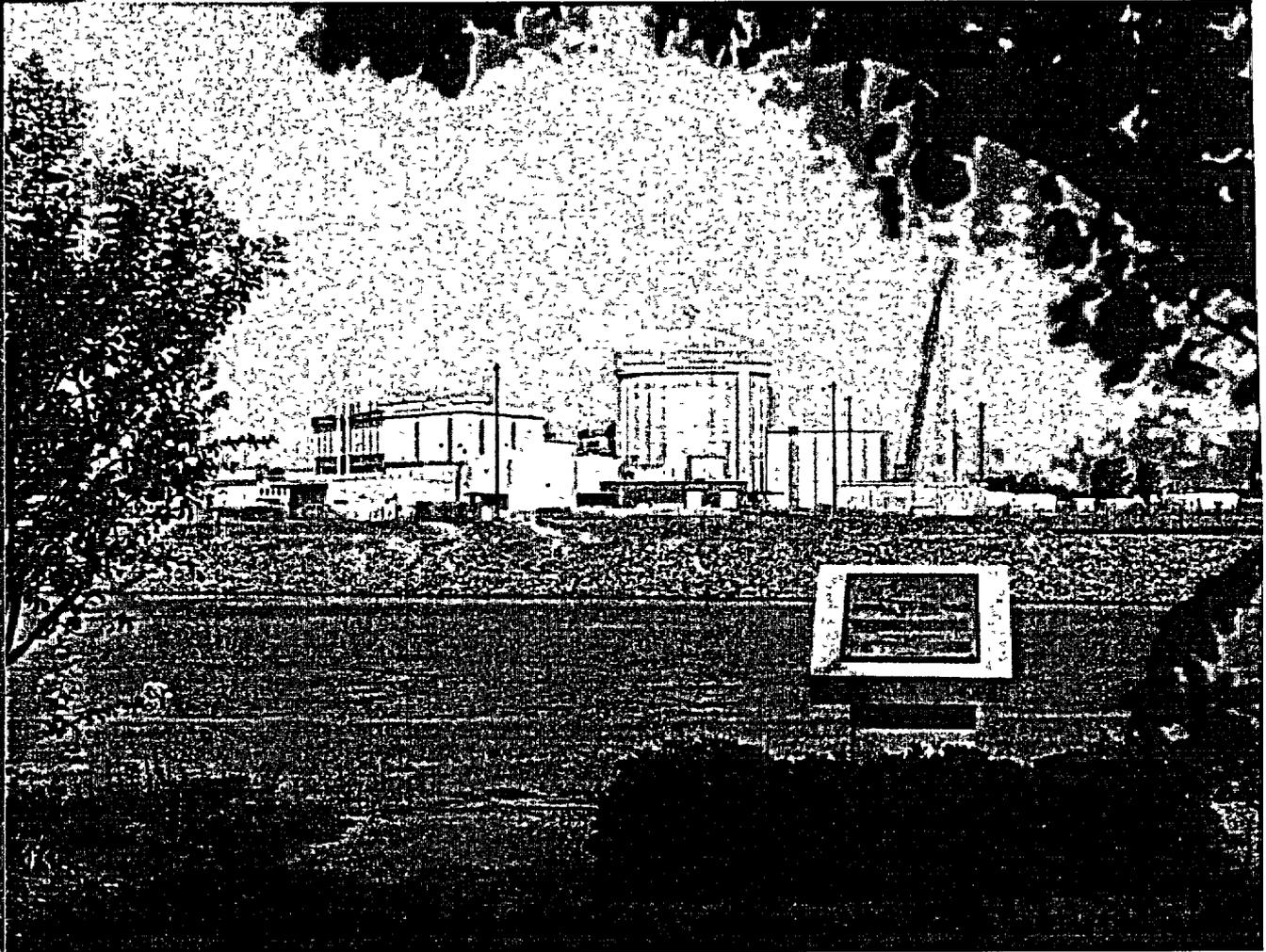


Summer Nuclear  
Station

# Environmental Report for License Renewal



Docket Number 50/395  
License Number NPF-12

**SCE&G**  
A SCANA COMPANY

**VIRGIL C. SUMMER NUCLEAR STATION  
APPLICATION FOR RENEWED OPERATING LICENSE  
APPENDIX E - ENVIRONMENTAL REPORT**

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**ACRONYMS AND ABBREVIATIONS**

AADT	Annual Average Daily Traffic
AQCR	Air Quality Control Region
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
DSM	demand side management
EPA	U.S. Environmental Protection Agency
EPACT	Energy Policy Act of 1992
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FONSI	Finding of No Significant Impact
FPSF	Fairfield Pumped Storage Facility
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GWH	gigawatt-hours
gpm	gallons per minute
IPA	Integrated Plant Assessment
IPE	Individual Plant Examination
kV	kilovolt
MGD	million gallons per day
msl	mean sea level
MW	megawatt
MWe	megawatts-electrical
MWt	megawatts-thermal
NEPA	National Environmental Policy Act
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NO <sub>x</sub>	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PM <sub>10</sub>	particulates having a diameter of less than 10 microns
PRA	Probabilistic Risk Assessment
PSC	Public Service Commission (of South Carolina)
psig	pounds per square inch gauge

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RTO	Regional Transmission Organization
SAMA	Severe Accident Mitigation Alternatives
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SSCs	systems, structures, and components
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VCSNS	Virgil C. Summer Nuclear Station

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## **1.0 INTRODUCTION**

### **1.1 Purpose and Need for Action**

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. South Carolina Electric & Gas Company (SCE&G) operates Virgil C. Summer Nuclear Station (VCSNS) Unit 1 pursuant to NRC Operating License Number NPF-12. The license will expire August 6, 2022. SCE&G has prepared this environmental report in conjunction with its application to NRC to renew the VCSNS 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(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating license for nuclear power plants such as VCSNS, as follows:

“...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers.” (NRC 1996a, pg. 28472)

The renewed operating license would allow 20 additional years of plant operation beyond the current VCSNS licensed operating period of 40 years.

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**1.2 Environmental Scope and Methodology**

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. Specifically, 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled *Applicant's Environmental Report - Operating License Renewal Stage*. In determining what information to include in the VCSNS Environmental Report, SCE&G has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the *Federal Register* (NRC 1996a, b, c; NRC 1999a)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d; NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (NRC 1996f)

SCE&G has prepared Table 1-1 to verify conformance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a boxed quote of the regulatory language and applicable supporting document language.

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**1.3 V. C. Summer Nuclear Station Licensee and Ownership**

VCSNS is a joint project between SCE&G, operator and two-thirds owner of the plant, and the South Carolina Public Service Authority (commonly referred to as "Santee Cooper"), owner of the remaining one-third. SCE&G is the principal subsidiary of SCANA Corporation, an energy-based holding company with headquarters in Columbia, South Carolina. SCE&G is involved in the generation, transmission, and delivery of electric power to customers in 24 South Carolina counties in the central and southern portions of the state.

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**1.4 References**

- NRC (U.S. Nuclear Regulatory Commission). 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 109. June 5.
- NRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." Federal Register. Vol. 61, No. 147. July 30.
- NRC (U.S. Nuclear Regulatory Commission). 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 244. December 18.
- NRC (U.S. Nuclear Regulatory Commission). 1996d. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC. May.
- NRC (U.S. Nuclear Regulatory Commission). 1996e. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. Washington, DC. May.
- NRC (U.S. Nuclear Regulatory Commission). 1996f. Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.
- NRC (U.S. Nuclear Regulatory Commission). 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules." Federal Register. Vol. 64, No. 171. September 3.
- NRC (U.S. Nuclear Regulatory Commission). 1999b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Section 6.3, "Transportation" and Table 9-1, "Summary of findings on NEPA issues for license renewal of nuclear power plants." NUREG-1437. Volume 1, Addendum 1. Washington, DC. August.

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**TABLE 1-1  
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL  
REGULATORY REQUIREMENTS**

<b>Regulatory Requirement</b>	<b>Responsive Environmental Report Section(s)</b>
10 CFR 51.53(c)(1)	Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0 Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2 Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3 Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0 Alternatives to the Proposed Action 8.0 Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5 Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4 Irreversible or Irrecoverable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions 6.2 Mitigation 7.2.2 Environmental Impacts of Alternatives 8.0 Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0 Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions 6.3 Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers using makeup water from Small River with Low Flow) 4.6 Groundwater Use Conflicts (Plants Using Cooling Towers withdrawing makeup water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2 Entrainment of Fish and Shellfish in Early Life Stages 4.3 Impingement of Fish and Shellfish 4.4 Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5 Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater) 4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8 Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9 Impacts of Refurbishment on Terrestrial Resources 4.10 Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11 Air Quality During Refurbishment (Non-Attainment or Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12 Microbiological Organisms

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**TABLE 1-1 (cont'd)  
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL  
REGULATORY REQUIREMENTS**

<b>Regulatory Requirement</b>	<b>Responsive Environmental Report Section(s)</b>	
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(J)	4.19	Historic and Archeological Resources
10 CFR 51.53(c)(3)(ii)(K)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(ii)(L)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
	2.11	Minority and Low-Income Populations
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.11	Minority and Low-Income Populations

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**2.0 SITE AND ENVIRONMENTAL INTERFACES**

**2.1 Location and Features**

Virgil C. Summer Nuclear Station (VCSNS) is located in Fairfield County, South Carolina, approximately 15 miles west of the county seat of Winnsboro and 26 miles northwest of Columbia, the state capital (Figure 2-1). 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 and serves as the boundary between Fairfield County (to the east) and Newberry County (to the west).

This reach of the Broad River, impounded for a small, run-of-the-river hydroelectric plant (Parr Hydro) in 1914, is known as Parr Reservoir (Figure 2-2). Originally 1,850 acres, Parr Reservoir was enlarged to approximately 4,400 acres in 1977 by raising the level of the dam by 9 feet (SCE&G 1978, pg. 2.1-16). This modification was necessary to support the development of the Fairfield Pumped Storage Facility (FPSF) (Figure 2-2), which was built on Frees Creek, a small tributary of the Broad River. In addition, Monticello Reservoir, a 6,500-acre impoundment, was built in the Frees Creek valley to serve as the upper pool for FPSF and the cooling water source for VCSNS. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing water for both Parr Hydro and FPSF.

The VCSNS powerblock area (generating facilities and switchyard) is located on the south shore of Monticello Reservoir (Figure 2-3). A nuclear exclusion zone, defined as the area within approximately one mile of the reactor building, is posted and access to land portions of this area is controlled. The nuclear exclusion zone is not a perfect circle; its western axis is slightly longer (5,850 feet, or 1.11 mile) than its eastern axis (5,350 feet, or 1.01 mile) (SCE&G 1978, pg. 2.1-2). The boundary of the exclusion zone also represents the site boundary. The VCSNS property, thus defined, covers approximately 2,245 acres, and includes the southern portion of Monticello Reservoir and parts of the FPSF (Figure 2-3).

Section 3.1 describes key features of the station, including reactor and containment systems, cooling and auxiliary water systems, and transmission facilities.

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**2.2 Aquatic and Riparian Ecological Communities**

Aquatic and riparian communities in the vicinity of VCSNS 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. This section characterizes both the hydrology and water quality of these waterbodies and the distribution and abundance of organisms within them.

**Broad River and Parr Reservoir Hydrology and Water Quality**

The Broad River originates on the eastern slope of the Blue Ridge Mountains near Lake Lure, North Carolina, and flows 220 miles southeast into South Carolina before joining the Saluda River at Columbia, South Carolina, to form the Congaree River. In South Carolina, the Broad River basin encompasses an approximately 4,500-square-mile watershed drained by 4,719 miles of streams (SCDHEC 1998, pg. 21). Major tributaries include the Pacolet, Tyger, and Enoree Rivers, all of which enter the Broad River from the west (Figure 2-1). 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 376 to 1,000 feet above mean sea level (SCDHEC 1998, pg. 22). 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 30 miles above Parr Reservoir.

The 1998 South Carolina Department of Health and Environmental Control (SCDHEC) report contains additional information on land use in the Broad River Basin, its sub-basins (upper Broad, Pacolet, Tyger, and Enoree), and watersheds within these sub-basins. In addition, it provides details on stream classifications and water quality of all major streams in the region, and describes potential threats to water quality (point sources and non-point sources). The 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, pg. 113) from upstream (agricultural and municipal) sources. In addition, fecal coliform bacteria levels are occasionally elevated in this stretch of the river.

The U.S. Geological Survey (USGS) operates and maintains gauging stations on the Broad River upstream and downstream of Parr Reservoir. Mean daily flow at the Carlisle gauging station (approximately 20 miles upstream of Parr Reservoir) over the 1939-2000 period ranged from 44 to 114,000 cubic feet per second (cfs) and averaged 3,933 cfs (Cooney et al. 2001, pg. 179). At the Alston gauging station, 1.2 miles downstream of Parr Shoals Dam, flows over the period of record (1896-1907; 1980-2000) ranged from 235 to 130,000 cfs and averaged 6,535 cfs (Cooney et al. 2001, pg. 226). Substantially higher flows at Alston, SC, reflect Tyger and Enoree River inflows. These streams enter the Broad River 18 and 13.5 miles, respectively, above the Parr Shoals dam, significantly increasing flows in the main stem of the river.

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Parr Reservoir (see Figure 2-2) was created in 1914 by damming the Broad River at Parr Shoals, approximately 26 miles upstream of the confluence of the Broad and Saluda Rivers for Parr Hydro, a small (15 megawatt) run-of-the-river hydroelectric facility (SCE&G 2000). Prior to 1977, the reservoir's surface area was 1,850 acres (SCE&G 1978, pg. 2.1-16). In 1977, the level of Parr Reservoir was raised by 9 feet, which increased its surface area to approximately 4,400 acres. 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 VCSNS. 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 29,000 acre-feet per day ( $9.5 \times 10^9$  gallons per day) of water from Parr Reservoir to Monticello Reservoir and back (NRC 1981, pg. 2-10). 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 10 feet (NRC 1981, pg. 2-10), but the daily average is approximately 4 feet (Dames & Moore 1985). These water level fluctuations can expose and then reinundate up to 2,550 acres 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, pg. 2-18).

Temperatures and dissolved oxygen (DO) levels in water leaving Parr Reservoir are monitored at a USGS 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 38.3°F in February to 87.8°F in August, with corresponding DO concentrations of 13.1 milligrams per liter and 4.9 milligrams per liter (Cooney et al. 2001, pp. 221-224).

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, pg. 114), meaning that water

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quality is adequate to support a balanced indigenous community of organisms, with no restrictions on recreational users.

**Monticello Reservoir Hydrology and Water Quality**

VCSNS lies on the south shore of Monticello Reservoir (Figure 2-2), 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 1.2 miles upstream of the Parr Shoals dam. As previously discussed, Monticello Reservoir was designed to serve both as a cooling pond for VCSNS and the upper pool for the FPSF, 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 11,000 acres, including the reservoir and its subimpoundment (discussed later in this section).

Monticello Reservoir is approximately six miles long with a surface area of 6,500 acres. The average depth is 59 feet and the maximum depth is approximately 126 feet (SCDHEC 1998, pg. 114). FPSF operations can cause water levels in Monticello Reservoir to fluctuate as much as 4.5 feet daily, from 420.5 feet above mean sea level to 425.0 feet above mean sea level. Daily elevation changes vary, depending on system needs.

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 Clean Water Act (CWA) Section 316(a) Demonstration for VCSNS and summarized in a final report (Dames & Moore 1985) submitted to SCDHEC and the U.S. Nuclear Regulatory Commission (NRC) in April 1985. A station-to-station comparison of pre-operational (1978-1982) and operational (1983-1984) water chemistry in Monticello Reservoir showed significant differences in 13 of 27 chemical parameters analyzed (Dames & Moore 1985, pg. 2.2-18). In 10 cases, concentrations of chemicals or measurements were higher in the pre-operational phase and in three cases concentrations were higher in the operational phase. None of these differences were related to operations of VCSNS.

The highest temperature observed in Monticello Reservoir over the 1983-1984 operational phase was 93.6°F at a depth of one foot at Station 14 (the sampling point closest to the discharge canal) in August 1983 (Dames & Moore 1985, pg. 2.2-10). 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 1 to 3 feet. Below this depth, the influence of the thermal plume was not evident. In more recent years (1995-2000), maximum temperatures at a sampling station just outside the mouth of the discharge canal ranged from 95.2°F to 103.7°F (see Section 4.12 for additional discussion).

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Long-term eutrophication studies indicate that Monticello Reservoir's trophic condition is improving (SCDHEC 1998, pg. 114). 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.

**Broad River/Parr Reservoir Aquatic Communities**

The Broad River in the area of VCSNS was characterized (prior to the operation of FPSF and VCSNS) by a high silt load, high DO levels, high suspended solids levels, and low buffering capacity (NRC 1981). Parr Reservoir, a narrow, shallow, run-of-the-river reservoir, had lotic rather than lentic characteristics. Turbidity and flows appeared to limit the production of phytoplankton, and as a consequence they appeared to contribute only marginally to productivity. Zooplankton were also of limited importance. Benthic macroinvertebrates showed very little diversity, but relatively high measures of biomass due to the presence of high densities of the Asiatic clam, *Corbicula*. Fish collections prior to operation of FPSF were dominated by sunfish (bluegill, in particular) and gizzard shad, a forage species. Largemouth bass and white catfish also made up a significant proportion of biomass in collections (NRC 1981).

South Carolina Electric & Gas Company (SCE&G) monitored water quality and aquatic communities in the Broad River, Parr Reservoir, and Monticello Reservoir from mid-1978 through 1984 to assess the impacts of FPSF and VCSNS operations. This represented more than three years of pre-operational data and two years of operational data. These studies, summarized in a final report submitted to SCDHEC in April 1985 as part of a CWA Section 316(a) Demonstration (Dames & Moore 1985), represent the most comprehensive information on the biotic communities of the Broad River in the vicinity of VCSNS.

Parr Reservoir fish collections were dominated numerically in 1983 and 1984 by common warm water species. Approximately 44 percent of fish collected were centrarchids (e.g., bluegill, pumpkinseed, redear sunfish, largemouth bass), while 43 percent were clupeids (gizzard shad and threadfin shad). Gizzard shad and bluegill accounted for the greatest biomass, with 20.9 and 3.4 kilograms/hectare, respectively (Dames & Moore 1985, pp. 2.8-3-2.8-21). Species composition was essentially the same in preoperational (1978-1982) and operational (1983-1984) periods, with collections dominated by centrarchids (sunfish), clupeids (shad), and ictalurids (catfish and bullheads). The species composition was typical of warm, shallow southeastern reservoirs. The fish community of Parr Reservoir appeared to be largely unaffected by operations of VCSNS.

No comprehensive surveys or studies of Parr Reservoir's fish community have been conducted since 1984. The South Carolina Department of Natural Resources (SCDNR) assessed the largemouth bass fishery in the early 1990s and determined that there were fewer largemouth bass per acre in Parr Reservoir than other reservoirs in Fisheries Region III (Hayes 1999). Mean lengths and weights of Parr Reservoir largemouth bass were also lower. Parr Reservoir

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largemouth bass grew slowly, with fish reaching a minimum harvestable size of 12 inches at age three (Hayes 1999, pg. 19).

No creel survey has ever been conducted on Parr Reservoir to quantify angler effort, harvest, or success. (Hayes 1999, pg. 15). Anecdotal reports and casual interviews of fishermen suggest that catfish, crappie, and largemouth bass are the most targeted species. The extreme water level fluctuations on the reservoir make navigation difficult at times (water levels can be extremely low after pump-back operations) and appear to limit fishing pressure (Hayes 1999, pg. 15).

SCDNR is currently inventorying the aquatic resources of the Broad River and creating a Geographic Information System (GIS) database for natural resource managers in the region. Work began in the fall of 2000 and is scheduled for completion in the fall of 2002 (Bettinger 2001). This work is being supported by SCE&G, Duke Power, and Lockhart Power Company under the auspices of the Broad River Mitigation Trust Fund, whose Trustees are SCE&G, Duke Power, SCDNR, and the U.S. Fish and Wildlife Service (FWS).

In the fall of 2000 and the spring of 2001, 43 species of fish representing 9 families were collected from 9 sampling stations ranging over approximately 75 miles of the Broad River, from Gaston Shoals (near the North Carolina state line) to Bookman Island (15 miles below the Parr Shoals dam). Overall, the most common fish collected were redbreast sunfish, whitefin shiner, and silver redhorse (Bettinger et al. 2001). No exotic species or nuisance species were collected, and no federally listed species were collected. Live native mussels were extremely rare, found only at a single station in the Bookman Island area (Bettinger et al. 2001). All native mussels found were of the genus *Elliptio*. Fish collections at a station 14 miles upstream of Parr Shoals dam (just upstream of the confluence of the Broad River and the Enoree River) were dominated by common centrarchids (e.g., redbreast sunfish and bluegill), notropids (e.g., whitefin shiner and spottail shiner), and ictalurids (e.g., snail bullhead and margined madtom). Because the surveys were intended to provide baseline information on unimpounded sections of the river (tailwaters of dams and reaches of river between dams), Parr Reservoir was not included in the surveys.

#### **Monticello Reservoir Aquatic Communities**

Contract biologists using gill nets and electrofishing gear collected 32 species of fish representing 8 families from Monticello Reservoir in 1983 and 1984 (Dames & Moore 1985, Table 2.8.10), the last two years that sampling was conducted in support of the station's CWA Section 316(a) Demonstration. The Monticello Reservoir fish community in 1983-1984 was dominated by centrarchids (55 percent of fish captured) and clupeids (28 percent of fish captured) (Dames & Moore 1985, p. 2.8-10). Smaller numbers of ictalurids (7 percent), catostomids (5 percent), and percids (3 percent) were also captured. The species composition and relative abundance of Monticello Reservoir fish changed very little from 1978 through 1984. In all preoperational and operational years, centrarchids ranked first in abundance and clupeids ranked second. There was no indication that VCSNS operations had an effect on fish populations in Monticello Reservoir.

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Based on cove rotenone studies conducted by SCDNR in 1987, 1988, 1995, and 1996, the fish community of Monticello Reservoir remains reasonably balanced and diverse, comprised of warmwater species common to the southeastern U.S. (Nash, Christie, and Stroud 1990; Christie and Stroud 1996, 1997). Three catfish species (blue catfish, channel catfish, and white catfish) made up a substantial proportion (56 percent, by weight) of the reservoir's standing stock in 1996 and provided an important recreational fishery, particularly in summer months. Other species more traditionally regarded as gamefish (largemouth bass, black crappie, white bass) contribute less to the reservoir's standing stocks, but considerable angler effort is directed toward these species in winter, spring, and fall.

In addition to the fish species that are normally sought and harvested by anglers, Monticello Reservoir contains a variety of game and non-game species including clupeids (threadfin shad and gizzard shad, which provide important forage for predators), cyprinids (e.g., common carp, golden shiner, whitefin shiner), catostomids (e.g., silver redhorse, shorthead redhorse, river carpsucker), ictalurids (brown bullhead, flat bullhead, and snail bullhead), centrarchids (e.g., bluegill, redear sunfish, redbreast), and percids (yellow perch and tessellated darter) (Nash, Christie, and Stroud 1990; Christie and Stroud 1996, 1997). All of these species are common to ubiquitous in South Carolina streams, ponds, and reservoirs (Loyacano 1975; Lee et al. 1980; Bennett and McFarlane 1983; SCDNR 1995).

There have been a number of changes in the Monticello Reservoir fish community since VCSNS began operating in 1982, none attributable to station operations. Two species (blue catfish and white perch) that now make up a major portion of the recreational catch first appeared in SCDNR samples in 1995. These species may have been introduced by fisherman or transferred into Monticello Reservoir from Parr Reservoir by pump-back operations. The blue catfish in particular "exploded" in numbers and importance in the reservoir between 1995 and 1996 (Christie and Stroud 1997, pg. 25). In an annual report on the status of fisheries in SCDNR Region IV, Christie and Stroud (1997, pg. 28) voiced concern about the booming population of blue catfish in Monticello Reservoir, noting that Monticello Reservoir has a "...relatively low prey base..." and "the unfortunate introduction of blue catfish may lead to competition for forage between catfish and game species."

The white perch, a semi-anadromous species native to the southeastern coast, is regarded as a "pest" by many inland fisheries managers (SC Bass Federation 2000). It is a species known for its high reproductive potential (high fecundity rate and high hatching rate), slow rate of growth, and long lifespan (up to 17 years), characteristics that tend to create crowded populations of stunted white perch in reservoirs (Wisconsin Sea Grant 1999; SAREP 2000). White perch are known to depress populations of other, more desirable gamefish species, such as walleye and white bass, by competing for limited forage and by feeding heavily on walleye and white bass eggs (Wisconsin Sea Grant 1999).

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A number of other fish species (brook silverside, swallowtail shiner, and green sunfish) appeared for the first time in SCDNR's Monticello Reservoir cove rotenone samples in 1995 (Christie and Stroud 1996, pg. 19). These species were known to occur in other waterbodies in the Santee-Cooper drainage basin (which includes the Broad River), but had not been collected previously in Monticello Reservoir by SCDNR. None of these species is expected to have a noticeable effect on the reservoir's fisheries, beyond some minor contribution to the forage base.

Although somewhat less productive than other, older reservoirs in the region, Monticello Reservoir continues to provide fishermen in the South Carolina Midlands and Upstate with a variety of fishing opportunities. Roving creel surveys in 1997-1998 and 1998-1999 that included interviews of selected anglers revealed that roughly half (51 percent in 1997-98; 42 percent in 1998-99) of all fishing effort in Monticello Reservoir was directed at catfish (Christie and Stroud 1999, pp. 20-28). Less effort was expended fishing for black crappie (15 percent in 1997-98; 5 percent in 1998-99), largemouth bass (12 percent in 1997-98; 10 percent in 1998-99), and other species (bluegill, carp, white bass, white perch). The creel surveys indicated that fishing effort (number of hours fished per annum) had increased substantially since the late 1980s. They also showed that fishing pressure (hours fished per acre) was lower on Monticello Reservoir than on other reservoirs in the region (Christie and Stroud 1999, Table 17).

Excluding blue catfish and white perch, both apparently introduced by fishermen, no undesirable non-native fish species appeared in Monticello Reservoir after it was created and no nuisance species appeared to be favored by its operational thermal regimes. There have been no outbreaks of disease, beyond the occasional appearance of *Aeromonas* (*Aeromonas hydrophila*; a bacterium) infections in spawning largemouth bass in the spring. These fish, already stressed by spawning, appeared to have been caught and released by anglers. Handling further stressed these fish and removed protective slime/mucous coating, which resulted in *Aeromonas* infection.

In the late 1980s, a number of limited fish kills (generally involving small catfish) occurred in the VCSNS discharge bay in late summer and early fall. SCE&G set up a monitoring program to help identify the cause of the fish kills. Investigations revealed that the fish kills were associated with relatively high discharge temperatures and Monticello Reservoir drawdowns (through the operation of FPSF). It was determined that reservoir drawdown reduced the inflow of cooler water (from the main body of the reservoir) along the bottom of the discharge canal and into the discharge bay. Reduction or loss of this inflow allowed water temperatures to rise rapidly and kill fish inhabiting the discharge bay. Since the reservoir level was subject to daily fluctuation with the operation of FPSF, fish kills recurred as high reservoir levels (following pumpback operations) allowed more cool water inflow and recolonization of the discharge canal and bay.

SCE&G took several actions over the 1991-1993 period to reduce the frequency and severity of fish kills (SCE&G Environmental Services 1994, pg. 2). In 1991, an elevated area (an old roadbed) was removed from the discharge canal by dredging. This initially appeared to have ameliorated the fish kills, but a major fish kill in August 1992 indicated that removal of the

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roadbed had not completely solved the problem. In September 1992, Monticello Reservoir drawdown was limited to 422.5 feet mean sea level to prevent further fish kills.

SCE&G dredged the entire length of the discharge canal in July and August of 1993 to allow more cool water inflow at low reservoir levels. The dredging of the discharge canal altered circulation patterns and increased cool water inflow such that temperature at the bottom of the discharge bay in summer remained significantly (10 to 15 degrees) cooler than "end-of-pipe" discharge temperatures (SCE&G Environmental Services 1996, Figure 2). Fish kills ceased once the dredging of the discharge canal was completed. The discharge bay and canal were monitored intensively over the summers of 1994 and 1995, and no fish kills were observed (SCE&G Environmental Services 1996, pg. 3). None have been observed since that time.

The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) (NRC 1996, pg. 4-57) briefly discusses the fish kills in the VCSNS discharge bay and mentions SCE&G's investigations on the specific causes of the kills. It concludes that "these fish kills were localized; they do not appear to have had any adverse effect on the cooling pond (fish) population."

**Monticello Subimpoundment Aquatic Communities**

Monticello Reservoir is a 6,500-acre impoundment. However, it is hydrologically connected (by a conduit that passes under the Highway 99 causeway) to a smaller 300-acre body of water known as the Monticello Subimpoundment (Figure 2-2). This smaller subimpoundment is managed for recreational boating and fishing by SCE&G and SCDNR. SCE&G maintains the property, which includes boat launch, swimming, and picnic facilities; SCDNR manages the subimpoundment's fisheries by setting creel and size limits on fish. Fishing is permitted on Wednesdays and Saturdays only.

Surveys of the subimpoundment's fishery were last conducted in 1984 (Dames & Moore 1985). At that time, the fish community of the subimpoundment was characterized by relatively low species richness (12 species collected in 1983 and 1984), with collections dominated by gizzard shad and centrarchids (e.g., bluegill, redear sunfish, black crappie, and largemouth bass) (Dames & Moore 1985, pg. 2.8-8 and Figure 2.8-24). The Monticello Subimpoundment continues to be a popular fishing spot for local fishermen.

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### **2.3 Groundwater Resources**

The VCSNS site lies within the Piedmont Physiographic Province and is underlain by igneous and metamorphic crystalline rocks, including migmatites in transitional areas between metamorphic and igneous bodies. Piedmont terrain is characterized by gently rolling hills and broad, relatively shallow valleys. Bedrock within the Piedmont is metasedimentary and metavolcanic and consists of granites, gneisses, and schists (SCE&G 2002). Crystalline bedrock has been deeply weathered into a saprolitic mantle of soil 40 to 85 feet thick at the site. The upper soil profile is characterized by a silty and clayey horizon (SCE&G 2002). For a generalized site location map, refer to Figure 2-1.

Groundwater in the region occurs in jointed and fractured crystalline bedrock and in the lower zones of the residual soil overburden. Recharge to these formations is principally by infiltration of precipitation falling on the upland areas. The aquifer at the VCSNS site exists under water table conditions in the saprolite and fractured bedrock. Discharge of groundwater commonly occurs as visible seeps and springs in low-lying areas or to nearby creeks and streams. Some groundwater is discharged via wells but the well yields are very small because the formations generally are not pervious enough to sustain yields greater than a few gallons per minute (gpm) (SCE&G 2002).

The groundwater table generally follows the land surface. The depth to the water table is governed by topography, and the direction of movement is therefore toward streams located in the lower elevations (SCE&G 2002). Within 20 miles of the site, groundwater wells range from 62 to 365 feet deep, but commonly are less than 200 feet deep, with yields of 10 gpm or less. Yields of up to 55 gpm have been reported in a small fraction of the region's wells (SCE&G 2002). The depth to groundwater in the vicinity of the site is typically from 20 to 90 feet, generally in jointed bedrock. There are no springs or groundwater wells downgradient from the site (SCE&G 2002).

The nearest groundwater well is approximately one mile east of VCSNS, just outside the site boundary. The closest public water supply is for the town of Jenkinsville, SC, which has two of its groundwater wells located to the southeast within two miles of the site (SCE&G 2002). The groundwater flow at the site prior to construction of Monticello Reservoir was toward Frees Creek and the Broad River at a rate of approximately one foot per day. The groundwater gradient varied from 0.005 foot/foot along the ridges to 0.07 foot/foot along the steeper sections of the valley walls (SCE&G 2002). After construction and filling of the reservoir, the local groundwater level would have been raised, causing a steepening of the gradient and reversing the groundwater flow direction from the Frees Creek drainage basin. The flow of groundwater ultimately would still be toward the Broad River via Terrible Creek, Mayo Creek, or Little River valleys at a rate of approximately one foot per day (SCE&G 2002). The low permeability of the surrounding soils and bedrock in the vicinity of the reservoir will limit the amount of

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groundwater flow from the impoundment (USAEC 1973, Section V.B.2, pg. V-8). No domestic or industrial wells are located downgradient of the groundwater flow direction. (SCE&G 2002).

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**2.4 Critical and Important Terrestrial Habitats**

The VCSNS site covers approximately 2,245 acres, an area that includes portions of Monticello Reservoir and FPSF (see Figure 2-3). Approximately 860 of the 2,200 acres are covered by the waters of Monticello Reservoir. A significant portion of the property (approximately 370 acres) consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. Some 125 acres are dedicated to transmission line rights-of-way. However, much of the VCSNS property consists of forested areas (approximately 890 acres). The primary terrestrial habitats at VCSNS are pine forest, deciduous forest, and mixed pine-hardwood forest (SCANA 2000). The pine forests at VCSNS 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.

Forested areas within the 2,245-acre VCSNS site are managed by SCANA Services' Forestry Operations group, but timber is not routinely harvested. Timber has been harvested in the past to remove diseased trees and trees damaged by tornadoes and wind storms. Once timber is removed, these areas are replanted with tree species appropriate to the terrain, soils, and drainage characteristics of a site. Dry upland areas are normally replanted in improved loblolly pine.

Parr Reservoir (see Figures 2-2 and 2-3) 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. SCE&G has been recognized by the South Carolina Wildlife Federation for its efforts in establishing a self-sustaining, non-migratory population of Canada geese on Parr and Monticello Reservoirs.

Terrestrial wildlife species found in the forested portions of the VCSNS 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).

Section 3.1.3 describes the transmission lines that SCE&G and Santee Cooper built to connect VCSNS to the transmission system. 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-Pineland corridors are situated within the Sandhills Physiographic Region. Barry (1980) contains descriptions of the soils, hydrology, and plant

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communities of the Piedmont and Sandhills regions. The principal land-use categories traversed by the transmission corridors are row crops, pasture, and forests. Forest habitats along transmission corridors consist primarily of pine forest, pine-hardwood forest, and bottomland hardwood forest.

No areas designated by the FWS as "critical habitat" for endangered species exist at VCSNS 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, trimming of undesirable vegetation from the sides of the corridors, and by use of "non-restricted use" 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.

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. The program offers grant money and wildlife management expertise to landowners who commit to participating in the program for five years.

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## **2.5 Threatened or Endangered Species**

In response to an SCE&G request, Holling (2001) reviewed the SCDNR Heritage Trust Program database and found no records of any state- or federally-listed species occurring within one mile of the VCSNS site. Animal and plant species that are state-listed or federally-listed as endangered or threatened, and that are known to occur in counties traversed by the associated transmission lines are listed in Table 2-1 (SCDNR 2002). The federal and state designations shown in Table 2-1 are those of the U.S. Fish and Wildlife Service and SCDNR.

Six bald eagle (*Haliaeetus leucocephalus*) nesting sites occur within a five-mile radius of the Station (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 in roughly the same area (within 0.5 mile of one another), on the western shore of the reservoir, approximately 2 miles west of VCSNS. The fourth is on the Heller's Creek arm of Parr Reservoir, approximately 4 miles northwest of the Station. There is a single bald eagle nesting site on the eastern shore of Monticello Reservoir, approximately 3.5 miles north of VCSNS. There is also a nesting site approximately 2 miles east of Monticello Reservoir (4 miles northeast of VCSNS) on a tributary of the Little River. One active bald eagle nest in Saluda County is approximately 0.5 mile west of the Summer-Graniteville transmission line, and one bald eagle nest in Richland County is located approximately 0.9 mile 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). Bald eagles are generally associated with lakes, rivers, and coastal areas (USACE 2002). The bald eagle is federally-listed as threatened and state-listed as endangered. 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 wood stork (*Mycteria americana*), state- and federally-listed as endangered, is known to occur in Aiken County. Although they don't nest in Aiken County, wood storks from the Birdsville Colony (near Millen, Georgia) forage in shallow wetlands on the 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 VCSNS cross or approach the Savannah River Site or the Silver Bluff Sanctuary.

Red-cockaded woodpeckers (*Picoides borealis*), state- and federally-listed as endangered, are known to occur in Aiken and Richland Counties (SCDNR 2002). Active nest cavities of this cooperative breeder occur in open, mature pine stands with sparse midstory vegetation (FWS 2002). Suitable habitat for this species does not occur at VCSNS, and there are no known active or abandoned cavity trees adjacent to VCSNS-associated transmission line corridors (SCDNR 2001).

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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 (Bellwood 1992, pg. 290). It roosts in hollow trees, under bark, in old cabins and barns, and in wells and culverts (Brown, 1997, pg. 72). The species has been recorded in Aiken and Richland Counties (SCDNR 2002), but there are no recorded occurrences in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

The gopher tortoise (*Gopherus polyphemus*) is state-listed as endangered, and is known to occur in Aiken County (SCDNR 2002). The gopher tortoise inhabits sandy, well-drained areas where adequate vegetation for foraging exists (Martoff et al. 1980, pg. 162). Gopher tortoises have not been recorded north of Aiken County, and no burrows have been recorded in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001). The species' burrows, which are readily visible, have not been observed at VCSNS. Gopher tortoises are generally not found in areas of Piedmont soils, which characterize most of the transmission corridors associated with VCSNS.

The pine barrens treefrog (*Hyla andersonii*) is state-listed as threatened, and is known to occur in Richland County (SCDNR 2002). This species inhabits trees in swamps adjacent to sandhill habitats (Martoff et al. 1980, pg. 113). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Webster's salamander (*Plethodon websteri*) is state-listed as endangered. It has been recorded in Saluda and Edgefield Counties (SCDNR 2002), which represent the eastern extent of its range. Webster's salamander inhabits moist, mixed hardwood forests on steep north-facing slopes with rock outcrops (Martoff et al. 1980, pg. 96). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

A mountain lion (cougar) was reportedly seen in the vicinity of VCSNS by a local private citizen during the early 1970s. The U.S. Nuclear Regulatory Commission (NRC) subsequently concluded that it was "...very unlikely that the mountain lion (if correctly identified) could be part of a reproducing population" (NRC 1981, pg. 2-18). The Eastern cougar (*Felis concolor cougar*) is state- and federally-listed as endangered, but is presumed by the FWS to be extinct in the wild (FWS 2002). SCDNR has no recent records of this species in the counties traversed by the transmission corridors (SCDNR 2001).

There are occasional sightings of Eastern cougars in eastern Canada and New England, but there have been no credible reports of cougars in the southeast (excluding some animals that had escaped from wild animal parks and small zoos). No breeding populations have been confirmed in the Eastern U.S. since the 1920s. At present, the only known breeding population of cougar in the Eastern U.S. is the Florida panther (*Felis concolor coryi*), which occurs in South Florida.

The pool sprite (*Amphianthus pusillus*), also known as little amphianthus, is state- and federally-listed as threatened. This aquatic plant occurs in small (usually less than one square meter)

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shallow pools on the crests and flattened slopes of granite outcrops (FWS 2002). These pools completely dry out in summer droughts. Within South Carolina, the pool sprite is known from three counties (FWS 2002; SCDNR 2002), one of which (Saluda) is crossed by the transmission lines associated with VCSNS. Only one occurrence of this plant is known from Saluda County (FWS 2002), but there are no recorded occurrences in or adjacent to the VCSNS-associated transmission line corridors (SCDNR 2001).

The Georgia aster (*Aster georgianus*), a candidate for federal 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). There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission corridors (SCDNR 2001).

The smooth coneflower (*Echinacea laevigata*), state- and federally-listed as endangered, is known to occur in Aiken and Richland Counties (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 (FWS 2002). There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission line corridors (SCDNR 2001).

The rough-leaved loosestrife (*Lysimachia asperulifolia*) is state- and federally-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 (FWS 2002); there are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Canby's dropwort (*Oxypolis canbyi*) is state- and federally-listed as endangered. This perennial plant is known to occur in 11 counties within South Carolina, one of which (Richland) is crossed by VCSNS 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 (FWS 2002). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Harperella (*Ptilimnium nodosum*) is state- and federally-listed as endangered. Typical habitat for this annual herb is rocky or gravel shoals, margins of swift-flowing streams, and edges of intermittent pineland ponds (FWS 2002). Harperella is known in South Carolina from Aiken and Saluda Counties (SCDNR 2002). There is one recorded population of Harperella approximately 0.5 mile 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).

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There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission corridors (SCDNR 2001).

Relict trillium (*Trillium reliquum*) is state- and federally-listed as endangered. Habitat for this perennial herb is mature, moist, undisturbed hardwood forests (FWS 2002). Relict trillium is known from Aiken and Edgefield Counties (SCDNR 2002). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Two state- and federally-listed aquatic species have been recorded in counties crossed by VCSNS transmission lines, but could not be affected by plant operations or transmission line maintenance over the license renewal term. The shortnose sturgeon (*Acipenser brevirostrum*), which SCDNR lists as occurring in Aiken County (SCDNR 2002), is found in the Savannah River, which is not crossed by VCSNS transmission lines. Small numbers of shortnose sturgeon may also ascend the Congaree River from Lake Marion, but are blocked from entering the Broad River by a hydroelectric facility (Columbia Hydro) in Columbia. The Carolina heelsplitter (*Lasmigona decorata*), a freshwater mussel, is found in Turkey Creek and two of its tributaries in the Sumter National Forest in western Edgefield County (FWS 1996); the Summer-Graniteville transmission line crosses a very small portion of eastern Edgefield County (see Figure 3-1).

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**2.6 Regional Demography**

The GEIS presents a population characterization method that is based on two factors: “sparseness” and “proximity” (NRC 1996, Section C.1.4). “Sparseness” measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

**Demographic Categories Based on Sparseness**

		<b>Category</b>
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: NRC 1996

“Proximity” measures population density and city size within 50 miles and categorizes the demographic information as follows:

**Demographic Categories Based on Proximity**

		<b>Category</b>
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: NRC 1996

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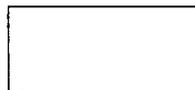
The GEIS then uses the following matrix to rank the population category as low, medium, or high.

**GEIS Sparseness and Proximity Matrix**

		Proximity			
		1	2	3	4
Sparseness	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4



Low  
Population  
Area



Medium  
Population  
Area



High  
Population  
Area

Source: NRC 1996, pg. C-159.

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

As derived from Census Bureau information, an estimated 1,027,842 people live within 50 miles of VCSNS. This equates to a population density of 131 persons per square mile within 50 miles. Applying the GEIS proximity measures, VCSNS 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 miles). According to the GEIS sparseness and proximity matrix, the VCSNS ranks of sparseness Category 3 and proximity Category 3 result in the conclusion that VCSNS is located in a "medium" population area.

All or parts of 21 South Carolina counties and the city of Columbia (state capital), are located within 50 miles of VCSNS (Figure 2-1). A small portion of one North Carolina county (Union) also lies within the 50-mile radius. Approximately 90 percent of VCSNS's employees live in four South Carolina counties: Richland, Lexington, Newberry, and Fairfield. The remaining

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8 percent are distributed across 16 South Carolina counties, with numbers ranging from 1 to 9 employees per county.

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 1990; USCB 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 1990; USCB 2000).

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). 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).

Table 2-2 shows estimated populations and annual growth rates for the four counties with the greatest potential to be socioeconomically affected by license renewal activities. Figure 2-1 shows these counties.

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**2.7 Economic Base**

VCSNS lies in Fairfield County, which is part of the Central Midlands Region. The Central Midlands Region (approximately 600,000 residents in year 2000) encompasses Lexington, Fairfield, Richland, and Newberry counties. The state capital, Columbia, is located in Richland County. The Columbia metropolitan statistical area, which includes Richland and Lexington Counties, had 536,691 residents in 2000 (Central Carolina Economic Development Alliance undated1). "Southern Business & Development" magazine ranked Columbia third in the large market categories that "support business through low taxes, available tax credits, and a commitment to help existing companies prosper and grow." (Realty World America 2002). 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 Central Midlands Region has a transportation network of trucking and railroad terminals, and interstate highway access to nine regional airports, three international airports, and three international seaports, giving the area access to both domestic and international markets (Central Carolina Economic Development Alliance undated2).

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 (City of Newberry South Carolina 1999). 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 (Central Carolina Economic Development Alliance 1998). Although agriculture played a more significant role in the past, it is no longer a dominant force in the region's economy.

The average monthly unemployment rate for the state of South Carolina for 2001 was 4.7 percent. In comparison, Lexington, Richland, Newberry, and Fairfield Counties had annual monthly unemployment rates of 2.3, 2.9, 6.9, and 11.4 percent, respectively, in 2001 (South Carolina Employment Security Commission 2002).

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**2.8 Taxes**

VCSNS pays annual property taxes to Fairfield County. Taxes fund Fairfield County operations, including the school system, the County General Fund, hospitals, road maintenance, and recreation facilities. For the years 1995 to 2000, VCSNS's property taxes provided about 47 percent of Fairfield County's total property tax revenue and approximately 47 percent of Fairfield County's total operating budget. If the operating license for VCSNS was not renewed and the plant was decommissioned, then impacts to the tax base of the surrounding communities and their economic structures could be significant, as discussed in Section 8.4.7 of the GEIS (NRC 1996).

SCE&G projects that VCSNS's annual property taxes will remain constant at about \$12-13 million through the license renewal period. The potential effects of deregulation are not yet fully known, however, and could affect utilities' tax payments to counties. Any changes to VCSNS tax rates due to deregulation, however, would be independent of license renewal. Table 2-3 compares VCSNS's tax payments to Fairfield County tax revenues and operating budgets.

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**2.9 Land Use Planning**

This section focuses on Richland, Newberry, Lexington, and Fairfield Counties because most (approximately 90 percent) of the permanent VCSNS workforce lives in these counties (see Section 3.4) and SCE&G pays property taxes in Fairfield County. All four counties have experienced growth over the last several decades and their Comprehensive Land Use Plans reflect planning efforts and public involvement in the planning process. Land use planning tools, such as zoning, guide future growth and development. All plans share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, are planned and discouraging strip development along county roads and highways.

**Richland County**

Richland County occupies roughly 748 square miles 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 sub-areas 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.

The Richland County Comprehensive Plan does, however, contain the "Town and Country Planning Concept" which sets forth the following goals:

- Improve the Middle Landscape in Urban and Suburban Villages – In existing urban and suburban areas, lessen the sprawling character by bringing the landscape into developed areas in order to define and separate neighborhoods. The strategy is to encourage mixed-use village centers that attract employment and services development.
- Promote the Idea of Towns and Villages – In rural areas, promote the development of compact, mixed-use development that has a distinct village edge and connection to the landscape.
- Continue Preservation Through the Use of Riparian Corridors – The County Riparian Corridor network should be used to develop a sub-contiguous county-wide greenway system.

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The strategy is to define growth areas, while preserving natural systems and rural landscapes. (Richland County 1999).

**Newberry County**

Newberry County has a total land area of 648 square miles. 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 semi-private 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 US 76 corridor between the Town of Little Mountain and the City of Newberry, and portions of SC Highways 773, 219, 34 and 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 platted 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 multi-family 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 500 or more acres 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 criss-crossed with streams and rivers, so there will be areas where topography and floodplain characteristics will constrain development. Infrastructure constraints will be mitigated by the construction of additional roads and water treatment facilities as the need arises (Newberry County 1998).

**Lexington County**

Lexington County contains over 110,000 parcels located in a 700-square-mile area (Lexington County 1999). Farmland represents 21 percent of the land, as the County is a relatively strong

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agricultural center. However, Lexington County is encouraging the growth of residential areas by touting 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 encourage 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.

**Fairfield County**

Fairfield County contains roughly 685 square miles acres. The largest land use category is forest, accounting for 87 percent of the total acreage. This includes public, commercial, and non-commercial forests, as well as farm woodlands. Non-forested land, including all urban or developed land, accounts for the remaining 13 percent. Surface water comprises four percent of the county and is represented by Lake Wateree, the Catawba River, Monticello Reservoir, and the Broad River (Fairfield County 1997).

Roughly three percent of the forested land in the county is government-owned. The primary parcel is the Sumter National Forest, located in the northwestern part of the county. Privately-owned forestland in the county is dominated by corporations, individuals, and the forest products industry. Only six 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).

Developed urban land use represents only two percent of Fairfield County. It is centered in and around the town of Winnsboro. Additional urban concentrations are found along the shores of Wateree Lake, in Ridgeway, in the Mitford community, and, to a lesser extent, around sections of Monticello Reservoir and Jenkinsville. 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. However, mobile homes and other manufactured structures are rapidly increasing in number. Residential development is found in both isolated and cluster patterns along most county roads. (Fairfield County 1997).

In the 20 years that VCSNS has operated, Fairfield County has experienced minimal growth. The population 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 in synch with the nationwide movement away from agricultural production and toward a commerce built on the processing/production of goods and the distribution of services.

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## **2.10 Social Services and Public Facilities**

### **2.10.1 Public Water Supply**

VCSNS pumps and treats water from the Monticello Reservoir for use as potable water and is not connected to a municipal system. Most (90 percent) of the permanent employees of Summer Station reside in Richland, Lexington, Newberry, and Fairfield Counties; therefore, the discussion of public water supply systems will focus on these four areas.

#### **Richland County**

Water service is available to Richland County through public and private water systems. The major public system is operated exclusively by the city of Columbia which has primary water lines extending into four major planning areas. Water service is provided as far west as Chapin and Lake Murray and north to the town of Blythewood. Water service in the northeast extends very close to the Kershaw County line. Southeast of the city, water lines reach to the McEntire Air National Guard Base and the Hopkins area. Columbia's position has been to delay further water extension into unserved, sparsely populated areas until a sufficient customer base has formed. Outside of Columbia's service area, water supply depends on private wells. Columbia's water treatment plants at Lake Murray and the Columbia Canal have the capacity to treat 130 million gallons per day (MGD) of drinking water. System water demand ranges from 45 MGD to 90 MGD (Richland County 1999). Average demand is approximately 60 MGD (Summers 2000).

#### **Newberry County**

There are four water systems in Newberry County: the Newberry County Water and Sewer Authority, the city of Newberry, the town of Whitmire, and the town of Prosperity. Residents who are not tapped on to one of these systems draw their water from wells.

The Water and Sewer Authority's service area focuses on the unincorporated areas of the county. The system is comprised of 200 miles of 6-inch-diameter or larger pipes and 240 fire hydrants. Demand is 800,000 to 933,00 gallons per day (Newberry County 1998). Eighty-five percent of the water is purchased from the city of Newberry, with the remaining 15 percent drawn from wells (Newberry County 1998). The Water and Sewer Authority is planning to build a water plant on Lake Murray, which will have an ultimate capacity of 6 MGD. The new water plant will serve the southern portion of Newberry County. While water is available at the interstate interchanges, the supply is not sufficient for industrial or large-scale 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).

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The city of Newberry pumps and treats raw water from the Saluda River and has the capacity to produce 8.1 MGD of treated water (Newberry County 1998). The transmission system from the plant to the city consists of one 16-inch line and one 20-inch line capable of carrying 10 MGD (Newberry County 1998). The distribution network contains approximately 142 miles of pipe, 4,556 hydrants, and 4,782 service connections (Newberry County 1998). The treatment plant is capable of being expanded to 10 MGD (Newberry County 1998). Additionally, the city owns storage facilities capable of holding 4 million gallons of treated water (Newberry County 1998).

The town of Whitmire has a 1-MGD surface water plant drawing from the Enoree River. Due to recent spills upriver, however, the town has recently constructed an alternate facility that draws from Duncan Creek. There are 1,133 water customers, 393 of which are outside of the town. In May 1998, the peak flow was 867,000 gallons per day and the average flow was 717,000 gallons per day (Newberry County 1998). The town is exploring the possibility of increasing the capacity of the water plant by an additional 500,000 gallons per day (Newberry County 1998).

The town of Prosperity draws water for 564 customers (42 of these outside the town limits) from 4 wells located within the town. Annual average consumption is 3.1 million gallons monthly, with peak monthly usage of 4.2 million gallons (Newberry County 1998).

**Lexington County**

The major public providers of water in Lexington County include the city of Columbia, city of West Columbia, Lexington County Joint Municipal Water and Sewer Commission, city of Cayce, town of Lexington, town of Batesburg-Leesville, town of Chapin, town of Pelion, town of Swansea, Gilbert-Summit Rural Water District, Gaston Water District, and the Bull Swamp Water District. The remainder are private systems. Non-public providers include AAA Utilities Inc., Carolina Water Service, and Heater Utilities Inc. Table 2-4 summarizes average daily use and maximum daily capacity for these systems (Lexington County 1999).

**Fairfield County**

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).

The five public water systems are the town of Winnsboro, the town of Ridgeway, the Jenkinsville Water District, the Mid-County Water District, and the Mitford Water District. 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

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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). Table 2-5 compares average daily use and capacity of Fairfield County water systems.

There are five private water systems in the county. Two systems serve mobile home parks, two serve nursing homes, and the fifth serves a subdivision. All are relatively small in terms of the number served (Fairfield County 1997). A few industrial water systems and 18 miscellaneous systems serve rural parks, schools, landings, and camps (SCDHEC 2000).

### **2.10.2 Transportation**

Road access to VCSNS is via County Road 311 (Ollie Bradham Boulevard), a two-lane paved road (see Figure 2-3). County Road 311 intersects with SC 215 approximately 1.5 miles east of the station. SC 215 has a north-south orientation and is used by employees traveling from the Richland and Fairfield County areas. Additionally, employees traveling from the Richland and Lexington County areas may use US 176 north to SC 213, which intersects with SC 215 two to three miles south of the station. Employees coming from the west and Newberry County area may use several secondary roads such as SC 773 or SC 202 to intersect with US 176 and head south to intersect with SC 213. Traffic count data for each of these highways/roads is shown in Table 2-6 (Jones 2002). The South Carolina Department of Transportation does not make Level of Service determinations for roads in rural, non-metropolitan areas unless deemed necessary. None of the roads listed in Table 2-6 has had a Level of Service determination.

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## **2.11 Minority and Low-Income Populations**

### **Background**

In performing environmental justice analyses for previous license renewal applicants, NRC used a 50-mile radius as the overall area that could contain environmental impact sites and the state as the geographic area for comparative analysis. This approach was adopted for identifying minority and low-income populations that could be affected by VCSNS operations.

ArcView® geographic information system software was used to combine U.S. Census Bureau (USCB) TIGER line data with USCB 2000 census data to determine the minority characteristics on a block group level. USCB 2000 low-income census data is not yet available; therefore, 1990 tract data was used for the low-income analysis. Block groups or tracts were included if any of their area lay within 50 miles of VCSNS. The 50-mile radius included 802 block groups in 2000 and 243 tracts in 1990. The geographic area for VCSNS is defined as the entire states of South Carolina and North Carolina separately for block groups and tracts contained in each state. Table 2-7 presents the numbers of census tracts within each county that exceed the thresholds for minority or low-income populations.

#### **2.11.1 Minority Populations**

The NRC's "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" defines a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; other; multi-racial; or the aggregate of all minority races; or Hispanic ethnicity (NRC 2001, Appendix D). The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population of the census block or environmental impact site exceeds 50 percent.
2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent USCB (decennial) census data. Census data for the year 2000 from the USCB website was used in determining the percentage of the total population within South Carolina and North Carolina for each minority category, and in identifying minority populations within 50 miles of VCSNS.

Each minority population within a block group was divided by the total population for that block group to obtain the percent of the block group's population represented by a given minority. For each of the 802 block groups within 50 miles of VCSNS, the

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percentage of each minority population was calculated and compared to the corresponding geographic area's minority threshold percentages to determine whether or not minority populations were present. The geographic area for VCSNS was the state of South Carolina when the block group was contained within South Carolina and the state of North Carolina when the block group was contained within North Carolina. USCB data characterizes South Carolina as 0.3 percent American Indian or Alaskan Native; 0.9 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 29.5 percent Black races; 1.0 percent all other single minorities; 1.0 percent multi-racial; 32.8 percent aggregate of minority races; and 2.4 percent Hispanic ethnicity (USCB 2000). USCB data characterizes North Carolina as 1.2 percent American Indian or Alaskan Native; 1.4 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 21.6 percent Black races; 2.3 percent all other single minorities; 1.3 percent multi-racial; 27.9 percent aggregate of minority races; and 4.7 percent Hispanic ethnicity (USCB 2000).

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no Native Hawaiian or other Pacific Islander, other single minorities, or multi-racial minorities exist in the geographic area. Table 2-7 presents the numbers of block groups within each county that exceed the threshold for minority populations.

Based on the "more than 20 percent" criterion, American Indian or Alaskan Native minority populations exist in a single block group (Table 2-7). Figure 2-4 displays the location of this minority block group in York County, South Carolina. The Catawba Indian Nation has tribal lands (approximately 700 acres) in the Rock Hill, South Carolina area (EDA 2000). Total tribal membership is believed to be around 3,000, with approximately half of this number living in York County and Lancaster County, South Carolina (EDA 2000; EPA 2001).

Based on the "more than 20 percent" criterion, the Asian minority population exists in a single block group (Table 2-7). Figure 2-5 displays the location of this minority block group in Richland County, South Carolina.

Based on the "more than 20 percent" criterion, the Black minority population exists in 209 block groups (Table 2-7). Figure 2-6 displays the location of these minority block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, aggregate minority populations exist in 230 block groups (Table 2-7). Figure 2-7 displays the location of these minority block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Hispanic ethnicity minority populations exist in two block groups (Table 2-7). Figure 2-8 displays the locations of these minority block groups, which are in Saluda County and Greenwood County, South Carolina.

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**2.11.2 Low-Income Populations**

The USCB has not yet released 2000 census data for low-income households. Therefore, 1990 census data was used from the USCB website (USCB 1990) in determining the percentage of the total households within the States of North Carolina and South Carolina that are deemed low-income households and in identifying low-income households within 50 miles of VCSNS.

NRC guidance defines "low-income" using USCB statistical poverty thresholds (NRC 2001, Appendix D). The "low-income" household numbers for each census tract were divided by the total households for that census tract to obtain the percentage of "low-income" households per census tract. USCB data (USCB 1990) characterize 15.8 percent of South Carolina and 14.0 percent of North Carolina households as low-income. A "low-income population" is considered to be present if:

1. The low-income population of the census block or environmental impact site exceeds 50 percent.
2. The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the "more than 20 percent" criterion, 15 census tracts contain a low-income population. Eleven of these tracts are found in Richland County, two in York County, and one each in Lexington and Sumter Counties, South Carolina. Figure 2-9 displays the locations of low-income household tracts, while Table 2-7 displays the low-income household tract distributions among the counties in the geographic area.

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**2.12 Meteorology and Air Quality**

VCSNS is located in Fairfield County, South Carolina, which is part of the Columbia Intrastate Air Quality Control Region (AQCR). The AQCR is designated as being in attainment for all criteria pollutants, as are all counties in South Carolina (EPA 2002). The nearest non-attainment area is the Metropolitan Atlanta Intrastate AQCR, approximately 200 miles west-southwest of VCSNS, which is a 1-hour ozone non-attainment area (40 CFR 81.311).

In July 1997, the U.S. Environmental Protection Agency (EPA) issued final rules establishing a new 8-hour ozone standard that would create non-attainment areas for ozone within North and South Carolina. In October 1999, the District of Columbia Court of Appeals ruled against EPA with regard to the federal 8-hour ozone standard. On February 27, 2001 the U.S. Supreme Court upheld the 8-hour ozone standard, but ordered EPA to reconsider its implementation policy and remanded the case to the D.C. Circuit for proceedings consistent with its opinion (66 FR 57268, November 14, 2001). If all other legal challenges to the revised standard are overcome by the EPA a portion of Richland County, which is approximately 15 miles southeast of VCSNS, would become an eight-hour ozone non-attainment area.

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### **2.13 Historic and Archeological Resources**

The Final Environmental Statement for construction of VCSNS listed three historic (National Register of Historic Places) sites in the vicinity of the station: the Little River Baptist Church (3.8 miles north of Jenkinsville), the Ebenezer Associate Reformed Presbyterian Church (4.3 miles north of Jenkinsville), and Davis Plantation (0.25 mile south of Monticello) (USAEC 1973, p. XII-11). At that time, it was determined that none of these sites was "endangered" by Summer Station (USAEC 1973, p. XII-11). Additionally, four archeological sites were discovered within or near the boundary of the site and a recommendation was made by Dr. Robert L. Stephenson, State Archeologist, that the area be surveyed and that two of the known sites be excavated (USAEC 1973, p. II-15). This work is described below.

#### **Below-Ground**

SCE&G subsequently funded an archeological survey that was conducted by a team from the University of South Carolina Institute of Archeology and Anthropology in 1972. According to the survey report, which was ultimately produced in 1979, completion of the "Parr Hydroelectric Project" would render approximately 12,000 acres inaccessible for archeological research.

The proposed Parr Hydroelectric Project consisted of a series of related actions:

1. elevation of the Parr Reservoir Dam, raising the level of the Parr Reservoir
2. construction of a series of dam on Frees Creek to create the upper reservoir for a new pumped-storage facility and supply cooling water for VCSNS
3. construction of the FPSF and VCSNS

The archeological survey was conducted to assess the nature and distribution of the sites present and to assess the effect of the project on these resources.

The Institute of Archeology and Anthropology team identified 27 additional sites and performed the excavation of two others (Teague 1979). Four or 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.

Because the Parr Hydroelectric Project report covered only the land upon which the project would have an impact, the Institute of Archeology and Anthropology archeological site files and maps were reviewed to determine the existence of sites within 1-mile and 6-mile radii of the Station. This broadened scope revealed 39 archeological sites within a 6-mile radius and one archeological site within a 1-mile radius of VCSNS.

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**Above-Ground**

Since the publication of the 1973 Final Environmental Statement, 41 “above-ground” locations have been added to the National Register of Historic Places for Fairfield County. Ten of these sites fall within a 6-mile radius of the Station (Table 2-8) (U.S. Department of the Interior 2002a). Twenty-eight locations have been added to the National Register for Newberry County. Four of these sites fall within a 6-mile radius of the Station (Table 2-8) (U.S. Department of the Interior 2002b). No sites listed on the National Register of Historic Places fall within a 1-mile radius of the Station.

One item of special note — there are two other historic sites within a 6-mile radius of the Station 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 the Station on land that is owned by SCE&G but is not part of the VCSNS property. This small family plot contains headstones dating back to 1895. The other historic site, approximately 1.5 miles southwest of the Station, is a large monument erected in 1934 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 in a wooded area on land that is not part of the VCSNS property, but is maintained as a buffer zone around the site. SCE&G’s Forestry Operations group is familiar with these sites, which are marked on their 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.

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**2.14 Related Federal Projects**

The Federal Power Commission (which became FERC) issued a license (Project Number 1894) to SCE&G on June 30, 1974 for the Parr Hydroelectric Project, which consisted of a set of related actions (elevation of Parr Shoals dam, enlargement of Parr Reservoir, construction of FPSF, impoundment of Frees Creek for Monticello Reservoir) as described in Sections 2.2 and 2.13. The Federal Power Commission prepared an EIS for this “major federal license” that evaluated potential environmental impacts of this action, including the inundation of 9,350 acres of land (eliminating farmland, timber, wildlife habitat, and 25 homes) and enhanced recreational opportunities provided by the public recreational facilities at the expanded Parr Reservoir and new Monticello Reservoir. The Federal Power Commission concluded that the loss of 9,350 acres of farmland and wildlife habitat was “significant” (Federal Power Commission 1974, pg. 2), but that “...with prudent evaluation and selection of construction methods and project operation, no serious cumulative adverse environmental impacts are foreseen.”

FPSF began commercial operation in 1978, four years before VCSNS. The FERC license for the Parr Hydroelectric Project, including FPSF, expires on June 30, 2020. Under current rules, SCE&G will have to file a notice of intent with FERC by the year 2015 declaring whether or not it intends to seek a new license for the hydroelectric project. At least two years before the current FERC license expires (i.e., prior to June 30, 2018) SCE&G will have to file an application for a new license.

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**TABLE 2-1  
ENDANGERED AND THREATENED SPECIES THAT OCCUR IN THE VICINITY OF VCSNS  
OR IN COUNTIES CROSSED BY TRANSMISSION LINES**

Scientific Name	Common Name	Federal Status <sup>a</sup>	State Status <sup>a</sup>
<b><u>Birds</u></b>			
<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
<b><u>Mammals</u></b>			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	-	E
<b><u>Reptiles</u></b>			
<i>Gopherus polyphemus</i>	Gopher tortoise	-	E
<b><u>Amphibians</u></b>			
<i>Hyla andersonii</i>	Pine barrens treefrog	-	T
<i>Plethodon websteri</i>	Webster's salamander	-	E
<b><u>Fish</u></b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	E	E
<b><u>Invertebrates</u></b>			
<i>Lasmigona decorata</i>	Carolina heelsplitter	E	E
<b><u>Vascular Plants</u></b>			
<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

a. E = Endangered; T = Threatened; C = Candidate for listing; - = Not listed.

Source: SCDNR 2002.

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**TABLE 2-2  
ESTIMATED POPULATIONS AND ANNUAL GROWTH RATES IN FAIRFIELD,  
LEXINGTON, RICHLAND, AND NEWBERRY COUNTIES FROM 1980 - 2040**

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

- a. U.S. Bureau of Census 2000.
- b. Central Midlands Council of Governments 1999.
- c. Projections.

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**TABLE 2-3  
PROPERTY TAX REVENUES GENERATED IN FAIRFIELD COUNTY, SOUTH CAROLINA;  
PROPERTY TAXES PAID TO FAIRFIELD COUNTY BY V.C. SUMMER NUCLEAR  
STATION; AND FAIRFIELD COUNTY OPERATING BUDGET, 1995 – 2000**

Year	Total Fairfield County Property Tax Revenues <sup>a</sup> (excluding debt)	Property Tax Paid By V.C. Summer Station	Percent of Total Property Taxes	Operating Budget for Fairfield County <sup>a</sup> (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. Douglas, R. 2002.

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**TABLE 2-4  
LEXINGTON COUNTY PUBLIC WATER SUPPLIERS AND CAPACITIES**

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
City of Columbia <sup>a</sup>		
Columbia Canal/Lake Murray	60,000,000	130,000,000
City of West Columbia <sup>b</sup>	4,900,000	12,000,000
City of Cayce <sup>b</sup>	3,200,000	6,400,000
Town of Lexington <sup>b</sup>	1,500,000	2,800,000
Town of Batesburg-Leesville <sup>b</sup>	1,100,000	2,100,000
Town of Chapin <sup>b</sup>	Not available	Storage tank holds 2 million gallons
Town of Pelion <sup>b</sup>	80,000	Purchases water from Lexington Joint Municipal Water and Sewer Commission
Town of Swansea <sup>b</sup>	162,000	From wells – capacity not indicated
Gilbert-Summit Rural Water District <sup>b</sup>	30,000	540,000
Gaston Rural Community Water District <sup>b</sup>	Not available	300,000

a. Richland County 1999.

b. Lexington County 1999.

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**TABLE 2-5  
FAIRFIELD COUNTY PUBLIC AND PRIVATE WATER SUPPLIERS AND CAPACITIES**

<b>Water Supplier</b>	<b>Average Daily Use (Gallons per day)</b>	<b>Maximum Daily Capacity (Gallons per day)</b>
<b>Community Systems</b>		
Town of Winnsboro <sup>b</sup>	1,782,600	3,100,000
Town of Ridgeway <sup>b</sup>	145,000	1,010,400
Jenkinsville Water District <sup>b</sup>	126,000	172,300
Mid-County Water District 1 <sup>b</sup>	72,700	241,900
Mid-County Water District 2 <sup>b</sup>	65,000	100,000
Mitford Water District <sup>b</sup>	79,800	400,000
<b>Private Residential Systems</b>		
Royal Hills SD <sup>a</sup>	2,000	12,000
Chappel MHP <sup>b</sup>	Not available	25,000
Coley's MHP <sup>b</sup>	Not available	30,000
Fairview Manor <sup>a</sup>	Not available	60,000
Lambright Care <sup>a</sup>	Not available	Not Available
<b>Industrial Systems</b>		
VC Summer Nuclear Station <sup>b</sup>	27,800	1,296,000

a. Fairfield County 1997.

b. SCDHEC 2000.

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**TABLE 2-6  
TRAFFIC COUNTS FOR ROADS IN THE VICINITY OF VCSNS**

<b>Route No.</b>	<b>Route Location</b>	<b>Est. AADT (Total of Both Directions)</b>	<b>AADT Year</b>
US 176	SC 34 to SC 219	900	2000
US 176	SC 219 to Richland Co. line	1450	2000
SC 213	Newberry Co. line to SC 215	2300	2000
SC 213	US 176 to Fairfield Co. line	1750	2000
SC 215	Richland Co. line to SC 213	1500	2000
SC 215	SC 213 to Chester Co. line	1250	2000
SC 202	I-26 to US 176	1100	2000
SC 202	US 76 to I-26	1850	2000
SC 773	US 76 to US 176	2700	2000

AADT = Annual Average Daily Traffic volume.

Source: Jones 2002.

**TABLE 2-7  
MINORITY AND LOW-INCOME POPULATIONS**

County	State	Minority Populations									Low-Income Populations	
		2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	1990 Tracts	1990 Tracts Low-Income
Union	NC	2	0	0	0	0	0	0	0	0	2	0
Aiken	SC	13	0	0	0	2	0	0	2	0	5	0
Calhoun	SC	7	0	0	0	4	0	0	4	0	3	0
Cherokee	SC	4	0	0	0	0	0	0	0	0	2	0
Chester	SC	31	0	0	0	9	0	0	9	0	10	0
Edgefield	SC	11	0	0	0	7	0	0	8	0	4	0
Fairfield	SC	19	0	0	0	13	0	0	14	0	5	0
Greenwood	SC	45	0	0	0	11	0	0	11	1	10	0
Kershaw	SC	40	0	0	0	5	0	0	6	0	9	0
Lancaster	SC	44	0	0	0	7	0	0	7	0	12	0
Laurens	SC	49	0	0	0	8	0	0	8	0	10	0
Lee	SC	2	0	0	0	2	0	0	2	0	1	0
Lexington	SC	135	0	0	0	7	0	0	12	0	33	1
McCormick	SC	1	0	0	0	1	0	0	1	0	1	0
Newberry	SC	32	0	0	0	3	0	0	3	0	6	0
Orangeburg	SC	5	0	0	0	1	0	0	1	0	3	0
Richland	SC	235	0	1	0	104	0	0	115	0	73	11
Saluda	SC	16	0	0	0	3	0	0	5	1	4	0
Spartanburg	SC	13	0	0	0	0	0	0	0	0	5	0
Sumter	SC	7	0	0	0	5	0	0	5	0	6	1
Union	SC	29	0	0	0	5	0	0	5	0	9	0
York	SC	62	1	0	0	12	0	0	12	0	30	2
<b>TOTALS</b>		<b>802</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>209</b>	<b>0</b>	<b>0</b>	<b>230</b>	<b>2</b>	<b>243</b>	<b>15</b>
<b>State Averages</b>												
States		American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity		1990 Tracts Low-Income	
North Carolina		1.2%	1.4%	0.0%	21.6%	2.3%	1.3%	27.9%	4.7%		14.0%	
South Carolina		0.3%	0.9%	0.0%	29.5%	1.0%	1.0%	32.8%	2.4%		15.8%	

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**TABLE 2-8  
FAIRFIELD AND NEWBERRY COUNTY SITES  
ON THE NATIONAL REGISTER OF HISTORIC PLACES  
(WITHIN THE VICINITY OF THE VCSNS)**

Site Name	City	Location
<i>Fairfield County</i>		
James Beard House	W of Ridgeway	Ridgeway
Davis Plantation	S of Monticello on SC 215	Monticello
Ebenezer Associate Reformed Presbyterian Church	4.3 mi. N of Jenkinsville on SC 213	Jenkinsville
Dr. John Glenn House	SC 215	Jenkinsville
Kincaid-Anderson House	NE of Jenkinsville of SC 213	Jenkinsville
Little River Baptist Church	3.8 mi. N of Jenkinsville on SC 213	Jenkinsville
Mayfair	Off SC 215	Jenkinsville
McMeekin Rock Shelter	Address Restricted	Winnsboro
Monticello Methodist Church	Off SC 215	Monticello
Monticello Store and Post Office	Off SC 215	Monticello
<i>Newberry County</i>		
Folk-Holloway House	Jct. of Holloway and Folk Sts.	Pomaria
Hatton House	Holloway St. between Folk St. and US 176	Pomaria
Pomaria	SE of Pomaria on US 176	Pomaria
St. John's Lutheran Church	SE of Pomaria	Pomaria

Source: U.S. Department of Interior 2002a, b.

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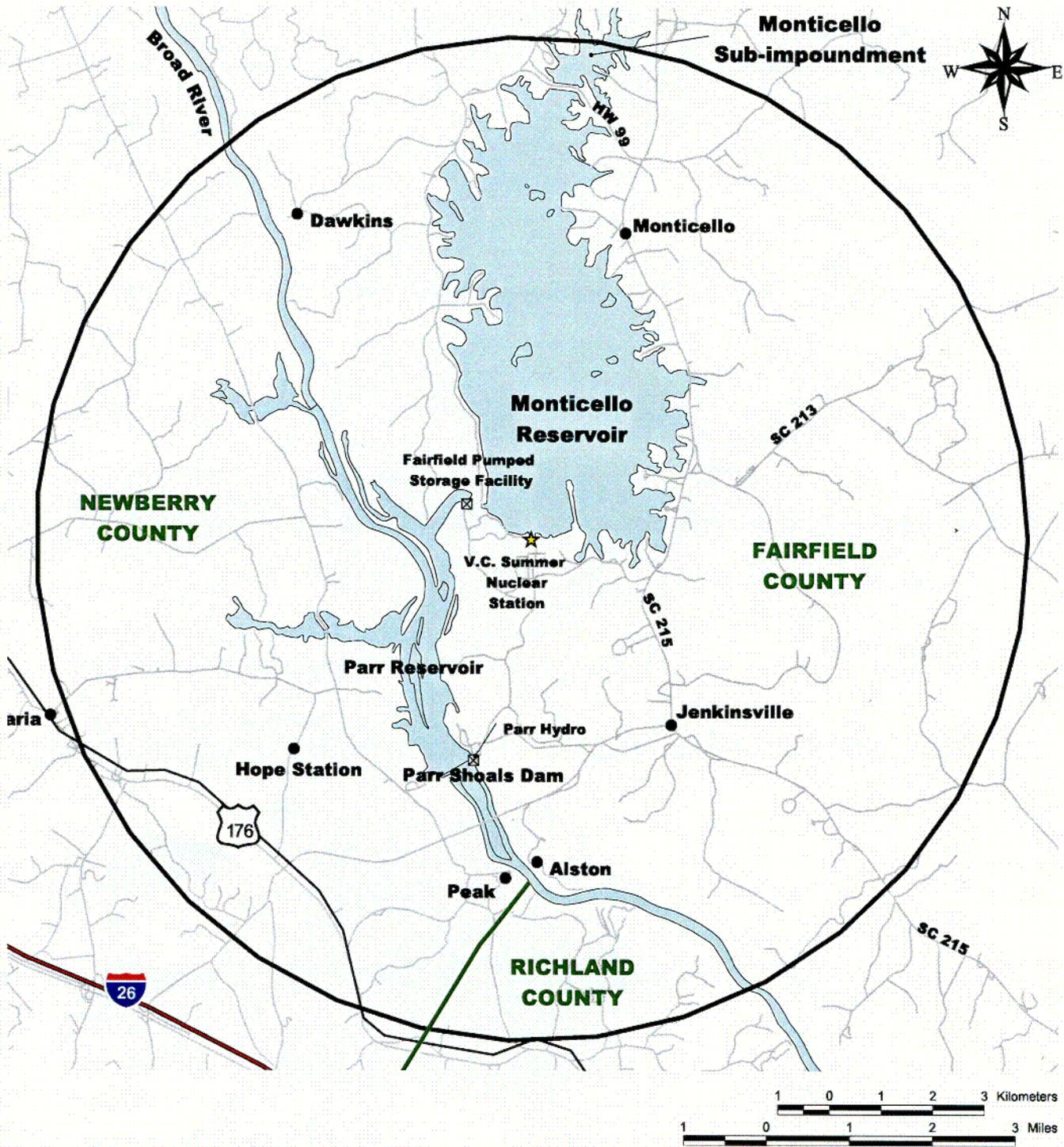


- LEGEND**
- ★ V.C. Summer Nuclear Station
  - 50 mile radius of V.C. Summer
  - ▬ Interstates
  - ▬ Major roads
  - ▬ County Boundaries
  - ▬ State Boundary
  - ▬ Lakes and Rivers

**FIGURE 2-1  
V.C. Summer Nuclear Station,  
50-Mile Locational Vicinity Map  
LICENSE RENEWAL APPLICATION**

C01

VIRGIL C. SUMMER NUCLEAR STATION  
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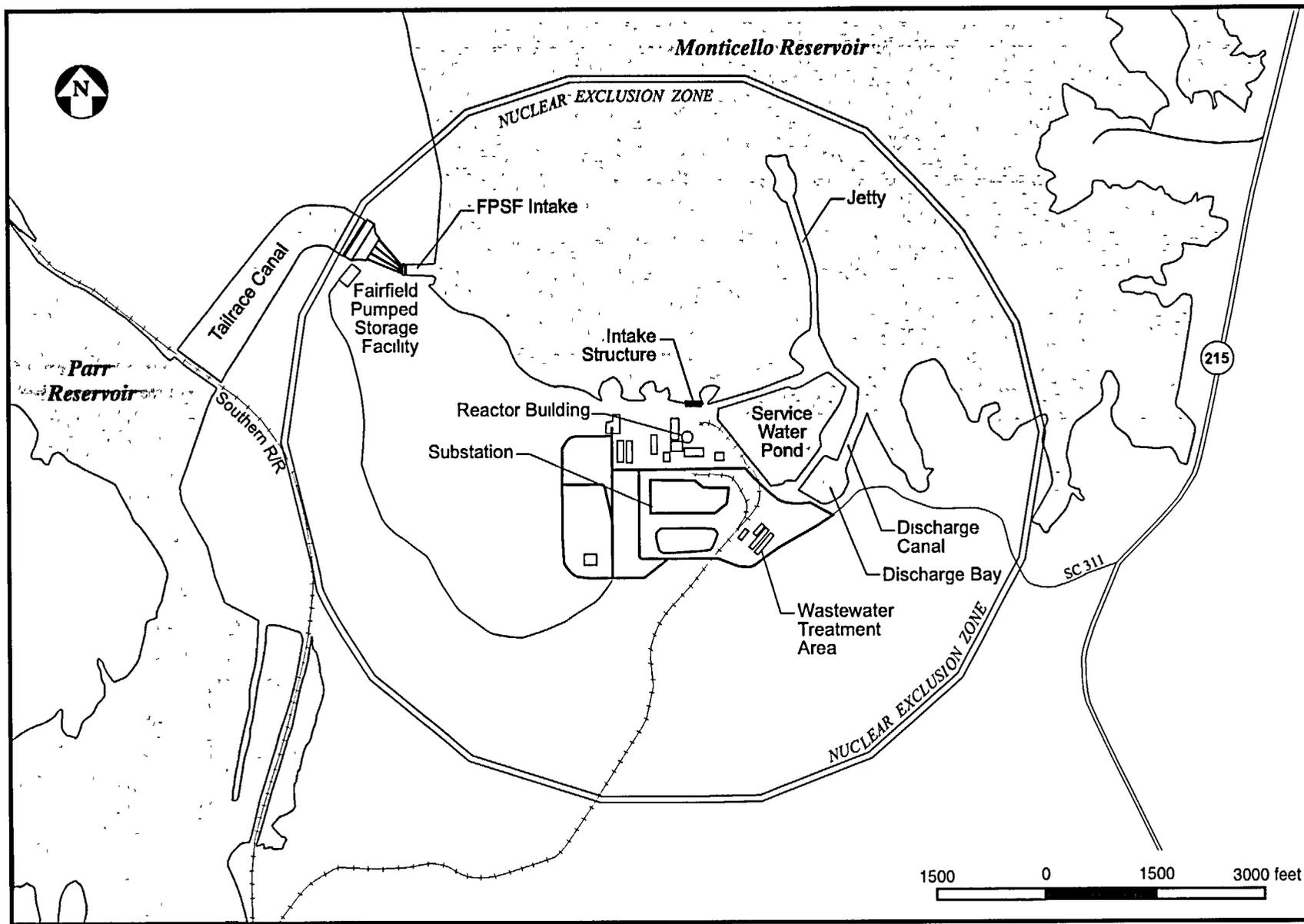


**LEGEND**

-  Six mile radius of V.C. Summer
-  Interstates
-  Major roads
-  Minor roads
-  County Boundaries
-  Lakes and Rivers

**FIGURE 2-2**  
**V.C. Summer Nuclear Station,**  
**6-Mile Vicinity Map**  
 LICENSE RENEWAL APPLICATION

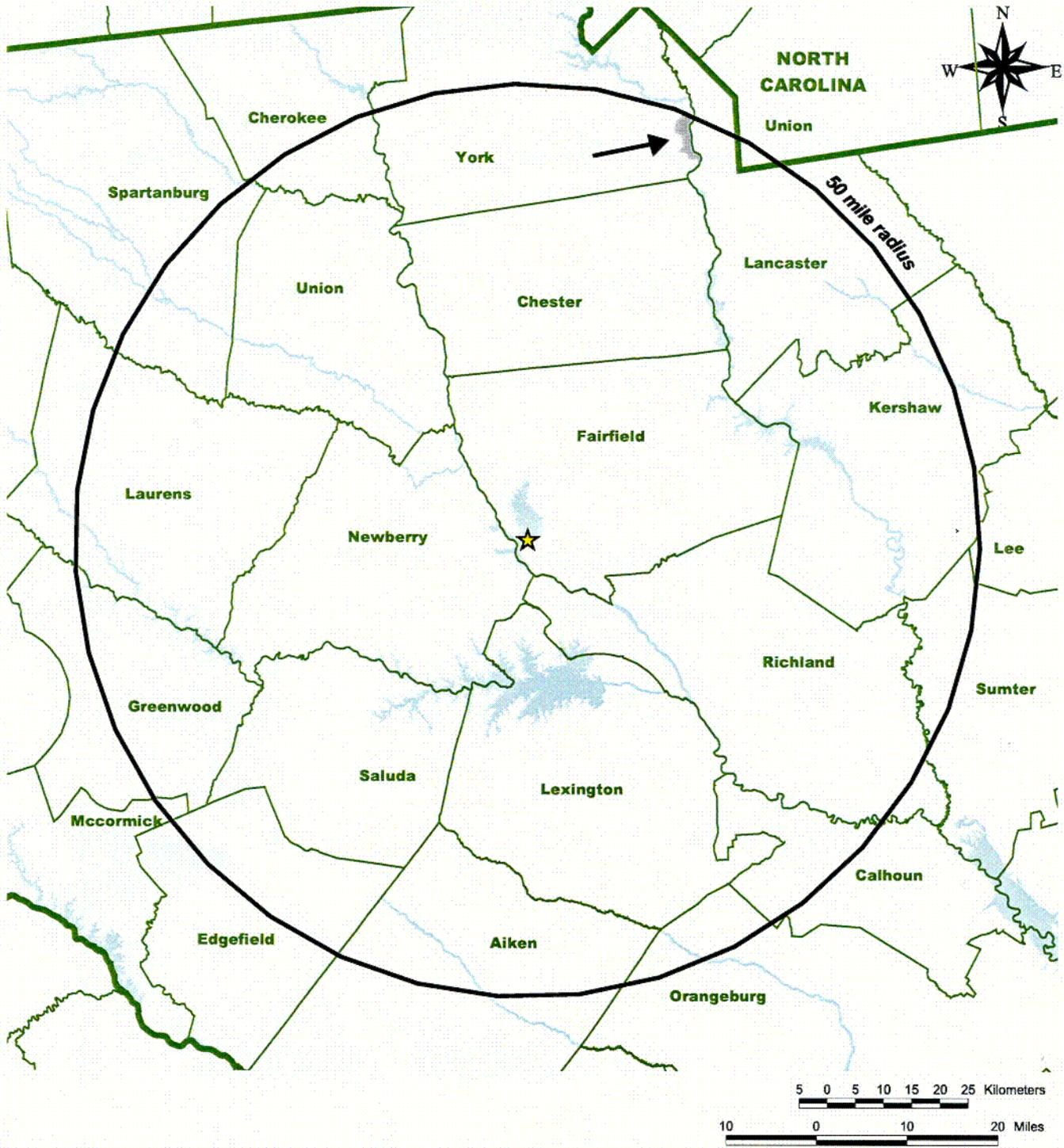
COZ



P /Utilities/Summer/Grb/Site Area Map at

Figure 2-3. South Carolina Electric & Gas Company, Virgil C. Summer Nuclear Station Site Area Map.

VIRGIL C. SUMMER NUCLEAR STATION  
 APPLICATION FOR RENEWED OPERATING LICENSE  
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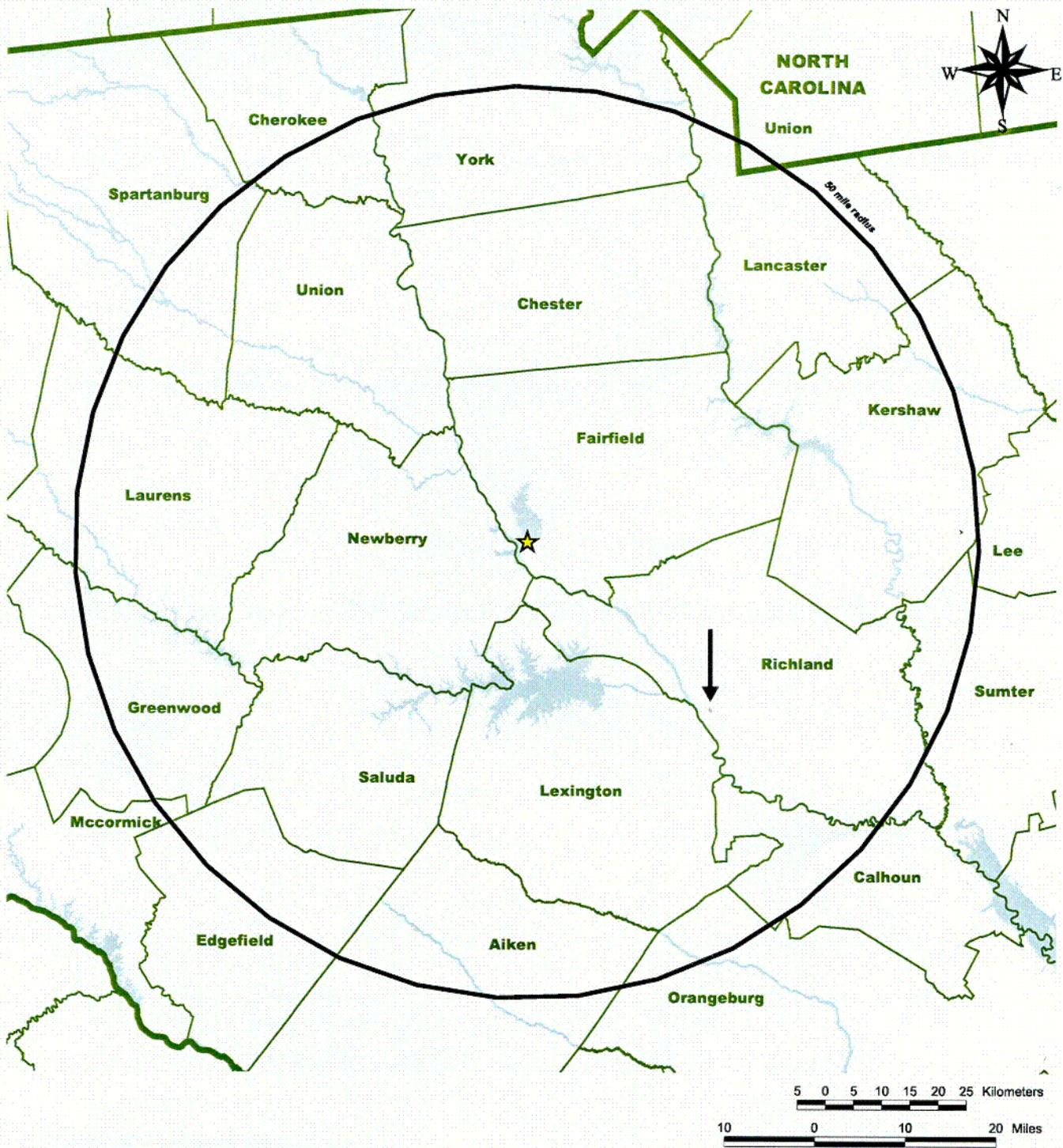


**LEGEND**  
 ★ V.C. Summer Nuclear Station  
 ■ American Indian or Alaskan Native Minority Populations

**FIGURE 2-4**  
**V.C. Summer Nuclear Station,**  
**American Indian or Alaskan Native Minority Populations**  
**LICENSE RENEWAL APPLICATION**

C03

**VIRGIL C. SUMMER NUCLEAR STATION  
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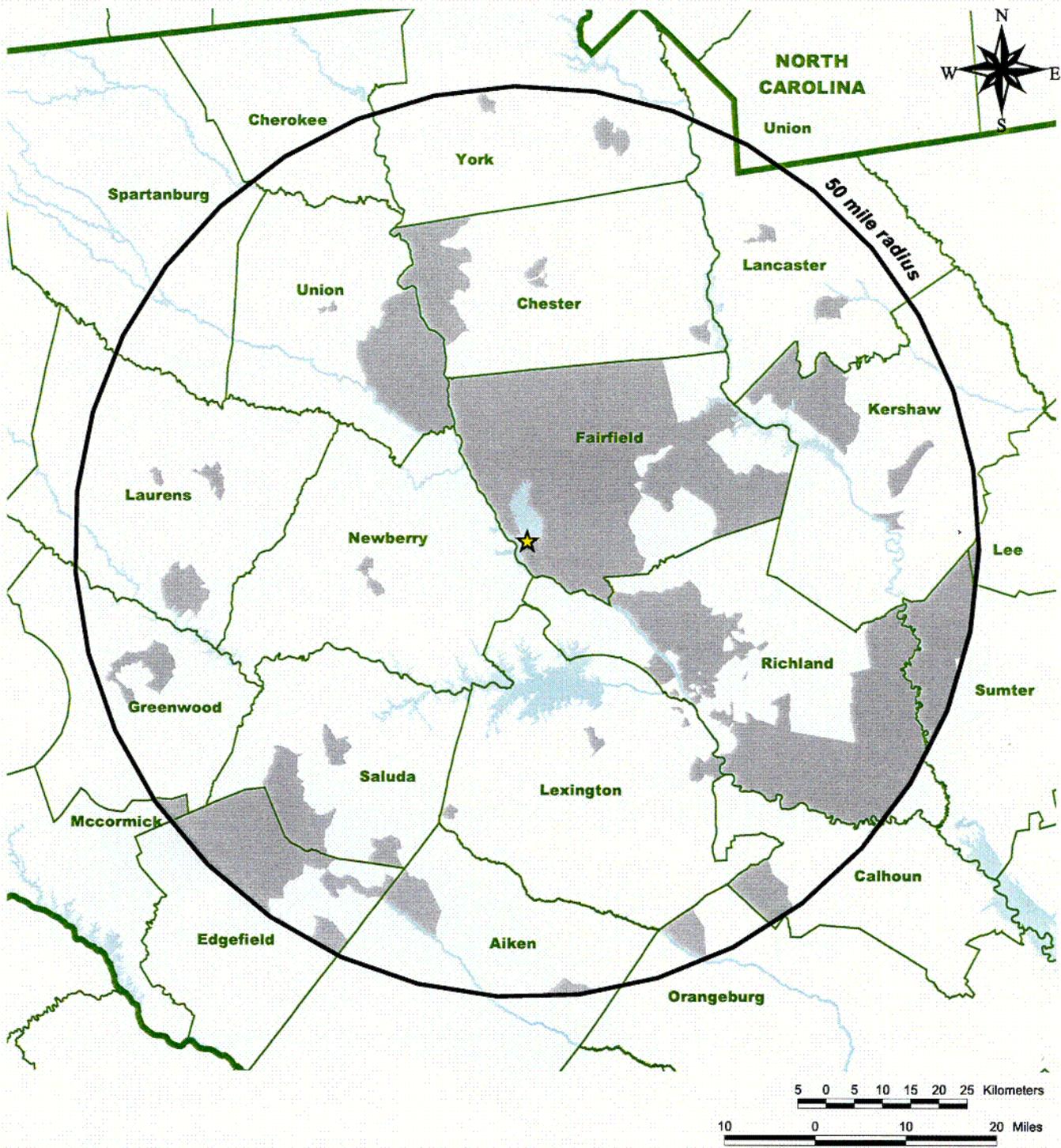
**LEGEND**

- ★ V.C. Summer Nuclear Station
- Asian Minority Populations

**FIGURE 2-5  
V.C. Summer Nuclear Station,  
Asian Minority Populations  
LICENSE RENEWAL APPLICATION**

CO4

VIRGIL C. SUMMER NUCLEAR STATION  
 APPLICATION FOR RENEWED OPERATING LICENSE  
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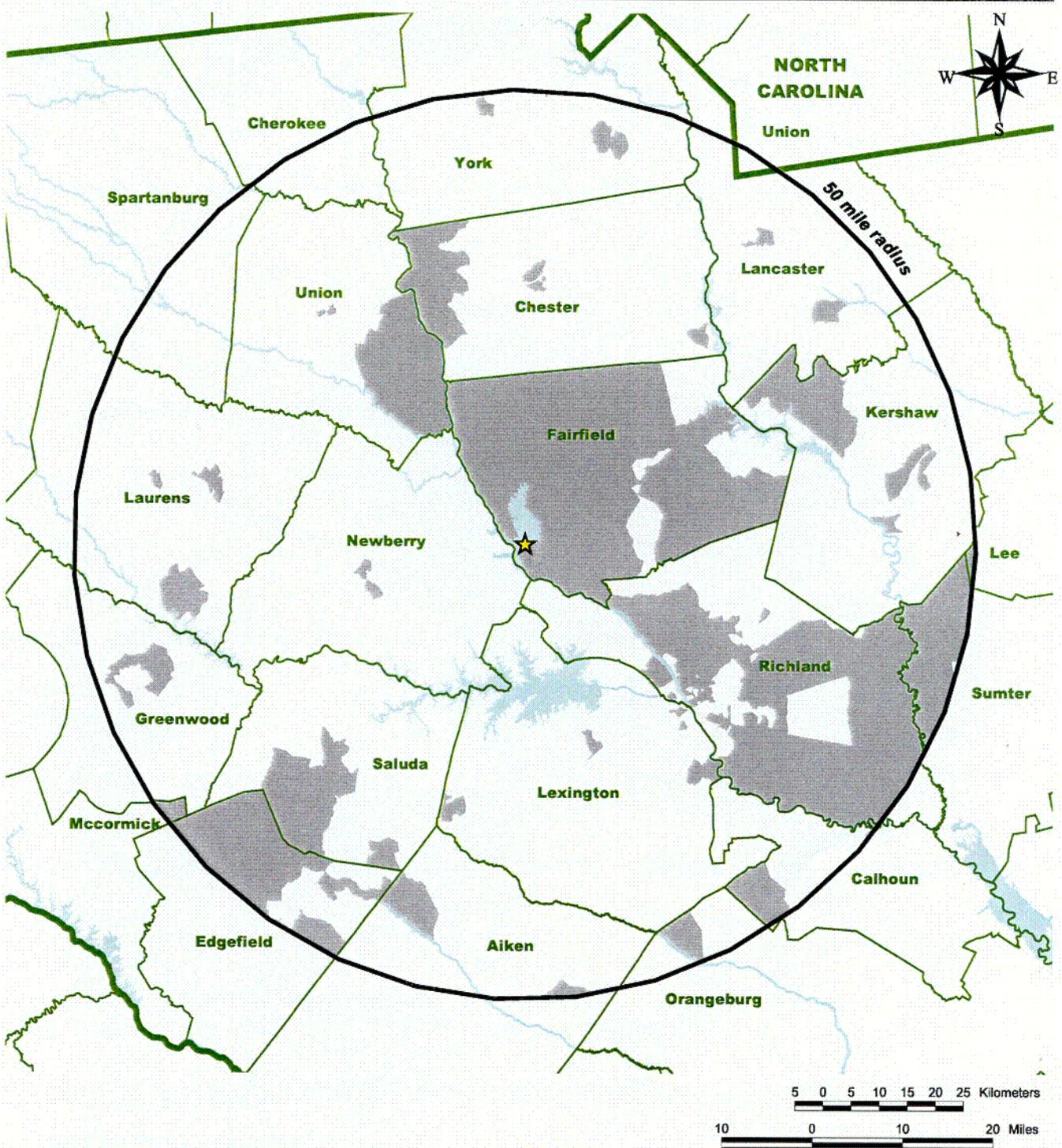
**LEGEND**

- ★ V.C. Summer Nuclear Station
- Black Races Minority Populations

**FIGURE 2-6**  
**V.C. Summer Nuclear Station,**  
**Black Races Minority Populations**  
**LICENSE RENEWAL APPLICATION**

C05

VIRGIL C. SUMMER NUCLEAR STATION  
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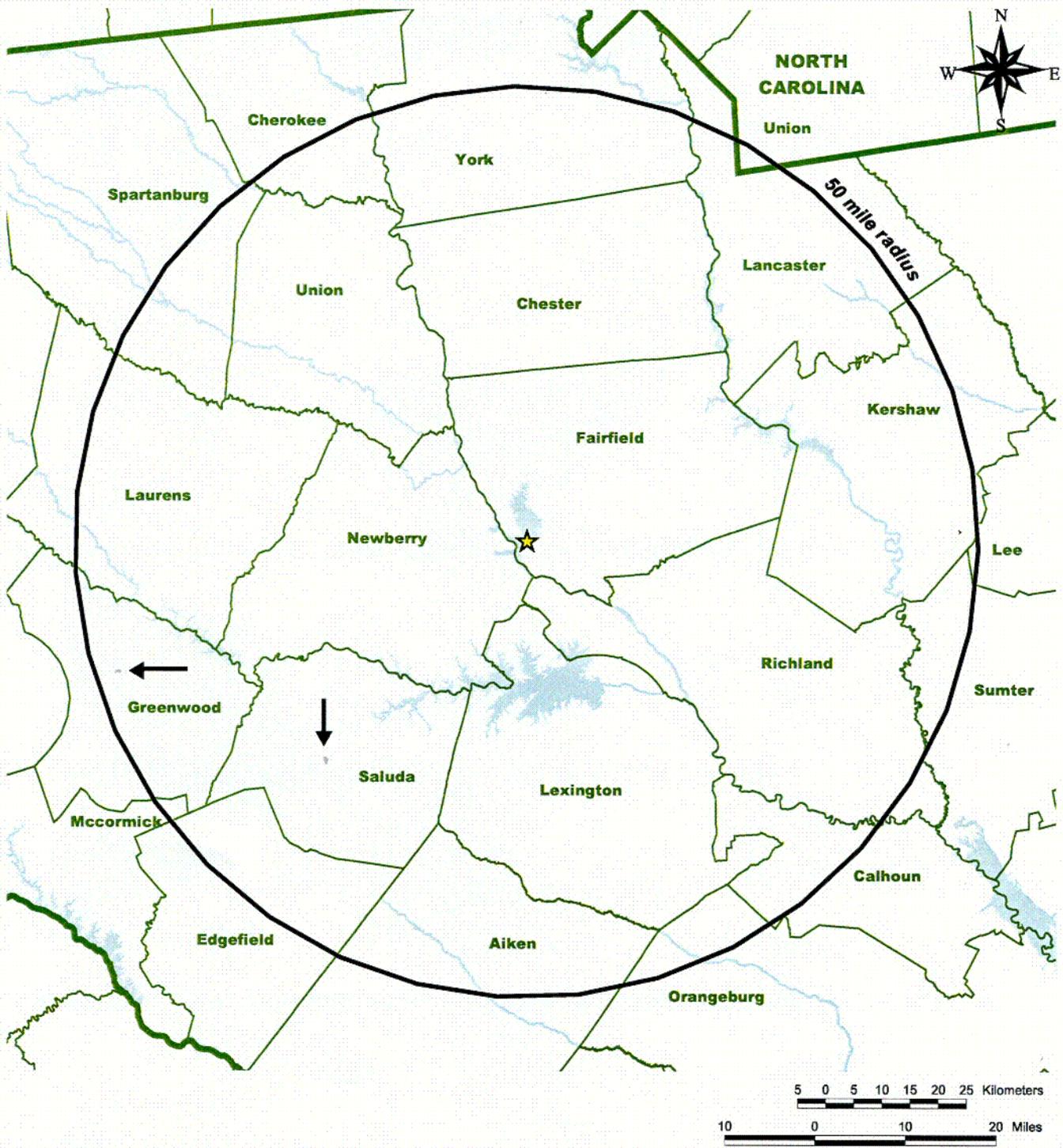


**LEGEND**  
 ★ V.C. Summer Nuclear Station  
 [Shaded Area] Aggregate of Minority Races Populations

**FIGURE 2-7**  
**V.C. Summer Nuclear Station,**  
**Aggregate of Minority Races Populations**  
**LICENSE RENEWAL APPLICATION**

COG

VIRGIL C. SUMMER NUCLEAR STATION  
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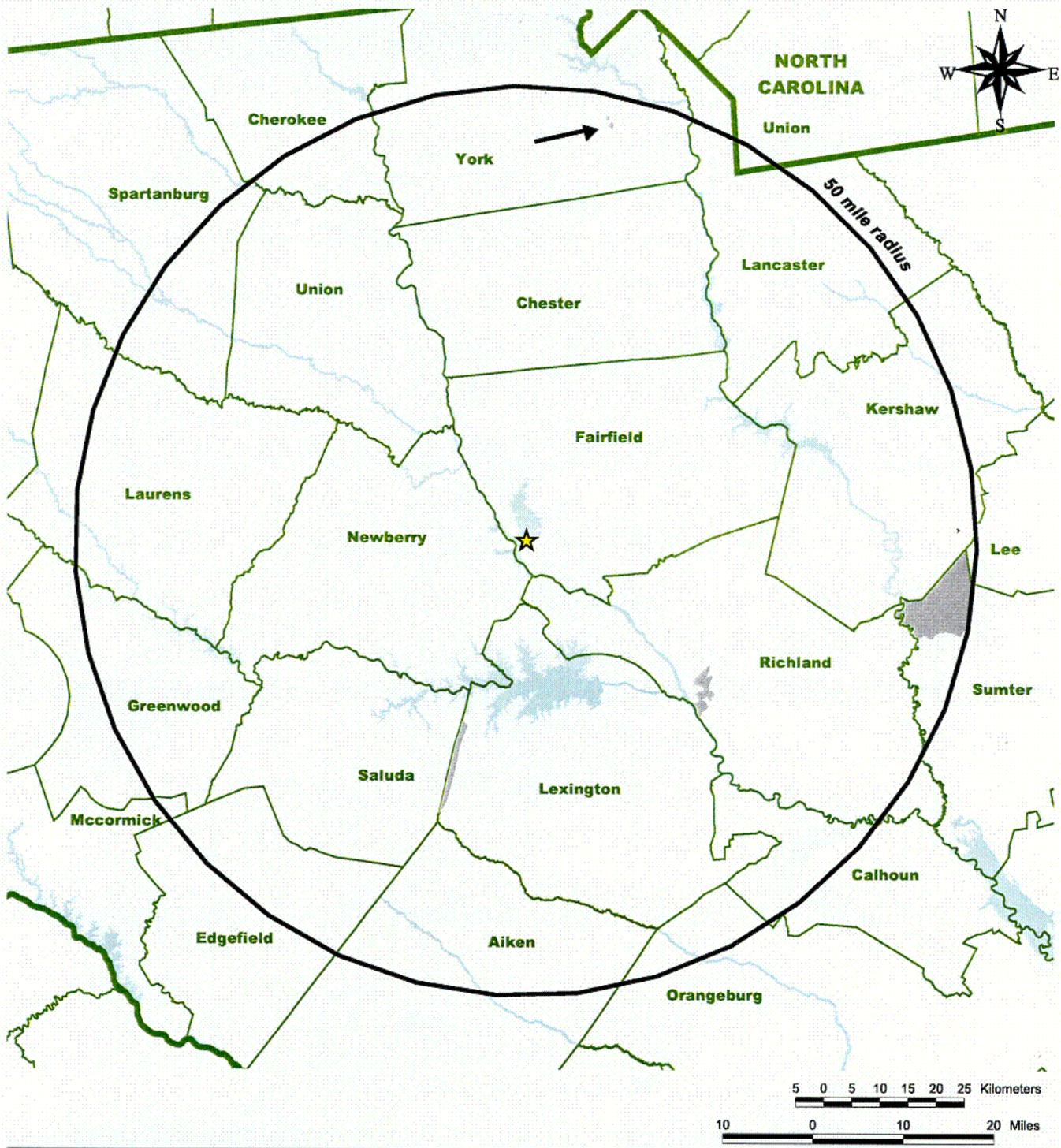
**LEGEND**

- ★ V.C. Summer Nuclear Station
- Hispanic Ethnicity Populations

**FIGURE 2-8**  
**V.C. Summer Nuclear Station,**  
**Hispanic Ethnicity Populations**  
**LICENSE RENEWAL APPLICATION**

07

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**LEGEND**

- ★ V.C. Summer Nuclear Station
- Low-Income Populations

**FIGURE 2-9**  
**V.C. Summer Nuclear Station,**  
**Low-Income Populations**  
**LICENSE RENEWAL APPLICATION**

COB

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### **3.0 PROPOSED ACTION**

**NRC**

**“The report must contain a description of the proposed action, including the applicant’s plans to modify the facility or its administrative control procedures....This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment....” 10 CFR 51.53(c)(2)**

South Carolina Electric & Gas Company (SCE&G) proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating license for V.C. Summer Nuclear Station Unit 1 (VCSNS) for an additional 20 years. Renewal would give SCE&G and the State of South Carolina the option of relying on VCSNS to meet future needs for electricity. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that license renewal could effect.

### **3.1 General Plant Information**

General information about VCSNS is available in several documents. In 1973, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared a Final Environmental Statement (FES) for construction and operation of VCSNS (USAEC 1973). In 1981, the NRC prepared an FES for operation of VCSNS (NRC 1981). The NRC *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996) describes important VCSNS features and, in accordance with NRC requirements, SCE&G maintains an updated Final Safety Analysis Report for the station. SCE&G has referred to each of these documents while preparing this environmental report for license renewal.

#### **3.1.1 Reactor and Containment Systems**

VCSNS 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, designed, and furnished by General Electric Corporation. It achieved initial criticality in October 1982 and began commercial operation in January 1983 (SCE&G 2002).

The reactor containment structure is a steel-lined, reinforced-concrete, 154-foot-diameter cylinder with a hemispheric dome and a flat reinforced concrete foundation mat (SCE&G 2002). The containment is designed to withstand an internal pressure of 57 pounds per square inch above atmospheric pressure (57 psig). Air pressure for routine operation inside the containment structure is maintained below atmospheric pressure. With its engineered safety features, the containment structure (Reactor Building) is designed to withstand severe weather (e.g., tornadoes and hurricanes) and provide radiation protection during normal operations and design-basis accidents. VCSNS fuel is slightly enriched uranium dioxide; the fuel enrichment is less than 4.95 percent by weight

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uranium 235. SCE&G operates the reactor at a typical cycle burnup rate of 22,000 megawatt-days per metric ton uranium.

As originally designed and operated, VCSNS had a core thermal rating of 2,775 megawatts-thermal (MWt) and a maximum dependable electrical capacity of approximately 900 megawatts-electrical (MWe). The Station's three Westinghouse Model D-3 steam generators were replaced with new Westinghouse Delta-75 generators in the fall of 1994 during Refueling Outage 8 (SCE&G 1995). Following the steam generator replacement and subsequent changes in plant operating conditions, the Station's core power level was uprated (in May 1996) to a nominal value of 2,900 MWt (SCE&G 1997). At the same time, the Station's maximum dependable electrical capacity was increased to 945 MWe. The NRC prepared an Environmental Assessment in 1996 (61 Federal Register 16272-167273, April 12, 1996) that examined potential environmental impacts of the uprate and concluded with a Finding of No Significant Impact (FONSI).

In August 1997, VCSNS made instrumentation changes that improved the accuracy of the measurement of thermal power. This resulted in a 9-megawatt increase in indicated electrical power output, to 954 MWe. The most recent change, which occurred in the spring of 1999 during Refueling Outage 11, involved replacement of the High Pressure Turbine Rotor with a more efficient model. This increased the maximum dependable electrical capacity of the station (which equates to net electrical output) to 966 MWe (SCE&G 2000).

SCE&G projected that increasing the core power level from 2,775 MWt to 2,900 MWt would increase the heat rejected to the environment by approximately 3 percent, to a maximum of  $6.4 \times 10^9$  Btu/hr (61 Federal Register 16272-16273, April 12, 1996). This value was below the heat rejection rate ( $6.67 \times 10^9$  Btu/hr) evaluated and found environmentally acceptable in the FES for operation of the Station (NRC 1981). However, to limit the heat load rejected to Monticello Reservoir, SCE&G installed the Turbine Building Closed-Cycle Cooling Water System in 1996 to provide cooling for certain station loads that were previously handled by the circulating water system.

The Turbine Building Closed-Cycle Cooling Water System supplies cooling water to equipment associated with the turbine, generator, and other non-nuclear systems in the Turbine Building. This system uses a forced-draft (closed-cycle) cooling tower with four fans and eight cooling coils to reject waste heat to the atmosphere. The cooling tower structure is 86.9 feet by 41.9 feet with a maximum elevation of 459.5 feet (grade elevation is 435.0 feet) (Byrne 1996). The cooling tower is located outside of the protected area fence, in a previously-unused area approximately 500 feet northwest of the Reactor Building.

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Under normal operation, one of the two closed-cycle cooling water pumps circulates treated water through the cooling tower coils, transferring heat removed from the various components to the spray water and then to the atmosphere by evaporation of the spray water in the air stream produced by the cooling tower fans. The Turbine Building Closed-Cycle Cooling Water System is independent of plant emergency cooling facilities, and is not required for reactor protection or safe shutdown (SCE&G 2002).

### **3.1.2 Cooling and Auxiliary Water Systems**

#### **3.1.2.1 Surface Water**

The circulating water system at VCSNS is designed to remove  $6.67 \times 10^9$  BTU/hr of heat from the main and auxiliary condensers as well as the turbine auxiliaries (NRC 1981, pg. 3-2). Cooling water is withdrawn from Monticello Reservoir at a rate of approximately 513,000 gallons per minute (gpm), passed through the condensers, and ultimately returned to Monticello Reservoir. The FES (NRC 1981) and other environmental assessments and evaluations prepared in the 1970s and 1980s report the circulating water flow as 534,000 gpm; studies of system efficiency in 1990 showed the actual flow to be approximately 513,000 gpm (Skolds 1990). The intake structure, located along the south shoreline of the reservoir, has three pump bays, each with two entrances. Each entrance is 13 feet wide and 25.5 feet high, extending from the bottom of the pump house (elevation 390.0 feet) to the bottom of a skimmer wall (elevation 415.5 feet). The entrances are each equipped with vertical travelling screens (mesh size  $0.4 \times 0.35$  inch) and two sets of trash racks of conventional design (NRC 1981, pg. 3-2).

Approach velocities vary, depending on reservoir level, but range from 0.44 to 0.51 feet per second under normal circumstances (reservoir elevation 420.5 to 425.0 feet above mean sea level) (Dames & Moore 1985). Velocities through the screens are somewhat higher, ranging from 1.0 foot per second (425 foot elevation/ 100 percent clean) to 2.27 feet per second (420.5 foot elevation/50 percent clean).

After leaving the condensers, circulating water moves via a 12-foot-diameter pipe from the plant to a semi-enclosed discharge basin. From the basin, the heated effluent moves through a 1,000-foot-long discharge canal to Monticello Reservoir. The discharge canal directs the discharge flow (heated effluent) to the northeast. A 2,600-foot-long jetty prevents recirculation of the heated water. Figure 2-3 shows the intake structure, discharge basin, discharge canal, and associated features of the VCSNS circulating water system.

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The NRC defines "cooling pond" as a manmade 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, Section 4.4.1). 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, Section 4.4.1). 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.

### **3.1.2.2 Groundwater**

There are no groundwater wells for process or potable use on the VCSNS site; all of the water used by the Station is withdrawn from Monticello Reservoir. Makeup water for Monticello Reservoir is obtained from Parr Reservoir on the Broad River (SCE&G 2002).

There are two groundwater removal (dewatering) wells on the site, however, that are used to lower the water table in the area and alleviate problems with water seepage into below-grade portions of buildings. These wells, with pumps designated XPP5003 A and B, are in the Protected Area, one outside near the Control Building and the other inside the Auxiliary Service Building. Both wells discharge to the site stormwater system. Based on stormwater outfall flows (Outfalls 012 and 013 in the Station's NPDES permit), it is estimated that these wells remove water at a rate of less than 26 gpm.

### **3.1.3 Transmission Facilities**

SCE&G built eight transmission lines for the specific purpose of connecting Summer Station to the transmission system (NRC 1981, Section 3.2.7). Two additional transmission lines were built by the South Carolina Public Service Authority (known as Santee Cooper), one-third owner of the station, to connect the Station to the regional grid. A pre-existing Duke Power Company line crosses the VCSNS site, but does not connect to the VCSNS switchyard or the SCE&G transmission system.

Beginning at VCSNS, the SCE&G transmission lines generally run in a southerly direction, with five terminations very near Summer Station, one near Aiken, South Carolina, and two near Columbia, South Carolina (see Figure 3-1). The Santee Cooper lines run approximately east and west to substations near Blythewood and Newberry, South Carolina, respectively. The list that follows identifies the transmission lines by the

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name of the substation (or other structure) at which each line connects to the overall electric grid. The accompanying paragraphs provide other features of the transmission lines, including voltage, right-of-way width and length, and presence of other lines in the right-of-way.

- Summer-Parr No. 1 and No. 2 – These two SCE&G lines, which occupy the same 240-foot right-of-way to the Parr Substation, operate at 230 kilovolts (kV). The lines' lengths are each 2.3 miles. For approximately 0.5 mile, these lines share the corridor with the Graniteville line and Santee Cooper's Newberry line (Figure 3-2).
- Summer-Fairfield No. 1 and No. 2 – These two 230-kV lines provide power to and from SCE&G's Fairfield Pumped Storage Facility. The lines are only 1 mile long and occupy a 170-foot, wholly-owned corridor.
- Summer-Denny Terrace No. 1 – This 2.5 mile, 230-kV tie line connects Summer Station to the Denny Terrace No. 1 line near Parr, South Carolina, well north of the Denny Terrace substation. The line was built by SCE&G and occupies a 100-foot right-of-way.
- Summer-Pineland No. 1 – This SCE&G line provides power at 230-kV to the Pineland Substation six miles northeast of Columbia. The right-of-way width is 240 feet for the approximately 18 miles that the line shares the corridor with the Denny Terrace No. 2 line and then 100 feet for the remaining 5.5 miles. Santee Cooper's Blythewood line parallels this line for approximately 17 miles. The VCSNS Final Environmental Statement (NRC 1981) describes a Summer-Pineland No. 2 line, but it was never built.
- Summer-Denny Terrace No. 2 – This 230-kV SCE&G line to the Denny Terrace substation two miles north of Columbia follows the Pineland corridor for approximately 18 miles and then continues for approximately 7 miles in a 100-foot right-of-way. Santee Cooper's Blythewood line parallels this line for 17 miles.
- Summer-Graniteville – This SCE&G line provides 230 kV of power to the Graniteville Substation. The line is 62.5 miles long. For the first 0.5 mile, it runs with the Newberry and Summer-Parr No. 1 and No. 2 line. Then for 2.5 miles it parallels the Newberry line. For the remaining 59.5 miles, it is the sole occupant of the corridor. The right-of-way width is 170 feet as far as the Broad River and then 100 feet to Graniteville.
- Summer-Blythewood – The Blythewood line is owned by Santee Cooper. It is a 230-kV line that runs for approximately 20 miles, sharing the corridor with the Summer-Pineland and the Denny Terrace No. 2 lines for the first 17 miles. For the remaining 3 miles, the right-of-way is 100 feet.

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- Summer-Newberry – This Santee Cooper line, which is approximately 18 miles long, operates at 230 kV and provides power to the Newberry Substation. For the first 0.5 mile, it shares the corridor with the Summer-Parr No. 1 and No. 2 and the Graniteville lines. For the next 2.5 miles it shares the corridor with the Summer-Graniteville line. For the remaining 15 miles, it occupies the 100-foot right-of-way alone.

In total, for the specific purpose of connecting VCSNS to the transmission system, SCE&G and Santee Cooper have constructed approximately 160 miles of transmission lines (120 miles of corridor) that occupy approximately 2,000 acres of corridor. The corridors pass through land that is primarily rolling hills covered in forests or farmland. The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways, including I-26 and I-20. Corridors that pass through farmlands generally continue to be used in this fashion. 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 after the Summer Station is decommissioned.

In mid-2002, SCE&G plans a modification to the transmission facilities that serve the Summer Station. The Summer-Denny Terrace No. 1 line will be disconnected near the Parr Substation and connected to an existing Parr-Edenwood line. This action will terminate the connection from Summer Station to Denny Terrace No. 1. The change will create a new Summer-Edenwood line. Simultaneously, the existing Parr-Edenwood line connection to the Parr Substation will be disconnected.

SCE&G and Santee Cooper designed and constructed all VCSNS transmission lines in accordance with the National Electrical Safety Code® and industry guidance that was current when the line was built. Ongoing right-of-way surveillance and maintenance of VCSNS transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13.

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**3.2 Refurbishment Activities**

**NRC**

**“The report must contain a description of...the applicant’s plans to modify the facility or its administrative control procedures....This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment....” 10 CFR 51.53(c)(2)**

**“...The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item....” (NRC 1996, Section 2.6.3.1, pg. 2-41) (SMITTR defined in NRC 1996, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping)**

SCE&G has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (NRC 1996, Section 2.6.2). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list structures, systems and components (SSCs) subject to an aging management review. SSCs that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

In turn, the NRC regulations for implementing the National Environmental Policy Act require environmental reports to describe in detail and assess the environmental impacts of refurbishment activities such as planned modifications to SSCs or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The GEIS (NRC 1996) provides information about the scope of refurbishment activities to be evaluated in an environmental report. As explained below, the GEIS describes major refurbishment activities that utilities might perform for license renewal that would necessitate changing administrative control procedures and modifying the facility. The GEIS analysis assumes that an applicant would begin any major refurbishment work shortly after NRC grants a renewed license and would complete the activities during five outages, including one major outage at the end of the 40th year of operation. The GEIS refers to this as the refurbishment period.

GEIS Table B.2 lists license renewal refurbishment activities that NRC anticipated utilities might undertake. In identifying these activities, the GEIS intended to encompass actions that typically take place only once, if at all, in the life of a nuclear plant. The GEIS analysis assumed that a utility would undertake these activities solely for the purpose of extending plant operations beyond 40 years, and would undertake them during the refurbishment period. The GEIS indicates

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that many plants will have undertaken various refurbishment activities to support the current license period, but that some plants might undertake such tasks only to support extended plant operations.

SCE&G has performed some major modifications at VCSNS in the past (e.g., replacement of steam generators in 1994). However, the VCSNS IPA that SCE&G conducted under 10 CFR 54, which SCE&G has included as part of its license renewal application, has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important SSCs during the license renewal period. Therefore, no refurbishment would be conducted that would directly affect the environment or plant effluents.

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**3.3 Programs and Activities for Managing the Effects of Aging**

**NRC**

**“The report must contain a description of...the applicant’s plans to modify the facility or its administrative control procedures....This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment....” 10 CFR 51.53(c)(2)**

**“...The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item....” (NRC 1996, Section 2.6.3.1, pg. 2-41) (SMITTR is defined in NRC 1996, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping)**

**SMITTR Activities**

The VCSNS IPA, required by 10 CFR 54.21a, identifies the programs and inspections for managing aging effects at VCSNS. These programs are fully described in the *Application for Renewed Operating License, V.C. Summer Nuclear Station*, to which this Environmental Report is appended.

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### **3.4 Employment**

#### **Current Workforce**

SCE&G employs a permanent workforce of approximately 600 employees at VCSNS 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 GEIS (NRC 1996, Section 2.3.8.1). Approximately 90 percent of the employees live in Lexington, Richland, Fairfield, and Newberry Counties, with the balance of employees living in various other locations (see Section 2.6). Figure 2-1 shows the locations of these counties.

VCSNS 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, VCSNS brought in 613 (RF-10), 591 (RF-11), and 791 (RF-12) contractors, an average of 665 additional workers per outage. This falls within the GEIS range of 200 to 900 additional workers per reactor outage.

#### **License Renewal Increment**

Performing the license renewal activities described in Section 3.3 would necessitate increasing the VCSNS staff workload by some increment. The size of this increment would be a function of the schedule within which SCE&G must accomplish the work and the amount of work involved.

The GEIS (NRC 1996, Section 2.6.2.7) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate SMITTR activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (NRC 1996, Section B.3.1.3), but mostly during normal refueling and the 5- and 10-year in-service refueling outages (NRC 1996, Table B.4).

It has been determined that the GEIS scheduling assumptions are reasonably representative of VCSNS incremental license renewal workload scheduling. Many VCSNS license renewal SMITTR activities would have to be performed during outages. Although some VCSNS license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the plant.

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers

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needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts....".

It is anticipated that existing "surge" capabilities for routine activities, such as outages, will enable SCE&G to perform the increased SMITTR workload without adding VCSNS staff. Therefore, no more than 60 additional permanent workers would be required to perform all license renewal SMITTR activities.

Adding 60 full-time employees to the plant workforce for the license renewal operating term would have the indirect effect of creating additional jobs and related population growth in the community. An employment multiplier appropriate to the State of South Carolina (3.95) (Martin 2000) was used to calculate the total direct and indirect jobs in service industries that would be supported by the spending of the VCSNS workforce. The addition of 60 license renewal employees would generate approximately 177 indirect jobs distributed in the potentially impacted communities of Richland, Lexington, Fairfield, and Newberry Counties. This number was calculated as follows:  $60 \text{ (additional employees)} \times 3.95 \text{ (regional multiplier)} = 237 \text{ (total jobs)}$ . Of these, 60 would be direct jobs (VCSNS employees) and 177 would be indirect jobs (service industries).

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**3.5 References**

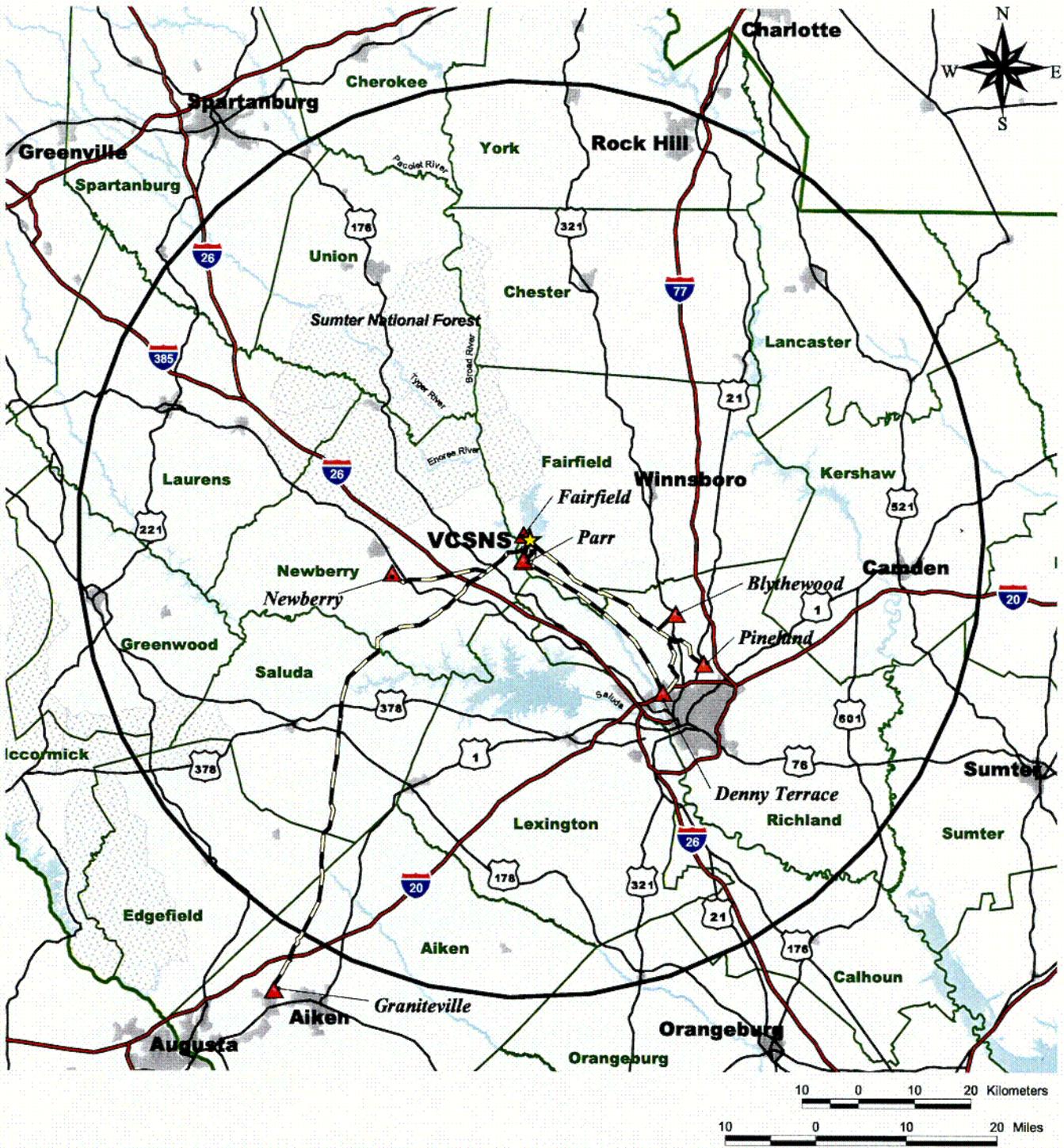
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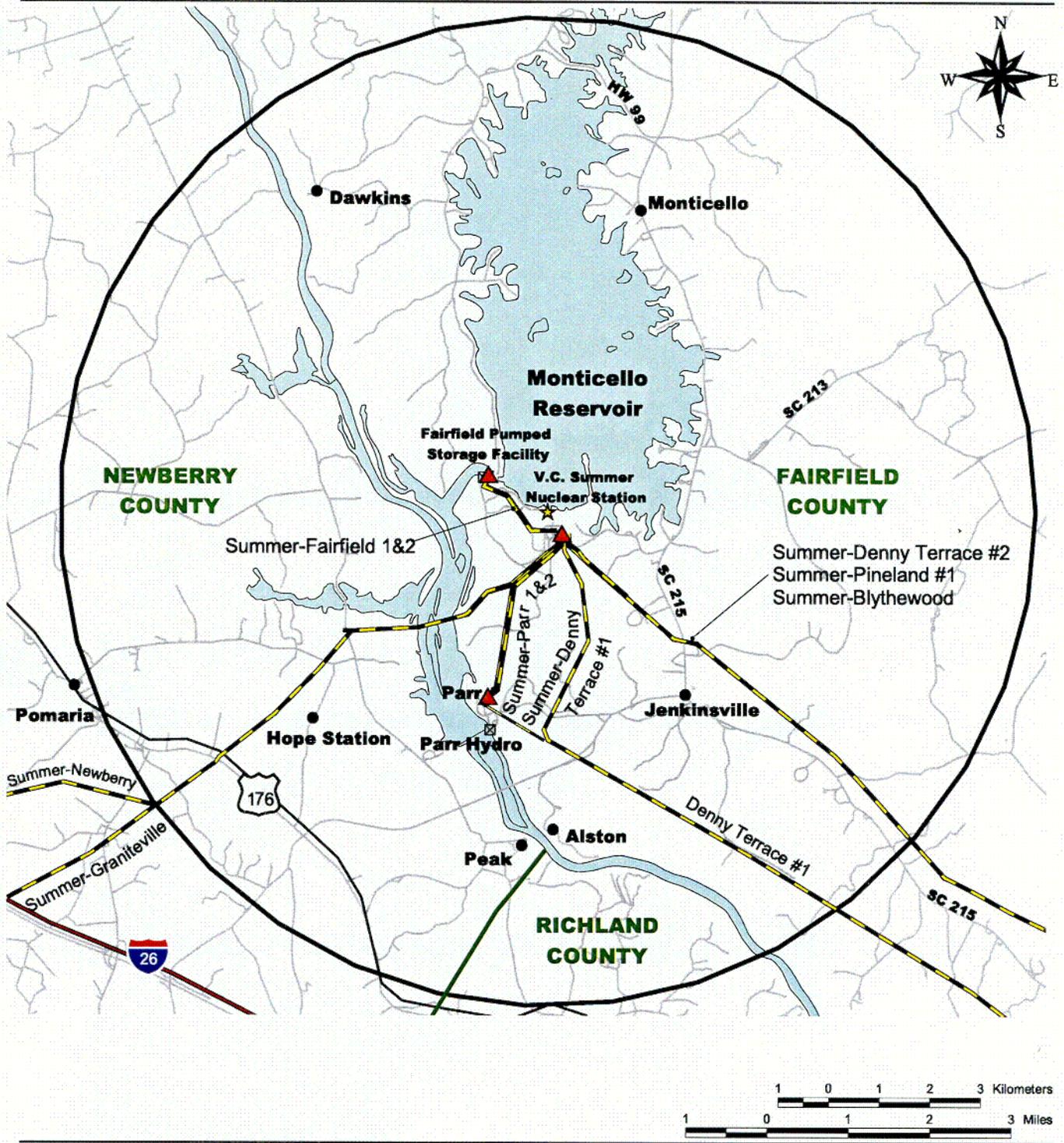


- LEGEND**
- ★ V.C. Summer Nuclear Station
  - ▲ Substations
  - ▬ Transmission Lines
  - 50 mile radius of V.C. Summer
  - ▬ Interstates
  - ▬ Major roads
  - ▬ County Boundaries
  - ▬ State Boundary
  - ▬ Lakes and Rivers
  - ▬ National Forests
  - ▬ Major Urban Areas

**FIGURE 3-1**  
**V.C. Summer Nuclear Station,**  
**50-Mile Transmission Line Map**  
**LICENSE RENEWAL APPLICATION**

C09

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**LEGEND**

- Substations
- Transmission Lines
- Six mile radius of V.C. Summer
- Interstates
- Major roads
- Minor roads
- County Boundaries
- Lakes and Rivers

**FIGURE 3-2**  
**V.C. Summer Nuclear Station,**  
**6-Mile Transmission Line Map**  
 LICENSE RENEWAL APPLICATION

C10

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**4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND  
MITIGATING ACTIONS**

**NRC**

**“The report must contain a consideration of alternatives for reducing adverse impacts...for all Category 2 license renewal issues....” 10 CFR 51.53(c)(3)(iii)**

**“The environmental report shall include an analysis that considers...the environmental effects of the proposed action...and alternatives available for reducing or avoiding adverse environmental effects....” 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2)**

**The environmental report shall discuss “the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance;” 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2)**

**“The information submitted...should not be confined to information supporting the proposed action but should also include adverse information.” 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)**

Chapter 4 presents an assessment of the environmental consequences and potential mitigating actions associated with the renewal of V.C. Summer Nuclear Station’s (VCSNS) operating license. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- 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;
- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- 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 to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, then NRC designated the issue as Category 2. The NRC requires plant-specific analysis for Category 2 issues. The NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues. NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51, Appendix B, Table B-1) as described in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996a). An applicant may reference the generic findings or GEIS analyses for Category 1

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issues. Appendix A of this report lists the 92 issues and identifies the Environmental Report section that addresses each issue.

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**Category 1 License Renewal Issues**

**NRC**

**“The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part.” 10 CFR 51.53(c)(3)(i)**

**“...Absent new and significant information, the analysis for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant’s environmental report for license renewal...”  
(NRC 1996b, pg. 28483)**

Of the 69 Category 1 issues identified in Appendix B of 10 CFR 51, 17 do not apply to VCSNS. Ten of the issues do not apply because they refer to design or operational features not found at VCSNS. In addition, because no refurbishment activities are planned, the NRC findings for the 7 Category 1 issues that apply only to refurbishment clearly overestimate VCSNS refurbishment impacts and do not apply. Table 4-1 lists these 17 issues and explains the basis for determining that these issues are not applicable to VCSNS.

Table 4-2 lists the 52 Category 1 issues that are applicable to VCSNS and also lists the 2 issues for which NRC came to no generic conclusion (Issues 60 and 92). The table includes the findings that NRC codified and references to supporting GEIS analysis. SCE&G has reviewed the NRC findings and has identified no new and significant information or become aware of any such information that would make the NRC findings inapplicable to VCSNS (see Chapter 5.0). Therefore, SCE&G adopts by reference the NRC findings for these Category 1 issues.

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**Category 2 License Renewal Issues**

**NRC**

**“The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part...” 10 CFR 51.53(c)(3)(ii)**

**“The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues....” 10 CFR 51.53(c)(3)(iii)**

The NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address each of the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues (3) apply to operational features that VCSNS does not have. In addition, some Category 2 issues (4) apply only to refurbishment activities. If the issue does not apply to VCSNS, then the section explains the basis for inapplicability.

For the 14 Category 2 issues that SCE&G has determined to be applicable to VCSNS, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for VCSNS and, when applicable, discuss potential mitigative alternatives to the extent required. SCE&G has identified the significance of the impacts associated with each issue as either Small, Moderate, or Large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 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. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission’s regulations are considered small.

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

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

In accordance with National Environmental Policy Act (NEPA) practice, SCE&G considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

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**“NA” License Renewal Issues**

The NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, SCE&G included these issues in Table 4-2. The NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). Environmental justice demographic information is presented in Section 2.11.

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**4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)**

**NRC**

**“If the applicant’s plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than  $3.15 \times 10^{12}$  ft<sup>3</sup>/year ( $9 \times 10^{10}$  m<sup>3</sup>/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided....” 10 CFR 51.53(3)(ii)(A)**

**“...The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13**

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are already a concern at two closed-cycle plants (Limerick and Palo Verde) and may be a problem in the future at other plants. In the GEIS, NRC notes two factors that may cause water use and availability issues to become important for some nuclear power plants that use cooling towers. First, some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Second, consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (NRC 1996a, Section 4.3.2.1.).

As discussed in Section 3.1.2, VCSNS 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 makeup water from the Broad River, which has an annual mean flow of approximately  $2.1 \times 10^{11}$  cubic feet per year (6,535 cubic feet per second [cfs]) (Cooney et al. 2001, pg. 226). Monticello Reservoir was built to supply cooling water to VCSNS 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 26 miles upstream of the confluence of the Broad and Saluda Rivers.

The Federal Power Commission (FERC’s predecessor agency) licensed the Parr Hydroelectric Project in 1974, contingent upon a minimum instantaneous release at the Parr Powerhouse of 150 cfs during most months of the year and a minimum instantaneous release of 1,000 cfs during the March-April-May striped bass spawning period (NRC 1981, pg. 2-11). 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 235 cfs (Cooney et al. 2001, pg. 226). The lowest recorded daily mean flow of 149 cfs was measured at the Richtex Station, approximately 7 miles downstream of Parr Reservoir (NRC 1981, pg. 2-10).

The 1981 Final Environmental Statement (FES) indicated that approximately 13 cfs of the 1,180 cfs of water withdrawn from Monticello Reservoir for condenser cooling would be lost to evaporation. This water loss was to be made up by pumping back from Parr Reservoir, as

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described in Section 2.2. The projected evaporative loss of 13 cfs from condenser cooling represented approximately 9 percent of the minimum allowable instantaneous flow of 150 cfs, 5.5 percent of the lowest daily mean flow (235 cfs), and approximately 0.2 percent of the annual mean flow (6,535 cfs) of the Broad River at Alston, SC.

Based on a higher (theoretical maximum) cooling water withdrawal rate of 1,308 cfs, the VCSNS Quarterly Water Use Reports indicate that 22 cfs is lost to evaporation (SCE&G 1998a, 1999a). This loss represents 14.7 percent of the minimum allowable instantaneous flow of 150 cfs, 9.4 percent of the lowest daily mean flow (235 cfs), and approximately 0.3 percent of the annual mean flow (6,535 cfs) of the Broad River at Alston, South Carolina.

Under normal circumstances, evaporative losses from Monticello Reservoir represent a small (less than one percent) reduction in Broad River flows. Any impacts to riparian ecological communities in Parr Reservoir would be small, particularly when compared to impacts from fluctuating water levels caused by operation of FPSF. As discussed in Section 2.2, Parr Reservoir levels can fluctuate as much as 10 feet daily with FPSF operations.

As noted earlier in this section, the relicensing of the Parr Hydroelectric Project was contingent upon minimum releases at the Parr Powerhouse. These FERC-mandated minimum instream flows would mitigate impacts (to the extent that they exist) to instream and riparian communities downstream of the Parr Shoals dam in the Broad River.

Changes in Broad River flows caused by VCSNS operations (i.e., evaporative losses) are small. Any impacts from VCSNS on instream and riparian communities in Parr Reservoir or the Broad River over the license renewal term would be small and would not warrant mitigation.

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**4.2 Entrainment of Fish and Shellfish in Early Life Stages**

**NRC**

**“If the applicant’s plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations...or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from...entrainment.” 10 CFR 51.53(c)(3)(ii)(B)**

**“...The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25**

The NRC made impacts on fish and shellfish resources resulting from entrainment a Category 2 issue, because it could not assign a single significance level (small, moderate, or large) to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996a, Section 4.2.2.1.2). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) current Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, VCSNS has a once-through heat dissipation system, but withdraws from and discharges to a cooling pond, Monticello Reservoir.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment through the condenser cooling system of fish and shellfish in early life stages is a potential adverse environmental impact that can be minimized by the best available technology.

The current National Pollutant Discharge Elimination System (NPDES) permit for VCSNS (No. SC0030856, issued 9-29-97) contains the following language, in the “Rationale” section:

“On April 19, 1985, determination was made, in accordance with Section 316(b) of the Act, that the location, design, construction, and capacity of the VCSNS cooling water intake structure(s) reflects the best technology available for minimizing adverse environmental impact.” This determination was based on information submitted by SCE&G in a 316(b) Demonstration dated March 1985 (Dames & Moore 1985a).

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Thus, the current NPDES permit, which was issued on September 29, 1997 and expires September 30, 2002, constitutes the VCSNS CWA Section 316(b) determination. Portions of the permit are included as Appendix B.

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**4.3 Impingement of Fish and Shellfish**

**NRC**

**“If the applicant’s plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations...or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from...impingement...”10 CFR 51.53(c)(3)(ii)(B)**

**“...The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 26**

The NRC made impacts on fish and shellfish resources resulting from impingement a Category 2 issue, because it could not assign a single significance level to the issue. Impingement impacts are small at many plants, but might be moderate or large at other plants (NRC 1996a, Section 4.2.2.1.3). Information that needs to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) current CWA 316(b) determination or equivalent state documentation.

As discussed in Section 4.2, SCE&G submitted a comprehensive CWA Section 316(b) Demonstration in 1985 that evaluated impingement at VCSNS and concluded that the intake structure represented the best technology available to minimize impacts. The current NPDES permit (Appendix B) constitutes the VCSNS CWA Section 316(b) determination.

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**4.4 Heat Shock**

**NRC**

**“If the applicant’s plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act...316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock....”  
10 CFR 51.53(c)(3)(ii)(B)**

**“...Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27**

The NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996a, Section 4.2.2.1.4). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, VCSNS has a once-through heat dissipation system, but withdraws from and discharges to a cooling pond, Monticello Reservoir. As discussed below, SCE&G also has a Section 316(a) variance for VCSNS discharges.

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary and, using a variance, obtain alternative facility-specific thermal discharge limits (33 USC 1326).

NPDES permit No. SC0030856 for VCSNS contains a detailed 316(a) chronology, a portion of which follows:

“On April 30, 1976, a determination was made that the permittee had submitted adequate information to demonstrate that the alternative limitations for the thermal component of the discharge would assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the Monticello Reservoir. The alternate maximum discharge temperature for Outfall 001 is 45°C (113°F). A maximum thermal plume temperature of 32.2°C (90°F) and temperature rise of 1.66°C (3.0°F) is also imposed.

On July 1, 1984 a continuation of the 316(a) variance was allowed by the reissuance of the NPDES permit. On January 3, 1989, a request to continue the variance was included as part of the application for reissuance of the NPDES Permit. To support the request, the permittee has indicated there has been no change in facility operation and no change in the biological community. A tentative determination was made that continuation of the 316(a) variance was appropriate in the reissuance of this permit.

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On April 3, 1997, the permittee submitted an application for reissuance of the permit. A request to continue the 316(a) variance was included as part of the application. On June 19, 1997, the Department determined that continuance was appropriate.”

In August 2001, South Carolina Department of Health and Environmental Control (SCDHEC) approved a modification of NPDES Permit No. SC0030856 that eliminated the 1.66°C (3.0°F) limit on plume temperature rise and the requirement to continuously monitor the plume temperature rise. The permit modification noted there had been no violations of the 1.66°C (3.0°F) limit between 1993 and 2001 and “...no useful data (was) being generated by the continuous monitoring at Monticello Reservoir...”

The current NPDES permit, which was issued on September 29, 1997 and expires September 30, 2002, constitutes a CWA Section 316(a) variance in accordance with applicable state and federal regulations.

As discussed in Section 2.2, there were a number of limited fish kills in the VCSNS discharge bay in the late 1980s and early 1990s that were associated with relatively high discharge temperatures in late summer and Monticello Reservoir drawdowns. SCE&G dredged the entire length of the discharge canal in 1993 to allow more cool water inflow at low reservoir levels. The dredging of the discharge canal altered circulation patterns and increased cool water inflow so that temperature at the bottom of the discharge bay in summer remained significantly (10 to 15 degrees) cooler than "end-of-pipe" discharge temperatures. No fish kills have been observed in the discharge bay or discharge canal since the canal was dredged.

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**4.5 Groundwater Use Conflicts (Plants Using > 100 gpm of Groundwater)**

**NRC**

**“If the applicant’s plant...pumps more than 100 gallons (total onsite) of ground water per minute, an assessment of the impact of the proposed action on groundwater use must be provided.” 10 CFR 51.53(c)(3)(ii)(C)**

**“Plants that use more than 100 gpm may cause ground water use conflicts with nearby ground water users.”  
10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 33**

Based on information presented in Section 3.1.2.2, V.C. Summer Nuclear Station’s groundwater use is substantially less than 100 gallons per minute (gpm). Therefore, the issue of groundwater use conflicts (plants using more than 100 gpm groundwater) does not apply.

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**4.6 Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds That Withdraw Makeup Water From a Small River)**

**NRC**

**“If the applicant’s plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than  $3.15 \times 10^{12}$  ft<sup>3</sup> / year[,...]the applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.” 10 CFR 51.53(3)(ii)(A)**

**“...Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34**

The issue of groundwater use conflicts applies to VCSNS 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  $2.1 \times 10^{11}$  cubic feet per year.

As discussed in Section 2.2, daily mean flow in the Broad River in the vicinity of VCSNS (at Alston, SC, 1.2 miles downstream of the Parr Shoals dam) ranged from 235 to 130,000 cfs over the period of record, with an annual average of 6,535 cfs. According to the Final Environmental Statements for construction (USAEC 1973) and operation (NRC 1981) of Summer Station, the lowest recorded daily mean flow at a gauging station in the vicinity of VCSNS was 149 cfs at Richtex, SC, 7 miles downstream of the Parr Shoals dam. This U.S. Geological Survey (USGS) 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 VCSNS water use reports for 1998 and 1999 indicate that evaporative losses as high as 22 cfs are associated with VCSNS operations (SCE&G 1998a, 1999a). This loss represents approximately 1.7 percent of the cooling water removed from the reservoir (1,308 cfs) and approximately 0.3 percent of the average annual natural stream flow of 6,535 cfs. The potential evaporative loss represents 14.8 percent of the lowest recorded daily mean stream flow of 149 cfs reported in the FES (NRC 1981).

Water potentially 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 impoundment’s level is regulated to maintain a minimum downstream release of 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 floodplain was inundated. The surrounding area is characterized by a surficial water table aquifer in saprolitic soils and shallow fractures in rocks

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(SCE&G 2002). 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 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 VCSNS operation on the alluvial aquifer over the license renewal term would likewise be small, and would not warrant mitigation.

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**4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)**

**NRC**

**“If the applicant’s plant uses Ranney wells...an assessment of the impact of the proposed action on groundwater use must be provided.” 10 CFR 51.53(c)(3)(ii)(C)**

**“...Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal...” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35**

The issue of groundwater use conflicts does not apply to VCSNS because the plant does not use Ranney wells. As Section 3.1.2 describes, VCSNS uses a once-through cooling system, but withdraws from and discharges to a cooling pond, Monticello Reservoir.

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**4.8 Degradation of Groundwater Quality**

**NRC**

**“If the applicant’s plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.” 10 CFR 51.53(c)(3)(ii)(D)**

**“...Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 39**

The issue of groundwater degradation applies to VCSNS because the station uses a cooling pond. As Section 3.1.2 describes, VCSNS 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 VCSNS 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. Makeup 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, pg. 4-3).

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 & Moore 1985b). 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 & Moore 1985b, Table 2.2.2; SCE&G 2002). There is no indication that evaporative losses associated with operation of VCSNS 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 VCSNS. Impacts of continued operation would be small and would not warrant mitigation.

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**4.9 Impacts of Refurbishment on Terrestrial Resources**

**NRC**

**The environmental report must contain an assessment of "...the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats...." 10 CFR 51.53(c)(3)(ii)(E)**

**"...Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 40**

**"...If no important resource would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant...." (NRC 1996a, Section 3.6, pg. 3-6)**

The NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996a, Section 3.6).

The issue of impacts of refurbishment on terrestrial resources is not applicable to VCSNS because, as discussed in Section 3.2, SCE&G has no plans for major refurbishment or replacement actions at VCSNS.

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**4.10 Threatened or Endangered Species**

**NRC**

**“Additionally, the applicant shall assess the impact of the proposed action on threatened and endangered species in accordance with the Endangered Species Act.” 10 CFR 51.53(c)(3)(ii)(E)**

**“...Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 49**

The NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996a, Sections 3.9 and 4.1).

Section 2.5 discusses threatened and endangered species that may occur at VCSNS or along associated transmission line corridors. As discussed in Section 3.2, SCE&G has not identified any major refurbishment or replacement actions that would be required for license renewal at VCSNS. Therefore, there would be no refurbishment-related impacts to threatened and endangered species, and no further analysis of refurbishment-related impacts is applicable.

Operation of VCSNS has not adversely affected any listed species and may have benefited at least one, the bald eagle, which forages on Monticello Reservoir and its subimpoundment and nests on neighboring Parr Reservoir. Evidence suggests that the number of eagles using the Parr Reservoir-Monticello Reservoir system is increasing. The FES for construction of VCSNS indicated that Fairfield County lay in the “ancestral range” of two endangered species, the Southern bald eagle and the peregrine falcon, but that neither had been recently observed in the region (USAEC 1973, pg. II-26). The Operating License Environmental Report contains an account of the first confirmed sighting of a bald eagle in the area, a mature bird that was seen in early August 1973 (SCE&G 1974, pg. 5.6-30). This eagle was believed to be migrating through the area, presumably towards nesting areas in coastal South Carolina. Bald eagles were first documented nesting in the Parr-Monticello system in the early 1980s (Dames & Moore 1985b, pg. Viii).

By the 1990s, bald eagles were routinely observed foraging around Monticello Reservoir, the FPSF tailrace canal, Parr Reservoir, and on the Broad River downstream of the Parr Shoals dam. South Carolina Department of Natural Resources (SCDNR) records indicate that there may be as many as four active bald eagle nests within five miles of VCSNS (Holling 2001; SCDNR 2001). Based on the fact that bald eagles were rarely observed prior to construction and operation of VCSNS and are now common in the area, it appears that construction and operation of VCSNS have had no adverse effect on this species and may have had a beneficial effect, by expanding

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foraging and nesting areas for the birds. Impacts over the license renewal term would be essentially the same, as Monticello Reservoir would continue to provide foraging habitat and potential nesting habitat for bald eagles.

Based on the VCSNS location and habitat types, other threatened or endangered species identified in Section 2.5 could be located on the VCSNS site or along associated transmission line corridors. SCE&G is not aware of any such occurrences but cannot rule them out. SCE&G is currently conducting surveys of the Summer Station site and transmission corridors to determine if listed plants or animals are present. Survey results will be available in late August 2002, after submittal of the License Renewal Application.

SCE&G has no plans for major refurbishment or replacement actions, and license renewal will not result in operational changes that would alter current natural resource management practices. The station and its transmission lines have been in existence for approximately 20 years, long enough for operational impacts to have stabilized. Current vegetation management practices in transmission corridors could actually be working to benefit threatened and endangered species that depend on open, prairie-like conditions. Species that could benefit from regular mowing and removal of shrubby vegetation in transmission corridors include the gopher tortoise, smooth coneflower, and Georgia aster (see Section 2.5).

SCE&G wrote the SCDNR and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur on the VCSNS site or along associated transmission line rights-of-way, with particular emphasis on species that might be adversely affected by continued operations over the license renewal term. Agency response are provided in Appendix C.

Due to the fact that operation of VCSNS to date has not adversely affected any listed species and SCE&G has no plans to alter current natural resource management practices, it seems likely that impacts to threatened or endangered species from license renewal would be small and could be beneficial to at least one species, the bald eagle. No mitigation measures appear to be warranted.

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**4.11 Air Quality During Refurbishment**

**NRC**

**“If the applicant’s plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended.” 10 CFR 51.53(c)(3)(ii)(F)**

**“...Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage....”  
10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50**

The NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (NRC 1996a, Section 3.3).

Air quality during refurbishment is not applicable to VCSNS because, as discussed in Section 3.2, SCE&G has no plans for major refurbishment or replacement actions at VCSNS.

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#### 4.12 Microbiological Organisms

**NRC**

**“If the applicant’s plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow of less than  $3.15 \times 10^{12}$  ft<sup>3</sup>/year ( $9 \times 10^{10}$  m<sup>3</sup>/year), an assessment of the proposed action on public health from thermophilic organisms in the affected water must be provided.” 10 CFR 51.53(c)(3)(ii)(G)**

**“...These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 57**

The NRC designated impacts on public health from thermophilic organisms a Category 2 issue because NRC did not have sufficient data available for facilities using cooling ponds, lakes, or canals that discharge to small rivers. Information to be determined is: (1) whether the plant discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are conducive to thermophilic organism survival in public waters.

This issue is applicable to VCSNS because the station uses a cooling pond (Monticello Reservoir) that discharges to the Broad River, which has an average annual flow of  $2.1 \times 10^{11}$  cubic feet per year and is categorized as a small river in the GEIS (NRC 1996a, Section 5.3.3.4.2, Table 18). Also, there is public access to Monticello Reservoir, including recreational fishing, boating, and waterfowl hunting. Some subsistence fishing may also occur along the eastern shore, where all the lakeshore residences are located.

Organisms of concern include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes (“fungi”), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria amoeba*.

Pathogenic bacteria have evolved to survive in the digestive tracts of mammals and, accordingly, have optimum temperatures of around 99°F (Joklik and Smith 1972, pg. 65). Many of these pathogenic microorganisms (e.g., *Pseudomonas*, *Salmonella*, and *Shigella*) are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds (and thus in natural waters), but are usually only a problem when the host is immunologically compromised. Thermophilic bacteria generally occur at temperatures of 77°F to 176°F, with maximum growth at 122°F to 140°F (Joklik and Smith 1972, pg. 65).

From a public health standpoint, the assessment of thermophilic organisms is more relevant to Monticello Reservoir in the vicinity of the discharge canal than to the discharge canal proper. This is because there is no public access to the discharge canal. The discharge basin and canal are within the nuclear exclusion zone, land access to which is controlled (see Section 2.1). The discharge canal area is patrolled by VCSNS security as well as SCDNR conservation officers.

SCE&G monitors water temperature and other parameters at an “uplake” location (near the northern end of the reservoir), a location near the Station water intake, and a location just outside

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of the northern end of the discharge canal as part of the Station's water quality monitoring program. Measurements are taken at these three locations monthly. The maximum temperature observed in monitoring years 1995 through 2000 was 103.7°F, which occurred in late July 1999 (SCE&G 2000a). Maximum temperatures for other monitoring years were 98.8°F (August 1995), 95.2°F (July 1996), 97.2°F (August 1997), 98.6°F (July 1998), and 101.2°F (July 2000), respectively (SCE&G 1996a, 1997a, 1998b, 1999b, 2001a). All of these maximum temperatures were observed in July and August at the surface (approximately 1-foot depth). Temperatures at 1 meter or deeper in the vicinity of the discharge canal were generally 3.0 to 9.0°F lower during the summer months and never exceeded 100°F.

Maximum temperatures in Monticello Reservoir outside of the discharge canal are below the optimal temperature range for growth and reproduction of thermophilic microorganisms. They could support limited survival of these organisms in summer months, although temperatures are generally below the range most conducive to the growth of thermophilic microorganisms.

Another factor controlling the survival and growth of thermophilic organisms in Monticello Reservoir is the disinfection of VCSNS sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the Station's discharge canal or Monticello Reservoir. Following primary treatment in an aeration lagoon and secondary treatment through sand filters, wastewater is moved to a contact chamber for chlorination. It is then dechlorinated prior to mixing with other plant waste streams and eventual discharge to the discharge canal.

Fecal coliform bacteria are regarded as indicators of other pathogenic microorganisms, and are the organisms normally monitored by state health agencies. The NPDES permit for the Station requires monitoring of fecal coliforms in sewage treatment plant effluent (after discharge from the chlorine contact chamber and prior to mixing with other waste streams). Samples are collected for fecal coliform analysis and other parameters twice per month. The NPDES permit specifies a maximum 30-day average of 200 organisms per 100 milliliter sample (200/100 ml), and a daily maximum of 400/100 ml. From 1995 through 2000, neither of these limits was exceeded during any sampling event (SCE&G 1996b, 1997b, 1998c, 1999c, 2000b, 2001b).

It should also be noted that waterborne-disease outbreaks are generally rare and depend upon specific exposure conditions. The Centers for Disease Control and Prevention (CDC) reports on waterborne-disease outbreaks throughout the United States. From 1977 to 1998, a total of 18 states reported 32 outbreaks associated with recreational water, which includes both thermophilic and non-thermophilic microorganisms as confirmed etiological agents (CDC 2000). Most of the outbreaks associated with thermophilic microorganisms involved swimming and wading pools, hot tubs, and springs. Fecal contamination was frequently a contributing factor. In 1998, only four cases of disease attributable to *Naegleria* were confirmed in the entire United States (CDC 2000). *Naegleria* infection usually only occurs in warm weather environments, when water near the bottom of a lake is forced up the nasal passage of a swimmer, and when pollution appears to

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be a factor (EPA 1979). However, studies have shown the absence of *Naegleria* infection and related diseases among swimmers in lakes with relatively high numbers of the pathogenic organisms present (EPA 1979).

Given the thermal characteristics of Monticello Reservoir in the vicinity of the discharge outfall and disinfection of sewage treatment plant effluent, SCE&G does not expect plant operations to stimulate growth or reproduction of thermophilic microorganisms. Under certain circumstances, these organisms might be present in limited numbers in the discharge bay and canal, where water temperatures can be as high as 107°F (SCE&G 1996a), but would not be expected in sufficient concentrations to pose a threat to recreational users of Monticello Reservoir or downstream water users in Parr Reservoir or the Broad River.

SCE&G wrote SCDHEC requesting information on any studies the agency might have conducted of thermophilic microorganisms in Monticello Reservoir and any concerns the agency might have relative to these organisms. SCDHEC's response indicated that public health hazards from thermophilic microorganisms are largely theoretical and do not represent a significant health threat to offsite users of Monticello Reservoir's waters. Based on this evaluation it appears that the impact of microbiological organisms on public health over the license renewal period would be small and would not warrant mitigation. Copies of the SCE&G letter and agency response are included in Appendix D of this Environmental Report.

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**4.13 Electric Shock From Transmission-Line-Induced Currents**

**NRC**

**The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines “[i]f the applicant’s transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code® for preventing electric shock from induced currents....” 10 CFR 51.53(c)(3)(ii)(H)**

**“...Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 59**

The NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant’s transmission line conformance with the National Electrical Safety Code® (NESC®) (Institute of Electrical and Electronics Engineers 1997) criteria, NRC could not determine the significance of the electrical shock potential.

In the case of VCSNS, there have been no previous NRC or NEPA analyses of transmission-line-induced-current hazards. Therefore, this section provides an analysis of the Station’s transmission lines’ conformance with the NESC® standard. The analysis is based on computer modeling of induced current under the lines.

Objects located near transmission lines can become electrically charged due to the effect of what is commonly called “static electricity,” but is more precisely termed “an electrostatic field.” This charge results in a current that flows through the object to the ground. The current is called “induced” because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is particularly well insulated from the ground, such as a car on rubber tires, can actually store an electrical charge, becoming what is called “capacitively charged.” A person standing on the ground and touching the car receives an electrical shock due to the sudden discharge of the capacitive charge through the person’s body to the ground. The intensity of the shock depends on several factors, including the following:

- the strength of the electrostatic field which, in turn, depends on the voltage of the transmission line
- the height of the line above the ground
- the size of the object on the ground
- the extent to which the object is grounded.

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In 1977, the NESC<sup>®</sup> adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98 kilovolt (kV) alternating current to ground.<sup>1</sup> The clearance must limit the induced current<sup>2</sup> due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. The NESC<sup>®</sup> chose this limit as being protective of the health of a person who wears a heart pacemaker. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 6 milliamperes; the shock that one feels on a dry day after walking on a carpet or sliding across a car seat and touching an object is the result of approximately 3 milliamperes of current.

As described in Section 3.1.3, there are 10 230-kV lines that were specifically constructed to distribute power from VCSNS to the electric grid. The analysis of the Santee Cooper transmission lines began by identifying the limiting case for each line. The limiting case is the configuration along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, the electric field strength and induced current for each transmission line were calculated. For SCE&G-owned lines, the analysis was based on the design template used for the lines. If the template design satisfies the NESC criteria, then all the lines built in accordance with the template would satisfy the criteria.

SCE&G calculated electric field strength and induced current for both Santee Cooper-owned 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 design features of the template or limiting-case scenario, the NESC<sup>®</sup> requirement that line sag be determined at 120°F conductor temperature, and the maximum vehicle size under the lines as a tractor-trailer 55 feet long, 8.2 feet wide, and an average of 11.8 feet high.

The analysis determined that none of the transmission lines has the capacity to induce as much as 5 milliamperes in a vehicle parked beneath the lines. Therefore, the VCSNS transmission line designs conform to the NESC<sup>®</sup> provisions for preventing electric shock from induced current. The results for each transmission line are provided in Table 4-3.

SCE&G surveillance and maintenance procedures provide assurance that design ground clearances will not change. These procedures include routine helicopter inspection two times a year and ground inspection once every eight years. These routine aerial patrols of all corridors include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. The ground inspections include examination for clearance at questionable locations and surveillance for dead or diseased

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1. Part 2, Rules 232C1c and 232D3c.

2. The NESC<sup>®</sup> and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.

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trees which might fall on the transmission line. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

SCE&G's assessment under 10 CFR 51 concludes that electric shock is of small significance for the VCSNS transmission lines. Due to the small significance of the issue, mitigation measures such as installing warning signs at road crossings or increasing clearances are not warranted. This conclusion would remain valid into the future, provided there are no changes in voltage, current, and maintenance practices and no changes in land use under the lines, conditions over which SCE&G has control.

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#### **4.14 Housing Impacts**

**NRC**

**The environmental report must contain “[a]n assessment of the impact of the proposed action on housing availability...” 10 CFR 51.53(c)(3)(ii)(I)**

**“...Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 63**

**“...[S]mall 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 occurs....” (NRC 1996a, Section 4.7.1.1, pp. 4-101 to 4-102)**

The NRC made housing impacts a Category 2 issue, because impact magnitude depends on local conditions that the NRC could not predict for all plants at the time of GEIS publication (NRC 1996a, Section 3.7.2). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, and (2) applicability of growth control measures.

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. As described in Section 3.2, SCE&G does not plan to perform refurbishment. SCE&G concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. Accordingly, the following discussion focuses on impacts of continued operations on local housing availability.

As described in Section 2.6, VCSNS is located in a medium population area. As noted in Section 2.9, the area of interest is not subject to growth control measures that limit housing development. In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in “medium” population areas where growth control measures are not in effect. Therefore, SCE&G expects housing impacts to be small.

This conclusion is supported by the following site-specific housing analysis. 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, approximately 90 percent of the VCSNS employees reside in Richland, Lexington, Fairfield, and Newberry Counties. Therefore, the focus of the housing impact analysis is on these areas. As also discussed in Section 3.4, SCE&G’s conservative estimate of 60 license renewal employees could generate the 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, approximately 213 housing units would be required in Richland, Lexington, Fairfield, and

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Newberry Counties. In an area with a population of nearly 600,000, it is reasonable to conclude that this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion. Therefore, impacts to housing availability resulting from plant-related population growth would be small and would not warrant mitigation.

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**4.15 Public Utilities: Public Water Supply Availability**

**NRC**

**The environmental report must contain "...an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(I)**

**"...An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65**

**"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as the quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services...." (NRC 1996a, Section 3.7.4.5, pg. 3-19)**

The NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996a, Section 4.7.3.5). Local information needed would be: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

The NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. Section 3.4 describes potential population increases, and Section 2.6 describes the distribution of that population in the area associated with license renewal activities at VCSNS. Section 2.10.1 describes the public water supply systems potentially affected by license renewal activities. VCSNS does not use water from a municipal system; therefore, SCE&G does not expect VCSNS to have an effect on local water supplies. As discussed in Section 3.2, no refurbishment is planned for VCSNS and, therefore, no refurbishment impacts are expected.

The impact to the local water supply systems from plant-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses between 50 and 80 gallons per day for personal use (Fetter 1980, pg. 2). As described in Section 3.4, SCE&G's conservative estimate of 60 license renewal employees could generate a total of 237 new jobs, which could result in a population increase of 640 in the area [237 jobs multiplied by 2.7, which is the average number of persons per household in the area (Central Midlands Council of Governments 1999)]. Using this consumption rate, the plant-related population increase could require an additional 51,200 gallons per day (640 people multiplied by 80 gallons per day) in an area where the public water supply capacity is more than 150 million gallons per day. If it is assumed that this increase is distributed across the four potentially affected counties, consistent with current employee trends, the increase in water demand would not create shortages in capacity of the water supply systems in these communities, based on recently completed assessments. (See Section 2.10.1 for a discussion of these systems.)

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Therefore, impacts from plant-related population growth on public water supplies would be small, requiring no additional capacity and not warranting mitigation.

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**4.16 Education Impacts from Refurbishment**

**NRC**

**The environmental report must contain “an assessment of the impact of the proposed action on...public schools (impacts from refurbishment activities only) within the vicinity of the plant....” 10 CFR 51.53(c)(3)(ii)(I)**

**“...Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 66**

**“...[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems’ abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts generally are associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service....Large impacts are associated with project-related enrollment increases greater than 8 percent....” (NRC 1996a, Section 3.7.4.1, pg. 3-15)**

The NRC made impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996a, Section 3.7.4.2).

This issue is not applicable to VCSNS because, as Section 3.2 discusses, SCE&G has no plans for major refurbishment or replacement actions at VCSNS.

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**4.17 Offsite Land Use**

**4.17.1 Offsite Land Use - Refurbishment**

**NRC**

**The environmental report must contain “an assessment of the impact of the proposed action on...land-use...(impacts from refurbishment activities only) within the vicinity of the plant...” 10 CFR 51.53(c)(3)(ii)(I)**

**“...Impacts may be of moderate significance at plants in low population areas...” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68**

**“...[I]f plant-related population growth is less than 5 percent of the study area’s total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km<sup>2</sup>), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)....” (NRC 1996a, Section 3.7.5, pg. 3-21)**

The NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land-use changes could be considered beneficial by some community members and adverse by others.

This issue is not applicable to VCSNS because, as Section 3.2 discusses, SCE&G has no plans for major refurbishment or replacement actions at VCSNS.

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**4.17.2 Offsite Land Use - License Renewal Term**

**NRC**

**The environmental report must contain “[a]n assessment of the impact of the proposed action on...land-use...within the vicinity of the plant....” 10 CFR 51.53(c)(3)(ii)(I)**

**“...Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal....” 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69**

**“...[I]f plant-related population growth is less than 5 percent of the study area’s total population, off-site land-use changes would be small....” (NRC 1996a, Section 3.7.5, pg. 3-21)**

**“...[I]f the plant’s tax payments are projected to be small relative to the community’s total revenue, new tax-driven land-use changes during the plant’s license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development....” (NRC 1996a, Section 4.7.4.1, pg. 4-108)**

The NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996a, Section 4.7.4.1). Site-specific factors to consider in an assessment of new tax-driven land-use impacts include: (1) the size of plant-related population growth compared to the area’s total population, (2) the size of the plant’s tax payments relative to the community’s total revenue, (3) the nature of the community’s existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996a, Section 4.7.4.1). Based on the GEIS case-study analysis, NRC concludes that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. This follows logically from the fact that population growth caused by license renewal would represent a much smaller percentage of the local area’s total population than has operations-related growth (NRC 1996a, Section 4.7.4.2).

**Tax-Revenue-Related Impacts**

The NRC has determined that the significance of tax payments as a source of local government revenue would be large, if the payments are greater than 20 percent of revenue (NRC 1996a, Section 4.7.2.1).

The NRC defined the magnitude of land-use changes as follows (NRC 1996a, Section 4.7.4):

- Small - very little new development and minimal changes to an area’s land-use pattern

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- Moderate - considerable new development and some changes to land-use pattern
- Large - large-scale new development and major changes in land-use pattern.

NRC further determined that, if a plant's tax payments are projected to be a dominant source of a community's total revenue (i.e., greater than 20 percent of revenue), then new tax-driven land-use changes would be large.

Table 2-3 provides a comparison of total tax payments made by SCE&G to Fairfield County and the County's operating budget. For the 6-year period from 1995 through 2000, VCSNS's tax payments to Fairfield County represented approximately 47 percent of the County's total annual property tax revenue and 47 percent of Fairfield County's annual operating budget. Using NRC's criteria, VCSNS's tax payments are of large significance to Fairfield County.

As described in Section 3.2, SCE&G does not anticipate major refurbishment or construction during the license renewal period. Therefore, SCE&G does not anticipate any increase in the assessed value of VCSNS due to refurbishment-related improvements nor any related tax-increase-driven changes to offsite land use and development patterns.

VCSNS has been, and would probably continue to be, the dominant source of tax revenue for Fairfield County. However, despite having this income source since the early 1980s, Fairfield County has not experienced large land-use changes. The VCSNS environs have remained largely rural, county population growth rates after VCSNS construction have been minimal, and county planners are not projecting large changes (Stowers 2000). Continued operation of VCSNS over the license renewal term would be important to maintaining the current level of development and public services, but should not bring plant-induced changes to local land-use and development patterns.

**Conclusion**

SCE&G views the continued operation of VCSNS as a significant benefit to Fairfield County through direct and indirect salaries and tax contributions to the County's economy. Because population growth related to the license renewal of VCSNS is expected to be relatively small and there would be no new tax impacts to Fairfield County land use, the renewal of VCSNS's license would have a continued beneficial impact on Fairfield County.

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**4.18 Transportation**

**NRC**

**The environmental report must contain an assessment of "...the impact of the proposed project on local transportation during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)**

**"...Transportation impacts...are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70**

**"...LOS [Level of Service] A and B are associated with small impacts because the operation of individual users is not substantially affected by the presence of other users....LOS C and D are associated with moderate impacts because the operation of individual users begins to be severely restricted by other users...." (NRC 1996a, Section 3.7.4.2, pg. 3-17)**

The NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which NRC could not forecast for all facilities (NRC 1996a, Section 3.7.4.2). Local road conditions to be ascertained are: (1) level of service conditions, and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no major refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated.

As described in Section 3.4 (Employment), SCE&G's VCSNS workforce includes approximately 600 permanent and 130 to 140 contract employees. On an 18-month cycle, 600 to 800 additional workers join the permanent workforce during refueling outages. SCE&G's conservative projection of 60 additional employees associated with license renewal for VCSNS represents a 10 percent increase in the current number of permanent employees and an even smaller percentage of employees present onsite during a typical refueling outage. Given these employment projections and the average number of vehicles per day currently using the surrounding roads to VCSNS (Table 2-6), it appears that impacts to transportation would be small and mitigative measures would be unwarranted.

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**4.19 Historic and Archeological Resources**

**NRC**

**The environmental report must contain an assessment of "...whether any historic or archeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)**

**"...Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71**

**"...Sites are considered to have small impacts to historic and archeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal-term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur...." (NRC 1996a, Section 3.7.7, pg. 3-23)**

The NRC made impacts to historic and archeological resources a Category 2 issue because determinations of impacts to historic and archeological resources are site-specific in nature, and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO) (NRC 1996a, Section 4.7.7.3). Correspondence between SCE&G and the State Historic Preservation Office is provided as Appendix E.

SCE&G has no plans for major refurbishment or replacement actions that would require land disturbance, and no refurbishment-related impacts are therefore anticipated. As described in Section 2.13, two archeological sites were excavated prior to construction and approximately four to five sites were flooded when Monticello Reservoir was filled. However, these were appropriately surveyed and reconciled in an approved manner by the University of South Carolina Institute of Archeology and Anthropology (Stephenson 1978). Archeological and historic sites of significance have been identified within a 6-mile radius of the site, and none appears to lie within (or near) a transmission corridor. Therefore, continued use of transmission lines and rights-of-way over the license renewal term is unlikely to affect these resources. Any impacts from continued operation of VCSNS on historic or archeological resources would be small and would not warrant mitigation.

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**4.20 Severe Accident Mitigation Alternatives**

**NRC**

**The environmental report must contain a consideration of alternatives to mitigate severe accidents "...If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment..." 10 CFR 51.53(c)(3)(ii)(L)**

**The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, 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. 10 CFR Part 51, Subpart A, Appendix B, Table B-1 (Issue 76)**

Section 4.20 describes how SCE&G analyzed a large number of alternatives to mitigate severe accidents and briefly summarizes the results of the analysis. Appendix F provides a more detailed description of the analysis and the results.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operational envelope) that results in the release or a potential for release of radioactive material to the environment. Generally, NRC categorizes accidents as "design-basis" or "severe." Design basis accidents are those for which the risk is great enough that an applicant is required to design and construct a plant to prevent unacceptable accident consequences. Severe accidents are those considered too unlikely to warrant design controls.

Historically, the NRC has not included in its Environmental Impact Statements (EISs) or environmental assessments any analysis of alternative ways to mitigate the environmental impact of severe accidents. A 1989 court decision ruled that, in the absence of an NRC finding that severe accidents are remote and speculative, severe accident mitigation alternatives (SAMAs) should be considered in the NEPA analysis [*Limerick Ecology Action v. NRC*, 869 F.2d 719 (3rd Cir. 1989)]. For most plants, including VCSNS, license renewal is the first licensing action that would necessitate consideration of SAMAs.

The NRC concluded in its generic license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because ongoing regulatory programs related to mitigation (i.e., Individual Plant Examination [IPE] and Accident Management) have not been completed for all plants. Since these programs have identified plant programmatic and procedural improvements (and in a few cases, minor modifications) as cost-effective in reducing severe accident and risk consequences, NRC thought it premature to draw a generic conclusion as to whether severe accident mitigation would be required for license renewal. Site-specific information to be presented in the environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes to key underlying assumptions.

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**Analysis**

SCE&G maintains a probabilistic risk assessment (PRA) model to use in evaluating the most significant risks of radiological release from VCSNS fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, SCE&G used PRA model output as input to an NRC-approved model that calculated economic costs and dose to the public from hypothesized releases from the containment structure into the environment. The results of the VCSNS-specific analyses for severe accidents (Appendix F) show that the total core damage frequency is estimated at  $5.59 \times 10^{-5}$  per year (internal events) and the dose risk is estimated at 0.954 person-rem per year.

Then, using NRC regulatory analysis techniques, SCE&G calculated the monetary value of the VCSNS severe accident risk based on the current plant operating characteristics. The result represents the monetary value of the base risk of dose to the public and workers, offsite and onsite economic costs, and replacement power. This value was used as a cost-benefit screening tool for potential SAMAs. This bounding analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvements) in excess of \$1,203,000 are not cost justified based on averted public health risk.

SCE&G used industry, NRC, and VCSNS-specific information to create a list of 268 SAMAs for consideration. SCE&G analyzed this list and screened out SAMAs that would not apply to the VCSNS design, that SCE&G had already implemented at VCSNS, or that would achieve results that SCE&G had already achieved at VCSNS by other means. SCE&G prepared preliminary cost estimates for the remaining SAMAs and used the maximum averted cost-risk value to screen out SAMAs that would not be cost beneficial. Thirty two candidate SAMAs remained for further consideration, twelve of which required full model quantification for disposition.

SCE&G evaluated the remaining SAMAs using PSA model insights or full model quantifications, which simulated SAMA implementation. The model runs simulating SAMA implementation yielded reduced cost-risk levels due to the impact of the modifications. The difference between the base case cost-risk value and the SAMA-reduced cost-risk value is defined as the averted risk, or a measure of the value of implementing the SAMA. SCE&G prepared more detailed estimates of the cost of implementing each SAMA and repeated the cost/benefit comparison. The results of this analysis are presented in Table 4-4. None of the candidate SAMAs emerged from the analysis for further consideration

The benefits of revising the operational strategies in place at VCSNS and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. The SAMA analysis has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected impact on a much larger future population. The results of the SAMA analysis indicate that none of the potential plant

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improvements identified are cost beneficial based on the methodology defined in this document. No SAMAs are suggested for implementation on a cost-benefit basis.

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**TABLE 4-1**  
**CATEGORY 1 ISSUES THAT ARE NOT APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)\***

<b>Issues</b>		<b>Basis for Inapplicability to VCSNS</b>
<b>Surface Water Quality, Hydrology, and Use (for all plants)</b>		
1.	Impacts of refurbishment on surface water quality	Issue applies to activity, refurbishment, that VCSNS will not undertake.
2.	Impacts of refurbishment on surface water use	Issue applies to activity, refurbishment, that VCSNS will not undertake.
4.	Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter, not inland freshwaters.
<b>Aquatic Ecology (for all plants)</b>		
14.	Refurbishment	Issue applies to activity, refurbishment, that VCSNS will not undertake.
<b>Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)</b>		
28.	Entrainment of fish and shellfish in early life stages	Issue applies to plants with cooling tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.
29.	Impingement of fish and shellfish	Issue applies to plants with cooling tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.
30.	Heat shock	Issue applies to plants with cooling tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.
<b>Groundwater Use and Quality</b>		
31.	Impacts of refurbishment on groundwater use and quality	Issue applies to activity, refurbishment, that VCSNS will not undertake.
36.	Groundwater quality degradation (Ranney wells)	Issue applies to a plant feature, Ranney wells, that VCSNS does not have.
37.	Groundwater quality degradation (saltwater intrusion)	Issue applies to plants in coastal areas, not inland sites such as VCSNS.
38.	Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to cooling ponds in salt marshes, not inland sites such as VCSNS.
<b>Terrestrial Resources</b>		
41.	Cooling tower impacts on crops and ornamental vegetation	Issue applies to plants with cooling-tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.
42.	Cooling tower impacts on native plants	Issue applies to plants with cooling-tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.
43.	Bird collisions with cooling towers	Issue applies to plants with cooling-tower-based heat dissipation systems; VCSNS uses a cooling pond to dissipate waste heat from condensers.

**TABLE 4-1 (Continued)**  
**CATEGORY 1 ISSUES THAT ARE NOT APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

<b>Issues</b>		<b>Basis for Inapplicability to VCSNS</b>
<b>Human Health</b>		
54.	Radiation exposures to the public during refurbishment	Issue applies to activity, refurbishment, that VCSNS will not undertake.
55.	Occupational radiation exposures during refurbishment	Issue applies to activity, refurbishment, that VCSNS will not undertake.
<b>Socioeconomics</b>		
72.	Aesthetic impacts (refurbishment)	Issue applies to activity, refurbishment, VCSNS will not undertake.

< = less than

gpm = gallons per minute

NRC = U. S. Nuclear Regulatory Commission

a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. SCE&G added issue numbers for expediency.

**TABLE 4-2**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
<b>Surface Water Quality, Hydrology, and Use (for all plants)</b>		
3. Altered current patterns at intake and discharge structures	SMALL. 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.	4.2.1.1/4-4 (once-through) 4.3.2.2/4-31 (cooling tower)
5. Altered thermal stratification of lakes	SMALL. Generally, lake stratification 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.	4.2.1.2.2./4-4 (once-through)
6. Temperature effects on sediment transport capacity	SMALL. These effects 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.	4.3.4.2.3/4-6 (once-through)
7. Scouring caused by discharged cooling water	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.	4.4.2.2/4-53
8. Eutrophication	SMALL. 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.	4.4.2.2/4-53
9. Discharge of chlorine or other biocides	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.	4.4.2.2/4-53
10. Discharge of sanitary wastes and minor chemical spills	SMALL. 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.	4.4.2.2/4-53
11. Discharge of other metals in waste water	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.	4.4.2.2/4-53
12. Water use conflicts (plants with once-through cooling systems)	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.	4.2.1.3/4-13 (once-through)
<b>Aquatic Ecology (for all plants)</b>		
15. Accumulation of contaminants in sediments or biota	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants, but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.	4.4.3/4-56 4.4.2.2/4-53
16. Entrainment of phytoplankton and zooplankton	SMALL. 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.	4.4.3/4-56

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

	Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
17.	Cold shock	SMALL. 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.	4.4.3/4-56
18.	Thermal plume barrier to migrating fish	SMALL. 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.	4.2.2.1.6/4-19 (once-through)
19.	Distribution of aquatic organisms	SMALL. Thermal discharge may have localized effects, but is not expected to affect the larger geographical distribution of aquatic organisms.	4.2.2.1.6/4-19 (once-through)
20.	Premature emergence of aquatic insects	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants, but has not been a problem and is not expected to be a problem during the license renewal term.	4.4.3/4-56
21.	Gas supersaturation (gas bubble disease)	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems, but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.	4.4.3/4-56
22.	Low dissolved oxygen in the discharge	SMALL. 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.	4.4.3/4-56
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	SMALL. 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.	4.4.3/4-56
24.	Stimulation of nuisance organisms (e.g., shipworms)	SMALL. 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.	4.4.3/4-56

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
<b>Groundwater Use and Quality</b>		
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	SMALL. Plants using less than 100 gpm are not expected to cause any groundwater use conflicts.	4.4.3/4-56
<b>Terrestrial Resources</b>		
44. Cooling pond impacts on terrestrial resources	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.	4.3.5.1/4-42
45. Power line right-of-way management (cutting and herbicide application)	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.	4.5.6.1/4-71
46. Bird collision with power lines	SMALL. Impacts are expected to be of small significance at all sites.	4.5.6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.	4.5.6.3/4-77
48. Floodplains and wetlands on power line right of way	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.	4.5.7/4-81
<b>Air Quality</b>		
51. Air quality effects of transmission lines	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.	4.5.2/4-62
<b>Land Use</b>		
52. Onsite land use	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.	3.2/3-1
53. Power line right of way	SMALL. Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.	4.5.3/4-62
<b>Human Health</b>		
56. Microbiological organisms (occupational health)	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.	4.3.6/4-48
58. Noise	SMALL. 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.	4.3.7/4-49

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
60. Electromagnetic fields, chronic effects	UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.	4.5.4.2/4-67
61. Radiation exposures to public (license renewal term)	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	SMALL. 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.	4.6.3/4-95
<b>Socioeconomics</b>		
64. Public services: public safety, social services, and tourism and recreation	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.	3.7.4/3-14 (refurbishment – public services) 3.7.4.3/3-18 (refurbishment – safety) 3.7.4.4/3-19 (refurbishment – social) 3.7.4.6/3-20 (refurbishment – tourism, recreation) 4.7.3/4-104 (renewal – public services) 4.7.3.3/4-106 (renewal - safety) 4.7.3.4/4-107 (renewal - social) 4.7.3.6/4-107 (renewal - tourism, recreation)
67. Public services, education (license renewal term)	SMALL. Only impacts of small significance are expected.	4.7.3.1/4-106
73. Aesthetic impacts (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.7.6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.5.8/4-83
<b>Postulated Accidents</b>		
75. Design basis accidents	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
<b>Uranium Fuel Cycle and Waste Management</b>		
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	SMALL. Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.	6.2.4/6-27 6.6/6-87
78. Offsite radiological impacts (collective effects)	<p>The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste and spent fuel disposal is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect, which will not ever be mitigated (for example, no cancer cure in the next thousand years), and that these dose projections over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.</p> <p>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.</p>	Not in GEIS.

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
79. Offsite radiological impacts (spent fuel and high level waste disposal)	<p>For the high-level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about <math>3 \times 10^{-3}</math>.</p> <p>Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the U.S. Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high-level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca</p>	Not in GEIS.

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
80. Nonradiological impacts of the uranium fuel cycle	<p>Mountain. However, (EPA's) generic repository standards in 40 CFR part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MTHM) repository.</p> <p>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.</p> <p>SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.</p>	<p>6.2.2.6/6-20 (land use)          6.2.2.7/6-20 (water use)          6.2.2.8/6-21 (fossil fuel)          6.2.2.9/6-21 (chemical)          6.6/6-90 (conclusion)</p>
81. Low-level waste storage and disposal	<p>SMALL. 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 onsite 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.</p>	<p>6.4.2/6-36 ("low-level" definition)          6.4.3/6-37 (low-level volume)          6.4.4/6-48 (renewal effects)          6.6/6-90 (conclusion)</p>

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
82. Mixed waste storage and disposal	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioned consistent with NRC decommissioning requirements.	6.4.5/6-63 6.6/6-91 (conclusion)
83. On-site spent fuel	SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.	6.4.6/6-70 6.6/6-91 (conclusion)
84. Nonradiological waste	SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.	6.5/6-86 6.6/6-92 (conclusion)
85. Transportation	SMALL. 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.	Addendum 1
<b>Decommissioning</b>		
86. Radiation doses	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.	7.3.1/7-15
87. Waste management	SMALL. 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.	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)

**TABLE 4-2 (Continued)**  
**CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO V.C. SUMMER NUCLEAR STATION (VCSNS)<sup>a</sup>**

Issue	NRC Findings <sup>b</sup>	GEIS, Ref. 4.0-2 (Section/Page)
88. Air quality	SMALL. 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.	7.3.3/7-21 (air) 7.4/7-25 (conclusion)
89. Water quality	SMALL. 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.	7.3.4/7-21 (water) 7.4/7-25 (conclusion)
90. Ecological resources	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.	7.3.5/7-21 (ecological) 7.4/7-25 (conclusion)
91. Socioeconomic impacts	SMALL. 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.	7.3.7/7-24 (socioeconomic) 7.4/7-25 (conclusion)
92. Environmental Justice	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.	Not in GEIS

- CFR = Code of Federal Regulations
- EPA = U.S. Environmental Protection Agency
- GEIS = Generic Environmental Impact Statement (NRC 1996a)
- Hz = Hertz
- NA = Not applicable
- NEPA = National Environmental Policy Act
- NPDES = National Pollutant Discharge Elimination System
- NRC = U.S. Nuclear Regulatory Commission

- a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. SCE&G added issue numbers for expediency.
- b. NRC has defined SMALL to mean that, for the issue, environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small. (10 CFR 51 Appendix B, Table B-1, Footnote 3).
- c. NRC published, on September 3, 1999, a GEIS addendum in support of its rulemaking that re-categorized Issue 85 from 2 to 1.

**VIRGIL C. SUMMER NUCLEAR STATION  
APPLICATION FOR RENEWED OPERATING LICENSE  
APPENDIX E - ENVIRONMENTAL REPORT**

**TABLE 4-3  
RESULTS OF INDUCED CURRENT ANALYSIS**

Transmission Line	Voltage (kV)	Limiting Case Peak Electric Field Strength (kV/meter)	Limiting Case Induced Current (milliamperes)
SCE&G Template <sup>a</sup>	230	3.8	3.5
Summer-Blythewood <sup>b</sup>	230	2.5	3.9
Summer-Newberry <sup>b</sup>	230	2.5	3.5

- a. Includes Summer-Parr Nos. 1&2, Summer-Fairfield Nos. 1&2, Summer-Denny Terrace Nos. 1&2, Summer-Pineland No. 1, and Summer-Graniteville.  
b. Owned and operated by Santee Cooper.

**TABLE 4-4  
SUMMARY OF THE DETAILED SAMA ANALYSES**

Phase 2 SAMA ID	Averted Cost-Risk	Cost of Implementation	Net Value	Cost Beneficial?
2	\$1,238	Not Estimated	Large Negative	No
3	\$103,086	\$150,000 to \$170,000	-\$46,914 to -\$71,914	No
9	\$23,812	Not Estimated	Large Negative	No
10	\$20,630	\$25,000 to \$50,000	-\$4,370 to -\$29,370	No
11/12	\$39,419	Not Estimated	Large Negative	No
13	\$5,788	Not Estimated	Large Negative	No
20	\$17,758	Not Estimated	Large Negative	No
24	\$377,695	\$1,225,000	-\$847,305	No
24a	\$117,629	\$1,225,000	-\$1,107,371	No
25	\$117,413	\$565,000	-\$447,587	No
26	\$13,147	Not Estimated	Large Negative	No
27	\$18,603	Not Estimated	Large Negative	No