reviewed studies of personnel exposed to occupational
27 levels of radiation (versus life-threatening accident doses or medical therapeutic levels) have
28 shown minimal effect on human health, and any effect was from exposures well above the
29 exposure levels of the typical member of the public from normal operation of a nuclear power
30 plant.

31
32 The NRC does not routinely evaluate medical records. The NRC is not aware of any increase
33 in health risk to citizens in the area around V.C. Summer that could be linked to station
34 operations or emissions and effluents.

35
36 Radiation exposures to the public and workers were evaluated in the GEIS and determined to
37 be Category 1 issues. Information regarding the expected radiological impacts on human
38 health is discussed in Chapters 2 and 4 of this SEIS. The comments provide no new
39 information and, therefore, will not be evaluated further.
40

Appendix A

4. Comments Concerning Terrestrial Resource Issues

Comment: We're a haven for wildlife. (SU-I-9)

Comment: On our site, you will hear a little bit more about this [haven for wildlife], but you will find deer, turkeys, obviously fish, eagles and more buzzards than I can count, and an occasional arrowhead. (SU-Q-10)

Response: *The comments are noted. Information regarding aquatic and terrestrial biological resources and cultural resources is discussed in Chapters 2 and 4 of this SEIS. The comments provide no new information and, therefore, will not be evaluated further.*

5. Comments Concerning Threatened and Endangered Species Issues

Comment: The creation of Summer Station and its companion generating plant, Fairfield Pumped Storage Facility, have provided an environment which has been conducive to the expansion of the bald eagle population. (SU-J-2) (SU-R-2)

Comment: This survey found no evidence of threatened or endangered species on the plant site or the transmission corridors. (SU-J-5)

Comment: This survey found no evidence of threatened or endangered species on the plant site or the transmission corridors, with the exception of the eagles that are not nesting on the site now, but they do come onto the site. (SU-R-7)

Response: *The comments are noted. Information regarding threatened and endangered species at the V.C. Summer site is discussed in Chapters 2 and 4 of this SEIS.*

6. Comments Concerning Water Resources Issues

Comment: ...it's just very important for me to know that we're protecting those lakes, because at some point, that may be the only source of drinking water we're going to have. So water is just a very important element to each of our lives. (SU-E-1)

Response: *The comment is noted. Information regarding water resources is discussed in Chapters 2 and 4 of this SEIS. The comment provides no new information and, therefore, will not be evaluated further.*

7. Comments Concerning Uranium Fuel Cycle and Waste Management Issues

Comment: As stewards of the environment, management of Summer Station has reduced the tri-annual cycle volume of low-level radioactive waste by 90 percent over the last six cycles for 18 years, recycling items previously disposed of and training the workforce to exercise prudent utilization and materials have accomplished the significant reduction. (SU-K-2) (SU-S-3)

Response: *The comment is noted. Information regarding low-level waste management is discussed in Chapters 2 and 6 of this SEIS. The comment provides no new information and, therefore, will not be evaluated further.*

Part II. Comments Received on the Draft SEIS

(Reserved for comments received on the draft SEIS.)

Appendix B

Contributors to the Supplement

Appendix B

Contributors to the Supplement

The overall responsibility for the preparation of this supplement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations and the Los Alamos National Laboratory, Pacific Northwest National Laboratory, Lawrence Livermore National Laboratory, and Argonne National Laboratory.

Name	Affiliation	Function or Expertise
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John Tappert	Nuclear Reactor Regulation	Section Chief
Barry Zalzman	Nuclear Reactor Regulation	Technical Monitor
Michael Masnik	Nuclear Reactor Regulation	Aquatic Ecology
James Wilson	Nuclear Reactor Regulation	Ecology
Tom Kenyon	Nuclear Reactor Regulation	Socioeconomics, Alternatives
Robert Palla	Nuclear Reactor Regulation	Severe Accident Mitigation
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Appendix B

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9

INFORMATION SYSTEMS LABORATORY

Kim Green	Severe Accident Mitigation Alternatives
Jim Meyer	Severe Accident Mitigation Alternatives

- (a) Los Alamos National Laboratory is operated for the U.S. Department of Energy (DOE) by the University of California.
- (b) Argonne National Laboratory is operated for DOE by the University of Chicago.
- (c) Pacific Northwest National Laboratory is operated for DOE by Battelle Memorial Institute.
- (d) Lawrence Livermore National Laboratory is operated for DOE by the University of California.

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to South Carolina Electric and Gas Company's Application for License Renewal of Virgil C. Summer Nuclear Station

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to South Carolina Electric and Gas Company's Application for License Renewal of Virgil C. Summer Nuclear Station

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and South Carolina Electric and Gas Company (SCE&G) and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 51, of SCE&G's application for renewal of the Virgil C. Summer Nuclear Station (V.C. Summer) operating license. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, MD, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: <http://www.nrc.gov/reading-rm.html>. From this site, the public can gain access to the NRC's Agencywide Document Access and Management Systems (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records (PARS) component of ADAMS. The ADAMS accession numbers for each document are included below.

August 6, 2002	Letter from Mr. Stephen A. Byrne, SCE&G to NRC, submitting the application for the renewal of the operating license for V.C. Summer (Accession No. ML022280018).
August 20, 2002	Letter from NRC to Ms. Sara McMaster, Fairfield County Library, regarding the maintenance of reference material for the V.C. Summer license renewal application (Accession No. ML022340250).
August 20, 2002	Letter from NRC to Mr. William Suddeth, Thomas Cooper Library, University of South Carolina, regarding the maintenance of reference material for the V.C. Summer license renewal application (Accession No. ML022340274).
August 26, 2002	Letter from NRC to Mr. Stephen A. Byrne, SCE&G, regarding the receipt and availability of the license renewal application for V.C. Summer (Accession No. ML022390066).
August 27, 2002	NRC press release announcing the availability of the license renewal application for V.C. Summer (Accession No. ML022390116).

Appendix C

- September 3, 2002** Federal Register Notice of receipt of application for renewal of Facility Operating License No. NPF-12 for an additional 20-year period (67 FR 56316) (Accession No. ML022390066).
- September 27, 2002** Letter from NRC to Mr. Stephen A. Byrne, SCE&G, forwarding determination of acceptability and sufficiency for docketing, proposed review schedule, and opportunity for a hearing regarding an application from SCE&G for renewal of the operating license for V.C. Summer (Accession No. ML022730054).
- October 23, 2002** Letter from NRC to Mr. Stephen A. Byrne, SCE&G, forwarding notice of intent to prepare an environmental impact statement and conduct scoping process for license renewal for V.C. Summer (Accession No. ML022960556).
- October 23, 2002** Federal Register Notice of intent to prepare an environmental impact statement and conduct scoping process for V.C. Summer (Accession No. ML022960605).
- November 27, 2002** NRC press release announcing public meetings on V.C. Summer license renewal (Accession No. ML023310303).
- November 27, 2002** Letter from NRC to Catawba Indian Nation inviting participation in scoping process for V.C. Summer license renewal (Accession No. ML023380747).
- November 27, 2002** Letter from NRC to Cherokee Indian Nation inviting participation in scoping process for V.C. Summer license renewal (Accession No. ML023380701).
- November 27, 2002** Letter from NRC to Eastern Band of the Cherokee Indian Nation inviting participation in scoping process for V.C. Summer license renewal (Accession No. ML023380734).
- November 27, 2002** Letter from NRC to United Keetoowah Band of Cherokee Indian Nation inviting participation in scoping process for V.C. Summer license renewal (Accession No. ML023380754).

December 11, 2002 Letter from Mr. John M. Spratt, Jr., to the NRC providing scoping comments on the V.C. Summer license renewal (Accession No. ML023540416).

December 11, 2002 Placement of presentation slides from December 11, 2002, scoping meeting in the public domain (Accession No. ML023470019).

December 23, 2002 Letter from NRC to Mr. Stephen A. Byrne, SCE&G, forwarding revision of schedule for the review of the V.C. Summer license renewal application (Accession No. ML023580338).

January 9, 2003 Letter from Mr. Stephen A. Byrne, SCE&G, transmitting additional information requested during site audit in support of V.C. Summer license renewal (Accession No. ML030300730).

January 14, 2003 Summary of public scoping meetings to support review of V.C. Summer license renewal application (Accession No. ML030140468).

January 17, 2003 Request for additional information regarding severe accident mitigation alternatives for V.C. Summer (Accession No. ML030230467).

January 27, 2003 Note to File: Summary of teleconference between NRC and SCE&G in support of the staff's review of the V.C. Summer license renewal application (Accession No. ML030270182).

February 21, 2003 Letter from NRC to Mr. Stephen A. Byrne, SCE&G, regarding issuance of the environmental scoping summary report associated with the staff's review of the application for renewal of the operating license for V.C. Summer (Accession No. ML030520531).

March 19, 2003 Letter from Mr. Stephen A. Byrne, SCE&G, providing a response to a NRC request for additional information regarding severe accident mitigation alternatives (Accession No. ML030920551).

April 2, 2003 Letter from SCE&G to NRC transmitting a copy of a modification to the V.C. Summer NPDES permit (Accession No. ML030920169).

Appendix C

April 16, 2003	Letter from NRC to U.S. Fish and Wildlife Service providing summary of conversation regarding protected species within the area under evaluation for the V.C. Summer plant license renewal (Accession No. ML031060341).
May 19, 2003	Note to File: Summary of teleconference between NRC and SCE&G in support of the staff's review of the V.C. Summer license renewal application (Accession No. ML031390642).
June 13, 2003	Letter from NRC to South Carolina Department of Archives and History regarding National Historic Preservation Act and the Section 106 Review Process (Accession No. ML031710717).
June 26, 2003	Letter from NRC to U.S. Fish and Wildlife Service transmitting biological assessment for V.C. Summer plant license renewal (Accession No. ML031770358).

Appendix D

Organizations Contacted

Appendix D

Organizations Contacted

During the course of the staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, and local agencies were contacted:

Catawba Indian Nation, Catawba, South Carolina

Central Carolina Economic Development Alliance, Columbia, South Carolina

Central Midlands Council of Governments, Columbia, South Carolina

Cherokee Nation, Tahlequah, Oklahoma

Clemson University Agricultural Extension Service, Winnsboro, South Carolina

Eastern Band of the Cherokee, Cherokee, North Carolina

Fairfield School District, Winnsboro, South Carolina

Fairfield County Planning, Winnsboro, South Carolina

Fairfield County Finance Director, Winnsboro, South Carolina

Holmes Realty, Winnsboro, South Carolina

Institute for South Carolina Archaeology, Columbia, South Carolina

National Oceanic and Atmospheric Administration, Columbia, South Carolina

South Carolina Department of Archives and History, Columbia, South Carolina

South Carolina Department of Natural Resources, Land and Water, and Conservation Division

South Carolina Institute of Archaeology and Anthropology, Columbia, South Carolina

United Keetoowah Band of Cherokee, Tahlequah, Oklahoma

United States Department of Interior, Bureau of Indian Affairs, Nashville, Tennessee

United States Fish and Wildlife Service, Charleston, South Carolina

United States Forest Service, Francis Marion & Sumter National Forests, South Carolina

United Way of the Central Midlands, Columbia, Columbia, South Carolina

Town of Winnsboro, South Carolina

Appendix E

V.C. Summer Compliance Status and Consultation Correspondence

Appendix E

V.C. Summer Compliance Status and Consultation Correspondence

The list of licenses, permits, consultation, and other approvals obtained from Federal, State, regional, and local authorities for Virgil C. Summer Nuclear Station (V.C. Summer) are shown in Table E-1. Following Table E-1 are reproductions of correspondence prepared and sent during the evaluation process of the application for renewal of the operating licenses for V.C. Summer.

Table E-1. Federal, State, and Local Licenses, Permits, and Consultations and other Approvals for V.C. Summer

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	Atomic Energy Act, 10 CFR Part 50	Operating license	NPF-12	8/6/1982	8/6/2022	Authorizes operation of V.C. Summer
FWS and NMFS	Endangered Species Act, Section 7 (16 U.S.C. 1536)	Consultation	NA	Consultation initiated		Requires a Federal agency to consult with FWS regarding whether a proposed action will affect endangered or threatened species. Depredation and salvage permit. Renewal annually.
FWS	Migratory Bird Treaty Act (16 U.S.C. 703-712)	Depredation Permit Salvage Permit	MB040209-0 MB83793-0	Annual	Annual	Removal and relocation of migratory bird nests. Retrieve dead birds.
SCDHEC-Bureau of Water	Clean Water Act, Section 402	NPDES wastewater permit	SC0030856	12/3/2002	4/30/2007	Discharges to Monticello Reservoir and Broad River
SCDHEC-Bureau of Air Quality	Clean Air Act	Air emissions permit	CM-1000-0012	8/10/1999	7/31/2004	Establishes emissions limits from diesel emergency generators, miscellaneous diesel engines, and other miscellaneous units
SCDHEC-Division of Radioactive Waste Management, Bureau of Land and Waste Management	Atomic Energy and Radiation Control Act (S.C. Code of Laws, Sections 13-7-40, et seq.)	Radioactive Material License	No. 517, Amendment 02	9/30/1999	9/30/2004	Authorizes storage of radioactive material in three stream generators removed from service in 1994.

Table E-1. (cont)

Agency	Authority	Requirement	Number	Issue Date	Expiration Date	Remarks
SCDHEC-Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.)	Radioactive Waste Transport Permit	0163-39-02	Annual	Annual	Authorizes shipment of radioactive waste to licensed collecting/processing facilities within state of South Carolina.
Tennessee Dept. of Environment and Conservation-Division of Radiological Health	Tennessee Code Annotated 68-202-206	License to Ship Radioactive Material	T-SC001-L02	Annual	Annual	Authorizes shipment of radioactive waste to licensed disposal/processing facilities within state of Tennessee.
SCDAH	National Historic Preservation Act, Section 106 (16 U.S.C. 4701)	Consultation	NA	Consultation Initiated		The National Historic Preservation Act requires Federal agencies to take into account the effect of any undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.

CFR - Code of Federal Regulations

EPA - U.S. Environmental Protection Agency

SCDHEC - South Carolina Department of Health and Environmental Control

SCDAH - South Carolina Department of Archives and History

FWPCA - Federal Water Pollution Control Act (also known as the Clean Water Act)

FWS - U.S. Fish and Wildlife Service

NMFS - National Marine Fisheries Service

NPDES - National Pollutant Discharge Elimination System

NA - Not applicable

USC - United States Code

April 16, 2003

Ms. Sandy Abbot
Field Supervisor, Ecological Services
US Fish and Wildlife Service
176 Croghan Spur Road, Suite 200
Charleston, SC 29407

**SUBJECT: SUMMARY OF CONVERSATION REGARDING PROTECTED SPECIES
WITHIN THE AREA UNDER EVALUATION FOR THE V.C. SUMMERS PLANT
LICENSE RENEWAL**

Dear Ms. Abbot:

The U.S. Nuclear Regulatory Commission (NRC) is preparing a Supplemental Environmental Impact Statement (SEIS) for the proposed license renewal for the Virgil C. Summer Nuclear Station (V.C. Summer) which expires August 2022. To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, NRC met with your office on December 12, 2002, to discuss the current list of species and information on protected, proposed, and candidate species and critical habitat that may be within the area of the proposed action per 50 CFR 402.12.

The plant is located in Fairfield County, South Carolina, approximately 15 miles west of the county seat of Winnsboro and 28 miles northwest of Columbia, the state capital. The Broad River flows in a northwest-to-southeast direction approximately one mile west of the site and serves as the boundary between Fairfield County (to the east) and Newberry County (to the west). The site covers approximately 2,245 acres, an area that includes portions of Monticello Reservoir. Beginning at the V.C. Summer Station, the South Carolina Electric and Gas Company (SCE&G) transmission lines generally run in a southerly direction, with five terminations very near V.C. Summer Station, one near Aiken, South Carolina, and two near Columbia, South Carolina. The Santee Cooper lines run approximately east and west to substations near Blythewood and Newberry, South Carolina, respectively. In total, for the specific purpose of connecting to the transmission system, approximately 160 miles of transmission lines (120 miles of corridor) that occupy approximately 2,000 acres of corridor were constructed.

License renewal would include use and continued maintenance of existing facilities and transmission lines for an additional 20 years of operation. The proposed action would not result in new construction or disturbance.

SCE&G contacted your office by letter dated January 19, 2001, requesting information on threatened, endangered, and candidate species that potentially occur in the vicinity of the plant. Your office responded on March 15, 2001 with a list of species. During the course of our December 12th discussion regarding threatened and endangered (T&E) species and other species of interest within the area, it was noted that the primary species of interest is the Bald Eagle that is found near the plant. It was also noted that the list provided on March 15, 2001,

S. Abbot

2

is still the current list. It is our intent to use this information as we initiate and write our Biological Assessment and prepare our license renewal SEIS.

The NRC looks forward to continuing to work with the U.S. Fish and Wildlife Service to ensure that the SEIS and Section 7 compliance activities adequately evaluate potential effects to biological resources. If you have any questions concerning this matter please contact Gregory Suber by phone at 301-415-1124 or by email at GXS@nrc.gov.

Sincerely,

/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-395

cc: See next page

June 13, 2003

Dr. Rodger E. Stroup, Director
South Carolina Department of Archives
and History
Archives and History Center
8301 Parklane Road
Columbia, SC 29223

SUBJECT: V. C. SUMMER NUCLEAR STATION LICENSE RENEWAL REVIEW AND
NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 REVIEW
PROCESS

Dear Dr. Stroup:

The U. S. Nuclear Regulatory Commission (NRC) is evaluating an application submitted by South Carolina Electric and Gas Company (SCE&G) for the renewal of the operating license for the V. C. Summer Nuclear Station (V. C. Summer), located in the southeastern corner of rural Fairfield County, South Carolina, approximately 28 miles northwest of Columbia, South Carolina. As part of its review of the proposed action, the NRC staff is preparing a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The SEIS will include analyses of relevant environmental issues, including potential impacts on historic and cultural resources from refurbishment activities, and for the extended period of operation. The application for renewal was submitted by SCE&G on August 8, 2002, pursuant to NRC requirements of Title 10 of the *Code of Federal Regulations*, Part 54 (10 CFR Part 54). SCE&G has indicated that it does not plan on any major refurbishment activity that would result in additional land disturbance in the site area.

For your reference, the Agency official (the Director, Office of Nuclear Reactor Regulation) has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs which may be impacted by post-license renewal land disturbing operation or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land disturbing operations or projected refurbishment activities specifically related to license renewal of the nuclear power plant potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On January 19, 2001, SCE&G sought feedback from the South Carolina State Historic Preservation Office (SHPO) regarding license renewal at V. C. Summer. In its letter, SCE&G stated that there are no plans to alter current operations, no plans to expand existing facilities, no plans to implement major structural modifications, no plans to initiate new construction, and no plans for additional land disturbance in support of license renewal. On January 29, 2001, the South Carolina SHPO responded to the SCE&G letter and stated that "license renewal for the continuing operation of plants such as this one typically has no effect on historic properties." The SHPO encouraged SCE&G to search the SHPO's Geographical Information System (GIS) database for a more accurate, up-to-date source of information.

2

During our independent review, the NRC staff met with a representative of your office on December 12, 2002, to discuss the potential impacts of the proposed V. C. Summer license renewal. Enclosed is the NRC's cultural resources review for this action. This review reports the results of the literature review conducted by the staff and information from historic and cultural records, which includes information from the SHPO GIS database (Enclosure 1). The results indicate that this undertaking will have no effect on historic properties.

We plan to issue the Draft SEIS for the V. C. Summer license renewal action for public comment in June 2003; it will reflect our interactions to date. If you have any questions or require additional information, please contact Gregory Suber, the NRC Environmental Project Manager for the V. C. Summer license renewal project, at 301-415-1124 or GXS@nrc.gov.

Sincerely,

/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-395

Enclosures: As stated

cc w/o encl.: See next page

**U.S. NUCLEAR REGULATORY COMMISSION (NRC)
OFFICE OF NUCLEAR REACTOR REGULATION
DIVISION OF REGULATORY IMPROVEMENT PROGRAMS**

**CULTURAL RESOURCES REPORT NARRATIVE
VIRGIL C. SUMMER NUCLEAR STATION LICENSE RENEWAL**

May 2003

CULTURAL RESOURCES REPORT NARRATIVE VIRGIL C. SUMNER NUCLEAR STATION LICENSE RENEWAL

PROJECT DESCRIPTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended and NRC implementing regulations. The proposed Federal action is the renewal of the Operating License for the Virgil C. Sumner Nuclear Station (V. C. Sumner), which is operated by South Carolina Electric & Gas Company (SCE&G). The current operating license will expire August 6, 2022. The renewed license would subsume the remaining time of the current license and permit an additional 20 years of plant operation beyond the expiration of the current operating license.

This report presents the findings of the Section 106 review conducted to establish whether any historic properties will be affected by the license renewal of V. C. Sumner.

AREA OF POTENTIAL EFFECT

V. C. Sumner is located in Fairfield County, South Carolina, approximately 15 miles west of Wrensboro and 28 miles northwest of Columbia. The site is in a sparsely-populated, largely rural area, with forests and small farms comprising the dominant land use. The Broad River flows in a northwest-to-southeast direction approximately one mile west of the site.

An exclusion area must be defined by the applicant wherein it can control access in the event of an emergency situation. In this case, the exclusion area is owner controlled (i.e., not subject to an alternative routine use such as leased farming) and encompasses the area within approximately one mile of the reactor building; the exclusion area is posted and access to land portions of this area is controlled at all times. The V. C. Sumner property covers approximately 2245 acres, and includes the southern portion of Monticello Reservoir and parts of the Fairfield Pumped Storage Facility.

In conjunction with this license renewal action, SCE&G does not plan to undertake a major refurbishment activity in the site vicinity or along the transmission lines expressly constructed to connect the plant to the electrical grid when the plant was initially licensed. Therefore, the area of potential effect (APE) for this license renewal action is the area at the power plant site and its immediate environs which may be impacted. Specifically, this area consists of the exclusion area boundary (1-mile radius) and the Monticello reservoir shoreline.

NOTIFICATIONS AND PUBLIC INVOLVEMENT

On January 19, 2001, SCE&G wrote the South Carolina State Historic Preservation Office (SHPO) regarding license renewal at V. C. Sumner. On January 29, 2001, the South Carolina SHPO responded to SCE&G letter and stated that license renewal for the continued operation of plants, such as this one, typically has no effect on historic properties. The SHPO encouraged that the SHPO Geographical Information System (GIS) database be searched for a more accurate, up-to-date source of information.

On December 12, 2002, NRC staff met with Marta Matthews and Chad Long at the South Carolina SHPO's office, and Keith Derding and Diane Boyd at the South Carolina Institute of Archaeology and Anthropology (SCIAA). Archaeological site file searches were conducted at SCIAA. The GIS database and files at the South Carolina SHPO's office were searched for cultural resource information that may pertain to the proposed action. At the time of this visit, Dr. Matthews and Mr. Long raised the issue of potential impacts to cultural resources caused by erosion on the Monticello shoreline. This report addresses those concerns that were raised during the site visit in the section called "Identification of Historic Properties".

Four Native American Tribes were sent letters on November 27, 2002, providing them an opportunity to have input regarding cultural resource issues in the vicinity of V. C. Summer and inviting them to participate in the National Environmental Policy Act (NEPA) scoping process. The Tribes were the Catawba Indian Nation, Eastern Band of the Cherokee, Cherokee Nation (Western Cherokee in Oklahoma), and the United Keetoowah Band of Cherokee (Attachment 4 contains an example of this letter).

The NRC public involvement process is conducted in accordance with NEPA principles; in general, the NRC actively pursues stakeholder engagement in excess of the minimum requirements. The Commission has determined that the NRC will prepare an environmental impact statement (EIS) as that discussed in Section 102 of NEPA (42 USC 4332) to assess whether the license renewal action would significantly affect the quality of the human environment. The NRC staff will prepare an EIS and, in the case of license renewal, it is a site-specific supplement (SEIS) to the NRC Generic EIS for License Renewal of Nuclear Power Plants (GEIS), NUREG-1437, for the renewal of a reactor Operating License (OL). NUREG-1437 considered almost 100 environmental issues across all nuclear power plants to determine whether issues could be resolved generically. The potential impact to cultural resources cannot be resolved generically and, therefore, must be addressed on a site-specific basis in each SEIS.

On October 24, 2002, the NRC published a Notice of Intent in the *Federal Register* to notify the public of the staff's intent to prepare a site-specific supplement to the GEIS to assess the environmental impacts of the proposed action (renewal of the OL for the V. C. Summer plant) and to conduct scoping. The NRC invited the applicant, Federal, State, and local government agencies; Tribes; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments to the NRC no later than January 6, 2003. Two public scoping meetings were held on December 11, 2002, at the Fellowship Hall at the Whitehall A.M.E. Church in Jenkinsville, South Carolina, to afford the public yet another opportunity to provide comments.

The draft Supplemental Environmental Impact Statement (SEIS) regarding license renewal at V. C. Summer is scheduled to be issued in July 2003. The NRC staff plans to conduct two public meetings on August 25, 2003, to present an overview of the draft V. C. Summer site-specific supplement to the GEIS, and to accept public comments on the document. The public comment period will end on September 15, 2003. The Final SEIS will be issued in February 2004.

- 3 -

Information regarding license renewal and documents associated with license renewal at V. C. Summer can be viewed at the NRC's website www.nrc.gov.

IDENTIFICATION OF HISTORIC PROPERTIES

Historic and archaeological site file searches were conducted at the South Carolina Master File in the South Carolina Department of Archives and History and the Institute of Archaeology and Anthropology at the University of South Carolina to identify cultural resources that might be present at V. C. Summer. In addition, record searches were conducted for nearby locations to gain perspective on the types of historic resources that may be present in the previously undeveloped and unsurveyed portions of V. C. Summer.

The Final Environmental Statement (FES) (AEC 1973) for the construction of V. C. Summer listed three historic sites in the vicinity of the station. At that time, it was determined that none of the sites were "endangered" by the construction and operation of the proposed V. C. Summer plant. Four archaeological sites were discovered within or near the site boundary and Dr. Robert L. Stephenson, State Archaeologist, recommended that the area be surveyed and that two of the known sites be excavated (AEC 1973).

In 1972, SCE&G supported an archaeological survey that was conducted by a team from the University of South Carolina Institute of Archaeology and Anthropology (Teague 1979). The archaeological survey was conducted to assess the nature and distribution of the sites present and to assess the effect of the Parr Hydroelectric Project on historic and archaeological resources. The Parr Hydroelectric Project included: raising the level of the Parr Reservoir by elevating the Parr Reservoir Dam; construction of a series of dams on Frees Creek to create the upper reservoir for a new pumped-storage facility and supply cooling water for V. C. Summer; and construction of the Fairfield Pumped Storage Facility and V. C. Summer.

The Institute of Archaeology and Anthropology team identified 27 additional sites and excavated two others. Four of the five sites were inundated by water when Monticello Reservoir was filled in 1978 and are now inaccessible. The remaining sites lie along the banks of Monticello and Parr Reservoirs. Periods represented included the Early Archaic, Middle Archaic, Woodland, Mississippian, and Early Historic (SCE&G 2002).

Since the publication of the 1973 FES, 41 sites have been added to the National Register of Historic Places for Fairfield County. Ten of these sites fall within a 6-mile radius of V. C. Summer. Twenty-eight sites have been added to the National Register for Newberry County. Four of these sites fall within a 6-mile radius of V. C. Summer. No sites listed on the National Register of Historic Places fall within a 1-mile radius of V. C. Summer.

Two other historic sites exist within a 6-mile radius of V. C. Summer that are not listed on the National Register of Historic Places but are protected by SCE&G. One is the Mayo family cemetery, which is in a wooded area approximately 2.5 miles south of V. C. Summer on land that is owned by SCE&G, but is not within the exclusion area boundary of the V. C. Summer site. This small family plot contains headstones dating back to 1895. The other historic site, approximately 1.5 miles southwest of V. C. Summer, is a large monument erected in 1943 by the Daughters of the American Revolution marking the grave of General John Pearson, a Fairfield County native who served with distinction in the Revolutionary War. This monument is

Appendix E

- 4 -

In a wooded area on land that is not within the exclusion area of the V. C. Sumner site, but is maintained as a buffer zone around the site. SCE&G's Forestry Operations group is familiar with these two other historic sites, which are marked on its timber inventory and land cover maps, and takes appropriate measures to protect them when conducting forest management activities in the vicinity of either historic site (SCE&G 2002).

Properties within the APE

The following table provides a summary of selected sites within the APE. No sites listed on the National Register fall within a 1-mile radius of V. C. Sumner.

Site Number	Description	National Register Status	Location
38-FA-33	Savannah River and Morrow Mountain projectile points, several pottery shards - all materials were collected	Not Evaluated	Monticello Lake east shoreline - outside 1 mile radius of V. C. Sumner
38-FA-37	50 pieces of quartzite chipping debris were dispersed over 500 square meters. 3 flakes were collected.	Not Evaluated	Monticello Lake west shoreline - outside 1 mile radius of V. C. Sumner
38-FA-41	McMeehan Rock Shelter - excavated. This site is currently under water.	Nominatied for the National Register of Historic Places in 1974 Site #74001854	Underwater - Lake Monticello
38-FA-42	Located along a road cut through a plowed field. 25 quartzite flakes, 1 biface, 1 Guilford projectile point base were found. The biface and projectile point were collected.	Not Evaluated	North of Monticello - outside 1 mile radius of V. C. Sumner
38-FA-43	1 Savannah River projectile point base, 1 biface fragment, and 25 quartzite flakes were collected. This site is currently under water.	Not Evaluated	Underwater - Lake Monticello
38-FA-46	25 flakes and broken stone tools. 3 flakes and 2 Savannah River projectile points were collected. This site is currently under water.	Not Evaluated	Underwater - Lake Monticello

- 5 -

38-FA-47	12 quartzite flakes (5 were collected). The site has been disturbed by a road cut and no intact archaeological deposits remain.	Not Evaluated	Within 1 mile of V. C. Summer
38-FA-51	5 quartzite flakes were collected. This site is currently under water.	Not Evaluated	Underwater - Lake Monticello
38-FA-53	50 quartzite flakes and 2 projectile points were seen. The projectile points were collected. This site is currently under water.	Not Evaluated	Underwater - Lake Monticello
38-FA-56	Davis Plantation - two story house built about 1840-50	Nominated for the National Register of Historic Places in 1971 Site #74000776	South of Monticello on SC 215 - outside 1 mile radius of V. C. Summer
38-FA-125	Gulford projectile points of quartz, 1 Kirk point, 1 Savannah River point, 1 finely shaped flint blade. This site is currently under water.	Not Evaluated	Underwater - Lake Monticello
38-FA-298	2 steatite bowl fragments. Artifacts were collected. Site form suggests if associated with an archaeological site it would be under water.	Not Evaluated	Boat Ramp - north end of Lake Monticello - outside 1 mile radius of V. C. Summer

Only one archaeological site (38-FA-47) is located within a 1-mile radius of V. C. Summer. This site has not been evaluated for inclusion on the National Register of Historic Places. At the time of recording, the site consisted of 12 quartzite flakes (5 were collected). Upon reviewing the National Register Criteria for Evaluation, site 38-FA-47 is not likely to be eligible for the National Register.

Several of the archaeological sites were flooded by the impoundment of Monticello Lake. The majority of these sites have not been evaluated for inclusion on the National Register of Historic Places. These sites are not likely to be eligible for inclusion when applying the criteria for evaluation.

The McMeekin Rock Shelter (38-FA-41) was evaluated and nominated to the National Register in 1974. The site was recorded, excavated and evaluated. Results are documented in the 1972 archaeological survey that was conducted by a team from the University of South Carolina Institute of Archaeology and Anthropology (Teague 1978). The McMeekin Rock Shelter is currently underwater and is located outside of the 1-mile radius of V. C. Summer.

- 6 -

The Davis Plantation (38-FA-56) was evaluated and nominated to the National Register in 1971. The site is a two-story house built in approximately 1845, and is located south of the town of Monticello on SC 215. The Davis Plantation is located outside the 1-mile radius of V. C. Summer. The Davis Plantation is not located on the shoreline of Monticello Lake.

Several archaeological sites were considered during the cultural resources review due to their proximity to the shoreline of Monticello Lake and the potential concern of impacts associated with erosion. During the environmental site audit conducted for the NEPA review in December 2002, the NRC team of environmental specialists toured V. C. Summer and the surrounding area. The team walked portions of the Monticello Lake shoreline. Environmental impacts that could be associated with erosion were not observed. The team included specialists in archaeology, aquatic and terrestrial biology, and hydrology. The team visited several locations of known archaeological sites in the area. No cultural materials were observed at any of the locations.

SCE&G has established a land use and shoreline management plan (SCE&G 2002). The purpose of this plan is to help maintain and conserve the area's natural and man-made resources as well as assist in providing a balance between recreational use, development, environmental preservation, and control. This management plan addresses environmental policies including the exclusion area and public access for fishing, boating, hunting, and other shoreline activities. Erosion control measures are identified, as are restrictions on the removal of underbrush.

FINDINGS

In October 1972, upon reviewing the cultural resources literature associated with the construction of V. C. Summer, the South Carolina SHPO (Attachment 3) determined that no adverse effects to historic properties would result from SCE&G Construction Project #1894.

Major refurbishment of V. C. Summer is not anticipated for continued operation during the license renewal period; therefore, there is no expectation that land in the undeveloped portions of the site will be disturbed for operations during the renewal period. Operation of V. C. Summer, as planned under the application for license renewal, would protect undiscovered historic or archaeological resources on the site because the undeveloped natural landscape and vegetation would remain undisturbed, and access to the site would remain restricted.

In January 2001, SCE&G wrote the South Carolina SHPO (Attachment 1), requesting their comments on the V. C. Summer license renewal process. In its letter, SCE&G suggested that the continued operation of V. C. Summer will have no effect on historic properties (SCE&G 2001). In a response dated January 29, 2001, the South Carolina SHPO (Attachment 2) stated that license renewal for the continuing operation of plants such as this one typically has no effect on historic properties (SHPO 2001).

Operating procedures of SCE&G consider actions upon the inadvertent discovery of historic and archaeological remains at V. C. Summer. Based on the cultural resources analysis, the representation by SCE&G that it does not plan to undertake major refurbishment activities related to the renewal of V. C. Summer, and the expectation that operations will continue within

- 7 -

the bounds of previously analyzed conditions, as evaluated in the FES (AEC 1973) and subsequent environmental assessments, the NRC staff concludes that there will be no effect on historic properties within the APE and no additional mitigation is warranted.

Appendix E

- 8 -

ATTACHMENTS

1. Letter - January 19, 2001 SCE&G wrote the South Carolina SHPO regarding license renewal at V. C. Summer. Includes Maps of V.C. Summer and surrounding environment.
2. Letter - January 29, 2001 South Carolina SHPO responded to SCE&G letter - agreed that license renewal for the continuing operation of plants such as this one typically has no effect on historic properties.
3. Letter - October 20, 1972 SHPO wrote letter to Federal Power Commission regarding the SCE&G construction Project 1894 - determined that no adverse effects to historic properties would result from this project.
4. Letter - November 27, 2002 the NRC wrote letters to the four Tribes - example of the letter that was sent to the Catawba Indian Nation.

- 9 -

CERTIFICATION OF RESULTS

I certify that I conducted the investigation reported here, that my observations and methods are fully documented, and that this report is complete and accurate to the best of my knowledge.

Tara O. Eschbach

Reporter,
Pacific Northwest National
Laboratory on behalf of the
U.S. Nuclear Regulatory Commission

Signature

Date

Darby C. Stapp, Ph.D., RPA

Reviewer,
Pacific Northwest National
Laboratory on behalf of the
U.S. Nuclear Regulatory Commission

Concurrence (Signature)

Date

REFERENCES

South Carolina Electric and Gas (SCE&G), 2002. *Virgil C. Summer Nuclear Station Application for Renewed Operating License, Appendix E - Environmental Report*. Docket No. 50-395, Columbia, South Carolina.

South Carolina Electric and Gas Company, 2002. *FERC Project 1894 Land Use and Shoreline Management Plan Monticello and Parr Reservoirs - Effective April 1, 2002*. Columbia, South Carolina.

Teague, G.A., 1979. *An Assessment of Archeological Resources in the Parr Project Area, South Carolina*. Institute of Archeology and Anthropology. University of South Carolina. Columbia, South Carolina.

U.S. Atomic Energy Commission (AEC), 1973. *Final Environmental Statement Related to the Virgil C. Summer Nuclear Station Unit 1; South Carolina Electric & Gas Company*. Docket No. 50-395, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC), 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report*. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 26, 2003

Ms. Sandy Abbot
U.S. Fish and Wildlife Service
Ecological Services Office
176 Crogham Spur Road
Suite 200
Charleston, SC 29407

**SUBJECT: BIOLOGICAL ASSESSMENT FOR LICENSE RENEWAL AT V. C. SUMMER
NUCLEAR STATION AND REQUEST FOR INFORMAL CONSULTATION
(TAC NO. MB5227)**

Dear Ms. Abbot:

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared the enclosed Biological Assessment to evaluate whether the proposed renewal of the V.C. Summer Nuclear Station (V.C. Summer) operating license for a period of an additional 20 years would have adverse effects on listed species. This Biological Assessment covers the site, which is approximately 909 hectares (2,245 acres) and includes portions of Monticello Reservoir as well as the 193-km- (120-mi-) long transmission line corridor.

The NRC has identified eleven species listed as threatened or endangered under the Federal Endangered Species Act and one Candidate species with the potential to be affected by this action. The primary species of concern is the bald eagle, which has been found within an 8-km (5-mi) radius of V.C. Summer. The staff has determined that the proposed action is not a major construction activity and that it may affect, but is not likely to adversely affect, the bald eagle. No designated critical habitat for any listed species is located near the project area. We are placing this Biological Assessment in our project files and are requesting your concurrence with our determination.

In reaching its conclusion, the NRC staff relied on the information available through local, State, and Federal agencies, on research performed by the NRC staff and contractors, and a current listing of species provided by the South Carolina field office of the Fish and Wildlife Service.

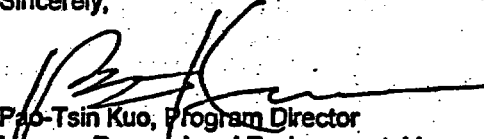
Appendix E

S. Abbot

- 2 -

If you have any questions regarding this Biological Assessment or the staff's request, please contact the license renewal project manager, Gregory Suber, by telephone at (301) 415-1124 or by e-mail at GXS@nrc.gov.

Sincerely,



Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-395

Enclosure: As stated

cc w/end: See next page

Biological Assessment

**Virgil C. Summer Nuclear
Station**

License Renewal Review

Jenkinsville, South Carolina

June 2003

**U.S. Nuclear Regulatory
Commission**

Rockville, Maryland

**Biological Assessment of the Effects of the V.C. Summer Power Plant License
Renewal on Threatened or Endangered Species**

Executive Summary

This Biological Assessment evaluates the potential impacts of the license renewal of the Virgil C. Summer Nuclear Station (V.C. Summer) on Federally listed threatened or endangered species. There will be no major construction, refurbishment, or replacement activities associated with this action. The U.S. Nuclear Regulatory Commission (NRC) has determined that license renewal for V.C. Summer will have no effect on the wood stork, red-cockaded woodpecker, shortnose sturgeon, Carolina heelsplitter, pool sprite, Georgia aster, smooth coneflower, rough-leaved loosestrife, Canby's dropwort, harperella, or relict trillium. The license renewal may affect, but is not likely to adversely affect, the bald eagle.

Project Description

The NRC licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. South Carolina Electric & Gas Company (SCE&G) operates V.C. Summer Unit 1 pursuant to NRC Operating License Number NPF-12, which expires August 6, 2022.

SCE&G has prepared an environmental report in conjunction with its application to NRC to renew the V.C. Summer operating license, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and
- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(e), Operating License Renewal Stage [10 CFR 51.53(e)].

The renewed operating license would allow 20 additional years of plant operation beyond the current V.C. Summer licensed operating period of 40 years.

No major refurbishment or replacement of important systems, structures, or components are expected during the V.C. Summer license renewal period. In addition, no construction activities are expected to be associated with the V.C. Summer license renewal.

Description of Project Area

V.C. Summer is located in Fairfield County, South Carolina, approximately 24 km (15 mi) west of the county seat of Winnsboro and 42 km (26 mi) northwest of Columbia, the State capital (Figure 1). V.C. Summer is a joint project between SGE&G, operator and two-thirds

owner, and the South Carolina Public Service Authority (Santee Cooper), owner of the remaining one-third. The site is in a sparsely populated, largely rural area, with forests and small farms comprising the dominant land use. The Broad River flows in a northwest-to-southeast direction approximately 1.6 km (1 mi) west of the site and serves as the boundary between Fairfield County (to the east) and Newberry County (to the west).

The V.C. Summer site covers approximately 909 ha (2245 ac), an area that includes portions of Monticello Reservoir and the Fairfield Pumped Storage Facility (FPSF). Approximately 348 ha (860 ac) are covered by the waters of Monticello Reservoir. A significant portion of the property (approximately 150 ha [370 ac]) consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. Some 50 ha (125 ac) are dedicated to transmission line rights-of-way. However, much of the V.C. Summer property consists of forested areas (approximately 360 ha [890 ac]). The primary terrestrial habitats at V.C. Summer are pine forest, deciduous forest, and mixed pine-hardwood forest (SCANA 2000). The pine forests at V.C. Summer include planted pines and naturally vegetated pines. Most of the deciduous forests at the site are located along stream bottoms and surrounding slopes.

Forested areas within the V.C. Summer site are managed by SCANA Services' Forestry Operations group, but timber is not routinely harvested. Parr Reservoir provides some limited freshwater marsh habitat in shallow backwaters, around low-lying islands, and in an area east of the FPSF tailrace that was used in the 1970s for the disposal of dredge spoil. These marshes and adjacent shallows are used by migrating dabbling ducks, including mallard, black duck, and teal. Monticello Reservoir and its subimpoundment also provide resting areas for wintering waterfowl and provide year-round habitat for non-migratory Canada geese.

Terrestrial wildlife species found in the forested portions of the V.C. Summer property are those typically found in the Piedmont forests of South Carolina. Wildlife characteristically found in the pine forests and mixed pine-hardwoods of the Piedmont include toads (e.g., Fowler's toad), lizards (e.g., Carolina anole, fence lizard, various skinks), snakes (e.g., black racer, rat snake, ringneck snake), songbirds (e.g., cardinal, bluejay, towhee, various warblers), birds of prey (e.g., red-tailed hawk, red-shouldered hawk), and a number of mammal species (e.g., gray squirrel, eastern cottontail, raccoon, white-tailed deer).

In total, for the specific purpose of connecting V.C. Summer to the transmission system, SCE&G and Santee Cooper constructed approximately 257 km (160 mi) of transmission lines (193 km [120 mi] of corridor) that occupy approximately 809 ha (2000 ac) of corridor. These transmission lines cross the counties of Fairfield, Newberry, Saluda, Aiken, Richland, and Edgefield (Figure 2). The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways, including Interstate 26 and Interstate 20. SCE&G and Santee Cooper plan to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. These transmission lines are expected to remain a permanent part of the regional transmission system even after V.C. Summer is decommissioned.

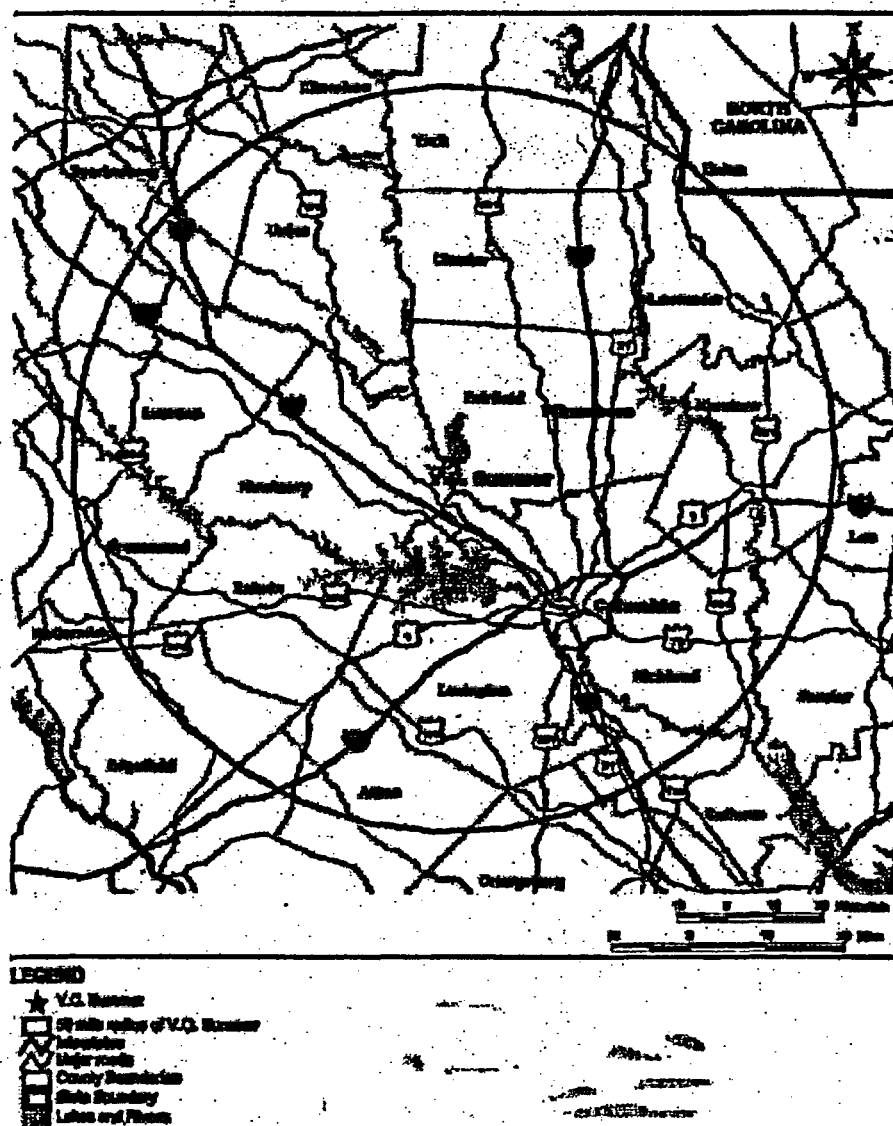


Figure 1. Location of V.C. Summer 80-km (50-mi) Region

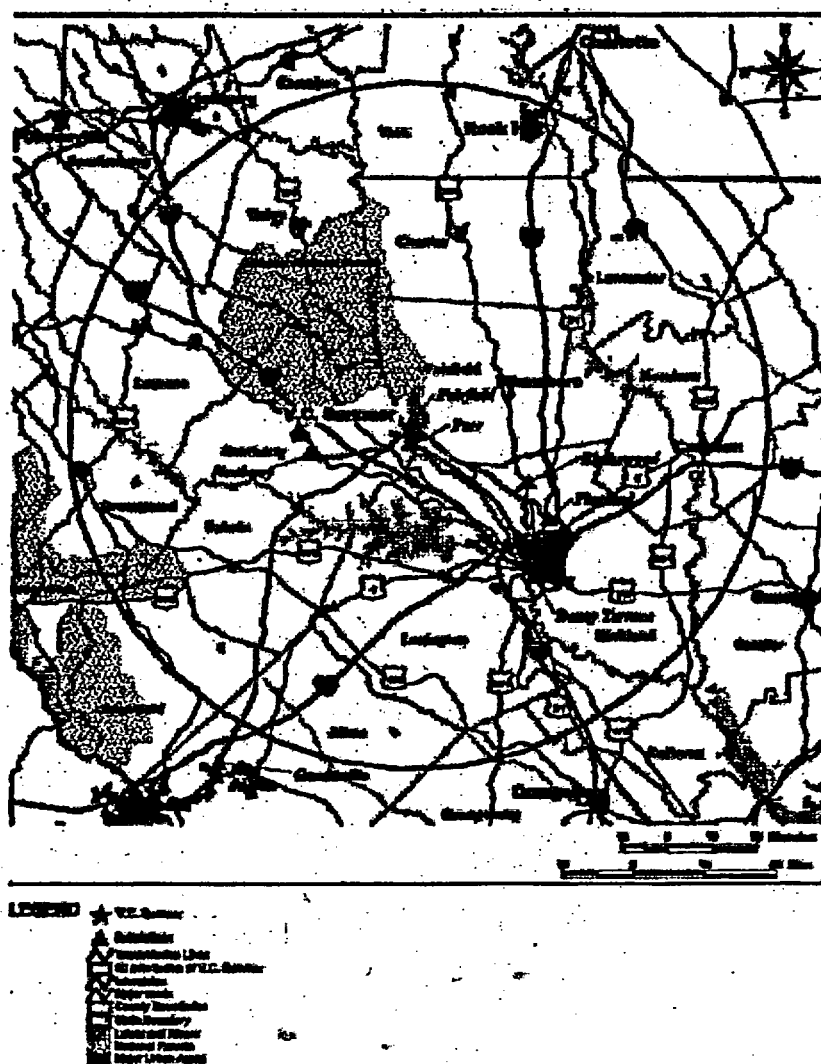


Figure 2. Location of V.C. Summer Transmission Lines

Appendix E

Most of the transmission corridors are situated within the Piedmont Physiographic Region, but the southernmost portions of the Summer-Graniteville, Summer-Denny Terrace No. 2, and Summer-Pine land corridors are situated within the Sandhills Physiographic Region. Most of the areas crossed by the transmission corridors are forest lands or agricultural lands (in pasture or row crops). Forest habitats along transmission corridors consist primarily of pine forest, pine-hardwood forest, and bottomland hardwood forest. Transmission corridors that run west from V.C. Summer cross more agricultural lands (mostly pasture) than corridors that run to the east. Conversely, corridors that run to the east cross more forested lands and residential areas (northern suburbs of Columbia) than corridors that run to the west.

No areas designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat for endangered species exist at the V.C. Summer site or on or adjacent to associated transmission lines. In addition, the transmission corridors do not cross any State or Federal parks, wildlife refuges, or wildlife management areas.

The transmission corridors are maintained by mowing, by trimming of undesirable vegetation from the sides of the corridors, and by use of approved herbicides. Under normal circumstances, the mowing and herbicide schedule follows a three-year cycle. Trees are "side-trimmed" every 10 years by helicopters carrying hydraulically operated saws. Aerial patrols of transmission corridors are conducted four times a year by SCE&G and twice a year by Santee Cooper. Dead and diseased trees at the edges of corridors are removed if it appears that they could fall and strike the transmission lines or support structures.

Periodic mowing in dry, upland portions of transmission corridors creates sunny, open conditions favorable for plants and animals normally found in fire-maintained ecosystems, such as successional grasslands and longleaf pine-wiregrass communities. Permanent and seasonal wetlands along transmission corridors hold potential for harboring a number of other plant species currently listed by the USFWS and South Carolina Department of Natural Resources (SCDNR), including the rough-leaved loosestrife and Canby's dropwort. Wetlands also provide habitat for several listed animal species, and some species (e.g., the wood stork) are found only in wetlands. Many animal species, however, are highly mobile and utilize more than one habitat type. The transmission corridors provide an open canopy and offer an abundance of herbaceous ground cover. Therefore, they can be natural avenues for movement and foraging by some animals.

Aquatic and riparian communities in the vicinity of V.C. Summer are influenced by the hydrology and water quality of the Broad River and movement of water between the Broad River/Parr Reservoir and Monticello Reservoir. The Broad River originates on the eastern slope of the Blue Ridge Mountains near Lake Lure, North Carolina, and flows 354 km (220 mi) southeast into South Carolina before joining the Saluda River at Columbia, South Carolina, to form the Congaree River. The Congaree River joins the Wateree River approximately 80 km (50 mi) southeast of Columbia, SC to become the Santee River. The Santee River flows southeast 230 km (143 mi) to empty into the Atlantic Ocean. In South Carolina, the Broad River basin encompasses an approximately 7242-km² (4500-mi²)

watershed drained by 7594 km (4719 mi) of streams (SCDHEC 1998). Major tributaries include the Pacolet, Tyger, and Enoree rivers, all of which enter the Broad River from the west. The Broad River Basin in South Carolina is entirely within the Piedmont region, which is an area of gently rolling to hilly terrain with relatively broad stream valleys; elevations range from 115 to 305 m (376 to 1000 ft) above mean sea level (SCDHEC 1998). For most of its length in South Carolina, the Broad River flows through agricultural and forested land, including the Sumter National Forest, which bounds the river for some 48 km (30 mi) above Parr Reservoir.

Parr Reservoir was created in 1914 by damming the Broad River at Parr Shoals, approximately 42 km (26 mi) upstream of the confluence of the Broad and Saluda rivers for Parr Hydro, a small (15 megawatt) run-of-the-river hydroelectric facility. Prior to 1977, the reservoir's surface area was 749 ha (1850 ac) (SCE&G 1978). In 1977, the level of Parr Reservoir was raised by 3 m (9 ft), which increased its surface area to approximately 1781 ha (4400 ac). This modification was necessary to support the development of FPSF, which was built on Frees Creek, a small tributary of the Broad River. In addition, Monticello Reservoir was created to serve as the upper reservoir for FPSF and the cooling water source for V.C. Summer. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing a headwater pool for Parr Hydro and a tailwater pool for FPSF. The daily cycle of operation at the FPSF transfers up to 35,771,181 m³ (29,000 acre-feet) per day of water from Parr Reservoir to Monticello Reservoir and back (NRC 1981). Operations vary, depending on the season and system needs. In summer, FPSF generally pumps water from Parr Reservoir to Monticello Reservoir between the hours of 11 pm and 8 am and generates power (by releasing water) between the hours of 10 am and 11 pm. In winter, FPSF generally pumps water from Parr Reservoir to Monticello Reservoir between 11 pm and 6 am and generates between the hours of 6 am and 1 pm. The level of generation varies from one generator up to the maximum output of eight, depending on demand. Maximum output may not be necessary on all days. Pumping is normally done at maximum capacity. FPSF is normally operated seven days a week.

As a result of FPSF operations, Parr Reservoir is subject to daily fluctuations in water level of as much as 3 m (10 ft) (NRC 1981), but the daily average is approximately 1 m (4 ft) (Dames & Moore 1985). These water level fluctuations can expose and then inundate up to 1032 ha (2550 ac) of Parr Reservoir with each cycle of pumpback and generation (release of water). The amount of water pumped from and returned to Parr Reservoir daily represents as much as 88 percent of its total volume (NRC 1981).

V.C. Summer is on the south shore of Monticello Reservoir (Figure 3), which serves as its cooling water source and heat sink. Monticello Reservoir was formed by damming Frees Creek, a small tributary of the Broad River that flowed into Parr Reservoir about 1.9 km (1.2 mi) upstream of the Parr Shoals dam. As previously discussed, Monticello Reservoir was designed to serve both as a cooling pond for V.C. Summer and the upper pool for the FPSF,

Appendix E

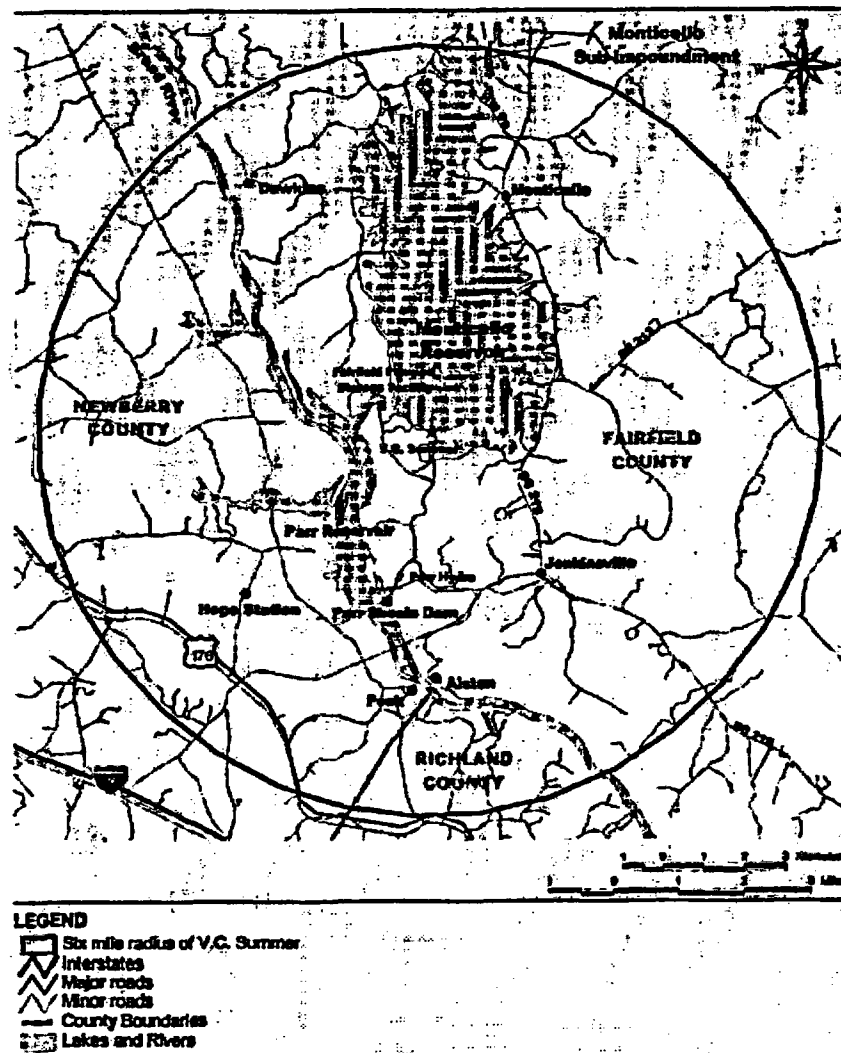


Figure 3 Location of V.C. Summer 10-km (6-mi) Region

with an enlarged Parr Reservoir serving as the lower pool. Water flow from the Frees Creek watershed into the newly created Monticello Reservoir was negligible, and FPSF's pumps were used initially to fill the reservoir with water from Parr Reservoir (NRC 1981). Monticello Reservoir's small watershed drains an area of only 4452 ha (11,000 ac), including the reservoir and its subimpoundment (discussed later in this section).

Monticello Reservoir is approximately 10 km (6 mi) long with a surface area of 2630 ha (6500 ac). The average depth is 18 m (59 ft) and the maximum depth is approximately 38 m (126 ft) (SCDHEC 1998). FPSF operations can cause water levels in Monticello Reservoir to fluctuate as much as 1.4 m (4.5 ft) daily. Daily water level changes vary, depending on system needs. It is currently rated as one of the least eutrophic reservoirs in South Carolina, and is characterized by low nutrient (total phosphorus and total nitrogen) concentrations.

List of Species

In preparing for renewal of its operating license, V.C. Summer assessed a wide variety of potential impacts, including those to ecological resources, in an environmental report that was submitted to the NRC on August 6, 2002, as part of a License Renewal Application. The *Threatened and Endangered Species Field Survey* (SCE&G 2002a) presents the results of field surveys of the V.C. Summer site and associated transmission corridors conducted in late spring (May) and summer (June, July, and August) 2002 to update information in the SCE&G environmental report (SCE&G 2002b) on ecological resources, emphasizing threatened and endangered species. Information obtained during the surveys was used by the NRC in its assessment of the potential impact of the V.C. Summer operation over the license renewal term on threatened and endangered species. This Biological Assessment describes the survey areas, presents a list of potentially occurring species, describes survey techniques, and discusses the results of the surveys.

The NRC has identified 11 species (Table 1) listed as threatened or endangered under the Federal Endangered Species Act and one Candidate species with the potential to be affected by this action based on information received from USFWS during a meeting of NRC and USFWS staff held at the USFWS Charleston Field Office in South Carolina on December 12, 2002. The list was again confirmed in a letter from NRC to USFWS April 16, 2003 (NRC 2002). The South Carolina counties included in the NRC assessment are Fairfield, Newberry, Saluda, Aiken, Richland, and Edgefield.

Additionally, SCE&G conducted field surveys to verify the presence or absence of these species (SCE&G 2002a). Before going into the field, project biologists conducted a literature review to identify species known to occur in the counties crossed by V.C. Summer transmission lines. Previous research for the V.C. Summer environmental report had shown that only one listed species, the bald eagle, was known to occur on the V.C. Summer site and there were no records of threatened and endangered species occurring along the V.C. Summer transmission corridors.

Appendix E

Table 1. Federal Endangered, Threatened, and Candidate Species that potentially occur in the vicinity of the V.C. Summer site or the Counties crossed by transmission lines.

Scientific Name	Common Name	Federal Status ^a	Determination
Invertebrates			
<i>Lasmigona decorata</i>	Carolina heelsplitter	E	No Effect
Fish			
<i>Acipenser brevirostrum</i>	shortnose sturgeon	E	No Effect
Birds			
<i>Haliaeetus leucocephalus</i>	bald eagle	T	Not likely to adversely affect
<i>Mycateria americana</i>	wood stork	E	No Effect
<i>Picoides borealis</i>	red-cockaded woodpecker	E	No Effect
Plants			
<i>Amphianthus pusillus</i>	pool sprite	T	No Effect
<i>Aster georgianus</i>	Georgia aster	C	No Effect
<i>Echinacea laevigata</i>	smooth coneflower	E	No Effect
<i>Lysimachia asperulifolia</i>	rough-leaved loosestrife	E	No Effect
<i>Oxpolis canbyi</i>	Canby's dropwort	E	No Effect
<i>Ptilimnium nodosum</i>	harperella	E	No Effect
<i>Trillium reliquum</i>	relict trillium	E	No Effect

^a E = Endangered; T = Threatened; C = Candidate for listing.
Source: USFWS 2002

The federally listed species known to occur in the counties crossed by V.C. Summer-associated transmission corridors are shown in Table 1. Although this species list was based primarily on information obtained from the USFWS, a number of other sources and authorities were consulted, including *Manual of the Vascular Flora of the Carolinas* (Radford et al. 1973), *Endangered, Threatened, and Rare Vascular Flora of the Savannah River Site* (Knox and Sharitz 1990), *Amphibians and Reptiles of the Carolinas and Virginia* (Martof et al. 1980), *Guide to the Reptiles and Amphibians of the Savannah River Site* (Gibbons and Semlitsch 1991), *South Carolina Bird Life* (Sprunt and Chamberlain 1970), and *Mammals of the Savannah River Site* (Cothran et al. 1991).

Species Survey

The undeveloped portions of the V.C. Summer site were surveyed on foot. The transmission corridors, because of their size, were surveyed by concentrating efforts in areas offering the greatest potential for harboring listed species. Areas of interest were identified using U.S. Geologic Survey (USGS) 7.5 minute topographic maps, county soil maps, and aerial photographs prior to conducting ground surveys. This initial "desk-top" survey allowed biologists to rapidly eliminate from consideration cropland, pastures, and other areas of poor-quality habitat for listed species. Following this phase of the survey, biologists drove to areas of potential interest and conducted surveys on foot. The survey of the V.C. Summer site was conducted in late May 2002. Surveys of the corridors were conducted over the May-August 2002 period (SCE&G 2002a).

Survey techniques are described in detail in the *Threatened and Endangered Species Field Survey* (SCE&G 2002a). The survey techniques for birds, mammals, reptiles, and amphibians were designed to provide information on the occurrence and potential for occurrence of listed species at V.C. Summer and along the transmission corridors. Biologists conducted the survey of the V.C. Summer site by systematic walkover within all natural habitats, such that each habitat type was thoroughly searched. Surveys conducted along the transmission corridors were focused on areas identified, through the examination of aerial photographs and topographic maps, as providing potential habitat for listed animal species. During each survey, wildlife species were identified through actual observations, as well as from tracks, scat, and birdcalls.

Notes regarding species observed, as well as pertinent data regarding habitat quality, weather conditions, time of day, etc., were recorded in a field notebook. No trapping or other collecting activities were conducted, except where slow-moving reptiles or amphibians were captured by hand and released after identification. Because many animal species are mobile and secretive, the absence of a species during a survey is not necessarily conclusive evidence that the species does not use the area in question. Therefore, the *potential* for use of V.C. Summer and transmission corridors by listed wildlife species was also evaluated, based on the quality of habitats observed.

The V.C. Summer site contains substantial acreage of intact forestland (exclusive of planted pines), and an attempt was made to visit all forested sites, especially those featuring steep topography and stream drainages, since these would be expected to support the highest diversity of vascular species. Similarly, portions of transmission corridors with intact forests on one or both sides were presumed most likely to harbor rare plants. A total of 75 locations representing more than 97 km (60 mi) of transmission corridor were surveyed on foot. Most of these sites were chosen based on terrain features (from topo maps), soils (from county soil surveys), land use in the area (from aerial photographs), and existing vegetation (from aerial photographs). Other sites were added due to proximity to known populations of threatened and endangered species. Several access points were locked/gated and thus inaccessible; these sites generally feature pastureland that otherwise offer little in the way of habitat for rare species.

Appendix E

Enlarged topographic maps developed from USGS quadsheets (7.5 minute series) and a hand-held global positioning system unit were used to record the locations of areas that were searched. Notes were taken at each area searched describing habitats and plant species present. Field surveys involved careful study of all vegetation in each target area. In the case of problematic genera, specimens were collected for further study and placed in a plant press. Specimens collected and preserved during this study are stored at the A.C. Moore Herbarium of the University of South Carolina.

Before fieldwork began, the transmission corridors were evaluated using USGS topographic maps, aerial photographs, soil maps, and other resources. Lengths of corridor that appeared to have potential for supporting a high level of biological diversity or harboring one or more rare species were identified and surveyed.

Species Evaluated

Invertebrates:

Lasmigona decorata, Carolina heelsplitter

Before a 1987 USFWS survey, the Carolina heelsplitter had not been recorded in the state since the mid-19th century (Keferl and Shelly 1988 as cited in USFWS 1993, Keferl 1991 as cited in USFWS 1993). This listed (Endangered) freshwater mussel was historically found in South Carolina in the Pee Dee River system (Clarke 1985 as cited in USFWS 1993, Keferl and Shelly 1988 as cited in USFWS 1993, Keferl 1991 as cited in USFWS 1993). The USFWS conducted intensive surveys between 1987 and 1990 and found only two surviving populations of the Carolina heelsplitter in the Pee Dee River system; the Goose Creek and Lynches River/Flat Creek populations (Keferl 1991 as cited in USFWS 1993). During the USFWS surveys, a total of only 12 live individuals were found in Flat Creek (1987-1990) and two individuals were found in the Lynches River (both found in 1990). Because the Carolina heelsplitter populations have been found only in other tributaries to the Pee Dee River and not in the Broad River system near the V.C. Summer site or transmission lines, the NRC staff has determined that the proposed license renewal would have no effect on the Carolina heelsplitter.

Fish:

Acipenser brevirostrum, shortnose sturgeon

The shortnose sturgeon is listed as Endangered. The shortnose sturgeon historically occurred in the Broad River in Lexington and Newberry counties, but was likely extirpated from that stretch of the Broad River. Passage of this species up the Broad River is blocked by dams (SCE&G 2002a). In South Carolina, the primary factors affecting populations of this species are habitat alteration, due to dredging and dam construction, and pollution. Currently, in South Carolina they inhabit Winyah Bay

Rivers, those that drain into Lake Marion, the Santee, Cooper, and Savannah rivers, and the ACE (Ashepoo, Combahee, and Edisto Rivers) Basin. In the latter, shortnose sturgeon are typically found at the freshwater-saltwater interface. The shortnose sturgeon has not been found near the V.C. Summer site or transmission lines. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the shortnose sturgeon.

Birds:

Haliaeetus leucocephalus, bald eagle

The bald eagle is generally associated with lakes, rivers, and coastal areas (USACE 2002). Bald eagles are commonly observed foraging around Monticello Reservoir, the FPSF tailrace canal, Parr Reservoir, and on the Broad River downstream of Parr Shoals dam. The bald eagle is listed as Threatened under the provisions of the Endangered Species Act. The bald eagle was the only listed species observed during the SCE&G field surveys.

There are no recorded bald eagle nests at the V.C. Summer site, but there are six nests within 8 km (5 mi) of the V.C. Summer site, the nearest being approximately 3.2 km (2 mi) from the site (Holling 2001). Four of these six nests are believed to be active nesting sites, while the status of two nests is unknown (SCDNR 2001). There are four bald eagle nesting sites on Parr Reservoir. Three (one active, two unknown status) are within 0.8 km (0.5 mi) of one another, on the western shore of the reservoir, approximately 3.2 km (2 mi) west of V.C. Summer. The fourth is on the Heller's Creek arm of Parr Reservoir, approximately 6 km (4 mi) northwest of V.C. Summer. There is a single bald eagle nesting site on the eastern shore of Monticello Reservoir, approximately 5.6 km (3.5 mi) north of V.C. Summer. There is also a nesting site approximately 3.2 km (2 mi) east of Monticello Reservoir (6 km [4 mi] northeast of V.C. Summer) on a tributary of the Little River. One active bald eagle nest in Saluda County is approximately 0.8 km (0.5 mi) west of the Summer-Graniteville transmission line, and one bald eagle nest in Richland County is located approximately 1.4 km (0.9 mi) south of the Summer-Denny Terrace transmission line (SCDNR 2001). The current status of the Richland County nest is unknown, but the nest was viable as recently as 1995 (SCDNR 2001).

The *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (USFWS 1987) prescribes two management zones around eagle nests, night roosts, and shoreline use areas in which the provisions of various laws and their implementing regulations may apply. The two management zones prescribed in the report are "primary" (from 229 to

457 m [750 to 1500 ft]) and "secondary" (from 23 m [75 ft] to 1.6 km [1 mi]) (USFWS 1987). The Habitat Management Guidelines provide recommendations, excluding certain activities within these zones, to minimize impacts to the bald eagle. The V.C. Summer site is located beyond the secondary management zone buffers of the active nests. Consequently, the potential for activities at the V.C. Summer site to disturb breeding/nesting at these nest sites is minimal.

Lehman (2001) summarized the literature regarding raptor electrocutions on power lines and emphasized that nearly all electrocutions in the United States occur on comparatively low-voltage distribution lines supplying individual users and businesses, not transmission lines. Because of their acute vision, maneuverability, and the fact that they migrate neither in flocks nor at night, the likelihood of transmission line collisions involving the eagles is remote. There are no known reports of bald eagle collisions with the V.C. Summer transmission lines or other structures. Based on a review of the literature and the absence of any reported electrocutions associated with the V.C. Summer transmission lines, the staff concludes that potential eagle losses due to transmission line-related electrocutions are highly unlikely. In the event that an electrocuted bald eagle were to be found, SCE&G's procedures require that a Raptor Incident Report be filed.

Based on the locations of the active eagle nests relative to the V.C. Summer site and associated transmission lines, the potential for disturbance during nesting/breeding, either from activities at the V.C. Summer site or from transmission line maintenance, is highly unlikely. SCE&G's procedures require that it follow the USFWS Habitat Management Guidelines for the bald eagle in the Southeast Region.

Additionally, a substantial number of bald eagles and other birds are commonly seen foraging at the FPSF as it transfers water from Parr Reservoir to Monticello Reservoir. Likely, the substantial number of bald eagles and other birds foraging at the FPSF indicates that the daily pumping of water creates a preferred foraging area for the birds. It is possible that the current water circulating system of V.C. Summer, more specifically the FPSF, increases the availability of fish. Therefore, based on the available information, the NRC staff makes a finding of "may affect, not likely to adversely affect" the bald eagles for the proposed license renewal.

Myceterla americana, wood stork

The wood stork, listed as Endangered, is known to occur in Aiken County. The Summer-Graniteville transmission line terminates in the northern part of Aiken County more than 80 km (50 mi) from the V.C. Summer site. Although they do not nest in Aiken County, wood storks from the Birdsville Colony (near Millen, Georgia) forage in shallow

wetlands on the U.S. Department of Energy's Savannah River Site and in specially constructed ponds on the National Audubon Society's Silver Bluff Sanctuary, near Jackson, South Carolina (DOE 1997; NAS undated). No transmission corridors associated with V.C. Summer cross or approach the Savannah River Site or the Silver Bluff Sanctuary, and wood storks have not been recorded near the V.C. Summer site or its transmission line corridors. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the wood stork.

Picoides borealis, red-cockaded woodpecker

The red-cockaded woodpecker, listed as Endangered, is known to occur in Aiken, Edgefield, Saluda, and Richland counties (SCDNR 2002). Active nest cavities of this cooperative breeder occur in open, mature pine stands with sparse midstory vegetation (USFWS 2002). When the hardwood midstory grows above 5 m (15 ft), cavity abandonment usually occurs (Hooper et al. 1980). Preferred habitat for this species is not found at the V.C. Summer site, nor is it found along the transmission corridors. There is one point on the Summer-Graniteville corridor where the Summer transmission corridor passes through mature, marginally open pine forests. At this location, however, numerous oaks of considerable height are scattered among the pines, significantly decreasing the probability that red-cockaded woodpeckers would occur here. Although the forest adjacent to that location was thoroughly searched during the 2002 field surveys, no active or abandoned nest cavities were found. Because suitable habitat does not occur at the V.C. Summer site or associated transmission lines, the NRC staff has determined that the proposed license renewal would have no effect on the red-cockaded woodpecker.

Plants:

Aster georgianus, Georgia aster

The Georgia aster, a Candidate for listing, is found in dry, open woodlands and disturbed areas, such as roadsides and utility rights-of-way that are regularly mowed. Populations have been found in Edgefield, Fairfield, and Richland counties (SCDNR 2002). However, there have been no recorded occurrences of this species in or adjacent to the transmission corridors or at the V.C. Summer site (SCDNR 2001). Furthermore, the Georgia aster was not found during the 2002 field surveys. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the Georgia aster.

Echinacea laevigata, smooth coneflower

The smooth coneflower, listed as Endangered, is known to occur in Aiken and Richland counties. There is no known record of smooth coneflower in Fairfield County (SCDNR 2002). Habitat for this perennial herb is open woods, cedar barrens, roadsides, clear cuts, limestone bluffs, and transmission line corridors. Fire or other disturbance, such as well-timed mowing or clearing, is essential to maintaining the open habitat required for this species (USFWS 2002). Considering the absence of truly circumneutral soils on the transmission corridors studied, the absence of apparent habitat on neighboring land, and the fact that fires are practically nonexistent in the transmission corridors, it is highly unlikely that smooth coneflower ever has been a resident of these areas. Although it was sought on open corridors featuring steep, rocky terrain throughout this project area during the 2002 field surveys, there have been no recorded occurrences of this species in or adjacent to the transmission line corridors associated with V.C. Summer or at the site (SCDNR 2001). Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the smooth coneflower.

Lysimachia asperulifolia, rough-leaved loosestrife

The rough-leaved loosestrife is listed as Endangered. Habitat for this perennial herb consists of Carolina bays and the ecotones between longleaf pine uplands and pond pine pocosins. The only known location of the rough-leaved loosestrife within South Carolina is at Fort Jackson in Richland County (USFWS 2002); there are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with V.C. Summer or at the site (SCDNR 2001). Some possibility exists that this species could survive on boggy places under power lines studied in the field survey, but there are only two sites that could reasonably be considered, and neither of them is burned. Portions of the Graniteville transmission corridor would be thought to potentially support loosestrife, but no sandhill seepage bogs were discovered. It is highly unlikely that rough-leaved loosestrife has ever grown anywhere within the study area. Furthermore, rough-leaved loosestrife was not found during the 2002 field surveys. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the rough-leaved loosestrife.

Oxypolis canbyi, Canby's dropwort

Canby's dropwort is listed as Endangered. This perennial plant is known to occur in 11 counties within South Carolina, one of which (Richland) is crossed by V.C. Summer transmission lines (SCDNR 2002). This coastal plain species grows in wet meadows, wet pineland savannas, ditches, sloughs, and along the edges of cypress-pine ponds (USFWS

2002). There have been no recorded occurrences of this species in or adjacent to the transmission line corridors associated with V.C. Summer or at the site (SCDNR 2001). No Canby's dropwort were found during the 2002 field surveys. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the Canby's dropwort.

Ptilimnium nodosum, harperella

Harperella is listed as endangered. Typical habitat for this annual herb is rocky or gravel shoals, margins of swift-flowing streams, and edges (bays) of intermittent pineland ponds (USFWS 2002). Harperella is known in South Carolina from Aiken and Saluda counties (SCDNR 2002). There is one recorded population of harperella approximately 0.8 km (0.5 mi) west of the Summer-Graniteville transmission line corridor in Saluda County. The most recent observation of this population in the SCDNR database was from 1985 (SCDNR 2001). There are no recorded occurrences of this species in or adjacent to the V.C. Summer-associated transmission corridors or the site (SCDNR 2001). It is of potential occurrence, therefore, in suitable habitat along portions of the Summer-Graniteville line, particularly around Ridge Spring. High ponds occur around State Highway SC 23 in the vicinity of the Graniteville line, but these bays are highly altered, and little resident native vegetation remains. On the other hand, the Graniteville line does not specifically cross any Carolina bays in the region. Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the harperella.

Trillium reliquum, relict trillium

The relict trillium is listed as Endangered. Habitat for this perennial herb is mature, moist, undisturbed hardwood forests (USFWS 2002). Relict trillium is known from Aiken and Edgefield counties (SCDNR 2002). Relict trillium is restricted to sites over mafic rock, within old-growth, intact forest systems. They do respond somewhat positively to disturbance, and may be expected to survive in openings under powerlines if present in adjacent forests. No relict trillium was seen during this survey. The Aiken County locations for this species are much unlike anything else seen in Aiken County under the Graniteville transmission line; it is extremely unlikely that this species ever occurred in the project area. There have been no recorded occurrences of this species in or adjacent to the transmission line corridors associated with V.C. Summer or at the site (SCDNR 2001). Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the relict trillium.

Amphibanthus pulillus, pool sprite

The pool sprite, also known as little amphibanthus, is listed as Threatened. This aquatic plant occurs in small (usually less than one square meter) shallow pools on the crests and flattened slopes of granite outcrops (USFWS 2002). These pools completely dry out in summer droughts. The pool sprite is known to occur within Saluda County (USFWS 2002; SCDNR 2002), which is crossed by the transmission lines associated with V.C. Sumner. This plant is endemic to open flat granite rocks, with enough surface area to allow the development of shallow pools that fill with water during spring rainy periods, when the seeds germinate, followed by rapid growth, flowering, and fruit set. Transmission corridors featuring granite rock anywhere within this project were examined for the slightest possibility of occurrence; the best developed "flatrocks" are just south of V.C. Sumner. Some boulders were seen elsewhere along power lines in Fairfield County, but none was adequate for supporting this species. It is highly unlikely that pool sprite ever occurred anywhere within the study area. Only one occurrence of this plant is known from Saluda County (USFWS 2002), but there are no recorded occurrences in or adjacent to the V.C. Sumner-associated transmission line corridors or at the site (SCDNR 2001). Therefore, the NRC staff has determined that the proposed license renewal would have no effect on the pool sprite.

Conclusions

The NRC has identified 11 species listed as Threatened or Endangered under the Federal Endangered Species Act and one Candidate species with the potential to be affected by the license renewal of V.C. Sumner. There will be no major refurbishment, construction, or replacement activities associated with this action. The NRC has determined that license renewal for V.C. Sumner will have no effect on the wood stork, red-cockaded woodpecker, shortnose sturgeon, Carolina heelsplitter, pool sprite, Georgia aster, smooth coneflower, rough-leaved loosestrife, Candy's dropwort, harpetella, and relict trillium and may affect, but is not likely to adversely affect, the bald eagle.

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- 10 CFR Part 54. Requirements for Renewal of Operating Licenses for Nuclear Power Plants.

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Appendix F

GEIS Environmental Issues Not Applicable to V.C. Summer

Appendix F

GEIS Environmental Issues Not Applicable to Virgil C. Summer

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996; 1999)^(a) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to the Virgil C. Summer Nuclear Station (V.C. Summer) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to V.C. Summer

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Altered salinity gradients	1	4.2.1.2.2 4.4.2.2	V.C. Summer cooling system does not discharge to an estuary.
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER BASED HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	1	4.3.3	This issue is related to heat- dissipation systems that are not installed at V.C. Summer
Impingement of fish and shellfish	1	4.3.3	This issue is related to heat- dissipation systems that are not installed at V.C. Summer.
Heat shock	1	4.3.3	This issue is related to heat- dissipation systems that are not installed at V.C. Summer.
GROUNDWATER USE AND QUALITY			
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	V.C. Summer does not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	V.C. Summer does not have or use Ranney wells.

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

Appendix F

Table F-1 (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
GROUNDWATER USE AND QUALITY			
Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	V.C. Summer is not in a coastal area.
Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	This issue is related to salt marshes which are not present at V.C. Summer.
Groundwater use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1 4.8.1.2	V.C. Summer uses less than 100 gpm groundwater.
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	4.8.1.3 4.4.2.1	This issue is related to heat-dissipation systems that are not installed at V.C. Summer.
TERRESTRIAL RESOURCES			
Cooling tower impacts on crops and ornamental vegetation	1	4.3.4	This issue is related to a heat-dissipation system that is not installed at V.C. Summer.
Cooling tower impacts on native plants	1	4.3.5.1	This issue is related to a heat-dissipation system that is not installed at V.C. Summer.
Bird collisions with cooling towers	1	4.3.5.2	This issue is related to a heat-dissipation system that is not installed at V.C. Summer.
HUMAN HEALTH			
Microbial organisms (occupational health)	1	4.3.6	V.C. Summer does not have or use a cooling tower for condenser cooling.

F.1 References

- 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."
- U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2. Washington, D.C.
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Appendix G

**NRC Staff Evaluation of Severe
Accident Mitigation Alternatives for
V.C. Summer Nuclear Station in
Support of License Renewal Application**

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Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives for V.C. Summer Nuclear Station in Support of License Renewal Application

G.1.0 Introduction

South Carolina Electric & Gas Company (SCE&G) submitted an assessment of SAMAs for V. C. Summer as part of the Environmental Report (ER) (SCE&G 2002). This assessment was based on the most recent V. C. Summer Probabilistic Risk Analysis (PRA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2), and insights from the V. C. Summer Individual Plant Examination (IPE) (SCE&G 1993) and Individual Plant Examination of External Events (IPEEE) (SCE&G 1995). In identifying and evaluating potential SAMAs, SCE&G considered SAMA analyses performed for other operating plants which have submitted license renewal applications, as well as industry and NRC documents that discuss potential plant improvements, such as NUREG-1560 (NRC 1997a). SCE&G identified 268 potential SAMA candidates. This list was reduced to 12 unique SAMA candidates by eliminating SAMAs that were not applicable to V. C. Summer due to design differences, had already been implemented, are related to changes that would be made during the design phase of a plant rather than to an existing plant, or had high implementation costs. SCE&G assessed the costs and benefits associated with each of the potential SAMAs and concluded that none of the candidate SAMAs evaluated would be cost-beneficial for V. C. Summer.

Based on a review of the SAMA assessment, the NRC issued requests for additional information (RAI) to SCE&G by letter dated January 17, 2003 (NRC 2003a), and by fax dated April 28, 2003 (NRC 2003b). Key questions concerned: dominant risk contributors at V. C. Summer and the SAMAs that address these contributors, the impact on dose consequences if all release categories are considered rather than just large early release categories, the potential impact of uncertainties and external event initiators on the assessment results, and detailed information on several specific candidate SAMAs. SCE&G submitted additional information by letters dated March 19, 2003 and May 21, 2003 (SCE&G 2003a and 2003b). In these responses, SCE&G provided tables containing importance measures for various events and their relationship to evaluated SAMAs, results of a revised screening based on consideration of uncertainties, an assessment of risk reduction benefits for external events, and the costs and benefits associated with several lower cost alternatives. SCE&G's responses addressed the staff's concerns and reaffirmed that none of the SAMAs evaluated would be cost beneficial.

Appendix G

An assessment of SAMAs for V. C. Summer is presented below.

G.2.0 Estimate of Risk for V. C. Summer

SCE&G's estimates of offsite risk at V. C. Summer are summarized in Section G.2.1. The summary is followed by the staff's review of SCE&G's risk estimates in Section G.2.2.

G.2.1 SCE&G's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the V. C. Summer Level 1 and 2 PRA model, which is an updated version of the Individual Plant Examination (IPE) (SCE&G 1993), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent Level 1 and 2 PRA model available at the time of the ER, referred to as model UP3a. The scope of the V. C. Summer PRA does not include external events.

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 5.6×10^{-5} per year, and the baseline large early release frequency (LERF) is approximately 7.0×10^{-7} per year. The CDF and LERF are based on the risk assessment for internally-initiated events. The CDF represents a sizeable change from the original IPE CDF value of 2.0×10^{-4} per year. SCE&G did not include the contribution of risk from external events within the V. C. Summer risk estimates, nor did it account for the potential risk reduction benefits associated with external events in the SAMA screening process described in the ER. It is SCE&G's position that the existing fire and IPEEE programs have already addressed potential plant improvements related to these areas (SCE&G 2002). In response to RAIs, SCE&G performed separate assessments of the impact on the results if the 95th percentile value of the internal events CDF was used in the SAMA evaluation, or if the additional risk reduction benefits in external events were included in the analysis. This is discussed further in Sections G.4.0 and G.6.2.

The breakdown of CDF by initiating event/accident type is provided in Table G-1. As shown in this table, loss of offsite power and transients (such as loss of feedwater, reactor and turbine trips, and main steam line breaks) are dominant contributors to the CDF. Bypass events (i.e., ISLOCA and SGTR) contribute less than one percent to the total internal events CDF.

The Level 2 PRA model has been updated since the IPE. SCE&G now uses a simplified LERF methodology as described in NUREG/CR-6595 (NRC 1999). The source terms are the same as those used in the IPE (SCE&G 1993). The conditional probabilities, fission product release fractions, and release characteristics associated with each release category were provided in response to an RAI (SCE&G 2003a).

Table G-1. V. C. Summer Core Damage Frequency

Initiating Event/Accident Class	CDF (Per Year)	% Contribution to CDF
Loss of Offsite Power (LOOP)	3.9×10^{-5}	70
Transients	7.5×10^{-6}	13
Special Initiators	4.4×10^{-6}	8
Loss-of-Coolant Accident (LOCA)	1.7×10^{-6}	3
Steam Generator Tube Rupture (SGTR)	1.7×10^{-7}	<1
Interfacing Systems LOCA (ISLOCA)	1.8×10^{-7}	<1
Others	2.6×10^{-6}	5
Total CDF (from internal events)	5.6×10^{-5}	100

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for this analysis include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 80 km [50-mi] radius) for the year 2042, emergency response evacuation modeling, and economic data.

In the ER, SCE&G estimated the dose to the population within 80 km (50 mi) of the V. C. Summer site to be approximately 0.0095 person-Sv (0.95 person-rem) per year based on consideration of only those release categories that would contribute to LERF (SGTR, ISLOCA, and containment isolation failure). Late containment failures would not contribute to LERF but could still have offsite consequences. In response to a staff request, SCE&G estimated the offsite doses from late containment failures, and included this contribution in their estimate of total offsite dose. The total offsite dose is estimated to be approximately 0.01 person-Sv (1.0 person-rem) per year, with 0.0095 person-Sv (0.95 person-rem) per year from LERF-related release categories and 0.0005 person-Sv (0.05 person-rem) per year from the late release category. This total offsite dose estimate was used in the subsequent SAMA evaluation. The breakdown of the total population dose by containment release mode is summarized in Table G-2.

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem^a Per Year)	% Contribution
SGTR	0.27	27
Interfacing Systems LOCAs	0.63	63
Containment isolation failure	0.05	5
Early containment failure	0	0
Late containment failure	0.05	5
Total	1.0	100

^aOne person-Rem = 0.01 person-Sv

G.2.2 Review of SCE&G's Risk Estimates

SCE&G's determination of offsite risk at V. C. Summer is based on the following three major elements of analysis:

- the Level 1 and 2 risk models that form the bases for the 1993 IPE and 1995 IPEEE submittals (SCE&G 1993 and SCE&G 1995),
- the major modifications to the IPE model that have been incorporated in the V. C. Summer PRA, and
- the MACCS2 analysis performed to translate fission product release frequencies from the Level 2 PRA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of SCE&G's risk estimates for the SAMA analysis, as summarized below.

The staff's review of the V. C. Summer IPE is described in an NRC report dated May 8, 1997 (NRC 1997b). In that review, the staff evaluated the methodology, models, data, and assumptions used to estimate the CDF and characterize containment performance and fission product releases. The staff concluded that SCE&G's analyses met the intent of Generic Letter 88-20 (NRC 1988); that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. The staff's review primarily focused on the licensee's ability to examine V. C. Summer for severe accident vulnerabilities and not specifically on the detailed findings or quantification estimates. Overall, the staff believed that the V. C. Summer IPE was of adequate quality to be used as a tool in searching for areas with high potential for risk reduction and to assess such risk reductions, especially when the risk models are used in conjunction with insights, such as those from risk importance, sensitivity, and uncertainty analyses. However, the staff did note that the elimination of early containment failure modes from containment failure quantification limits the use of the Level 2 analysis for systematic

1 evaluations of the relative importance of these failure modes and the investigation of potential
2 benefit of recovery actions on overall containment performance. The impact of this deficiency
3 on the SAMA analysis is discussed below.

4
5 A comparison of internal events risk profiles between the IPE and the PRA used in the SAMA
6 analysis indicates a decrease of approximately 1.4×10^{-4} per year in the total CDF (from 2.0×10^{-4}
7 per year to 5.6×10^{-5} per year). The reduction is attributed to plant and modeling improvements
8 that have been implemented at V. C. Summer since the IPE was submitted. A summary listing
9 of those changes that resulted in the greatest impact on the total core damage frequency was
10 provided in the ER and in response to an RAI (SCE&G 2003a), and include:

- 11
12 • Changed the cooling medium for the component cooling water (CCW) pumps and
13 charging pumps from HVAC chilled water to CCW to eliminate chilled water
14 dependencies,
- 15
16 • Developed an abnormal operating procedure for use following a loss of both trains of
17 chilled water,
- 18
19 • Developed a procedure for local operation of the power-operated relief valve (PORV)
20 dominating failure to re-establish instrument air,
- 21
22 • Eliminated six check valves in the emergency feedwater (EFW) system as well as
23 incorporated associated modeling changes,
- 24
25 • Updated initiating event frequencies using data in NUREG/CR-5750, "Rates of Initiating
26 Events at U.S. Nuclear Power Plants: 1987 - 1995," and updated LOOP frequency with
27 information from EPRI TR-106306, "Loss of Off-Site Power at U.S. Nuclear Power
28 Plants—Through 1995", and
- 29
30 • Updated common cause failure probability modeling and the human reliability analysis.

31
32 The CDF changes from the IPE version to the current PRA are significant. For example, an
33 initial data and modeling update, plant modifications to change the cooling medium for the
34 CCW pumps and charging pumps from HVAC chilled water to CCW, and plant modifications to
35 eliminate check valves in the EFW system, collectively resulted in about a factor of two
36 reduction in the CDF. A second data update involving the use of initiating event frequencies
37 from NUREG/CR-5750 and EPRI TR-106306 resulted in an additional factor of two reduction.
38 Given the magnitude of the plant and model changes, the overall reduction in CDF appears to
39 be reasonable.
40

Appendix G

1 The IPE CDF value for V. C. Summer is within the range of the CDF values reported in the IPEs
2 for other pressurized water reactors (PWRs) with large dry containments. Figure 11.6 of
3 NUREG-1560 shows that the IPE-based total internal events CDF for three-loop Westinghouse
4 plants ranges from 7×10^{-5} to 4×10^{-4} per year (NRC 1997a). It is recognized that other plants, in
5 addition to V. C. Summer, have reduced the values for CDF subsequent to the IPE submittals,
6 due to modeling and hardware changes. The current CDF results for V. C. Summer remain
7 comparable to other plants of similar vintage and characteristics.

8
9 In the ER, SCE&G states that there would be no early containment failures at V. C. Summer, as
10 reflected in Table 5-4. In a response to an RAI, SCE&G further supports that position by stating
11 that the most important feature of the V. C. Summer containment with respect to fission product
12 retention is the ability to remain intact for several tens of hours following core damage. The
13 position that the early containment failure probability is zero is supported by a site-specific
14 evaluation performed by Westinghouse in January 2003 which, according to SCE&G, shows
15 that it is appropriate to assign a zero containment failure probability for direct containment
16 heating and hydrogen burns, steam explosions and induced steam generator tube rupture. The
17 staff did not review the Westinghouse study, which is referenced by SCE&G in its response to
18 RAIs (SCE&G, 2003b). The staff does note, however, that SCE&G did perform a sensitivity
19 analysis that assumed that the containment would fail early with a 10% probability for the high-
20 pressure core melt events. This assumption is consistent with insights from severe accident
21 assessments for large dry containments, which in general, have shown the conditional
22 probability of early containment failure (excluding the contribution from ISLOCA, SGTR, and
23 containment isolation failures) to be very small. The analysis yielded an increase in the
24 maximum averted cost-risk of about \$4,000. This additional averted cost-risk is small and will
25 have a negligible impact on the SAMA conclusions, particularly since modifications to reduce
26 early containment failure (e.g., enhancing reactor depressurization or hydrogen control
27 capabilities) would generally involve hardware or procedure modifications with implementation
28 costs much greater than this estimated benefit. The staff concludes that while the assumption
29 that the early containment failure probability is zero is optimistic, the sensitivity analysis
30 provided by SCE&G nevertheless demonstrates that inclusion of early containment failures
31 within the risk analysis would have a negligible impact on the SAMA conclusions for V. C.
32 Summer.

33
34 The staff considered the peer reviews performed for the V. C. Summer PRA, and the potential
35 impact of the review findings on the SAMA evaluation. In response to an RAI (SCE&G 2003a),
36 SCE&G described the previous reviews, the most significant of which were the Westinghouse
37 review in March 2001 and the Westinghouse Owners Group (WOG) Peer Review of August
38 2002. The Westinghouse review of model UP3a concluded that the technical elements of the
39 PRA were such that the PRA is generally suitable for plant risk-informed applications. Specific
40 recommendations from this review were reflected in a subsequent PRA update, referred to as
41 model UP3h, which formed the basis for the WOG Peer Review. Three observations from the

WOG Peer Review were noted as extremely important and necessary to address in order to ensure the technical adequacy of the PRA. One of these was in the area of initiating events (specifically the ISLOCA) and the other two were in the systems analysis technical element (the diesel generator model and the EFW mission times). The PRA model (UP3h) has not yet been updated to address these weaknesses in the PRA, since the WOG Peer Review Report was not issued until December 2002. However, SCE&G provided the results of sensitivity analyses in which they assessed the impact of anticipated modeling changes in these areas on the SAMA evaluations. SCE&G estimated that changes to address the WOG Peer Review comments could potentially increase the CDF by about 15% relative to PRA model UP3a, with a corresponding but smaller increase in LERF. This increase is accounted for in the consideration of averted risk for the candidate SAMAs, as described in Section G.6.2.

Given that the V. C. Summer PRA has been peer reviewed and the potential impact of the peer review findings on the SAMA evaluation has been assessed, that SCE&G satisfactorily addressed staff questions regarding the PRA, including concerns related to omission of early containment failure modes (SCE&G 2003a and 2003b), and that the CDF falls within the range of contemporary CDFs for Westinghouse three-loop plants, the staff concludes that the Level 1 and Level 2 PRA models are of sufficient quality to support the SAMA evaluation.

SCE&G submitted an IPEEE in June 1995 (SCE&G 1995) in response to Supplement 4 of Generic Letter 88-20. SCE&G did not identify any fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, or other external events. The V. C. Summer hurricane, tornado and high winds analyses show that the plant is adequately designed or procedures exist to cope with the effects of these natural events. Additionally, the V. C. Summer IPEEE demonstrated that transportation and nearby facility accidents were not considered to be significant vulnerabilities at the plant. However, a number of areas were identified for improvement in both the seismic and fire areas. In a letter dated June 14, 2000, (NRC 2000), the staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities.

The IPEEE uses a focused scope EPRI seismic margins analysis (SMA). This method is qualitative and does not provide the means to determine numerical estimates of the CDF contributions from seismic initiators. However, since V. C. Summer has a plant-level "high confidence of low probability of failure" (HCLPF) value significantly greater than its design basis, it can be qualitatively expected from the SMA that the seismic CDF is relatively low (NRC 2002). SCE&G estimated the plant's HCLPF to be greater than 0.3g peak ground acceleration, with the exception of service water pond dams that have a 0.22g HCLPF. As noted in the IPEEE SER (NRC 2000), there is no cost effective solution for increasing the seismic capacity of the service water pond dams. A number of actions were taken by SCE&G as part of the IPEEE evaluation of seismic risk. These included bolting together adjacent electrical cabinets

Appendix G

at 17 locations throughout the plant to remove interaction concerns, providing lateral support for an isolation valve where the support was missing, and performing an analysis to show an adequate HCLPF value for a neutral grounding resistor that uses ceramic components. No additional outliers or potential areas for improvement were identified in the IPEEE.

The licensee's overall approach in the IPEEE fire analysis is similar to other fire analysis techniques, employing a graduated focus on the most important fire zones using qualitative and quantitative screening criteria. The fire zones or compartments were subjected to at least two screening stages. In the first stage, a zone was screened out if it was found to not contain any safety-related equipment. In the second stage, a CDF criterion of 1×10^{-6} per year was applied. Plant information gathered for Appendix R compliance was extensively used in the fire IPEEE. The licensee used the IPE model of internal events to quantify the CDF resulting from a fire initiating event. The conditional core damage probability (CCDP) was based on the equipment and systems unaffected by the fire. All fire event sequences were quantified assuming all equipment/cables in the area would fail by the fire. The CDF for each zone was obtained by multiplying the frequency of a fire in a given fire zone by the CCDP associated with that fire zone. The screening methodology applied by the licensee makes less and less conservative assumptions until a fire zone is screened out, the results do not indicate a vulnerability, or a vulnerability is identified and addressed. If applied correctly, this type of analysis will always produce a conservative result.

Using the Fire Induced Vulnerability Evaluation (FIVE) Method, the IPEEE fire CDF was estimated to be about 4×10^{-4} per year. In response to IPEEE RAIs, this was reduced to 8.5×10^{-5} per year (NRC 2002b). After the CDF was lowered to 8.5×10^{-5} per year, only five compartments contributed more than the screening value of 1.0×10^{-6} ; these are:

<u>Zone Description</u>	<u>CDF</u>
Control Room	3.44×10^{-5}
1 DA Switchgear Room	2.44×10^{-5}
Relay Room	1.28×10^{-5}
Turbine Room	7.09×10^{-6}
1 DB Switchgear Room	2.75×10^{-6}

In a response to an RAI, SCE&G discussed the potential for cost-effective hardware changes to address the five fire-related matters listed above (SCE&G, 2003a). This included consideration of the major fire contributors assumed in the analysis, and existing plant features and detection/mitigation capabilities. SCE&G concluded that no hardware modifications aimed at reducing risk were cost-effective for any of the zones. However, SCE&G did describe several procedural and training enhancements that have been implemented to address fire-related issues.

1 The staff notes that additional SAMAs to reduce the fire risk contributors might be viable at
2 V. C. Summer. However, given that the original fire CDF has already been reduced by over a
3 factor of seven through a combination of hardware and procedure changes, that the updated
4 fire CDF is conservative (since it is based on the IPE model which is over a factor of 3.6 greater
5 than that of the current PRA), and that the plant meets Appendix R fire requirements, it is
6 unlikely that further modifications would both substantially reduce risk and remain cost
7 beneficial.

8
9 The risk associated with other external events at V. C. Summer is small. The CDFs due to high
10 winds, floods and other events were not estimated since they were screened out using the
11 NUREG-1407 approach.

12
13 For purposes of the SAMA evaluation, the contribution of external events to total risk would be
14 bounded by the sensitivity assessment on internal events CDF (discussed in Section G.6.2) if:
15 (1) the total contribution from external events is on the same order of magnitude as the
16 contribution from internal events, and (2) there are no external event vulnerabilities that can be
17 eliminated or mitigated by cost-effective SAMAs. As discussed above, the seismic CDF is
18 relatively low given the high HCLPF value at V. C. Summer, and the contribution from fires is
19 comparable to that from internal events. SCE&G has previously made modifications specifically
20 addressing external event vulnerabilities, and further improvements are not expected to be cost
21 effective. Furthermore, for several SAMAs that were close to being cost beneficial, SCE&G
22 considered the additional risk reduction that might be achieved in external events. Accordingly,
23 the staff finds SCE&G's consideration of external events to be acceptable.

24
25 The staff reviewed the process used by SCE&G to extend the containment performance
26 (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3
27 PRA). This included consideration of the source terms used to characterize fission product
28 releases for the applicable containment release category and the major input assumptions used
29 in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite
30 consequences. Plant-specific input to the code includes the V. C. Summer reactor core
31 radionuclide inventory, source terms for each release category, emergency evacuation
32 modeling, site-specific meteorological data, and projected population distribution within a 80 km
33 (50 mile) radius for the year 2042. This information is provided in Appendix F of the ER
34 (SCE&G 2002).

35
36 In the ER, SCE&G estimated the dose consequences based on consideration of only those
37 release categories that would contribute to LERF (SGTR, ISLOCA, and containment isolation
38 failure). Late containment failures would not contribute to LERF but could still have offsite
39 consequences. In response to a staff request, SCE&G estimated the offsite doses from late
40 containment failures, and included this contribution in their estimate of total offsite dose. This
41 total offsite dose estimate was used in the subsequent SAMA evaluation. Table 1.f-1 of the

Appendix G

1 response to the RAI provides a break out of the source term by release category (SCE&G
2 2003a). The source terms used for the SAMA evaluation are taken from the IPE. Accordingly,
3 the staff concludes that the assignment of release categories and source terms is acceptable
4 for use in the SAMA analysis.

5
6 The core inventory input used in the MACCS2 was obtained from the MACCS2 User's Guide,
7 and corresponds to the end-of-cycle values for a 3,412 MWt PWR plant. A scaling factor of
8 0.85 was applied to provide a representative core inventory of 2,900 MWt for V. C. Summer.
9 Release frequencies for three sequences and release fractions were analyzed to determine the
10 50-mile population dose. In response to an RAI, SCE&G re-evaluated the dose after including
11 a non-LERF sequence to account for any contribution from late releases (SCE&G 2003a). All
12 releases were modeled as occurring at ground level. The staff questioned the non-
13 conservatism of this assumption and requested an assessment of the impact of alternative
14 assumptions (e.g., releases at a higher elevation). In response to the RAI, SCE&G assessed
15 the sensitivity of the assumption by analyzing a release from the steam generator release
16 valves with a release height as high as 22 meters. The results showed that the increase in the
17 50-mile population dose would be only about one percent (SCE&G 2003a). Additionally,
18 SCE&G analyzed the sensitivity of the assumption that all releases have a thermal content the
19 same as ambient. This was done by analyzing the releases with a heat content of 0, 3, 30, and
20 300 megawatts. The results showed an increase in the population dose as high as four
21 percent. These small increases have a negligible impact on the analysis and its results.

22
23 SCE&G used site-specific meteorological data, obtained from the plant meteorological tower,
24 processed from hourly measurements for the 1997 calendar year as input to the MACCS2
25 code. Data from this year was selected because it was found to result in the largest doses
26 based on the analysis of data from 1996 through 2000. Therefore, the staff considers use of the
27 1997 data in the base case to be conservative.

28
29 The population distribution the applicant used as input to the MACCS2 analysis was estimated
30 for the year 2042, based on the NRC geographic information system (GIS) for 1990 (NRC
31 1997c), and the population growth rates were based on 1990 and 2000 County-level census
32 data (USCB 2001). The staff considers the methods and assumptions for estimating population
33 reasonable and acceptable for purposes of the SAMA evaluation.

34
35 The emergency evacuation model was modeled as a single evacuation zone extending out 16
36 km (10 mi) from the plant. It was assumed that 95 percent of the population would move at an
37 average speed of approximately 0.43 meter per second (0.96 mph) with a delayed start time of
38 30 minutes (SCE&G 2003a). This assumption is conservative relative to the NUREG-1150
39 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the
40 emergency planning zone. The evacuation assumptions and analysis are deemed reasonable
41 and acceptable for the purposes of the SAMA evaluation.

1 Much of the site-specific economic data were provided from SECPOP90 (NRC 1997c) by
2 specifying the data for each of the 22 counties surrounding the plant, to a distance of 50 miles.
3 In addition, generic economic data that are applied to the region as a whole were revised from
4 the MACCS2 sample problem input when better information was available. The agricultural
5 economic data were updated using available data from the 1997 Census of Agriculture (USDA
6 1998). These included per diem living expenses, relocation costs, value of farm and non-farm
7 wealth, and fraction of farm wealth from improvements (e.g., buildings).

8
9 SCE&G did not perform sensitivity analyses for the MACCS2 input parameters, such as
10 evacuation and population assumptions. However, sensitivity analyses performed as part of
11 previous SAMA evaluations for other plants have shown that the total benefit of the candidate
12 SAMAs would increase by less than a factor of 2 (typically about 20 percent) due to variations in
13 these parameters. This change is small and would not alter the outcome of the SAMA analysis.
14 Therefore, the staff concludes that the methodology used by SCE&G to estimate the offsite
15 consequences for V. C. Summer provides an acceptable basis from which to proceed with an
16 assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its
17 assessment of offsite risk on the CDF and offsite doses reported by SCE&G.

18 19 **G.3.0 Potential Plant Improvements**

20
21 The process for identifying potential plant improvements, an evaluation of that process, and the
22 improvements evaluated in detail by SCE&G are discussed in this section.

23 24 **G.3.1 Process for Identifying Potential Plant Improvements**

25
26 SCE&G's process for identifying potential plant improvements (SAMAs) consisted of the
27 following elements:

- 28
29 • review of plant-specific improvements identified in the V.C. Summer IPE and IPEEE and
30 subsequent PRA revisions
- 31
32 • review of SAMA analyses submitted in support of original licensing and license renewal
33 activities for other operating nuclear power plants
- 34
35 • review of other NRC and industry documentation discussing potential plant
36 improvements, e.g., NUREG-1560.

37
38 Based on this process, an initial set of 268 candidate SAMAs was identified, as reported in
39 Table F.4-1 in Appendix F to the ER. In Phase 1 of the evaluation, SCE&G performed a
40 qualitative screening of the initial list of SAMAs and eliminated SAMAs from further
41 consideration using the following criteria:

Appendix G

- the SAMA is not applicable at V. C. Summer due to design differences,
- the SAMA has already been implemented at V. C. Summer,
- the SAMA is sufficiently similar to another SAMA such that they may be combined, or
- the systems/items associated with the SAMA have no significant safety benefit.

Based on this screening, 199 SAMAs were eliminated leaving 69 for further evaluation. Of the 199 SAMAs eliminated, 55 were eliminated because they were not applicable to V. C. Summer, 83 were eliminated because they already had been implemented at V. C. Summer, 56 were similar to another SAMA and were combined, and five were determined not to provide a significant safety benefit.

A preliminary cost estimate was prepared for each of the 69 remaining candidates to focus on those that had a possibility of having a net positive benefit. A screening cutoff of \$1.2M (the maximum attainable benefit or MAB, corresponding to eliminating all severe accident risk) was then applied to the remaining candidates (see discussion in Section G.6.1 for a derivation of the MAB). Thirty-seven of the 69 SAMAs were eliminated because their estimated cost exceeded this MAB, leaving 32 candidate SAMAs for further evaluation in Phase 2. Of these remaining SAMAs, 20 were screened from further analysis because, based on plant-specific PRA insights, they did not provide a significant safety benefit, or because the cost of implementation would be greater than the benefits associated with implementing the SAMA. This culminated in identification of 12 candidate SAMAs.

In response to an RAI, SCE&G re-evaluated the Phase 1 SAMAs using the 95th confidence level. The screening cutoff became \$2.8M. When applied, seven additional Phase 1 SAMAs were identified for further consideration. Table 4.b-1 of the response to the RAI contains the additional SAMAs and their subsequent disposition. None of the newly identified SAMAs were judged to be cost beneficial (SCE&G 2003a), as discussed in Section G.6.2.

The 12 remaining SAMAs were further evaluated and subsequently eliminated in the Phase 2 evaluation, as described in Sections G.4.0 and G.6.0 of this appendix.

G.3.2 Staff Evaluation

SCE&G's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events. The initial list of SAMAs generally addressed the accident categories that are dominant CDF contributors or issues that tend to have a large impact on a number of accident sequences at V. C. Summer.

1 The preliminary review of SCE&G's SAMA identification process raised some concerns
2 regarding the completeness of the set of SAMAs identified and the inclusion of plant-specific
3 risk contributors. The staff requested clarification regarding the portion of risk represented by
4 the dominant risk contributors. Because a review of the importance ranking of basic events in
5 the PRA could identify SAMAs that may not be apparent from a review of the top cut sets, the
6 staff also questioned whether an importance analysis was used to confirm the adequacy of the
7 SAMA identification process. In response to the RAI, SCE&G provided a tabular listing of the
8 contributors with the greatest potential for reducing risk as demonstrated by the risk reduction
9 worth (RRW) assigned to the event (SCE&G 2003a). SCE&G used a cutoff of 1.025, and
10 stated that events below this point would influence the CDF by less than 2.5 percent. This
11 equates to an averted cost-risk (benefit) of approximately \$30,000. SCE&G also reviewed the
12 LERF-based RRW events to determine if there were additional equipment failures or operator
13 actions that should be included in the provided table. In addition, SCE&G correlated the top
14 RRW events with the SAMAs evaluated in the ER (SCE&G 2003a). Based on these additional
15 assessments, SCE&G concluded that the set of 268 SAMAs evaluated in the ER addresses the
16 major contributors to CDF and LERF, and that the review of the top risk contributors does not
17 reveal any new SAMAs.

18
19 The staff questioned SCE&G about lower cost alternatives to several of the SAMAs evaluated,
20 including the use of: (1) portable battery chargers to supply power to the steam generator
21 instrument panels, (2) a cross-tie to the existing non-safety station batteries, (3) a direct-drive
22 diesel emergency feedwater pump, and (4) an automatic safety injection pump trip on low
23 refueling water storage tank (RWST) level as an alternative to an automatic swap to
24 recirculation (NRC 2003a). In response, SCE&G provided estimated benefits and
25 implementation costs for each alternative (SCE&G 2003a). These are discussed further in
26 Section G.6.2 of this appendix.

27
28 The staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly
29 even less expensive, design alternatives can always be postulated. However, the staff
30 concludes that the benefits of any additional modifications are unlikely to exceed the benefits of
31 the modifications evaluated and that the alternative improvements would not likely cost less
32 than the least expensive alternatives evaluated, when the subsidiary costs associated with
33 maintenance, procedures, and training are considered.

34
35 The staff concludes that SCE&G used a systematic and comprehensive process for identifying
36 potential plant improvements for V. C. Summer, and that the set of potential plant
37 improvements identified by SCE&G is reasonably comprehensive and therefore acceptable.
38 This search included reviewing insights from the IPE and IPEEE, and plant improvements
39 considered in previous SAMA analyses. While explicit treatment of external events in the
40 SAMA identification process was limited, the staff recognizes that the absence of external event

Appendix G

1 vulnerabilities reasonably justifies examining primarily the internal events risk results for this
2 purpose.

3 4 **G.4.0 Risk Reduction Potential of Plant Improvements**

5
6 SCE&G evaluated the risk-reduction potential of the 12 Phase 2 SAMAs applicable to V. C.
7 Summer, as well as several additional SAMAs suggested by the staff.

8
9 SCE&G used model re-quantification to determine the potential benefits. The CDF and
10 population dose reductions were estimated using version UP3a of the V. C. Summer PRA. The
11 changes made to the model to quantify the impact of each SAMA are detailed in Sections 5.1
12 through 5.11 of Appendix F to the ER (SCE&G 2002).

13
14 In response to a staff request, SCE&G further examined several SAMAs including those closest
15 to being cost beneficial to determine the extent to which the SAMAs might reduce external
16 event risk (SCE&G 2003b). The SAMAs considered include: Phase 2 SAMA 3, Phase 2 SAMA
17 10, use of a portable 120V DC generator to supply power to the steam generator level
18 instrumentation, installation of a direct-drive diesel emergency feedwater pump, and use of the
19 fire service water for make-up to the steam generators. This assessment included
20 consideration of both seismic and fire risk. Based on this assessment, SCE&G concluded that
21 although some credit may be taken for these SAMAs in external events, the benefit is more
22 limited than in the internal events analysis. For example, power recovery in fire events may
23 create additional difficulties not present for the initiators addressed in the internal events model.
24 Also, the low cost alternatives would not be required to meet the rigors of a seismically-qualified
25 component, and therefore, may not be useable following a seismic event. Nevertheless,
26 SCE&G conservatively increased the benefit for these SAMAs by a factor of two to account for
27 external events. Table G-3 lists the assumptions used to estimate the risk reduction for each of
28 the 12 SAMAs and several alternatives suggested by the staff (SCE&G 2003a), the estimated
29 risk reduction in terms of percent reduction in CDF and population dose, and the estimated total
30 benefit (present value) of the averted risk. The estimated benefit for all SAMAs was increased
31 by 15% to account for the resolution of peer review comments. The determination of the
32 benefits, and the impact of uncertainties and external events is discussed in Section G.6.2.

Table G-3. SAMA Cost/Benefit Screening Analysis

Phase 2 SAMA	Assumptions	% Risk Reduction		Total Benefit (\$)	
		CDF	Population Dose	Baseline	Revised ¹
2 - Add redundant DC control power for service water pumps	Reduce CDF by lowering the failure probability of the service water system. Reduce the loss of service water initiating event frequency.	0.2	-0	1,200	1,400
3 - Use existing hydro-test pump for reactor coolant pump (RCP) seal injection	Reduce CDF by providing an alternate source of seal cooling when component cooling water has failed. Add CNU_8 event to account for cold water injection shock.	9	0.5	10,300 ²	23,700 ³
9 - Refill the refueling water storage tank (RWST)	Reduce CDF during extended SBO or LOCAs which render the residual heat removal (RHR) system inoperable	2	1.5	23,800	27,400
10 - Improve the 7.2 kV bus cross-tie capability through emergency procedure and hardware change	Reduce CDF from loss of offsite power events with one failed diesel generator in combination with failure of required equipment on the remaining powered emergency bus	1	0.1	20,600	47,400 ³
11 - Install relief valves in the component cooling system	Decrease ISLOCA frequency by providing overpressure protection for the component cooling system	0.2	65.9	39,700	45,700
12 - Ensure all ISLOCA releases are scrubbed	Reduce the radionuclide release to the environment given that an ISLOCA has occurred	0.2	65.9	39,700	45,700
13 - Improved main steam isolation valve design	Impact isolation capability in accident response scenarios as well as for spurious closures that would be classified as initiating events. The failure to close probability is reduced by a factor of 10 as is the loss of condenser initiating event.	0.4	0.1	5,800	6,700

Table G-3. (contd)

Phase 2 SAMA	Assumptions	% Risk Reduction		Total Benefit (\$)	
		CDF	Population Dose	Baseline	Revised ¹
20 - Replace current power-operated relief valves (PORVs) with larger ones so that only one is required for successful feed and bleed	Change success criteria for feed and bleed from two of three to one of three PORVs.	1.6	0.2	17,800	20,400
24 - Create automatic swap over to recirculation on refueling water storage tank (RWST) depletion — charging pump suction swap to RHR heat exchanger discharge	Improve the reliability of the transition to recirculation mode after depletion of the RWST. Add new logic to control the RWST and charging pump suction valves.	31	30.1	377,800	434,500
24a - Create automatic swap over to recirculation on RWST depletion — RHR suction swap to the sump from the RWST	This is a sensitivity case which assumes the operator always fails to align and establish cold leg recirculation.	9	28.2	117,800	135,400
25 - Improved low pressure system, i.e., use of the fire service system pumps for low-pressure injection to the reactor pressure vessel (RPV)	Use current RHR piping as injection path for fire pumps. Operator action to align pumps is required. Use lumped event to represent hardware and operator action.	9.3	19.9	117,500	135,100
26 - Replace old air compressors with more reliable ones	Increase reliability of the instrument air system. Reduce initiating event frequency for loss of instrument air, and the failure to start and run probabilities of the air compressors.	1.1	0.3	13,100	15,100
27 - Install motor generator (MG) set trip breakers in control room	Increase the reliability of manual RCP trip in anticipated transient without scram (ATWS). Eliminates all ATWS risk as a bounding estimate.	1.6	0.1	18,600	21,300

Table G-3. (contd)

Phase 2 SAMA	Assumptions	% Risk Reduction		Total Benefit (\$)	
		CDF	Population Dose	Baseline	Revised ¹
Low Cost Alternatives [not originally part of the Phase 2 SAMA process]					
A-1 - Use portable 120V DC generator to supply power to steam generator (SG) level instrumentation	Provide power to EFW instrumentation during an SBO event to aid the operators in controlling SG level after battery depletion at 4 hours.	0.2	-0	3,300	7,600 ³
A-2 - Add a cross-tie to existing non-safety station batteries	Permit successful operation of the turbine-driven EFW pump (TDEFWP) during an SBO following battery depletion.	0.2	-0	3,300	3,800
A-3 - Use direct-drive diesel emergency feedwater (EFW) pump	Provide flow to the SGs during an SBO event given the failure of the TDEFWP. The direct-drive diesel EFW pump will be available as an alternate motive source for the TDEFWP. Use independent start and run failure term for the direct-drive diesel. Use shared test and maintenance terms as failure modes for direct-drive diesel.	13.1	0.9	152,600	351,000 ³
A-4 - Create automatic safety injection pump trip on low RWST level	Prevent pump damage due air entrainment or cavitation upon a loss of suction source. Provide an addition cue for control room operators to complete alignment of recirculation mode cooling.	0.02	-0	300	350
A-5 - Use fire service water for makeup to steam generators	Provide flow to SGs during an SBO event. Secondary side depressurization has succeeded. Further SG depressurization (from 240 psig to 100 psig) is necessary to as part of the alignment of the fire service system to the SGs.	<0.1	-0	1,100	2,600 ³

¹The reported benefit for all SAMAs includes a 15% increase to account for an expected increase in CDF when PRA peer review comments are addressed.

²In the ER, the benefit was estimated to be \$103,000 (SCE&G 2002). In response to an RAI, the benefit was reduced to \$10,300 when using more realistic assumptions (SCE&G 2003a).

³The reported benefit includes a 15% increase to account for an expected increase in CDF when PRA peer review comments are addressed, plus an additional factor of two increase to account for benefits from external events (SCE&G 2003b).

Appendix G

The staff has reviewed SCE&G's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and, for the above reasons, are generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on SCE&G's risk reduction estimates.

G.5.0 Cost Impacts of Candidate Plant Improvements

SCE&G estimated the costs of implementing the 12 SAMAs which were not initially screened out. The cost estimates conservatively did not include the cost of replacement power during any extended outages that might be needed to implement the modifications. Estimates that were taken from prior SAMA analyses were not adjusted to present-day dollars. For many of the SAMAs considered, the cost estimates were significantly greater than the benefits calculated such that a detailed evaluation was not necessary and a specific dollar value was not reported. Cost estimates were provided for the following SAMAs:

SAMA	Description	Cost Estimate (\$)
3	Use existing hydro-test pump for RCP seal injection	150K - 170K
10	Improve 7.2 kV bus cross-tie capability	>50K
24	Create automatic swap over to recirculation on RWST depletion	1.2M
25	Install additional diesel-driven fire pump to provide low-pressure injection to the RPV from the RWST through existing RHR piping	565K
A-1	Use portable 120V DC generator to supply power to steam generator level instrumentation	84K
A-2	Add a cross-tie to existing non-safety station batteries	59K
A-3	Add direct-drive diesel EFW pump	800K
A-4	Create automatic safety injection pump trip on low RWST level	750K
A-5	Use fire service water for makeup to steam generators	28K

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates (presented in Table F.6-1 of Appendix F to the ER) to

estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. A majority of the SAMAs were eliminated from further consideration on the basis that the expected implementation cost would be much greater than the estimated risk reduction benefit. This is reasonable for the SAMAs considered given the relatively small estimated benefit for the SAMAs (a maximum benefit of about \$378K based on the analyses contained in the ER), and the large implementation costs typically associated with major hardware changes and hardware changes that impact safety-related systems. In previous SAMA evaluations the implementation costs for such hardware changes were generally estimated to be \$1 million or more.

The staff notes that the cost to implement a direct-drive diesel EFW pump at another plant was estimated to be about \$200K. SCE&G estimated the cost of the modification to be about \$800K based on the following: \$200K for design, \$200K for evaluations, \$100K for materials, \$200K for implementation, \$30K for training, and \$80K for documentation and closeout (SCE&G 2003c). To verify the validity of the \$800K cost, the staff reviewed the costs for similar modifications evaluated in other plants' SAMA analyses as summarized below:

- \$460K for installation of a safety-related SW pump (Calvert Cliffs)
- \$300K - \$600K to provide capability for diesel-driven, low pressure vessel makeup (adding a line from the firewater header, a post indicator valve in the yard and safety-related double isolation valves to the connection with the LHSI) (Surry)
- >\$890K to replace two of the four safety injection pumps with diesel pumps (Turkey Point). Assuming that one pump would be half of this cost, the value would be >\$445K.
- >\$2M to install a motor-driven feedwater pump (Peach Bottom)
- \$480K to install a suppression pool jockey pump (Peach Bottom).

Although SCE&G's cost estimate is significantly greater than \$200K, it does not appear to be unreasonable relative to the cost estimates for similar modifications. The staff concludes that the cost estimates provided by SCE&G are sufficient and appropriate for use in the SAMA evaluation.

G.6.0 Cost-Benefit Comparison

SCE&G's cost-benefit analysis and the staff's review are described in the following sections.

Appendix G

G.6.1 SCE&G Evaluation

The methodology used by SCE&G was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997d). The guidance involves determining the net value for each SAMA according to the following formula:

$$\text{Net Value} = (\text{APE} + \text{AOC} + \text{AOE} + \text{AOSC}) - \text{COE}$$

where,

APE = present value of averted public exposure (\$)
AOC = present value of averted offsite property damage costs (\$)
AOE = present value of averted occupational exposure costs (\$)
AOSC = present value of averted onsite costs (\$)
COE = cost of enhancement (\$).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost beneficial. SCE&G's derivation of each of the associated costs is summarized below.

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

$$\begin{aligned} \text{APE} = & \text{Annual reduction in public exposure } (\Delta \text{person-rem/year}) \\ & \times \text{monetary equivalent of unit dose } (\$2,000 \text{ per person-rem}) \\ & \times \text{present value conversion factor } (10.76 \text{ based on a 20-year period with a 7-} \\ & \text{percent discount rate}). \end{aligned}$$

As stated in NUREG/BR-0184 (NRC 1997d), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the renewal period for the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, SCE&G calculated an APE of approximately \$20,500 for the 20-year license renewal period, which assumes elimination of all severe accidents.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

$$\begin{aligned} \text{AOC} = & \text{Annual CDF reduction} \\ & \times \text{offsite economic costs associated with a severe accident (on a per-event basis)} \\ & \times \text{present value conversion factor.} \end{aligned}$$

For the purposes of initial screening which assumes all severe accidents are eliminated, SCE&G calculated an annual offsite economic risk of about \$2,700 based on the Level 3 risk analysis. This results in a discounted value of approximately \$29,500 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

$$\begin{aligned} \text{AOE} = & \text{Annual CDF reduction} \\ & \times \text{occupational exposure per core damage event} \\ & \times \text{monetary equivalent of unit dose} \\ & \times \text{present value conversion factor.} \end{aligned}$$

SCE&G derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997d). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of \$2,000 per person-rem, a real discount rate of 7-percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes all severe accidents are eliminated, SCE&G calculated an AOE of approximately \$21,300 for the 20-year license renewal period.

Averted Onsite Costs (AOSC)

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. SCE&G derived the values for AOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997d).

Appendix G

SCE&G divided this cost element into two parts – the Onsite Cleanup and Decontamination Cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

$$\begin{aligned} \text{ACC} = & \text{Annual CDF reduction} \\ & \times \text{present value of cleanup costs per core damage event} \\ & \times \text{present value conversion factor.} \end{aligned}$$

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes all severe accidents are eliminated, SCE&G calculated an ACC of approximately \$663,000 for the 20-year license renewal period.

Long-term replacement power costs (RPC) were calculated using the following formula:

$$\begin{aligned} \text{RPC} = & \text{Annual CDF reduction} \\ & \times \text{present value of replacement power for a single event} \\ & \times \text{factor to account for remaining service years for which replacement power is} \\ & \quad \text{required} \\ & \times \text{reactor power scaling factor} \end{aligned}$$

SCE&G based its calculations on the value of 966 MWe. Therefore, SCE&G applied a power scaling factor of 966 MWe/910 MWe to determine the replacement power costs. For the purposes of initial screening, which assumes all severe accidents are eliminated, SCE&G calculated an RPC of approximately \$469,000 for the 20-year license renewal period.

Using the above equations, SCE&G estimated the total present dollar value equivalent associated with completely eliminating severe accidents at V. C. Summer to be about \$1.2M.

SCE&G's Results

If the implementation costs were greater than the maximum attainable benefit (MAB) of \$1.2M, then the SAMA was screened from further consideration. Thirty-seven of the 69 SAMAs surviving the Phase 1 screening were eliminated from further consideration in this way. Twenty additional SAMAs were eliminated because, based on plant-specific PRA insights, they did not provide a significant safety benefit, or because the cost of implementation would be greater than the benefits associated with implementing the SAMA, leaving 12 for final analysis. A more refined look at the costs and benefits was performed for the remaining 12 SAMAs, plus several alternative SAMAs identified by

the staff. The cost-benefit results for these SAMAs are presented in Table G-3. As a result, all SAMAs that were evaluated were eliminated because the cost was expected to exceed the estimated benefit.

SCE&G performed sensitivity analyses to evaluate the impact of parameter choices on the analysis results (SCE&G 2002, 2003a). The sensitivity analyses included the calculation of candidate SAMA benefits using a 3-percent real discount rate as recommended in NUREG/BR-0184 (NRC 1997d). This sensitivity case resulted in less than a factor of 1.2 increase in the benefit calculation. Additionally, SCE&G considered the impact on results if the 95th percentile value of the CDF were utilized in the cost-benefit analysis instead of the mean CDF. This analysis resulted in about a factor of 2.3 increase in the benefit calculation. These analyses did not change SCE&G's conclusion that none of the candidate SAMAs would be cost beneficial.

G.6.2 Staff Evaluation

The cost-benefit analysis performed by SCE&G was based primarily on NUREG/BR-0184 (NRC 1997d) and was executed consistent with that guidance.

In response to an RAI, SCE&G considered the uncertainties associated with the calculated CDF (Table G-4). If the 95th percentile values of the CDF were utilized in the cost-benefit analysis instead of the mean CDF value cited above, the estimated benefits of the SAMAs would increase by about a factor of 2.3. SCE&G revisited the set of SAMAs screened out in Phase 1 of the evaluation and identified seven additional SAMAs that could be cost-beneficial using the 95th percentile value of the CDF. In Table 4.b-1 of the response to the RAI, SCE&G discusses the cost of implementation and the benefit for each of these additional SAMAs (SCE&G 2003a). The averted cost-risk (benefit) was estimated by utilizing RRWs or the averted cost-risk for similar SAMAs, and then scaling this value by a factor of 2.3 in order to account for the 95th percentile PRA results. All seven SAMAs were found to have implementation costs greater than their averted cost-risk (benefit), and thus, were eliminated from further consideration. The staff reviewed the information provided by the applicant in response to this RAI and agrees with the conclusion that none of the newly identified Phase 2 SAMAs would be cost beneficial.

Table G-4. Uncertainty in the calculated CDF for V. C. Summer

Percentile	CDF (per year)
5th	1.87×10^{-5}
median	4.44×10^{-5}
mean	5.63×10^{-5}
95th	1.32×10^{-4}

Appendix G

1 SCE&G revisited the cost-benefit analyses for the 12 Phase 2 SAMAs and found that when the
2 95th confidence level is used, SAMAs 3 and 10 potentially become cost beneficial (SCE&G
3 2003a). These SAMA were further evaluated and dispositioned as summarized below:

4
5 SAMA 3 involves use of the existing hydro-test pump for RCP seal injection. This would
6 reduce the CDF by providing an alternate source of cooling when CCW has failed. A
7 benefit of \$103K was initially calculated for this SAMA based on internal events, as
8 described in Response 4c to the RAI. In their RAI response (SCE&G 2003a), SCE&G
9 noted that the evaluation used a lumped event in the model which did not account for
10 power dependencies, and assumed an optimistic reliability value (a failure probability of
11 0.001). Additionally, the benefit estimate did not consider that the RCP seals may heat
12 up and fail while the alternate cooling method is being aligned, or could fail as a result of
13 thermal shock when cold water is eventually reintroduced. When power dependencies
14 and thermal effects are included in the model, the benefit of this SAMA is reduced to
15 about \$10K. The staff agrees that these modeling considerations are valid and that the
16 benefits associated with this SAMA would be small, given that it derives from low
17 probability sequences in which CCW is lost in conjunction with the charging pumps. This
18 benefit was subsequently increased by 15% to account for an expected increase in CDF
19 when PRA peer review comments are addressed, plus an additional factor of two to
20 account for benefits from external events, resulting in a total benefit of about \$24K.
21 Using the 95th percentile CDF for internal events, the benefit would also be about \$24K.
22 SCE&G estimated the cost of implementation to be approximately \$150K to \$170K.
23 Accordingly, this SAMA is not cost-beneficial.

24
25 SAMA 10 involves improvements to the 7.2 kV bus cross-tie via the development of
26 emergency procedures that contain step-by-step instructions for performing the cross-
27 tie. An averted cost-risk (benefit) of \$20.6K was initially calculated for this SAMA based
28 on internal events, as described in response 4c to the RAI (SCE&G 2003a). The
29 estimated benefit was subsequently increased by 15% to account for an expected
30 increase in CDF when PRA peer review comments are addressed, plus an additional
31 factor of two to account for benefits from external events, resulting in a total benefit of
32 about \$48K (SCE&G 2003b). Using the 95th percentile results in conjunction with the
33 internal events CDF, the benefit would also be about \$48K (SCE&G 2003a). In the ER,
34 SCE&G estimated the cost of implementation to be approximately \$25,000 to \$50,000.
35 However, in their RAI response (SCE&G 2003a), SCE&G noted that this SAMA would
36 require modification to controls in the main control room. Costs associated with this
37 aspect were not considered in the original cost estimate provided, nor were costs
38 associated with the engineering analysis needed to support the modification. When
39 these additional costs factors are included, the implementation costs would be
40 substantially greater than \$50K. Accordingly, this SAMA is not cost-beneficial.
41

1 The staff questioned SCE&G about lower cost alternatives to several of the SAMAs evaluated,
2 including the use of: (1) a portable 120V DC generator to supply power to the steam generator
3 instrument panels, (2) a cross-tie to the existing non-safety station batteries, (3) a direct-drive
4 diesel emergency feedwater pump, and (4) an automatic safety injection pump trip on low
5 RWST level as an alternative to an automatic swap to recirculation (NRC 2003a). In response,
6 SCE&G provided estimated benefits and implementation costs for each alternative. Based on
7 these estimates, none of these alternatives appear cost beneficial. Specifically, SCE&G
8 estimated that the portable 120V DC generator alternative would have a benefit of \$7.6K
9 (including impact of external events) and an implementation cost of \$84K (SCE&G 2003a,
10 2003b). The cross-tie to the existing non-safety station batteries would have a benefit of \$3300
11 and an implementation cost of \$59K. The direct-drive emergency feedwater pump would have
12 a benefit of \$351K (including impact of external events) and a revised implementation cost of
13 \$800K (SCE&G 2003a, 2003b). The fourth alternative would have a benefit of \$300 which is far
14 less than the estimated implementation cost of \$750K (SCE&G 2003a). SCE&G determined
15 that none of the alternative SAMAs suggested in the RAI would be cost beneficial.

16
17 For the portable 120V DC generator alternative, a key factor in the evaluation is the human error
18 probability associated with the operation of the turbine driven EFW pump after battery
19 depletion. SCE&G assumed a value of 0.0041 in the baseline analysis, and provided
20 supporting justification for this value in response to RAIs (SCE&G 2003a and 2003b). The
21 rationale includes consideration of the long time period available for operator and technical
22 support center staff to achieve specified steam generator levels prior to battery depletion, the
23 relatively minor adjustments to feed rates that would be necessary following battery depletion,
24 and the available procedures and local indications associated with the necessary human
25 actions. Although it is SCE&G's position that the value of 0.0041 is appropriate, they provided
26 a sensitivity case in which the baseline human error probability for operation of the turbine
27 driven EFW was increased to a nominal value of 0.1. Given this assumption, the benefit
28 increases to about \$51K. If a factor of two is added to account for benefits from external
29 events, as was done for the baseline case, the benefit would become \$102K. When compared
30 to the implementation cost of \$84K, this SAMA appears to be cost beneficial. However, as
31 noted in Section G.4.0, the benefit of this SAMA in external events would be limited by factors
32 such as equipment operability after a seismic event. The staff concludes that given more
33 realistic assumptions regarding risk reduction achievable in external events, and a somewhat
34 lower nominal human error probability that might be justified based on the rationale provided by
35 SCE&G, this SAMA would not be cost beneficial.

36
37 SCE&G estimated the benefit of the direct-drive diesel EFW pump to be \$153K. The staff,
38 noting that the estimated cost to implement this modification at another plant was about \$200K,
39 issued a supplemental RAI regarding the estimated benefits. In response to the supplemental
40 RAI, SCE&G provided a revised risk reduction estimate of about \$350K, which included both a
41 15% increase to account for the resolution of peer review comments and a factor of two

Appendix G

1 increase to account for additional benefits that might be achieved in external events. However,
2 SCE&G also estimated the plant-specific cost to implement this modification to be about \$800K
3 for V. C. Summer. The cost estimates are discussed further in Section G.5.0. Based on the
4 revised cost and benefit estimates, the staff finds that the applicant's assessment is
5 reasonable, and concludes that this SAMA is not cost-beneficial.
6

7 In addition, the staff requested a cost-benefit assessment for using the fire protection system as
8 a backup for maintaining steam generator inventory. This alternative was estimated to have a
9 benefit of \$2.6K (including impact of external events) and an implementation cost of \$28K, and
10 would therefore not be cost beneficial (SCE&G 2003b).
11

12 SCE&G also performed a sensitivity analysis that addressed variations in discount rate. The
13 use of a three-percent real discount rate (rather than seven percent used in the baseline)
14 results in an increase in the maximum attainable benefit of approximately 13 percent. The
15 results of the sensitivity study are bounded by the uncertainty assessment described above,
16 which considered an increase of a factor of 2.3.
17

18 The staff concludes that the costs of all of the SAMAs assessed would be higher than the
19 associated benefits. This conclusion is supported by sensitivity analysis and upheld despite a
20 number of additional uncertainties and non-quantifiable factors in the calculations, summarized
21 as follows:
22

- 23 • Uncertainty in the internal events CDF was not initially included in the calculations,
24 which employed best-estimate values to determine the benefits. The 95th percentile
25 CDF for internal events is approximately 2.3 times the mean value. Even upon
26 considering the benefits at the 95th percentile value, no SAMAs were judged to be cost-
27 beneficial. Therefore, the staff does not expect the consideration of CDF uncertainty to
28 alter the conclusions of the analysis.
29
- 30 • External events were similarly not included in the V. C. Summer risk profile. However,
31 given that the expected external events contribution to CDF is calculated in a
32 conservative fashion and is expected to be on the same order of magnitude as the
33 internal events contribution to CDF, a factor of two increase in the maximum attainable
34 benefits to account for the external events should be conservative. In response to an
35 RAI, SCE&G re-evaluated several SAMAs that were closest to being cost beneficial by
36 increasing the benefits by 15% to account for PRA peer review comments, plus an
37 additional factor of two to account for external events. This equates to a factor of 2.3
38 which is the same as the factor considered in the uncertainty assessment. As a result,
39 none of the evaluated SAMAs were cost beneficial. Therefore, the staff concludes that
40 a more detailed assessment would not yield any new SAMAs.
41

- The staff finds the risk reduction and cost estimates to be reasonable, and generally conservative. As such, uncertainty in the costs of any of the contemplated SAMAs would not likely have the effect of making them cost beneficial.

G.7.0 Conclusions

SCE&G compiled a list of 268 SAMA candidates using the SAMA analyses as submitted in support of licensing activities for other nuclear power plants, NRC and industry documents discussing potential plant improvements, and the plant-specific insights from the V. C. Summer IPE, IPEEE, and current PRA model. A qualitative screening removed SAMA candidates that (1) were not applicable at V. C. Summer due to design differences, (2) were sufficiently similar to another SAMA such that they could be combined, (3) had already been implemented at V. C. Summer, or (4) did not provide a significant safety benefit. A total of 199 SAMA candidates were eliminated based on the above criteria, leaving 69 SAMA candidates for further evaluation.

Using guidance in NUREG/BR-0184 (NRC 1997d), the current PRA model, and a Level 3 analysis developed specifically for SAMA evaluation, a maximum attainable benefit of about \$1.2M was calculated, representing the total present dollar value equivalent associated with completely eliminating severe accidents at V. C. Summer. Thirty-seven of the 69 SAMAs were eliminated from further evaluation because their implementation costs were greater than this maximum attainable benefit. An additional 20 SAMAs were eliminated because, based on plant-specific PRA insights, they did not provide a significant safety benefit, or because the cost of implementation would be greater than the benefits associated with implementing the SAMA. For the remaining 12 SAMA candidates and several additional alternatives identified by the staff, more detailed conceptual design and cost estimates were developed as shown in Table G-3. The cost-benefit analyses showed that none of the candidate SAMAs were cost-beneficial.

The staff reviewed the SCE&G analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs, the generally large negative net benefits, and the small baseline risks support the general conclusion that the SAMA evaluations performed by SCE&G are reasonable and sufficient for the license renewal submittal. The unavailability of a seismic and fire PRA model precluded a quantitative evaluation of SAMAs specifically aimed at reducing risk of these initiators; however, improvements have been realized as a result of the IPEEE process at V. C. Summer that would minimize the likelihood of identifying further cost-beneficial enhancements in these areas. To assess the potential impact of uncertainties in the analysis or the inclusion of additional benefits in external events, SCE&G applied a factor of two multiplier to the estimated benefits based on internally-initiated events, and confirmed that even when considering the increase in the benefits, none of the SAMAs become cost beneficial.

Appendix G

Based on its review of the SCE&G SAMA assessment and as explained above, the staff finds that none of the candidate SAMAs are cost beneficial. This is based on conservative treatment of costs and benefits. This conclusion is consistent with the low residual level of risk indicated in the V. C. Summer PRA and the fact that V. C. Summer has already implemented plant improvements identified from the IPE and IPEEE processes.

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Docket Number 50-395

11. ABSTRACT (200 words or less)

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC on August 6, 2002, by the South Carolina Electric & Gas Company (SCE&G) to renew the operating license for the Virgil C. Summer Nuclear Station for an additional 20 years under 10 CFR Part 54. This SEIS includes the staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental effects of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse effects. It also includes the staff's preliminary recommendation regarding the proposed action.

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Virgil C. Summer Nuclear Station are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS, (2) the Environmental Report submitted by SCE&G, (3) consultation with Federal, State, and local agencies, (4) the staff's own independent review, and (5) the staff's consideration of public comments.

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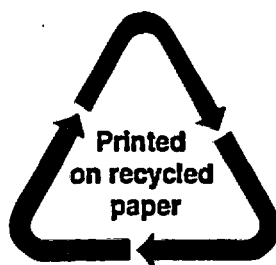
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