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9.0 ALTERNATIVES

The proposed action is for NRC to issue a COL to SCE&G for Units 2 and 3 at the VCSNS site. The SCE&G goal in preparing this COL application environmental report is to obtain authorization from NRC for construction and operation of two nuclear power facilities to meet future baseload generating needs, as such needs may be determined by the state of South Carolina and co-owner decision-makers.

Chapter 9 describes the alternatives to construction and operation of new nuclear units with closed-cycle cooling at the VCSNS site, and alternative plant and transmission systems. The descriptions provide sufficient detail for the reader to evaluate the impacts of the alternative generation options or plant and transmission systems relative to those of the proposed action. The chapter is divided into four sections:

- No-Action Alternative (Section 9.1)
- Energy Alternatives (Section 9.2)
- Alternative Sites (Section 9.3)
- Alternative Plant and Transmission Systems (Section 9.4)

For most of the Chapter 9 analysis, SCE&G defined the region of interest as the state of South Carolina. The region of interest does not limit power purchase analysis; the co-owners can purchase power generated almost anywhere in the United States, Canada, or Mexico provided there is transmission capability to import the power.

9.1 NO-ACTION ALTERNATIVE

The no-action alternative for a proposed combined construction and operating license (COL) is for NRC to not issue a COL for Units 2 and 3. Under the no-action alternative, the proposed project would not be constructed or operated at the VCSNS site. The applicant would lose the benefit of being able to provide baseload power from the proposed project.

As discussed in Chapter 8, electricity demand in South Carolina, which is driven primarily by increased population and higher per capita consumption of electricity, is expected to increase by about 2.0% annually for the foreseeable future. Without additional capacity, the co-owners of the proposed project would not be able to maintain an adequate reserve margin to mitigate uncertainties in meeting load requirements that can arise from unit outages, adverse weather conditions, unexpected demand, or an unplanned loss in the transmission system. The co-owners—SCE&G and Santee Cooper—would be at potential variance with their public service obligations to provide sufficient power within their respective service territories. Customers would lose the possibility of having less expensive nuclear-generated electricity displace more expensive generation options in the dispatch mix. The co-owners would not be able to support national goals to advance the use of nuclear energy. South Carolina's fuel supply portfolio could become increasingly dependent on fossil-fuel generation and air quality in the region might be negatively affected by increased air emissions. If the co-owners took no action at all to meet growing demands, the ability of the co-owners of the proposed project to continue to supply low-cost, reliable power to their customers would be impaired. Consequently, it would be unreasonable for the co-owners or the state of South Carolina to take no action at all to meet growing demands for electricity. From this point, the no-action alternative could take the following general paths:

- <u>No New Generating Capacity</u> – The co-owners and the state may choose not to pursue construction of any new generating capacity, and thus the need for power presumably must be met by other alternative means that involve no new generating capacity. These alternatives would include demand-side management (*i.e.*, energy conservation, efficiency and load management), and power purchased from other electricity providers. This evaluation is discussed in Subsection 9.2.1.

- <u>Construct Nonnuclear Alternatives</u> – The required generating capacity could be provided by the construction of generating alternatives other than the proposed project. The new capacity may be constructed at the VCSNS site, other existing generating facility sites, or at other, non-designated, "greenfield" sites. Assessments of these alternatives are provided in Subsection 9.2.2.

- <u>Construct New Nuclear Capacity at an Alternative Site</u> – Because the no-action alternative is non-issuance of a COL, the proposed project would not be constructed or operated at the VCSNS site. It follows, therefore, that the environmental impacts described and predicted in this report for the new facility at VCSNS would not occur. However, while the predicted impacts would not occur at VCSNS if the facility were not built, some of these impacts (or greater impacts) could occur at other sites if new nuclear generating capacity is constructed and operated at those other sites to meet the presumed need for power. These impacts are evaluated (*i.e.*, compared with those of the proposed project) in Section 9.3.

- Combination – It is possible that some combination of the above approaches could be taken to provide the equivalent of the generating capacity precluded by the NRC's denial of the COL. For example, the proposed capacity could be met by a certain amount of new coal-fired capacity, combined with purchased power from outside the relevant service area. Combinations of alternative energy sources are considered in Subsection 9.2.2.12.

9.2 ENERGY ALTERNATIVES

Alternatives that do not require new generating capacity are discussed in Subsection 9.2.1, while new generation alternatives are discussed in Subsection 9.2.2. In Subsection 9.2.2, some of the alternatives that require new generating capacity were eliminated from further consideration and discussion based on their availability in the region, overall feasibility, ability to supply baseload power, or environmental consequences. In Subsection 9.2.3, the alternatives that were not eliminated are investigated in further detail relative to specific criteria such as environmental impacts, reliability, and economic costs.

9.2.1 ALTERNATIVES THAT DO NOT REQUIRE NEW GENERATING CAPACITY

This subsection is intended to provide an assessment of the economic and technical feasibility of meeting the demand for energy without constructing new generating capacity. Specific elements may include:

- Purchasing power from other utilities or power generators
- Reactivating or extending the service life of existing plants within the power system
- Implementing demand side management actions (including conservation measures)
- A combination of these elements that would be equivalent to the output of the project and therefore eliminate its need

In Subsection 9.2.1, the relevant service area definition is applicable only to SCE&G's and Santee Cooper's demand side management analysis because reducing demand outside the relevant service area would not relieve demand within the relevant service area.

9.2.1.1 Purchasing Power from Other Utilities or Power Generators

SCE&G has evaluated conventional and prospective purchase power supply options that could be reasonably implemented (SCE&G 2007). SCE&G constantly monitors the markets for electric energy and capacity and at times is an active purchaser and seller in those markets. Where it appears that market resources may be able to meet supply needs for its system appropriately, SCE&G polls the market, in some cases informally, and in other cases through the issuance of formal requests for proposals. In cases where resources can be an appropriate part of SCE&G's supply mix, SCE&G includes those resources in its comparative analysis of alternative supply options.

SCE&G's integrated resource plan calls for the addition of 500 MW of peaking/ intermediate capacity and firm purchased power in the 2009–2015 time frame (SCE&G 2007). The plan projects the need for increases in baseload capacity of

600 MW in 2016 and an additional 600 MW in 2019. SCE&G projects an increase in total capacity of approximately 24% from 5,808 to 7,197 MW from 2007 to 2021 (SCE&G 2007).

Santee Cooper periodically reviews its power resources, which include nuclear, natural gas, oil- and coal-fired units, as well as long-term power purchase agreements. Santee Cooper's current total summer peak generating capacity is 4,509 MW (Santee Cooper 2006). In addition, Santee Cooper presently purchases 84 MW of firm supply from the U.S. Army Corps of Engineers and 327 MW of hydroelectric power from the Southeastern Power Administration (Santee Cooper 2006). By 2015, Santee Cooper projects to be purchasing 486 MW or 7% of total system capacity (Santee Cooper 2006). Thus, power purchased from others is a small contribution to the overall system capacity and Santee Cooper will continue this practice where practical and appropriate.

If power were purchased from sources within the U.S., Canada, or Mexico, the generating technology would likely be one of those described in this ER (probably coal, natural gas, or nuclear). The description of the environmental impacts of other technologies described in Subsection 9.2.2 is representative of the purchased electrical power alternative to a new nuclear unit. Under the purchased power alternative, the environmental impacts of power production would still occur, but would be located elsewhere within the region or the nation or in another country.

While purchased power will remain a source of power for SCE&G and Santee Cooper, it will not be adequate to provide the required increase in baseload capacity projected for 2015.

9.2.1.2 Reactivating or Extending Service Life of Existing Plants

The plants that would likely replace the proposed project would be coal or natural gas units. Coal and natural gas plants slated for retirement tend to be ones that are old enough to have difficulty in economically meeting today's air emissions limits. In the face of increasingly stringent environmental restrictions, delaying retirement, or reactivating plants in order to avoid the construction of a large baseload plant would require major construction to upgrade or replace plant components. As a result, the environmental impacts of a refurbishment scenario are bounded by the coal- and natural gas-fired alternatives evaluated in Subsection 9.2.3.

It is conceivable that another nuclear plant could be a potential alternative source by reactivation or license renewal. However, Unit 1, the only nuclear plant owned by SCE&G and Santee Cooper, has received a renewed operating license and this analysis assumes the continued operation of Unit 1. Continued operation of a nuclear power plant would avoid the environmental impacts related to construction, so continued operation of a nuclear power plant would have fewer environmental impacts than construction of a new plant. However, continued operation of an existing nuclear plant does not provide additional generating capacity.

Therefore, given a real need for the proposed project, reactivation or extended service life for existing plants are not considered reasonable or environmentally preferable alternative energy sources.

9.2.1.3 Demand Side Management

Demand side management is the practice of reducing customers' demand for energy through programs such as energy conservation, efficiency, and load management so that the need for additional generation capacity is eliminated or reduced. Demand side management can minimize environmental effects by avoiding the construction and operation of new generating facilities. Those impacts that would result from the construction of the proposed facility, or from the supply of the additional power through other means, would be avoided if demand side management were sufficient to reduce the need for additional power. SCE&G's and Santee Cooper's ongoing demand side management programs to reduce the demand for power are described below.

9.2.1.3.1 SCE&G Demand Side Management

SCE&G's program is divided into three major categories: customer information programs, energy conservation programs, and load management programs. These programs are summarized below (SCE&G 2007).

<u>Customer Information Programs</u>

SCE&G's customer information programs fall under two headings: the annual energy campaigns and the web-based information initiative.

- <u>Annual Energy Campaigns</u>: SCE&G proactively educates its customers to create awareness of issues related to energy and conservation management. Radio and newspaper campaigns are conducted in major service areas on energy saving tips, online energy management tools, and energy saving clinics. Energy saving tips are promoted on the Weatherline (the "Energy Wise" newsletter distributed to customers with their bills), in brochures/printed materials available in business offices, in recorded messages for customers placed on hold, on the SCE&G website, by the SCE&G Speakers Bureau that provides talks to local organizations about energy conservation, and by featured news guests in which SCE&G experts are interviewed by news media regarding energy conservation and useful tips.

- <u>Web-based Information</u>: SCE&G has available a web-based tool that allows customers to access current and historical consumption data and compare their energy usage month to month and year to year, noting trends and spikes in their consumption. Feedback on this tool has been positive and over 166,000 customers have registered to access this tool as well as other account-related information.

Energy Conservation Programs

SCE&G has implemented three energy conservation programs: the Value Visit Program, the Conservation Rate, and the use of Seasonal Rate structures.

- Value Visit Program: This program is designed to assist residential electric customers that are considering an investment in upgrading their home's energy efficiency. An SCE&G representative visits the customer's home and guides them in their purchase of energy-related equipment and materials such as heating and cooling systems, duct insulation, attic insulation, storm windows, etc. Financing is offered to qualified customers and rebates offered for upgrading certain areas of the home to encourage upgrading to higher energy efficiency.

- Rate 6 Energy Saver/Energy Conservation Program: The Rate 6 program rewards homeowners and home builders who upgrade their existing homes or build their new homes to a high level of energy efficiency with a reduced electric rate. Information on the program is available on the SCE&G website and by brochure.

- Seasonal Rates: Many SCE&G rates are designed with components that vary by season. Energy provided in the peak usage season is charged a premium to encourage conservation and efficient use.

Load Management Programs

SCE&G's load management programs have as their primary goal the reduction of the need for additional generating capacity. There are four load management programs: Standby Generator Program, Interruptible Load Program, Real Time Pricing Rate, and the Time of Use Rates.

- Standby Generator Program: The Standby Generator Program for commercial and industrial retail customers was introduced in 1990 to serve as a load management tool. General guidelines authorize SCE&G to initiate a standby generator run request when reserve margins are stressed because of a temporary reduction in system generating capability, or high customer demand. Through consumption avoidance, generator customers release capacity back to SCE&G where it is then used to satisfy system demand. Qualifying customers receive financial credits determined initially during a load test, and future demand credits are based on the power the customer actually delivers when SCE&G requests the customer to run their generators.

- Interruptible Load Program: SCE&G has over 200 MW of interruptible customer load under contract. Participating customers receive a discount on their demand charges for shedding load when SCE&G is short of capacity.

- Real Time Pricing Rate: A number of customers receive power under the real time pricing rate. During peak usage periods throughout the year when capacity is low in the market, the real time pricing rate sends a high price signal to participating customers which encourages conservation and load shifting. During low usage periods, prices are lower.

- Time of Use Rates: Time of use rates contain higher charges during the peak usage periods of the day to encourage conservation and load shifting during these periods.

The Standby Generator Program and Interruptible Load Program, SCE&G's principal contributors to demand side management, make 206 MW of capacity available to the system. Additional contracts are expected in the future, but without additional savings the current 206 MW are projected to decrease system demand by approximately 3.5% in 2015.

9.2.1.3.2 Santee Cooper Demand Side Management

Santee Cooper has implemented demand side management programs for both residential and commercial customers to encourage conservation and shifting energy usage to off-peak hours (Santee Cooper 2006). These programs are described below:

Residential Programs

- Good Cents New and Improved Home Program: The Good Cents Program provides residential customers an incentive to build new homes to higher levels of energy efficiency and improve existing homes by upgrading heating and air conditioning equipment and the thermal envelope to high-energy efficiency standards. All homes are evaluated to determine if they meet the standards set for the program. Inspections are completed during construction for new homes and at the completion of construction for new and improved homes. As an incentive, participants are eligible for a reduced rate. Program participation in 2005 (the most recent data) resulted in an estimated demand savings of 15,470 kW.

- H_2O Advantage Water Heating Program: H_2O Advantage is a storage water heating program designed to shift the demand related to water heating to off-peak hours. This is accomplished with the installation of an electronic timer or radio controlled switch on an 80-gallon water heater. This program was offered for the last time in 2000, and will no longer be impacting the system after 2010 when the 10-year contracts expire. Program participation in 2005 (the most recent data) resulted in an estimated demand savings of 853 kW.

Commercial Programs

- Commercial Good Cents: The Commercial Good Cents Program is offered to commercial customers building new facilities that improve the efficiency in the building thermal envelope, heating and cooling equipment, and lighting. Commercial customers that meet program standards are given an up-front rebate to encourage participation in the program. Program participation in 2005 (the most recent data) resulted in an estimated demand savings of 119 kW.

- Thermal Storage Cooling Program: The Thermal Storage Cooling Program shifts energy used by commercial customers for air conditioning from peak to off-peak hours by using thermal energy stored in a medium such as ice or water. Rebates are offered to customers who install this type of equipment.

- Interruptible Load Program: Santee Cooper has 500 MW of interruptible customer load under contract (Santee Cooper 2006). Participating customers receive a discount on their demand charges for shedding load when Santee Cooper is short of capacity.

9.2.1.3.3 State of South Carolina Demand Side Management Projections

Despite the ongoing demand side management programs promoted by SCE&G and Santee Cooper, significant additional reductions in demand are not considered likely in South Carolina, given the expected customer growth rate of approximately 2% and the relatively low cost of electricity in the service area (SCEO 2005). According to the South Carolina Energy Office, "the future of electric demand-side programs in South Carolina appears bleak, due in part to the low cost of electricity as compared with the other states" (SCEO 2005). The South Carolina Energy Office report continues, "not only does South Carolina have a lower average rate per kilowatt-hour in the residential sector than the national average but also in the commercial and industrial sectors." The relatively low cost of electricity in South Carolina works counter to the incentives provided in the available demand side management programs for reducing demand. Thus, given the customer growth and the low cost of electricity, the available energy savings from demand side management will not be sufficient to offset a significant portion of future demand.

9.2.2 ALTERNATIVES THAT COULD PROVIDE NEW GENERATING CAPACITY

9.2.2.1 Introduction

This subsection discusses possible alternatives that could reasonably be expected to meet the additional generating capacity expected from the proposed project for the VCSNS site. SCE&G's COL application is premised on the installation of two units that would serve as large baseload generators and that any feasible alternative would also need to be able to generate baseload power. In performing this evaluation, SCE&G determined that NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (U.S. NRC 1996) provides a useful analysis of alternative sources. To generate the reasonable set of alternatives in NUREG-1437, NRC included commonly known generation technologies and consulted various state energy plans to identify alternative generation sources typically being considered by state authorities across the country. From this review, NRC established a reasonable set of alternative technologies for power generation. This subsection, as a starting point, considers alternatives not yet commercially available, fossil fuels, and alternatives available within South Carolina.

During the lifetime of the proposed project, technology is expected to continue to improve operational and environmental performances. Thus, any analyses of future relative competitiveness or impacts are subject to that uncertainty. However, as in the case of alternatives evaluated in Subsection 9.2.1, SCE&G believes that sufficient knowledge is available to make a reasonable assessment.

NRC considered these reasonable alternatives pursuant to its statutory responsibility under the National Environmental Policy Act: wind, photovoltaic cells, solar thermal power, hydropower, geothermal, biomass, municipal solid wastes, oil, fuel cells, coal, and natural gas. Although NUREG-1437 is specific to license renewal, the alternatives analysis in it can be compared to the proposed action to determine if the alternative technology represents a reasonable alternative to the proposed action and satisfies the intent and requirements of 10 CFR 52 regarding a COL application.

The alternative technologies considered in this analysis are consistent with national policy goals for energy use, and are not prohibited by federal, state, or local regulations. Each of the alternatives are assessed and discussed in the subsequent subsections relative to the following criteria:

- The alternative energy conversion technology is developed, proven, and available in the relevant region within the life of the proposed project.
- The alternative energy source provides baseload generating capacity equivalent to the capacity needed, and to the same level as the proposed Units 2 and 3
- The alternative energy source does not result in environmental impacts in excess of a nuclear plant, and the costs of an alternative energy source do not exceed the costs that make it economically impractical

Based on one or more of these criteria, several of the alternative energy sources were considered technically or economically infeasible after a preliminary review and were not considered further. Alternatives that were considered to be technically and economically feasible were assessed in greater detail in Subsection 9.2.3.

SCE&G is considering a two-unit plant using Westinghouse's AP1000 configuration for the VCSNS site. For analysis purposes, SCE&G assumed a target value of 2,214 MWe for the net electrical output from a new facility at VCSNS. This is the basis for the alternatives analysis in the following paragraphs.

9.2.2.2 Wind

Wind power systems produce power intermittently because they are only operational when the wind is blowing at sufficient velocity and duration (McGowan and Connors 2000). While recent advances in technology have improved wind turbine reliability, average annual capacity factors for wind power systems are relatively low (25% to 40%) (McGowan and Connors 2000) compared to 90% to 95% industry average for a baseload plant such as a nuclear plant.

The energy potential in the wind is expressed by wind generation classes ranging from 1 (least energetic) to 7 (most energetic). Wind regimes of Class 4 or higher are suitable for the advanced utility-scale wind turbine technology currently under development. Class 3 wind regimes may be suitable for future utility-scale technology (APPA 2004).

Wind resource studies indicate that the wind resource of South Carolina is relatively good offshore and at exposed points along the coast but declines substantially inland. Offshore wind regimes range from Class 3 near the coast to Class 6 farther offshore. Class 2 wind regimes are found in coastal areas and inland lakes. The wind resource in the rest of the state is generally considered to be Class 1, except for a few isolated high ridges in the extreme northwestern corner of the state along the North Carolina border, where the wind power density may reach Class 6 (AWS Truewind 2005; NREL 1986). The American Wind Energy Association estimates that the available land area within South Carolina with wind regimes of Class 3 or higher is approximately 22 square miles and the total wind energy potential in the state is approximately 59 MWe (AWEA 2002).

Mountain ridge-top locations are remote, requiring incremental costs for developing access roads and power transmission infrastructure. Moreover, the hilly terrain increases the complexity of installation and the overall costs of wind energy due to the variable directional wind flows observed in mountainous regions compared to flatter landscapes. This variation tends to decrease the amount of usable energy that can be extracted from the wind, resulting in lower capacity factors. Reduced capacity factors increase overall cost per kilowatt-hour of energy generated (Bowers 2005).

Use of mountain ridgetops is of additional concern in South Carolina because of aesthetic concerns. Mountain locations are enjoyed for recreation by a large percentage of the public. Scenic vistas are important and considerable public resistance to the use of mountain ridges for the location of wind farms is likely. For similar reasons, public resistance to the use of coastal areas for wind farms is also likely.

Estimates based on existing installations indicate that a utility-scale wind farm would require about 50 acres per MWe of installed capacity (McGowan and Connors 2000). Wind farm facilities would occupy 3% to 5% of the wind farm’s total acreage (McGowan and Connors 2000). Assuming ideal wind conditions and a 35% capacity factor, a wind farm with a net output of 2,214 MWe would require about 316,000 acres (494 square miles) of which at least 9,490 acres (15 square miles) would be occupied by turbines and support facilities. Based on the amount of land needed, the wind alternative would require a large green field site, which would result in a large environmental impact.

Capital costs in 2006 dollars for onshore wind energy systems are approximately $1,190 per kilowatt (NRRI 2007). In areas with wind regimes of Class 4 or higher, the levelized cost of electricity produced by wind energy systems escalated to 2006 dollars is 4.7 to 7.0 cents per kilowatt-hour (FPSC&DEP 2003; BLS 2007). Wind energy costs are expected to be much higher in areas like South Carolina that have lower wind regimes.

As discussed above, wind resources off of South Carolina's coast offer the potential for large amounts of wind-based energy production. Offshore wind turbines have a number of advantages over onshore ones. At a sufficient distance from the coast, visual intrusion is minimized and wind turbines can be larger, thus increasing the overall installed capacity per unit area. Similarly, less attention needs to be devoted to reduce turbine noise emissions offshore, which adds significant costs to onshore wind turbines. Also, the wind tends to blow faster and more uniformly at sea than on land. A higher, steadier wind means less wear on the turbine components and more electricity generated per square meter of swept rotor area. Onshore turbines are often located in remote areas, where the electricity must be transmitted by relatively long power lines to densely populated regions, but offshore turbines can be located close to urban load centers, simplifying transmission issues (Musial and Butterfield 2004).

However, significant challenges associated with offshore wind power development exist. To date, offshore wind development has been limited to very shallow waters of 15 to 40 feet. Turbine manufacturers have taken conventional land-based turbine designs, upgraded their electrical and corrosion control systems to marinize them, and placed them on concrete bases or steel monopiles to anchor them to the seabed. Most of the offshore wind resources in the United States are in areas where the water depth is 100 feet or more, and new substructure technologies will be needed to support the turbines. Environmental conditions at sea are more severe—more corrosion from saltwater and additional loads from waves. New turbine designs will be needed to withstand these harsh conditions. Also, investment costs are higher and accessibility is more difficult, resulting in higher capital and maintenance costs (Musial and Butterfield 2004).

Wind energy is not a reasonable alternative because wind energy, because of its intermittent nature, cannot be relied upon for baseload power. Furthermore, there are insufficient onshore wind resources in the relevant service area to offer a comparable generating capacity and offshore wind energy systems have considerable technical challenges, wind energy generating costs exceed nuclear power, and wind energy offers a distinct environmental disadvantage, relative to nuclear energy because of its large land use impacts.

SCE&G has concluded that, because of the limited availability of area having suitable wind speeds, daily and seasonal variability of wind in the region, the amount of land needed, and aesthetic impacts, wind generation is not a reasonable alternative for baseload power in South Carolina.

9.2.2.3 Solar Technologies

There are two basic types of solar technologies that produce electrical power: photovoltaic and solar thermal power. Photovoltaics convert sunlight directly into electricity using semiconducting materials. Solar thermal power systems use mirrors to concentrate sunlight on a receiver holding a fluid or gas, heating it, and causing it to turn a turbine or push a piston coupled to an electric generator (Leitner and Owens 2003).

Solar technologies produce more electricity on clear, sunny days with more intense sunlight and when the sunlight is at a more direct angle (*i.e.*, when the sun is perpendicular to the collector). Cloudy days can significantly reduce output. To work effectively, solar installations require consistent levels of sunlight (solar insolation) (Leitner and Owens 2003).

Solar thermal systems can be equipped with a thermal storage tank to store hot heat transfer fluid, providing thermal energy storage. By using thermal storage, a solar thermal plant can provide dispatchable electric power (WGA 2006).

The lands with the best solar resources are usually arid or semi-arid. While photovoltaic systems use both diffuse and direct radiation, solar thermal power plants can only use the direct component of the sunlight. This makes solar thermal power unsuitable for areas like South Carolina with high humidity and frequent cloud cover, both of which diffuse solar energy and reduce its intensity. In addition, the average annual amount of solar energy reaching the ground needs to be 6.0 kilowatt-hours per square meter per day or higher for solar thermal power systems (Leitner 2002). South Carolina receives 3.5 to 5 kilowatt-hours of solar radiation per square meter per day (NREL 2005).

Like wind, capacity factors are too low to meet baseload requirements. Average annual capacity factors for solar power systems are relatively low (24% for photovoltaics and 25.2% to 48% for solar thermal power) (Leitner 2002) compared to 90% to 95% for a baseload plant such as a nuclear plant.

Land use requirements (and associated construction and ecological impacts) are also much greater for solar technologies than for a nuclear plant. The area of land required depends on the available solar insolation and type of plant, but ranges from about 3.8 to 7.6 acres per MW for photovoltaic systems and from 4 to 8 acres per MW for solar thermal power plants (Leitner 2002). Assuming capacity factors of 24% for photovoltaics and 32% for solar thermal power, facilities having 2,214 MWe net capacity are estimated to require 35,100 acres (55 square miles), if powered by photovoltaic cells, and 55,400 acres (86 square miles), if powered by solar thermal power.

Solar-powered technologies, photovoltaic cells, and solar thermal power, do not currently compete with conventional technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. Capital costs escalated to 2006 dollars for photovoltaic installations are approximately $4,220 per kilowatt and capital costs for solar thermal installations range from $2,745 to $3,410 per kilowatt (NRRI 2007). Estimates indicate that in areas with good solar insolation, the levelized cost of electricity escalated to 2006 dollars produced by photovoltaic cells is 21.3 to 51.9 cents per kilowatt-hour, and electricity from solar thermal systems can be produced for a cost of 11.8 to 20.5 cents per kilowatt-hour (FPSC&DEP 2003; BLS 2007). Solar energy costs are expected to be much higher in areas like South Carolina that have lower solar insolation (FPSC&DEP 2003).

SCE&G has concluded that solar energy is not a reasonable alternative because solar energy, because of its intermittent nature, cannot be relied on for baseload power. Furthermore, SCE&G finds that there are insufficient solar resources in the relevant service area to offer a comparable generating capacity, solar energy generating costs exceed nuclear power, and solar energy offers a distinct environmental disadvantage, relative to nuclear energy because of its large land use impacts.

Solar-powered technologies, photovoltaic cells, and solar thermal power do not currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. Southeastern utilities have evaluated a number of solar options over the past 20 years. Data derived from these technology evaluations, coupled with high capital costs, indicates that solar power is not practical as a utility-scale baseload power generation option (Bowers 2005).

SCE&G has concluded that, because of the high cost, low capacity factors, lack of sufficient incident solar radiation, and the substantial amount of land needed to produce the desired output, solar energy is not practical as a utility-scale baseload power generation option.

9.2.2.4 Hydroelectric Power

Hydroelectric power is a fully commercialized technology. About 6% of the electric generating capacity in South Carolina is hydroelectric (EIA 2006a). Hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of environmental concerns and legal and institutional constraints (Conner et al. 1998).

According to the U.S. Hydropower Resource Assessment, the undeveloped hydropower potential in South Carolina is approximately 480 MW. Studies have concluded that there are no remaining sites in South Carolina that would be suitable for a large hydroelectric facility (Conner et al. 1998).

Land use for a large scale hydropower facility is estimated to be quite large. NUREG-1437 estimates land use of 1,600 square miles per 1,000 MWe generated by hydropower. Based on this estimate, a 2,214 MWe project would require flooding more than 3,542 square miles resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic species.

Estimates in 2006 dollars indicate that capital costs for a hydropower facility are approximately $2,380 per kilowatt (NRRI 2007). The levelized cost of electricity produced from new hydropower facilities escalated to 2006 dollars is estimated at 4.4 to 15.3 cents per kilowatt-hour (FPSC&DEP 2003; BLS 2007).

SCE&G has concluded that, because of the lack of suitable sites in South Carolina and the amount of land needed, in addition to the adverse environmental impacts, hydropower is not a reasonable alternative for baseload power.

9.2.2.5 Geothermal

Geothermal energy is a proven resource for power generation. Geothermal power plants use naturally heated fluids as an energy source for electricity production. To produce electric power, underground high-temperature reservoirs of steam or hot water are tapped by wells and the steam rotates turbines that generate electricity. Typically, water is then returned to the ground to recharge the reservoir (NREL 1997).

Geothermal energy can achieve average capacity factors of 95% and can be used for baseload power where this type of energy source is available (NREL 1997). Widespread application of geothermal energy is constrained by the geographic availability of the resource (NREL 1997). In the United States, high-temperature hydrothermal reservoirs are located in the western states, Alaska, and Hawaii (SMU 2004). There are no known high-temperature geothermal sites in South Carolina (SMU 2004).

Geothermal power plants require relatively little land. An entire geothermal field uses 1 to 8 acres per MWe (Shibaki 2003). Assuming a 95% capacity factor, a geothermal power plant with a net output of 2,214 MWe would require at least 2,330 acres (4 square miles).

The major environmental concerns associated with geothermal development are the release of small quantities of carbon dioxide and hydrogen sulfide, noise, and disposal of sludge and spent geothermal fluids (Shibaki 2003, NREL 1997). Subsidence and reservoir depletion may be a concern if withdrawal of geothermal fluids exceeds natural recharge or injection (Shibaki 2003).

Estimates indicate that capital costs in 2006 dollars for geothermal power plants approximately $2,250 per kilowatt (NRRI 2007). The levelized cost of electricity produced from geothermal power plants escalated to 2006 dollars is estimated to be in the range of 4.8 to 7.9 cents per kilowatt-hour (CEC 2003; BLS 2007).

SCE&G has concluded that, because of the lack of high-temperature geothermal reservoirs, geothermal power is not a reasonable alternative for baseload power in the relevant service area.

9.2.2.6 Biomass Related Fuels

Electric power generation from combustion of biomass has been demonstrated and offers a reliable source of renewable energy. Because biomass technologies employ combustion processes to produce electricity, they can generate electricity at any time. Biomass fired facilities generate electricity using commercially available equipment and well-established technology.

South Carolina does have abundant biomass resources in the form of wood waste and other agricultural residues. Over 22 million tons of sustainable biomass, with an energy equivalent to 4.8 million tons of coal, is produced each year in South Carolina (Harris et al. 2004).

Energy crops such as switchgrass could be grown to ensure a reliable supply of biomass feedstocks for generation of electricity. The environmental impacts from converting large tracts of land to production of energy crops may include detrimental effects on wildlife habitat and biodiversity, reduced soil fertility, increased erosion, and reduced water quality. The net environmental impacts would depend on previous land use, the particular energy crop, and how the crop is managed. Displacing natural land cover, such as forests and wetlands, with energy crops would likely have negative impacts.

Nearly all of the biomass-energy-using electricity generation facilities in the United States use steam turbine conversion technology. The technology is relatively simple to operate and it can accept a wide variety of biomass fuels. However, at the scale appropriate for biomass (the largest biomass power plants are 40 to 50 MW in size), the technology is expensive and inefficient. Therefore, the technology is relegated to applications where there is a readily available supply of low-, zero-, or negative-cost delivered feedstocks.

Estimates in 2006 dollars indicate that capital costs for biomass power plants range from $1,760 to $2,160 per kilowatt (NRRI 2007). The levelized cost of electricity produced from biomass power plants escalated to 2006 dollars is 6.9 to 12.9 cents per kilowatt-hour (FPSC&DEP 2003; BLS 2007).

Construction of a biomass-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste and agricultural residues for fuel would be built on smaller scales. Like coal-fired plants, biomass-fired plants require areas for fuel storage, processing, and waste (*i.e.*, ash) disposal. Additionally, operation of biomass-fired plants has environmental impacts, including potential impacts on the aquatic environment and air.

Another option for using biomass feedstocks to generate electricity is co-firing with coal. For over 10 years, Southern Company has been evaluating co-firing biomass fuels in existing coal-fired generating plants. While these studies have proven that biomass can be successfully co-fired with coal, it is not without technical challenges. Biomass is much less dense than coal, requiring a large volume of fuel to be handled. Larger areas of biomass storage and additional handling are required to accommodate the lower density materials. Moreover, the ash residue left from combusting biomass contains alkali and alkaline earth elements, such as sodium, potassium, and calcium. These compounds bind irreversibly with the catalysts used in selective catalytic reduction reactors that have been installed on coal-fired generating plants. These compounds can lead to increased catalyst plugging and cause deactivation of selective catalytic reduction catalysts, thus reducing or eliminating the ability of this technology to reduce NO_x emissions (Bowers 2005).

SCE&G has concluded that, because of the small scale of biomass generating plants, high cost, and lack of an obvious environmental advantage, biomass energy is not a reasonable alternative for baseload power.

9.2.2.7 Municipal Solid Waste

The initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at biomass-fired facilities because of the need for specialized waste separation and handling equipment. Estimates indicate that capital costs in 2006 dollars for municipal solid waste plants range from $2,740 to $5,040 per kilowatt. The levelized cost of electricity produced from municipal solid waste plants escalated to 2006 dollars is 3.8 to 16.8 cents per kilowatt-hour (FPSC&DEP 2003; BLS 2007).

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. Combusting waste usually reduces its volume by approximately 90%. The remaining ash is buried in landfills (FPSC&DEP 2003). It is unlikely, however, that many landfills will begin converting waste to energy due to the numerous obstacles and factors that may limit the growth in municipal solid waste power generation. Chief among them are environmental regulations and public opposition to siting municipal solid waste facilities near feedstock supplies (FPSC&DEP 2003).

The overall level of construction impacts from a municipal solid waste-fired plant should be approximately the same as that for a conventional coal-fired plant. The air emission profile and other operational impacts (including impacts on the aquatic environment, air, and waste disposal) for a municipal solid waste plant would also be similar to a conventional fossil-fueled unit (FPSC&DEP 2003). Some of these impacts would be moderate, but still larger than the proposed action.

SCE&G has concluded that, because of the high costs and lack of obvious environmental advantages, other than reducing landfill volume, burning municipal solid waste to generate electricity is not a reasonable alternative for baseload power.

Another option of converting landfill waste into electricity is using the gases that are produced as the waste decomposes. This gas, which is primarily methane, is collected in wells within the landfill, pumped to the surface, filtered, and is used as fuel for engines connected to generators. Depending on the size and age of the landfill, the scale of these plants is in the range of 3 MW to 8 MW and can economically produce power for 10 to 15 years. This scale is much smaller than what is needed for a baseload power source. Nevertheless, the burning of this waste gas is beneficial to the environment by preventing methane, a greenhouse gas with global-warming potential 21 times that of carbon dioxide, from entering the atmosphere directly. Santee Cooper founded GreenPower which, in part, harnesses enough landfill gas for three plants to produce approximately 14 MW of electricity (Santee Cooper 2007).

9.2.2.8 Petroleum Liquids

South Carolina has several petroleum-fired units (including units fired by distillate fuel oil, residual fuel oil, petroleum coke, jet fuel, kerosene, other petroleum and waste oil); however, they produce less than 1% of the state's electricity (EIA 2006a). While capital costs for new petroleum-fired plants would be similar to the cost of a new gas-fired plant, petroleum-fired operation is more expensive than nuclear and other conventional technologies because of the high cost of petroleum. Estimates indicate that the levelized cost of electricity produced by petroleum-fired operation escalated to 2006 dollars is 6.7 to 7.3 cents per kilowatt-hour (DeLaquil et al. 2005; BLS 2007). Future increases in petroleum prices are expected to make petroleum-fired generation increasingly more expensive relative to other alternatives.

The high cost of petroleum has prompted a steady decline in its use for electricity generation in recent decades. From a peak of 365 million MWh in 1978 (17% of total U.S. net electricity generation in that year), petroleum accounted for just 122 million MWh – 3% – of net electricity generated in 2005 (EIA 2006b). With the peak of domestic petroleum production in 1970, rising imports since then, increasing global prices over the last few years and the prospect for more of the same, plus competition for this valuable fuel commodity not only from the transportation sector but also from the petrochemical industry, it is likely that the downward trend for using petroleum to generate electricity will continue.

Also, construction and operation of a petroleum-fired plant would have identifiable environmental impacts. For example, NUREG-1437 estimates that construction of a 1,000 MWe petroleum-fired plant would require about 120 acres. Assuming a 95% capacity factor, a petroleum-fired power plant with a net output of 2,214 MWe would require about 280 acres. Additionally, operation of petroleum-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant (U.S. NRC 1996).

SCE&G has concluded that, because of the high fuel costs and lack of obvious environmental advantage, petroleum-fired generation is not a reasonable alternative for baseload power.

9.2.2.9 Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. While more than 650 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generating capacity in 2003 was only 125 MWe. The largest stationary fuel cell power plant yet built is only 11 MWe (Fuel Cell Today 2003).

Fuel cells are not cost-effective when compared with other generation technologies, both renewable and fossil based. Capital costs in 2006 dollars for fuel cell installations range from $1,620 to $4,015 per kilowatt (NRRI 2007). Estimates indicate that the levelized cost of electricity produced by fuel cells escalated to 2006 dollars is 10.6 to 23.8 cents per kilowatt-hour (CEC 2003; BLS 2007). Estimates suggest that manufacturers would need to at least triple their production capacity to achieve a competitive price of $1,500 to $2,000 per kilowatt (Shipley and Elliott 2004).

SCE&G believes that this technology has not matured sufficiently to support production for a baseload facility. SCE&G has concluded that, because of the cost and production limitations, fuel cell technology is not a reasonable alternative for baseload capacity.

9.2.2.10 Coal

Coal-fired electric plants provide the majority of electric generating capacity in the United States, accounting for about 50% of the electricity generated and about 33% of electric generating capacity in 2004. In South Carolina, coal-fired plants provide about 40% of the electricity generated and about 27% of its electric generating capacity (EIA 2006a).

The United States has abundant low-cost coal reserves, and the price of coal for electric generation is likely to increase at a relatively slow rate (EIA 2006c). Coal-fired plants are likely to continue to be a reliable energy source well into the future, assuming environmental constraints do not cause the gradual substitution of other fuels. Even with recent environmental legislation, new coal capacity is expected to be an affordable technology for reliable, near-term development (EIA 2006c).

There are three primary technologies identified for generating electrical energy from coal: conventional pulverized coal boiler, fluidized bed boiler, and integrated gasification combined-cycle (IGCC). As part of the alternatives evaluation, all three technologies (conventional, fluidized bed, and IGCC) were evaluated.

9.2.2.10.1 Pulverized Coal Boiler

In pulverized coal-fired plants, pulverized coal is blown into a combustion chamber of a boiler where it is combusted. The hot gases and heat energy from the combustion process convert water in the boiler into steam. This high-pressure steam is then passed into a steam turbine to produce electricity. Flue gas is transferred from the steam generator, through a selective catalytic reduction for nitrogen oxides (NO_x) reduction and into an air heater. From the air heater, the flue gas flows to a sulfur dioxide (SO_2) scrubber system and a particulate removal system.

Depending on the pressure of the steam system, pulverized coal plants can be further classified as conventional (also called subcritical) or supercritical. Conventional pulverized coal plants operate at 2,400 pounds per square inch (psi); whereas supercritical units operate at pressures of 3,500 psi or more allowing them to achieve higher efficiencies than conventional units. As the efficiency of the steam system is increased, the heat rates lower, and the amount of fuel necessary to produce the same amount of energy is reduced, thereby reducing plant emissions (NRRI 2007).

Pulverized coal-fired boilers have been built to match steam turbines that have outputs between 50 MWe and 1300 MWe. To take advantage of the economies of scale, most new units are rated at over 300 MWe, but there are relatively few really large ones with outputs from a single boiler/turbine combination of over 700 MWe. This is because of the substantial effects such units have on the distribution system if they were to “trip out” for any reason, or be unexpectedly shut down (IEACCC 2006).

The environmental impacts of constructing a typical pulverized coal-fired steam plant are well known because coal-fired steam plants are the most prevalent type of central generating technology in the United States. Supercritical pulverized coal plants are a highly proven and reliable technology with installations dating back to 1957 (NRRI 2007).

Estimates in 2006 dollars indicate that capital costs for pulverized coal-fired power plants range from $1,235 to $1,350 per kilowatt (NRRI 2007). The advanced materials and systems necessary for a supercritical plant make the cost to construct generally higher than that of a similarly sized conventional plant. The levelized cost of electricity in 2006 dollars produced from pulverized coal-fired power plants is 4.3 to 5.2 cents per kilowatt-hour (NRRI 2007).

9.2.2.10.2 Fluidized Bed Boiler

Fluidized bed is an advanced electric power generation process that minimizes the formation of gaseous pollutants by controlling coal combustion parameters and by injecting a sorbent (such as crushed limestone) into the combustion chamber along with the fuel. Crushed fuel mixed with the sorbent is fluidized on jets of air in the combustion chamber. Sulfur released from the fuel as SO_2 is captured by the sorbent in the bed to form a solid compound that is removed with the ash. The resultant byproduct is a dry, benign solid that is potentially a marketable byproduct for agricultural and construction applications. More than 90% of the sulfur in the fuel is captured in this process. NO_x formation in fluidized bed power plants is lower than that for conventional pulverized coal boilers because the operating temperature range is below the temperature at which thermal NO_x is formed (U.S. DOE 2003).

Currently, fluidized bed units are limited to a maximum size of approximately 265 MW (U.S. DOE 2003). Although a multiunit facility could be built, this would not be able to benefit from the economies of scale associated with a 2,214 MW project. Also, because of the lower operating temperature of the fluidized bed system, it doesn't achieve the higher efficiency levels achieved by conventional pulverized coal boilers. Because of the limited size of available units and lower thermal efficiency, fluidized bed is not a cost-effective alternative for the proposed project.

To improve the thermal efficiency of the fluidized bed technology, a new type of fluidized bed boiler is being proposed that encases the entire boiler inside a large pressure vessel. Burning coal in a pressurized fluidized bed boiler results in a high-pressure stream of combustion gases that can spin a gas turbine to make electricity, then boil water for a steam turbine. It is estimated that plants using the pressurized fluidized bed technology will be able to generate 50% more electricity from coal than a regular power plant from the same amount of coal (U.S. DOE 2003). The pressurized fluidized bed technology is in the early stages of commercialization and has limited operational experience. SCE&G believes that this technology has not matured sufficiently to support production as a large baseload facility.

9.2.2.10.3 Integrated Gasification Combined Cycle

IGCC is an innovative electric power generation concept that combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is substantially cleaner than conventional pulverized coal plants because major pollutants can be removed from the gas stream before combustion.

The IGCC alternative generates substantially less solid waste than a conventional coal fired boiler. The largest solid waste stream produced by IGCC installations is slag, a black, glassy, sand-like material that is potentially a marketable byproduct. Slag production is a function of ash content. The other large-volume byproduct produced by IGCC plants is sulfur, which is extracted during the gasification process and can be marketed rather than placed in a landfill. IGCC units do not produce ash or scrubber wastes.

IGCC power plants are in the early stages of commercialization. Five commercial-scale, coal gasification-based power systems have been successfully demonstrated in the United States. Experience has been gained with the chemical processes of gasification, coal properties and their impact on IGCC design, efficiency, economics, etc. However, system reliability is still relatively lower than conventional pulverized coal-fired power plants and the major reliability problem is from the gasification section. There are problems with the integration between gasification and power production as well. For example, if there is a problem with gas cleaning, uncleaned gas can cause various damages to the gas turbine (Rardin et al. 2005).

Overall, IGCC plants are estimated to be about 15% to 20% more expensive than comparably sized conventional pulverized coal plants, due in part to the coal gasifier and other specialized equipment (Moore 2005).

IGCC technology has not matured sufficiently to support production for a large baseload facility and is not a reasonable alternative for a large baseload facility.

SCE&G concludes that supercritical pulverized-coal-boiler technology is a reasonable alternative to the proposed nuclear plant. SCE&G defined the coal-fired alternative as consisting of three conventional boiler units, each with a net capacity of 738 MWe for a combined capacity of 2,214 MWe. SCE&G chose this configuration to be equivalent to the gas-fired alternative described below. This equivalency makes impact characteristics most comparable, facilitating impact analysis. Table 9.2-1 describes assumed basic operational characteristics of the coal-fired units. SCE&G based its emission control technology and percent-control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (U.S. EPA 1998). For the purposes of analysis, SCE&G has assumed that coal and limestone (calcium carbonate) would be delivered by rail after upgrading the existing rail spur into the VCSNS site.

Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a coal-fired power generation plant, it is considered a reasonable alternative and is, therefore, examined further in Subsection 9.2.3.

9.2.2.11 Natural Gas

SCE&G has chosen to evaluate gas-fired generation, using combined-cycle turbines, because it has determined that the technology is mature, economical, and feasible. However, the volatility of gas prices has made combined-cycle turbines less economically attractive. Studies indicate that when natural gas prices exceed $6 per million cubic feet, new combined cycle units lose their competitiveness with other technologies. Capital costs for gas-fired combined-cycle power plants in 2006 dollars range from $410 to $430 per kilowatt. The levelized cost of electricity produced from gas-fired power plants in 2006 dollars is 3.1 to 5.0 cents per kilowatt-hour, when the cost of natural gas is less than $7 per thousand cubic feet (NRRI 2007).

Existing manufacturers' standard-sized units include a gas-fired combined-cycle plant of 738 MWe net capacity, consisting of two 198 MWe gas turbines (*e.g.*, Siemens SGT6-5000F) and 342 MWe of heat recovery capacity. SCE&G assumed three 738 MWe units, having a total capacity of 2,214 MWe, as the gas-fired alternative at the VCSNS site. Although this provides less capacity than two AP1000 units, it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods, such as purchasing power. Table 9.2-2 describes assumed basic operational characteristics of the gas-fired units. As for the coal-fired alternative, SCE&G based its emission control technology and percent-control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (U.S. EPA 2000). For the purposes of analysis, SCE&G has assumed that there would be sufficient gas availability.

Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a natural gas-fired power generation plant, it is considered a reasonable alternative and is therefore examined further in Subsection 9.2.3.

9.2.2.12 Combination of Alternatives

Even though individual alternatives might not be sufficient on their own to provide 2,214 MWe capacity due to the small size of the resource or lack of cost-effective opportunities, it is conceivable that a mix of alternatives might be cost effective. The possible combinations of fuel types to generate 2,214 MWe is large, and SCE&G has not exhaustively evaluated each combination. However, SCE&G reviewed combinations that due to technological maturity, economics, and other factors, could be reasonable alternatives to the proposed project. Two of these combinations of alternatives are addressed below.

As discussed in Subsection 9.2.2.2, wind energy, as a stand-alone technology, is not a feasible alternative for baseload power. However, it is conceivable that a mix of wind energy and gas-fired combined cycle units could provide baseload power. For example, the 2,214 MWe target capacity could be met by developing a 50 MWe wind farm, along with three 738 MWe natural gas combined-cycle units. When operating, a combined cycle plant can “follow” the wind load by ramping up and down quickly. When the wind is blowing hard, the combined cycle plant can be ramped down; when the wind is not blowing or is blowing too softly to turn the wind turbines, the combined cycle plant can be ramped up. The impacts associated with the wind portion of the alternative—land use impacts, noise impacts, visual impacts, impacts on birds, etc.—would be more than the stand-alone natural gas alternative; therefore, the combination would have greater impacts than a single fuel type. The environmental impacts associated with the combined alternative would compare unfavorably with the proposed project.

If the hypothetical mix included coal-fired generation, the environmental impacts associated with construction (land use, ecology) and air quality would be expected to be greater than that of the proposed project. For example, the 2,214 MWe target capacity could be met by building two 738 MWe coal-fired units along with one 738 MWe natural gas combined-cycle unit. This combination coal-gas facility would require approximately 267 acres for permanent structures. As discussed in Subsection 4.1.1, construction of the proposed project would require about 500 acres of which about 240 acres would be required for permanent facilities. Air quality impacts for the 738 MWe coal-fired units would compare unfavorably with the proposed project due to the large amount of combustion products from coal-fired generation. The additional impact resulting from the natural gas unit would only strengthen the overall favorable position of the proposed project.

Other combinations of the various alternatives are not discussed here. In general, poor annual average capacity factors, higher environmental impacts (land use, ecological, air quality), immature technologies, and a lack of cost-competitiveness are not expected to lead to a viable, competitive combination of alternatives which would be either environmentally equivalent or preferable.

9.2.3 ASSESSMENT OF REASONABLE ALTERNATIVE ENERGY SOURCES AND SYSTEMS

This subsection evaluates the environmental impacts from what SCE&G has determined to be reasonable alternatives to the proposed project—pulverized coal-fired generation and gas-fired generation.

SCE&G has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE. This characterization is 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 the National Environmental Policy Act 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).

9.2.3.1 Coal-Fired Generation

SCE&G has reviewed the NRC analysis of environmental impacts from coal-fired generation alternatives in NUREG-1437 and found NRC’s analysis to be reasonable. Construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative defined by SCE&G in Subsection 9.2.2.10 would be located at the VCSNS site.

9.2.3.1.1 Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant would emit sulfur dioxide (SO_2, as SO_x surrogate), oxides of nitrogen (NO_x), particulate matter (PM), carbon monoxide (CO), and mercury (Hg) all of which are regulated pollutants. A coal-fired plant would also emit carbon dioxide (CO_2), which has been linked to global warming. As Subsection 9.2.2.10 indicates, SCE&G has assumed a plant design that would minimize air emissions through a combination of boiler technology and post combustion pollutant removal. SCE&G estimates the coal-fired alternative emissions to be as follows:

- SO_2 = 7,044 tons per year
- NO_x = 1,495 tons per year
- CO = 1,495 tons per year
- CO_2 = 16,500,000 tons per year
- Hg = 0.25 tons per year
- PM_{10} (particulates having a diameter of less than 10 microns) = 67 tons per year
- $PM_{2.5}$ (particulates having a diameter of less than 2.5 microns) = 0.17 tons per year

The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. In 2004, emissions of SO_2 and NO_x from South Carolina's generators ranked 18th and 29th highest nationally, respectively (EIA 2006a). Both SO_2 and NO_x emissions would increase if a new coal-fired plant were operated at the VCSNS site. To operate a fossil-fuel burning plant, SCE&G would have to purchase SO_2 allowances from the open market or shut down existing fossil-fired capacity and apply the credits from that plant to the new one.

In October 1998, EPA promulgated the NO_x State Implementation Plan Call regulation that requires 22 states, including South Carolina, to reduce their NO_x emissions by over 30% to address national ozone transport. The regulation imposes a NO_x "budget" to limit the NO_x emissions from each state. Each new fossil-fuel-fired electrical generating unit in South Carolina will need to acquire enough NO_x credits to cover its annual NO_x emissions.

In March 2005, EPA issued the final Clean Air Interstate Rule which addresses power plant SO_2 and NO_x emissions that contribute to non-attainment of the 8-

hour ozone and fine particulate matter standards in downwind states. Twenty-eight eastern states, including South Carolina, are subject to the requirements of the rule. The rule calls for further reductions of NO_x and SO_2 emissions from power plants. These reductions can be accomplished by the installation of additional emission controls at existing coal-fired facilities or by the purchase of emission allowances from a cap-and-trade program.

In March 2005, EPA finalized the Clean Air Mercury Rule which sets emissions limits on mercury to be met in two phases beginning in 2010 and 2018, and encourages a cap and trade approach to achieving those caps. NO_x and SO_2 controls also are effective in reducing mercury emissions. However, according to the EPA, the second phase cap reflects a level of mercury emissions reduction that exceeds the level that would be achieved solely as a co-benefit of controlling NO_x and SO_2 under the Clean Air Interstate Rule. Each new coal-fired electrical generating unit in South Carolina will need to acquire enough mercury allowances to cover its annual mercury emissions.

The likelihood of buying offsets for a new facility would be extremely remote, if possible at all. The coal-fired alternative, while possible, would not be economically feasible because there are no mitigating efforts (like emissions trading) to make the alternative worthwhile. In addition, emission credits' trading (for NO_x and SO_2) generally applies to non-attainment areas. The proposed site is located in an attainment area, making emission credit trading not effective as a mitigation technique.

Air impacts from fossil fuel generation would be substantial. Adverse human health effects from coal combustion have led to important federal legislation in recent years and public health risks, such as cancer and emphysema, have been associated with coal combustion. Global warming and acid rain are also potential impacts. SCE&G notes that federal legislation and concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. SO_2 and mercury emission allowances, NO_x emission offsets, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are regularly imposed mitigation measures. As such, SCE&G concludes for purposes of this alternatives analysis that the coal-fired alternative may have MODERATE impacts on air quality: the impacts may be noticeable, but would not destabilize air quality in the area due to the use of mitigating technologies.

9.2.3.1.2 Waste Management

The coal-fired alternative would generate substantial solid waste. The coal-fired plant, using coal having an ash content of 9.75%, would annually consume approximately 5,980,000 tons of coal. Particulate control equipment would collect most (99.9%) of this ash, approximately 582,000 tons per year. SCE&G recycles more than 75% of its coal ash (SCE&G 2006). Assuming continuation of this waste mitigation measure, the coal-fired alternative would generate approximately 146,000 tons of ash per year for disposal.

SO_x-control equipment, annually using approximately 231,000 tons of limestone, would generate another 275,000 tons per year of waste in the form of scrubber sludge. SCE&G estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 254 acres.

With proper placement of the facility, coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the SCE&G property for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, SCE&G believes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation of the impact would be unwarranted.

9.2.3.1.3 Other Impacts

Construction of the power block and coal storage area would impact approximately 357 acres of land and associated terrestrial habitat. Because most of this construction would be in previously disturbed areas, impacts would be minimal. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. It is assumed that construction debris from clearing and grubbing could be disposed of onsite and municipal waste disposal capacity would be available. Socioeconomic impacts would result from the approximately 150 people needed to operate the coal-fired facility. SCE&G believes that these impacts would be SMALL due to the mitigating influence of the site's proximity to the surrounding population area. Cultural resource impacts would be unlikely, due to the previously disturbed nature of the site, and could be, if needed, minimized by survey and recovery techniques.

Impacts to aquatic resources and water quality would be minimized because of the plant's use of cooling towers, and SCE&G believes that these impacts would be SMALL. The new stacks, boilers, and rail deliveries would be an incremental addition to the visual impact from existing VCSNS structures and operations. Coal delivery would add noise and transportation impacts associated with unit train traffic. Assuming a unit train has 125 cars and each car holds 100 tons, approximately 500 unit trains per year (about 10 trains per week) would be needed to deliver coal and limestone to the coal-fired plant.

SCE&G believes that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Because of the minor nature of these impacts, mitigation would not be warranted beyond that mentioned.

9.2.3.1.4 Design Alternatives

The VCSNS location lends itself to coal delivery by rail. Subsection 9.4.1 analyzes alternative designs for the Units 2 and 3 heat dissipation systems. Based on this analysis, SCE&G assumed that cooling towers would be used for the coal-fired alternative. Use of cooling towers would minimize impingement, entrainment, and thermal impacts; consumptive water use through evaporation would be a SMALL impact, and 70-foot-high mechanical towers or 600-foot-high natural draft towers would introduce a visual impact.

9.2.3.2 Natural Gas Generation

SCE&G has reviewed the NRC analysis of environmental impacts from gas-fired generation alternatives in NUREG-1437 that focused on combined-cycle plants and found it to be reasonable. Subsection 9.2.2.11 presents SCE&G's reasons for defining the gas-fired generation alternative as a combined-cycle plant at VCSNS. Land-use impacts from gas-fired units would be less than those of the coal-fired alternative. Reduced land requirements, due to construction on the existing site and a smaller facility footprint would reduce impacts to ecological, aesthetic, and cultural resources as well. As discussed under "Other Impacts," an incremental increase in the workforce could have socioeconomic impacts. Human health effects associated with air emissions would be of concern, but the effect would be less than those of coal-fired generation.

The gas-fired alternative defined by SCE&G in Subsection 9.2.2.11 would be located at the VCSNS site.

9.2.3.2.1 Air Quality

Natural gas is a relatively clean-burning fossil fuel. Also, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient (56% versus 40% for the coal-fired alternative). Therefore, the gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative. Control technology for gas-fired turbines focuses on the reduction of NO_x emissions. SCE&G estimates the gas-fired alternative would use approximately 98,900,000,000 standard cubic feet of natural gas per year and would generate the following emissions:

- SO_2 = 34 tons per year
- NO_x = 558 tons per year
- CO = 116 tons per year
- CO_2 = 5,630,000 tons per year
- PM = 97 tons per year (all particulates are $PM_{2.5}$)

The Subsection 9.2.3.1 discussion of regional air quality, Clean Air Act requirements, the NO_x State Implementation Plan Call, and the Clean Air Interstate Rule are also applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could be issues of concern for gas-fired combustion. SCE&G concludes that emissions from a gas-fired alternative could noticeably alter local air quality, but would not destabilize regional resources. Air quality impacts would, therefore, be MODERATE, and substantially larger than those of nuclear generation.

9.2.3.2.2 Waste Management

Gas-fired generation would result in essentially no waste generation, producing minor (if any) impacts. SCE&G concludes that gas-fired generation waste management impacts would be SMALL.

9.2.3.2.3 Other Impacts

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative at VCSNS would reduce construction-related impacts relative to construction on a greenfield site.

A new 26- to 30-inch-diameter pipeline would need to be constructed from an existing natural gas transmission pipeline located approximately 35 miles southeast of the VCSNS site near Gaston, South Carolina. Upgrades to the existing pipeline and gas storage facilities would also be required. To the extent practicable, SCE&G would route the new gas supply pipeline in existing rights-of way to minimize impacts. Assuming a 75-foot easement, about 318 acres would need to be graded to permit the installation of the pipeline. Construction impacts would be minimized through the application of best management practices that minimize soil loss and restore vegetation immediately after the excavation is backfilled. Construction could result in the loss of some less mobile animals (*e.g.*, moles and salamanders). Because these animals are common throughout the area, SCE&G expects negligible reduction in their population as a result of construction. SCE&G does not expect that installation of a gas pipeline would create a long-term reduction in the local or regional diversity of plants and animals. In theory, impacts from construction of a pipeline could be reduced or eliminated by locating the gas-fired plant at a site adjacent to an existing pipeline.

Construction of the power block would impact approximately 87 acres of land. This much previously disturbed acreage is available at VCSNS, reducing loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation buildup, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative. Socioeconomic impacts would result from the approximately 50 people needed to operate the gas-fired facility. SCE&G believes that these impacts would be SMALL due to the mitigating influence of the site's proximity to the surrounding population area.

9.2.3.2.4 Design Alternatives

Subsection 9.4.1 analyzes alternative designs for the Units 2 and 3 heat dissipation systems. Based on this analysis, SCE&G assumed that cooling towers would be used for the gas-fired alternative. Use of cooling towers would minimize impingement, entrainment, and thermal impacts; consumptive water use through evaporation would be a SMALL impact, and 70-foot-high mechanical towers would introduce visual impacts.

9.2.4 CONCLUSION

SCE&G has determined, based on environmental impacts, that neither a coal-fired nor a gas-fired plant would provide an appreciable reduction in overall environmental impact relative to a nuclear plant. This conclusion is shown in detail in Tables 9.2-3 and 9.2-4. Furthermore, each of these types of plants would entail a significantly greater relative environmental impact on air quality than would the proposed project. Therefore, SCE&G concludes that neither a coal-fired or gas-fired plant would be environmentally preferable to the proposed project.

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Table 9.2-1
Coal-Fired Alternative

Characteristic	Basis
Unit size = 738 MWe ISO rating net[(a)]	Assumed
Unit size = 785 MWe ISO rating gross[(a)]	Calculated based on 6% onsite power
Number of units = 3	Assumed
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (U.S. EPA 1998)
Fuel type = bituminous, pulverized coal	Typical for coal used in South Carolina
Fuel heating value = 12,565 Btu/lb	2001 value for coal used in South Carolina (EIA 2006d)
Fuel ash content by weight = 9.75%	2004 value for coal used in South Carolina (EIA 2006d)
Fuel sulfur content by weight = 1.24%	2004 value for coal used in South Carolina (EIA 2006d)
Uncontrolled NO_x emission = 10 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (U.S. EPA 1998)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (U.S. EPA 1998)
Heat rate = 8,568 Btu/kWh	(U.S. EPA 2001) supercritical pulverized coal
Capacity factor = 0.85	Typical for large coal-fired units
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95% reduction)	Best available and widely demonstrated for minimizing NO_x emissions (U.S. EPA 1998)
Particulate control = fabric filters (baghouse-99.9% removal efficiency)	Best available for minimizing particulate emissions (U.S. EPA 1998)
SOx control = Wet scrubber - limestone (95% removal efficiency)	Best available for minimizing SO_x emissions (U.S. EPA 1998)

a) The difference between “net” and “gross” is electricity consumed onsite.

Btu	=	British thermal unit
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60% relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh	=	kilowatt hour
NSPS	=	New Source Performance Standard
lb	=	pound
MWe	=	megawatt electric
NO_x	=	nitrogen oxides
SO_x	=	oxides of sulfur

Table 9.2-2
Gas-Fired Alternative

Characteristic	Basis
Unit size = 738 MWe ISO rating net:[(a)]	Assumed
Unit size = 785 MWe ISO rating gross[(a)]	Calculated based on 4% onsite power
Number of units = 3	Assumed
Fuel type = natural gas	Assumed
Fuel heating value = 1,035 Btu/ft^3	2004 value for gas used in South Carolina (EIA 2006d)
Fuel SO_x emission factor = 0.0007 lb/MMBtu	INGAA No date
NO_x control = selective catalytic reduction with steam/water injection	Best available for minimizing NO_x emissions (U.S. EPA 2000)
Fuel NO_x emission factor = 0.0109 lb/MMBtu	Typical for large selective catalytic reduction-controlled gas fired units with water injection (U.S. EPA 2000)
Fuel CO emission factor = 0.00226 lb/MMBtu	Typical for large selective catalytic reduction-controlled gas fired units (U.S. EPA 2000)
Fuel $PM_{2.5}$ emission factor[(b)] = 0.0019 lb/MMBtu	U.S. EPA 2000, Table 3.1-2a
Heat rate = 5,960 Btu/kWh	Assumed based on manufacturer data (Siemens 2006)
Capacity factor = 0.85	Assumed based on performance of modern plants

a) The difference between “net” and “gross” is electricity consumed onsite.
b) All particulate matter is PM2.5.

ft3 = cubic foot
MM = million
$PM_{2.5}$ = particulates having diameter of 2.5 microns or less

Table 9.2-3
Impacts Comparison Summary

Impact Category	Proposed Action (VCSNS COL)	Coal-Fired Generation	Gas-Fired Generation
Land Use	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL
Air Quality	SMALL	MODERATE	MODERATE
Ecological Resources	SMALL	SMALL	SMALL
Threatened or Endangered Species	SMALL	SMALL	SMALL
Human Health	SMALL	MODERATE	SMALL
Socioeconomics	SMALL	SMALL	SMALL
Waste Management	SMALL	MODERATE	SMALL
Aesthetics	SMALL	SMALL	SMALL
Cultural Resources	SMALL	SMALL	SMALL
Accidents	SMALL	SMALL	SMALL

Table 9.2-4 (Sheet 1 of 4)
Impacts Comparison Detail

Proposed Action (VCSNS COL)	Coal-Fired Generation	Gas-Fired Generation
	Alternative Descriptions	
New construction at the VCSNS COL site	New construction at the VCSNS COL site	New construction at the VCSNS COL site
Two 1,107-MWe (net) AP1000 pressurized water reactors; capacity factor 0.90	Three 738 MWe (net) tangentially-fired, dry bottom boilers; capacity factor 0.85	Three 738 MWe (net) combined-cycle units, consisting of two 198 MWe gas turbines and a 342 MWe heat recovery steam generator; capacity factor 0.85
	Pulverized bituminous coal, 12,565 Btu/pound; 8,568 Btu/kWh; 9.75% ash; 1.24% sulfur; 10 lb/ton NO_x; 5,980,000 tons coal/year	Natural gas, 1,035 Btu/ft^3; 5,960 Btu/kWh; 0.0007 lb sulfur/MMBtu; 0.0109 lb NO_x/MMBtu; 98,900,000,000 ft^3 gas/year
	Low NO_x burners, overfire air and selective catalytic reduction (95% NO_x reduction efficiency).	Selective catalytic reduction with steam/water injection
	Wet scrubber –limestone desulfurization system (95% SO_2 removal efficiency); 231,000 tons limestone/year	
	Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)	
	Upgrade existing rail spur	Construct 35 miles of gas pipeline in a 75-foot-wide corridor, disturbing 318 acres. May require upgrades to existing pipelines.
Construct new switchyard 6 new 230kV transmission lines	Construct new switchyard 6 new 230kV transmission lines	Construct new switchyard 6 new 230kV transmission lines
New closed cycle cooling water system that withdraws water from Monticello Reservoir and discharges to the Broad River.	New closed cycle cooling water system that withdraws water from Monticello Reservoir and discharges to the Broad River.	New closed cycle cooling water system that withdraws water from Monticello Reservoir and discharges to the Broad River.
800 workers	150 workers	50 workers

**Table 9.2-4 (Sheet 2 of 4)
Impacts Comparison Detail**

Proposed Action (VCSNS COL)	Coal-Fired Generation	Gas-Fired Generation
	Land Use Impacts	
SMALL – 240 acres required for facility at VCSNS.	SMALL – 357 acres at VCSNS required for the powerblock and coal storage; 254 acres ash/scrubber waste disposal.	SMALL – 87 acres for facility at VCSNS; 318 acres for pipeline.
	Water Quality Impacts	
SMALL – Construction impacts would be minimized by use of best management practices. Operational impacts would be minimized by use cooling towers and compliance with applicable SCDHEC water quality standards.	SMALL – Construction impacts would be minimized by use of best management practices. Operational impacts would be minimized by use cooling towers and compliance with applicable SCDHEC water quality standards.	SMALL – Construction impacts would be minimized by use of best management practices. Operational impacts would be minimized by use cooling towers and compliance with applicable SCDHEC water quality standards.
	Air Quality Impacts	
SMALL – Construction impacts would be minimized by use of best management practices. Operational impacts are negligible.	MODERATE – 7,044 tons SO_2 per year 1,495 tons NO_x per year 1,495 tons CO per year 16,500,000 tons CO_2 per year 0.25 tons Hg per year 67 tons PM_{10} per year 0.17 tons $PM_{2.5}$ per year	MODERATE – 34 tons SO_2 per year 558 tons NO_x per year 116 tons CO per year 5,630,000 tons CO_2 per year 97 tons $PM_{2.5}$ per year[(a)]
	Ecological Resource Impacts	
SMALL –Construction of the power block would impact approximately 260 acres of terrestrial habitat, displacing various species. Use of cooling towers would minimize impingement, entrainment, and thermal impacts to aquatic species.	SMALL –Construction of the power block and coal storage areas and 40 years of ash/sludge disposal would impact approximately 611 acres of terrestrial habitat, displacing various species. Use of cooling towers would minimize impingement, entrainment, and thermal impacts to aquatic species.	SMALL –Construction of the power block and pipeline would impact up to 405 acres of terrestrial habitat, displacing various species. Use of cooling towers would minimize impingement, entrainment, and thermal impacts to aquatic species.

Table 9.2-4 (Sheet 3 of 4)
Impacts Comparison Detail

Proposed Action (VCSNS COL)	Coal-Fired Generation	Gas-Fired Generation
Threatened or Endangered Species Impacts		
SMALL – No areas designated as critical habitat exist at or near the VCSNS site. Several endangered, threatened, and other special status species are known to occur in Fairfield County and the counties that could be crossed by new power lines. The bald eagle is the only federally or state-listed species that has been observed at or near the VCSNS site. SCE&G and Santee Cooper siting procedures would be employed to avoid adverse impacts to protected species and their habitats.	SMALL – No areas designated as critical habitat exist at or near the VCSNS site. Several endangered, threatened, and other special status species are known to occur in Fairfield County and the counties that could be crossed by new power lines. The bald eagle is the only federally or state-listed species that has been observed at or near the VCSNS site. SCE&G and Santee Cooper siting procedures would be employed to avoid adverse impacts to protected species and their habitats	SMALL – No areas designated as critical habitat exist at or near the VCSNS site. Several endangered, threatened, and other special status species are known to occur in Fairfield County and the counties that could be crossed by new power lines. The bald eagle is the only federally or state-listed species that has been observed at or near the VCSNS site. SCE&G and Santee Cooper siting procedures would be employed to avoid adverse impacts to protected species and their habitats
Human Health Impacts		
SMALL – Impacts associated with noise are not anticipated. Radiological exposure is not considered significant. Risk from microbiological organisms is minimal due to thermal characteristics at the discharge. Risk due to transmission-line induced currents is minimal due to conformance with consensus code.	MODERATE – Adopting by reference NUREG-1437 conclusion that risks such as cancer and emphysema from emissions are likely.	SMALL – Adopting by reference NUREG-1437 conclusion that some risk of cancer and emphysema exists from emissions.
Socioeconomic Impacts		
SMALL – Increase in permanent workforce at VCSNS by 800 workers could affect surrounding counties, but impact would be mitigated by the site’s proximity to metropolitan areas within the region.	SMALL – Increase in permanent workforce at VCSNS by 150 workers could affect surrounding counties, but impact would be mitigated by the site’s proximity to metropolitan areas within the region.	SMALL – Increase in permanent workforce at VCSNS by 50 workers could affect surrounding counties, but impact would be mitigated by the site’s proximity to metropolitan areas within the region.

Table 9.2-4 (Sheet 4 of 4)
Impacts Comparison Detail

Proposed Action (VCSNS COL)	Coal-Fired Generation	Gas-Fired Generation
	Waste Management Impacts	
SMALL – Nonradiological impacts would be negligible. Radiological impacts would be small. All radioactive wastes would be managed according to established laws, regulations, and exposure limits. A disposition path exists for each radioactive waste stream and the anticipated quantities would not challenge the commercially available treatment and disposal capacities.	MODERATE – 146,000 tons of coal ash and 275,000 tons of scrubber sludge per year would require 254 acres over the 40-year term.	SMALL – Almost no waste generation.
	Aesthetic Impacts	
SMALL – Visual impacts would be consistent with the industrial nature of the site.	SMALL – Visual impacts would be consistent with the industrial nature of the site.	SMALL – Visual impacts would be consistent with the industrial nature of the site.
	Cultural Resource Impacts	
SMALL – Impacts to cultural resources would be unlikely due to disturbed nature of the site. SCE&G maintains procedures to protect cultural resources.	SMALL – Impacts to cultural resources would be unlikely due to disturbed nature of the site.	SMALL – Impacts to cultural resources would be unlikely due to disturbed nature of the site.
	Accident Impacts	
SMALL – Although the consequences of accidents could be potentially high, the overall risk of accidents is low given the low probability of an accident involving a significant release of activity.	SMALL – Impacts of radiological accidents are not applicable to coal-fired plants.	SMALL – Impacts of radiological accidents are not applicable to gas-fired plants.

a) All particulates for gas-fired alternative are $PM_{2.5}$.

Notes:

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

MODERATE = Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. (10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3).

gal = gallon

lb = pound

MM = million

PM_{10} = particulates having diameter less than 10 microns

9.3 ALTERNATIVE SITES

As required by 10 CFR 52.17(a)(2), this section provides an analysis of alternative sites to the proposed VCSNS site for the construction and operation of two nuclear power facilities (the proposed project). National Environmental Policy Act mandates that reasonable alternatives to an action be evaluated. Consistent with this requirement, the site selection process focused on those alternative sites that are considered to be reasonable with respect to the purpose of this application for a COL. The objective of this analysis is to verify there is no “obviously superior site” for the eventual construction and operation of the proposed project.

The traditional way of reviewing alternative sites has changed because existing nuclear sites capable of supporting additional units can be included in the mix of alternatives. Existing sites offer decades of environmental and operational information about the impacts of a nuclear plant on the environment. These sites support licensed nuclear facilities; thus, the NRC has found them to be acceptable. The NRC recognizes in NUREG-1555 (U.S. NRC 1999) that proposed sites may not be selected as a result of a systematic review:

> “Recognize that there will be special cases in which the proposed site was not selected on the basis of a systematic site-selection process. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power-plant sites. For such cases, the reviewer should analyze the applicant’s site-selection process only as it applies to candidate sites other than the proposed site, and the site-comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site. As a corollary, all nuclear power plant sites within the identified relevant service area having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant’s proposed site.”

The review process outlined in this section was consistent with the special case noted in NUREG-1555, and took into account the advantages already present at existing nuclear facilities within the relevant service area that have been previously reviewed by NRC and found to be suitable for construction and operation of a nuclear power plant. That prior review process included an alternative site analysis.

9.3.1 REGION OF INTEREST

NUREG-1555 provides that the region of interest includes the state where the candidate site is located, so that alternative sites may be considered for review. Both SCE&G and Santee Cooper have generating facilities that supply electric power to their respective service territories within the state of South Carolina. Therefore, the region of interest is defined as the state of South Carolina.

Generally, the region is rural/agricultural with pockets of heavy population near important waterways such as the Savannah River, or in traditionally populated areas such as the state capital, university campuses, and manufacturing centers.

9.3.2 IDENTIFICATION OF CANDIDATE SITES

In developing a list of reasonable candidate sites, multiple categories of sites were evaluated including federal nuclear facility sites and existing nuclear power plant sites within the identified region of interest. The use of existing nuclear power plant sites for new power generation has many environmental and cost benefits. The federal sites were considered under the assumption that such sites could accommodate new reactor technologies. Additionally, SCE&G considered 18 candidate sites with no existing nuclear facilities that were evaluated in an earlier nuclear SCE&G power plant siting study (Dames & Moore 1974). These sites were reviewed to ensure that there are no sites in the region of interest that are obviously superior to VCSNS.

9.3.2.1 Phased Site Selection Process

Site selection for Units 2 and 3 was conducted in 2005 in accordance with the overall process outlined in the EPRI *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application* (Siting Guide), March 2002. This process, as adapted for the SCE&G site selection study, is shown in Figure 9.3-1.

This process began with a review of a previous site selection study conducted for SCE&G (Dames & Moore 1974), updated, as applicable, with publicly available data. The 1974 study examined the entire state of South Carolina, including offshore locations, for potential nuclear plant sites. Eighteen of the sites evaluated in 1974 were determined to be licensable, but none were found to be obviously superior to VCSNS (Table 9.3-1). Figure 9.3-2 shows the locations of the sites considered in this analysis. Because this analysis indicated that no other sites in the region of interest are likely to be obviously superior to VCSNS, no additional evaluation of the 18 sites was performed during this phase of the site selection process.

Screening-level criteria developed from the EPRI Siting Guide were then used to evaluate the VCSNS site and Savannah River Site (SRS). SRS is the only federal nuclear facility in the region of interest. Once the initial screening-level evaluations were developed, reconnaissance-level, onsite visits to the two sites were conducted to support the site selection analysis.

Using available data and criteria developed based on the EPRI general site criteria, detailed site suitability evaluations of VCSNS and SRS were conducted. Weight factors reflecting the relative importance of each criterion were applied and overall composite site suitability ratings were developed for the two sites. The preferred site for the SCE&G COL application was selected based on these composite ratings and other applicable considerations that relate to the SCE&G and Santee Cooper business plans.

9.3.2.2 Site Screening Criteria

The EPRI general site criteria were used to screen for candidate sites. By using the criteria, sites were selected that:

- Did not pose significant issues that would preclude the use of the site for a nuclear power plant
- Did not cause significant impacts or degradation of local natural resources on the site that would be created
- Did not pose significant impacts to surrounding terrestrial and aquatic ecosystems
- Were not located near major population centers
- Did not affect site development costs significantly, when compared to the proposed site

9.3.2.3 Initial Phase (EPRI) Screening Results

Results of the screening evaluation are presented in Table 9.3-2. The VCSNS site was found to rate higher with regard to railroad access, transmission access, and seismic criteria; the two sites were rated essentially equal in the remaining criteria. Overall, based on the screening-level evaluation, VCSNS was found to be a superior location for the SCE&G COL application.

9.3.2.4 Identification of Representative Nonnuclear Sites for Detailed Analysis

As discussed in Subsection 9.3.2.1, SCE&G reviewed a previous siting study (Dames & Moore 1974) to identify nonnuclear sites in the region of interest that would be suitable for development of new nuclear generating capacity. This study examined a wide variety of sites across the region of interest using criteria similar to the candidate site criteria described in NUREG-1555 and the EPRI general site criteria. Evaluation of the reported characteristics of these sites indicates that 18 of the sites could be potential candidates for new nuclear capacity, but none of them are obviously superior to VCSNS for a new nuclear plant, especially considering its:

- Status as an existing nuclear power plant site
- Availability of adequate land and water for new units
- Availability of existing transportation and transmission infrastructure
- Favorable location with respect to SCE&G and Santee Cooper power loads

The 18 sites were classified as primary, secondary, or tertiary based on the information provided in the 1974 siting study. Primary sites are sites that appear to be licensable with no apparent economic or environmental constraints. Secondary sites are sites that appear to be licensable with one or two economic or environmental constraints. Tertiary sites are sites that appear to be licensable with more than two economic or environmental constraints. Results from the 1974 siting study are presented in Table 9.3-1.

To identify representative sites, SCE&G focused its review on the primary and secondary sites from the 1974 study. All of the primary sites are greenfield sites on the Saluda River near Lake Murray or the Savannah River. All the primary sites have similar environmental characteristics; however, the sites on the Saluda River have more favorable locations based on geotechnical and land use considerations. The Saluda site, an undeveloped property owned by SCE&G, which is located in Saluda County on the Saluda River arm of Lake Murray at the confluence with Mill Creek, was identified as the representative greenfield site. The Saluda site was chosen because of its favorable location on the Saluda River and because it is located within the study area for the Saluda Hydro Relicensing Project, the site characteristics are well documented. Two of the secondary sites are nonnuclear generating facilities—the Cope Generating Station, a 430 MWe coal-fired facility located in Orangeburg County, South Carolina, and the Wateree Generating Station, a 700-MWe coal-fired facility located in Eastover, South Carolina. The two sites have similar environmental characteristics; however, the Cope Generating Station has more available land area and a more favorable location based on lower population density, fewer endangered species, and greater distance from recreational areas and hazardous facilities.

9.3.2.5 Federal Sites

The only federal site within the region of interest is the U.S. DOE's SRS near Aiken, South Carolina. The SRS was selected as a candidate site because:

- The site represents a valuable national asset with prior or existing nuclear energy potential.
- New nuclear power facilities would represent potentially promising new missions for the SRS.
- The site has the potential to support reactor demonstrations and/or commercial reactor development.
- There is extensive site information and an available infrastructure that could help to reduce site development costs.

Because of the partially developed site environment and the available infrastructure, the incremental environmental impacts associated with the new plant construction and operation on land use, ecological resources, aesthetics, and local transportation network are reduced.

The site is not near major population centers.

The 310-square-mile SRS is about 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. Augusta is the largest city in the vicinity with a 2000 census population of 195,182 (USCB 2000a). The site is located in a generally rural area on the Savannah River in southwest South Carolina. The entire area within 5 miles about the center of the site is government-owned property, with approximately 95% of the site undeveloped. The SRS has an extensive history of nuclear facilities, with substantial site characteristic information and infrastructure available to support DOE and new nuclear-related missions.

9.3.2.6 Existing Nuclear Sites

There are four commercial nuclear sites within the region of interest: the two-unit Catawba Nuclear Plant, the single-unit Robinson Nuclear Plant, the three-unit Oconee Nuclear Station, and the single-unit VCSNS. Of these sites, the only one controlled by SCE&G is VCSNS.

There are obvious benefits to locating a new nuclear power plant at VCSNS rather than a nonnuclear site. These benefits are summarized below:

9.3.2.6.1 Environmental Benefits

- The environmental conditions and the environmental impacts of VCSNS are known from data collected during years of monitoring air, water, ecological, and other parameters. Based on the knowledge of the reactors and ancillary facilities being considered, it is reasonable to assume that the impacts of additional units would be comparable to those of the operating unit.
- Construction of new transmission corridors may be avoided if the existing transmission system (lines and corridors) can accommodate the increased power generation. This could substantially reduce environmental impacts associated with construction of the new plant.
- No additional land acquisitions would be necessary if a new transmission corridor can be avoided, and the resulting land use impacts of the new plant would be small.
- The site has already been subject to the alternative review process mandated by the NEPA.
- Extensive environmental studies performed during the Unit 1 site selection process can be updated and used for new units.

9.3.2.6.2 Constructability and Cost Benefits

- Site physical criteria, including primarily geologic/seismic suitability, has been characterized at VCSNS.
- No additional land acquisitions would be necessary, if a new transmission corridor can be avoided and the site can accommodate the land requirements of the new units.
- Plant construction, operation, and maintenance costs would be reduced because of existing site infrastructure (*e.g.*, roads, transmission lines, water source, intake/discharge system) and its maintenance.

9.3.2.6.3 Other Benefits

- VCSNS has nearby power markets.
- VCSNS has gained local community acceptance and support.
- VCSNS has relevant nuclear experience.

9.3.2.7 Sites Without Existing Nuclear Facilities

In addition to VCSNS and SRS, SCE&G also chose to compare a representative nonnuclear generating facility and a representative greenfield site as alternative sites in this review. As discussed in Subsection 9.3.2.4, SCE&G selected two representative sites, Cope Generating Station and the Saluda site, based on a review of 18 potential nuclear sites that were identified in Dames & Moore 1974. The Saluda site was chosen because of its favorable location on the Saluda River and because it is located within the study area for the Saluda Hydro Relicensing Project, the site characteristics are well documented. Cope Generating Station was chosen because of the availability of land and its favorable location based on lower population density, fewer endangered species, and distance from recreational areas and hazardous facilities.

9.3.3 ALTERNATIVE SITE REVIEW

The proposed site (VCSNS) is reviewed at length in this environmental report. This subsection reviews other candidate sites using the selection criteria suggested in NUREG-1555, in order to consider whether any of the candidate sites is obviously superior to VCSNS.

Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations* (U.S. NRC 1976) notes: “The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type investigations need be conducted.” The alternatives described here are compared based on recent information about existing facilities and the surrounding area, and existing environmental studies. The Saluda site, an undeveloped (greenfield) site on the Saluda River arm of Lake Murray, was also reviewed to determine if this greenfield site was obviously superior to an existing nuclear site, and if greenfield sites in general were obviously superior.

In accordance with 10 CFR 51, potential impacts from construction and operation of the proposed project at candidate sites other than the proposed site are analyzed, and a single significance level of potential impact (*i.e.*, SMALL, MODERATE, or LARGE) is assigned to each analysis 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.

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.

For some analyses, SCE&G determined the criteria used by NRC in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (U.S. NRC 1996), were appropriate for the analyses presented here and reviewed the criteria to assign a significance level to impacts.

Impact initiators for the alternative sites are the same as those described in Chapter 4 for construction and Chapter 5 for operation of Units 2 and 3 at VCSNS.

9.3.3.1 Evaluation of the Savannah River Site

The SRS, owned by the DOE, is an approximately circular tract of land occupying 310 square miles in the Aiken, Barnwell, and Allendale counties in southwestern South Carolina. All of the area within 5 miles from the center of SRS is government-owned property. The center of SRS is approximately 25 miles southeast of the city limits of Augusta, Georgia; 100 miles from the Atlantic Coast; and about 110 miles south-southeast of the North Carolina border. The largest nearby population centers are Aiken, South Carolina, and Augusta, Georgia. The only towns within 15 miles of the center of SRS are New Ellenton, Jackson, Barnwell, Snelling, and Williston, South Carolina. The SRS is bounded along its southwest border by the Savannah River for about 35 river miles (Dominion 2002). The site for the proposed project at SRS is a 500-acre parcel that lies on the Aiken County-Barnwell County line approximately 6 miles from the nearest SRS boundary to the north (Figure 9.3-3).

The SRS is not open to the public, but specific access is permitted for guided tours, controlled hunts of species including whitetail deer and feral hogs, and environmental studies. In addition, the public can traverse portions of the site along established transportation corridors. These include a rail line for CSX Transportation Inc. railroad, and road traffic along South Carolina State Route (SC) 125 (SRS Road A), US-278, and SRS Road 1 near the northern edge of the site. SRS highways connect with state highways leading northward to Interstate Routes 20, 26, and 85 and eastward to I-26 and I-95. (Dominion 2002)

9.3.3.1.1 Land Use Including Site and Transmission Line Rights-of-Way

SRS occupies approximately 198,000 acres in a generally rural area. Administrative, production, and support facilities occupy 5% (approximately 17,000 acres) of the total SRS area. The remaining land, approximately 181,000 acres, is forestland and swamp managed by the U.S. Department of Agriculture Forest Service under an interagency agreement with DOE. Approximately 14,000 acres of SRS have been set aside exclusively for nondestructive environmental research in accordance with the designation of SRS as a National Environmental Research Park. (Dominion 2002)

Prominent geographical features within 50 miles of SRS are Thurmond Lake (formerly called Clarks Hill Reservoir) and the Savannah River. Thurmond Lake, operated by the U.S. Army Corps of Engineers, is the largest nearby public recreational area. This lake is an impoundment of the Savannah River and is located about 40 miles northwest of the center of SRS. (Dominion 2002)

The principal surface-water body associated with SRS is the Savannah River, which flows along the site’s southwest border. Six principal tributaries to the Savannah River can be found on SRS: Upper Three Runs Creek, Beaver Dam Creek, Four Mile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek (Dominion 2002).

The SRS elevations range from 80 feet MSL at the Savannah River to approximately 400 feet MSL about 1 mile south of the intersection of Highways 19 and 278. Two distinct physiographic subregions are represented at SRS. They are the Pleistocene Coastal Terraces, which are below 270 feet MSL in elevation, and the Aiken Plateau, which is above 270 feet MSL in elevation. The lowest terrace is the present floodplain of the Savannah River. The higher terraces have level to gently rolling topography. The Aiken Plateau subregion is hilly and cut by small streams (Dominion 2002).

DOE is considering several new facilities at SRS and additional private initiatives are encouraged. Land use issues from the proposed project would be mostly limited to the SRS property due to its large size. The proposed project would require that a small portion (approximately 500 acres) of the site be cleared for development. If undisturbed land were used for the proposed project, habitat for onsite wildlife could be reduced. However, these impacts would be SMALL because greater than 180,000 acres of wildlife preserve at SRS would remain undisturbed.

The transmission system on the SRS consists of multiple transmission lines forming a ring network around the site. The existing onsite transmission system would not be capable of transmitting the power from two new nuclear power facilities to offsite locations. SCE&G assumed that each AP1000 unit would necessitate the addition of three 230kVt transmission lines, requiring a 170-foot-wide transmission corridor. For each AP1000 unit, it is assumed that one transmission line would connect to the Barnwell substation, approximately 13 miles southeast of the SRS project site; another line would connect to the Orangeburg substation, approximately 45 miles northeast of the SRS project site; and the third line would connect to the Graniteville substation, approximately 22 miles northwest of the SRS project site. Routing the new transmission lines would require about 1,650 acres of transmission corridor. Although the most direct route would, in general, be used between terminations, consideration would also be given to avoiding possible conflicts with any natural or man-made areas where important environmental resources are located. Route selection would also avoid populated areas and residences to the extent possible. The procedures for adding new transmission lines to connect the proposed project at SRS to the transmission grid are similar to those described in Subsection 4.1.2. Land-use, which is currently a mixture of natural forests and planted forests used for timber production would be altered. Trees would be replaced by grasses and other low-growing types of ground cover. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect residents along the right-of-way. The land use impacts associated with the addition of six 230kV transmission lines could be MODERATE, but would be mitigated by careful siting to avoid sensitive land uses.

The region surrounding the SRS is not within the South Carolina Coastal Zone and the route for the new transmission lines would not pass through any portion of the South Carolina Coastal Zone (SCDHEC 1995).

9.3.3.1.2 Air Quality

The SRS site is located in Augusta (Georgia)-Aiken (South Carolina) Interstate Air Quality Control Region (40 CFR 81.114), which is designated as being unclassified or in attainment of the National Ambient Air Quality Standards (NAAQS) (40 CFR 81.341). The nearest non-attainment areas are Lexington and Richland Counties (the Columbia, South Carolina metropolitan area), which are classified as non-attainment areas due to exceedances of the 8-hour ozone standard (40 CFR 81.341). These counties are approximately 30 miles north and 50 miles northeast of the SRS site, respectively.

Air quality impacts from construction and operation of the proposed project at SRS would be similar to those at the VCSNS site as described in Subsections 4.4.1.3 and 5.8.1.2, respectively. Construction impacts would be temporary, and would be similar to any large-scale construction project. Construction emissions would include dust from disturbed land, roads, and construction activities and emissions from construction equipment. Mitigation measures similar to those described in Subsection 4.4.1.3 would be taken. During station operation, standby diesel generators would be used for auxiliary power. It is expected that these generators would see limited use and, when used, they would operate for short time periods. The proposed project would be subject to a Conditional Major Operating Permit to ensure that the facility operations would not interfere with attaining or maintaining Primary and Secondary NAAQS (SCDHEC 2006a). Therefore, air pollutant emissions from the standby diesel generators and auxiliary power systems are expected to be minimal and would not result in any violation of NAAQS.

The Cape Romain National Wildlife Refuge, approximately 112 miles east of SRS, is the closest mandatory Class I federal area in which visibility is an important value (40 CFR 81, Subpart D). Because there are no mandatory Class I federal areas within 50 miles of the site, any potential visibility impacts from the proposed units on Class I areas would be negligible.

The air quality impacts from construction and operation of the proposed project at SRS would be SMALL.

9.3.3.1.3 Hydrology, Water Use, and Water Quality

The Savannah River is the principal surface water source for SRS and runs along the southern site boundary for a distance of about 35 river miles. There are 6 tributaries to the Savannah River that drain the SRS. In addition, SRS has two water impoundments with surface areas totaling approximately 3,700 acres. These impoundments were used for cooling three nuclear production reactors that are no longer operational. (Dominion 2002)

The annual mean and lowest annual mean flows for the 1952–2005 period of record for the Savannah River at Augusta, Georgia (Station 02197000) were 9,200 cfs and 4,470 cfs, respectively (USGS 2006). SRS (including D-Area Power House), SCE&G's Urquhart Station, and the Vogtle nuclear plant are the major water users in the area. In 2004, these facilities used an average of 73 cfs, 128 cfs, and 99 cfs, respectively, for a total average of 300 cfs of water from the Savannah River (SNC 2006).

SCE&G assumes that the proposed project at SRS would withdraw makeup water from either the Savannah River or one of the existing SRS impoundments. As shown on Figure 3.3-1, the average withdrawal rate for two nuclear power facilities, including makeup for the cooling towers, during normal operations would be approximately 37,200 gpm (83 cfs) and 61,800 gpm (138 cfs) during maximum use operations. Consumptive loss of water during normal operations would be 27,800 gpm (62 cfs) and 31,100 gpm (69 cfs) during maximum use operations. Therefore, the cumulative net loss to the Savannah River would be a maximum of 369 cfs. The cumulative loss for the proposed project would represent 4.0% of the annual mean flow and 8.3% of the lowest annual mean flow for the Savannah River. Therefore, SCE&G expects that impact from surface water use for construction and operation of the proposed project would be SMALL.

Several aquifers occur under the SRS; however, none are federally designated sole-source aquifers (U.S. NRC 2005). The DOE is required to report SRS groundwater usage to South Carolina, but there is no regulation restricting groundwater withdrawals (U.S. NRC 2005). At the SRS, groundwater is the only source of potable water (U.S. 2005). All groundwater at the SRS is classified by the U.S. EPA as a Class II water source (*i.e.*, a current and potential source of drinking water) (U.S. NRC 2005). The existing capacity at the SRS is approximately 8.9 billion gallons of water per year (U.S. NRC 2005). In 2000, the SRS withdrew 2.1 billion gallons from the Crouch Branch Aquifer to support site operations (U.S. NRC 2005). Using the general assumption of 2.0 liters as average daily water consumption by an adult, it can be assumed that with the anticipated construction and operations workforce could increase this annual withdrawal by a maximum of 0.03%, based on a five-day work week. Most of the potable water produced is used directly by the SRS workforce population; however, some potable water is used for equipment cooling, fire protection water, and as makeup water to cooling towers (U.S. DOE 2005). The amount of groundwater pumped at SRS has had only localized effects on water levels in the three aquifers used for potable water, and it is unlikely that water usage at the site will ever cause drawdown problems that could impact surrounding communities (WSRC 2006). Therefore, SCE&G expects that impact from groundwater use for construction and operation of the proposed project would be SMALL.

The proposed project would operate under a National Pollutant Discharge Elimination System (NPDES) permit issued by the South Carolina Department of Health and Environmental Control (SCDHEC). As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating discharges into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or human health. Any releases of contaminants to the Savannah River (or other South Carolina waters) as a result of construction or operation of the proposed project at the SRS site would be regulated by the SCDHEC through the NPDES permit process to ensure that water quality is protected. Therefore, impacts to water quality would be SMALL.

9.3.3.1.4 Terrestrial Resources Including Protected Species

SRS occupies approximately 198,000 acres in a generally rural area. Administrative, production, and support facilities occupy 5% of the total SRS area. The remaining land, approximately 181,000 acres, is forestland and swamp managed by the U.S. Department of Agriculture Forest Service under an interagency agreement with DOE. Approximately 14,000 acres of SRS have been set aside exclusively for nondestructive environmental research in accordance with the designation of SRS as a National Environmental Research Park. It is assumed that structures for the proposed project would require that a portion of the wildlife preserve be cleared and developed. (Dominion 2002)

The SRS site consists of mostly wooded land, predominantly loblolly and slash pine that have been planted since the late 1950s (Dominion 2002). The site is part of a designated forest timber unit under the SRS land use system. U.S. Department of Agriculture Forest Service-Savannah River would coordinate the removal and sale of marketable timber from the site (Dominion 2002). SRS has a large number of wetland areas, including approximately 300 Carolina bays (U.S. NRC 2005). However, there are no wetlands on the proposed project site (Dominion 2002).

Terrestrial wildlife species that reside in the forested portions of the SRS property are those typically found in similar habitats in South Carolina. Common mammals at the site include the opossum *(Didelphis virginiana)*, eastern cottontail *(Sylvilagus floridanus)*, gray squirrel *(Sciurus carolinensis)*, raccoon (*Procyon lotor)*, and whitetail deer *(Odocoileus virginianus)*. Numerous bird species (*e.g.*, wild turkey *[Meleagris gallopavo]*, northern mockingbird *[Mimus polyglottos]*, and various warblers) reside at the site. The SRS has one of the nation's highest biodiversity of reptiles and amphibians because of its climate and wide variety of habitats. Populations of whitetail deer, feral hogs, and beavers are controlled through selective harvest strategies, which include controlled hunts that are open to the public to help regulate deer and feral hog populations. Increasing numbers of coyotes and armadillos may require the SRS to initiate control measures for these species in the future. (U.S. NRC 2005)

Eight federally listed threatened or endangered terrestrial species are known to reside in the vicinity of SRS or its transmission lines: the endangered wood stork (Mycteria americana), the endangered red-cockaded woodpecker *(Picoides borealis)*, the threatened (by virtue of its similarity to the endangered American crocodile *[Crocodylus acutus]*) American alligator *(Alligator mississippiensis)*, the threatened Carolina Slabshell *(Elliptio congarea)*, the endangered Canby's dropwort *(Oxypolis canbyi)*, the endangered Piedmont mock bishopweed *(Ptilimnium nodosum)*, the endangered Relict Trillium *(Trillium reliquum)*, and the endangered smooth coneflower *(Echinacea laevigata)*. SRS contains no designated critical habitat for any listed threatened or endangered species. (U.S. NRC 2005)

Before construction activities, SCE&G would be required to perform a detailed survey to ensure protection of all endangered species. Construction impacts on terrestrial resources (including threatened or endangered species) would be SMALL because mitigation would be performed. Impacts of operation of the proposed project would also be SMALL because sufficient habitat would remain at SRS to support existing wildlife.

9.3.3.1.5 Aquatic Resources Including Protected Species

Six major streams and several associated tributaries flow through the SRS and the Savannah River bounds the southwestern border of the SRS. Two large reservoirs—L Lake on Steel Creek, and Par Pond on Lower Three Runs Creek—previously provided production reactor cooling water. (U.S. NRC 2005)

At least 81 fish species have been identified at the SRS. Sport fishing on the SRS is allowed only within the Crackerneck Wildlife Management Area. Extensive fishing also occurs in the Savannah River. Commercial fish species include the American Shad *(Alosa sapidissima)*, hickory shad (*Alosa mediocris*), and striped bass (*Morone saxatilis*). Recreational fish species include largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), and various crappie, bream, sunfish, and catfish. Many man-made ponds support populations of bass and sunfish. (U.S. NRC 2005)

The only federally listed (and state-listed) species in the vicinity of SRS is the endangered shortnose sturgeon *(Acipenser brevirostrum)* (U.S. NRC 2005), which spawns in the Savannah River upstream of SRS. Some SRS surface waters are classified as Category I resources that are defined by the U.S. Department of the Interior as unique and irreplaceable on a national or eco-regional basis (U.S. NRC 2005). Any surface waters supporting species of concern and areas containing high-quality wetlands or headwater streams (*e.g.*, portions of Upper Three Runs Creek) would also be considered for Category I status (U.S. NRC 2005).

Water from the Savannah River was used for nuclear reactor condenser cooling at SRS and would be expected to be used to cool the proposed project constructed at the site. Although aquatic biota, including the common southeastern fishes described previously, would be temporarily displaced during construction of new intake and discharge structures, they would be expected to recolonize the area after construction is complete. Any disturbance to aquatic resources from construction would be localized and of relatively short duration. Any impacts of construction on aquatic resources, including federally listed threatened and endangered species would be SMALL.

Withdrawing water from the Savannah River for the proposed project is not expected to result in significant adverse impacts to aquatic environments as a result of impingement and entrainment because the proposed project would use cooling towers, which are considered Best Technology Available by the EPA. The EPA's recent rulings on cooling water intake structures (40 CFR Part 125) require new facilities to meet criteria designed to protect organisms from entrainment and impingement. The potential for adverse impacts to aquatic resources from the operation of the proposed project at SRS would be SMALL.

9.3.3.1.6 Socioeconomics

This subsection evaluates the social and economic impacts to the surrounding region as a result of constructing and operating the proposed project at the SRS. The evaluation assesses impacts of construction, station operation, and demands placed by the construction and operation workforce on the surrounding region.

9.3.3.1.6.1 Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odors, vehicle exhaust, and dust. Vibration and shock impacts would not be expected because of the strict control of blasting and other shock-producing activities by SRS. It is assumed that all construction activities would occur within the site boundary for the proposed project and within the existing SRS property, which is an industrial area, surrounded by forests. The use of public roadways and railways would be necessary to transport construction materials and equipment. Commuter traffic would be controlled by speed limits which, in connection with good road conditions, would minimize the noise level and dust generated by the workforce commuting to the site. No extensive work would be required to the existing public roads or railways and no new offsite routes would be required.

Offsite areas that would support construction activities (*e.g.*, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. The proposed project would produce noise from the operation of pumps, fans, transformers, turbines, generators, and switchyard equipment. Vehicular traffic would also be a source of noise. However, noise attenuates quickly so that noise levels would be minimal at the project boundary. SRS is a large industrial area surrounded by forests and agricultural land and no one resides within 5 miles of the proposed project site.

The proposed project would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the proposed project would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values.

Construction activities would be temporary and would occur mainly within the site boundary for the proposed project. Offsite impacts would represent small incremental changes to existing offsite impacts. During station operations, ambient noise levels would be minimal at the site boundary for the proposed project. Air quality permits would be required for the diesel generators, and chemical use would be limited, which would limit odors. Therefore, the physical impacts of construction and operation would be SMALL.

9.3.3.1.6.2 Demography

The SRS is an approximately circular tract of land occupying 310 square miles in the Aiken, Barnwell, and Allendale counties in southwestern South Carolina. All of the area within 5 miles from the center of SRS is government-owned property. The center of SRS is approximately 25 miles southeast of the city limits of Augusta, Georgia; 100 miles from the Atlantic Coast; and about 110 miles south-southeast of the North Carolina border. The SRS is bounded along its southwest border by the Savannah River for about 35 river miles. (Dominion 2002)

Of the current workers at SRS, 84% reside in the Richmond and Columbia counties in Georgia and Aiken, and Barnwell counties in South Carolina. Therefore, these four counties comprise the region of influence and are the focus of the analysis. The remaining 15% of the current workers maintain a permanent address elsewhere (Dominion 2002). Of the current employees who live in the region of influence, approximately 60.7% would settle in Aiken County, 7.1% in Barnwell County, 20.2% in Richmond County, and 11.9% in Columbia County. SCE&G assumed that the construction workforce who would migrate to the four-county region from outside the region would locate in individual counties in approximately the same proportion as the current SRS workforce has chosen to live.

Based on the 2000 census, the total population of the four most affected counties is 455,093 people. The 2000 population within the counties was 142,552 in Aiken County, 23,478 in Barnwell County, 199,775 in Richmond County, and 89,288 in Columbia County (USCB 2000b). The population within 50 miles of the site was 766,127 (97.5 people per square mile), and the population within 20 miles of the site was 101,249 people (80.6 people per square mile) (U.S. NRC 2003). The nearest population center, as defined in 10 CFR 100, is Aiken, South Carolina (population 25,337); to the northwest of the SRS site (USCB 2000c). The distance between the SRS site and the Aiken city limits is approximately 13 air miles, with the distance to the center of the city approximately 17.5 miles. Based on the sparseness and proximity matrix in NUREG-1437, the SRS site is located in a medium population area.

SCE&G estimates that the peak construction workforce for the proposed project at the SRS would be 3,600. Approximately 70% of the required workforce would be skilled crafts labor and approximately 30% of the workforce is expected to be management or related administrative support personnel. SCE&G estimates that 50% of the skilled crafts workers (1,260 people) would be drawn from within the four-county region, with the remainder of skilled crafts workers (1,260 workers) and 100% of the managerial/administrative support personnel (about 1,080 individuals) residing outside of the region of influence.

Of the 2,340 construction workers in-migrating to the region of influence, 1,800 would bring their family and 540 would relocate without families. The average household size in South Carolina is 2.53 people (USCB 2002a). Therefore, construction would increase the population in the region of influence by 5,094 people, which is approximately 1.1% of the four-county population in 2000. SCE&G assumed that the in-migrating construction workforce and their families would settle in Richmond and Columbia counties in Georgia and Aiken and Barnwell counties in South Carolina in approximately the same proportions as the current SRS workforce. Based on 2000 census data, the addition of the new employees and their families would increase the population in Aiken County by 2.2%, Barnwell County by 1.5%, Richmond County by 0.5%, and Columbia County by 0.7%. SCE&G is adopting the NRC definition of impacts as small if plant-related population growth is less than 5% of the study area's total population. Therefore, the potential increases in population during construction of the proposed project at SRS would represent a SMALL impact for all of the four-counties.

As discussed in Subsection 9.3.3.1, the SRS is owned by the DOE and is not open to the public. Access to the SRS is controlled by an established security force. Other site support functions (*e.g.*, grounds maintenance, emergency services, etc.) would also be provided by the existing SRS workforce. Therefore, SCE&G assumes that no additional workers are required beyond those already included in Subsection 5.8.2.1. Based on the analysis in Subsection 5.8.2.1, SCE&G estimates that 800 workers would be required for the operation of nuclear power facilities at the SRS. Most of these workers would be expected to come from within the region of influence. Any employees relocating to the region would most likely be scattered throughout the counties in the region, with most choosing to live in Aiken, Barnwell, Richmond, or Columbia counties. If all 800 employees and their families were to come from outside the region, the potential increase in population in the most affected counties would not be substantial. *For example*, the 800 employees would translate into an additional 2,024 people (assuming an average household size of 2.53 people). Based on 2000 census data, the addition of the new employees and their families would increase the population in Aiken County by 0.9%, Barnwell County by 0.6%, Richmond County by 0.2%, and Columbia County by 0.3%. Overall, the small potential increase in population from operation of the proposed project at the SRS site would represent a SMALL impact on the total population for the four counties.

9.3.3.1.6.3 Economy

Based on 2000 census data, within the region of influence, there are 218,694 people in the labor force. Of those people in the labor force, 95.8% are in the civilian labor force and 4.2% are in the armed forces. Of the civilian labor force, 93.4% are employed and 6.6% are unemployed (USCB 2000d). The overall unemployment rate for the four-county region is higher than that of South Carolina and Georgia, which are 5.9% and 5.5%, respectively (USCB 2002a, 2002b).

In 2000, Aiken County had a civilian labor force of 67,734 people and an unemployment rate of 5.9%. Barnwell County had a civilian labor force of 10,195 people and an unemployment rate of 7.7%. Richmond County had a civilian labor force of 86,904 people and an unemployment rate of 8.4%. Columbia County had a civilian labor force of 44,727 people and an unemployment rate of 3.6% (USCB 2000d).

The economy of the four-county region has a dominant service base followed by manufacturing, transportation and utilities, and retail trade. (USCB 2000d)

An influx of 2,340 construction workers migrating into the region would have positive economic impacts in the region. Assuming a multiplier of 1.75 jobs (direct and indirect) for every construction job (U.S. BEA 2007a), an influx of 2,340 construction workers would create 1,762 indirect jobs, permanent or temporary, for a total of 4,102 new jobs in the region of influence. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries, including the housing industry. Workers would be expected to spend most of their earnings in the county of permanent residence; hence, most of the indirect jobs related to the SRS site construction activities would be in those counties in proportion to the residential distribution patterns. However, Aiken and Barnwell counties could receive a disproportionately high number of these indirect jobs because the large onsite workforce would likely purchase fuel, food, and other incidentals in these counties. Barnwell County would experience the greater socioeconomic impacts because of its relatively small population and employment base. In the two other counties, Columbia and Richmond, the socioeconomic impacts would be less.

SCE&G concludes that the impacts from construction on the economy or labor force in the region of influence would be SMALL in Aiken, Columbia, and

Richmond County. The impact in Barnwell County would be SMALL to MODERATE because the proposed project is partially located in the county and because the county currently has such a small labor pool and population base. Because the impacts enhance the economic viability of the county specifically and the region of influence generally, mitigation would not be warranted.

As discussed in Subsection 9.3.3.1.6.2, about 800 workers would be required for the operation of two nuclear power facilities at the SRS site. SRS employs a highly skilled work force, most of which is college educated. During the last decade, SRS has undergone a major downsizing. The addition of commercial nuclear power facilities would be expected to add jobs of similar quality to the existing workforce, many of which could be filled by current or former SRS employees (Dominion 2002). However, for the purpose of analysis, SCE&G conservatively assumes that all the new employees would migrate into the region. Assuming a multiplier of 2.64 jobs (direct and indirect) for every operations job at the proposed project (U.S. BEA 2007a), an influx of 800 workers would create 1,312 indirect jobs for a total of approximately 2,112 new jobs in the region. SCE&G concludes that the impacts of operation of the proposed project on the economy would be beneficial and SMALL everywhere in the region of influence.

9.3.3.1.6.4 Taxes

Taxes collected as a result of constructing and operating the proposed project at the SRS would be of benefit to the state and local jurisdictions that collected and spent them. Corporate and personal income taxes and sales and use taxes would be collected during both the construction and operation of a commercial nuclear power facility at the SRS. In lieu of property taxes, the SRS, a federally owned property, pays a fee to the counties whose land area includes the SRS. For 2002, Barnwell County received a fee of approximately $2 million, Aiken County approximately $800,000, and Allendale County approximately $100,000. The proposed project site lies on the Aiken County-Barnwell County line. Adding commercial nuclear power facilities to the SRS would increase the fee base to Aiken and Barnwell counties for the life of the proposed project. (Dominion 2002)

The current fees paid by SRS represented 0.28% and 3.3% of the total 2002 revenues for Aiken and Barnwell counties, respectively (SCORS 2005). The increased fees from the proposed project would be for the facilities, not the land; therefore, it is assumed that the fees paid to Aiken and Barnwell counties would increase by a small percentage. Since the workforce for construction and operation of the proposed project represents less than 1.0% of the total population in the region of influence, tax revenues generated by the additional workforce would also represent a small percentage of the taxes paid in the region. The benefits of taxes are defined by the NRC as SMALL when new tax payments represent less than 10% of total revenues for local jurisdictions. Therefore, SCE&G concludes that the potential impacts of taxes collected during construction and operation of the proposed project would be SMALL and beneficial in the region of influence.

9.3.3.1.6.5 Transportation

The regional transportation networks in the SRS vicinity serve four South Carolina counties (Aiken, Allendale, Bamberg, and Barnwell) and two Georgia counties (Columbia and Richmond), from which 88% of SRS commuter traffic is generated. One interstate highway serves the SRS area. I-20 provides a primary east-west corridor in the region. US-1 and US-25/SC 121 are principal north-south routes in the region, and US-78 and US-278 provide east-west connections. Several other highways (US-221, US-301, US-321, and US-601) provide additional transport routes for the area. For the roads in the general region, the worst case Level of Service is associated with routes near the Savannah River bridges, including I-20 and US-1 and urban routes in North Augusta and Aiken, including SC 230, SC 25, SC 19, and SC 118. Long delays are experienced offsite along routes I-20, US-25, and US-1 where they cross the Savannah River. General weight, width, and speed limits have been established for highways in the SRS vicinity. However, there are no unusual laws or restrictions that would significantly influence general regional transportation. (Dominion 2002)

Access to SRS is controlled. The SRS is served by more than 200 miles of primary roads and more than 1,000 miles of unpaved secondary roads. In the past, significant traffic congestion occurred during peak traffic periods on road 1A and on US-278 at SRS access points (Dominion 2002). Two of the major access points, SC 19 and SC 125, were enlarged in 2006 to remedy the congestion on these routes.

Most materials are transported to and around the SRS by road. Rail transportation is used to move irradiated fuel and certain high-level radioactive wastes and to transport coal for steam plants; there are sufficient rail lines near the site for the proposed project. (Dominion 2002)

The Savannah River is part of the U. S. Inland Waterway System and an authorized navigation channel exists from the mouth of the Savannah River to Augusta, Georgia. All of the major large components for the Vogtle plant were delivered by barge using the Savannah River navigation channel and, in recent years, several decommissioned reactor vessels have been transported by barge to SRS for offloading and overland transport to Energy Solutions' low-level waste disposal facility in Barnwell. SCE&G would coordinate with the Savannah District Corps of Engineers, who operates and maintains the channel, to develop a strategic plan to support any required shipments for the proposed project. The plan would include a schedule of shipments, identify maintenance needs and navigation aids, and identify contingencies, where appropriate.

Approximately 13,000 people work at the SRS. For the proposed project, up to 3,600 personnel could be required (Subsection 9.3.3.1.6.2). This increase is around 28% of the existing site workforce. As many as 26,000 people were employed at SRS in the recent past. The extensive existing roadway network in the area is capable of handling the additional 28% workforce commuting and transportation of bulk materials to and from the site. (Dominion 2002)

Transportation impacts are considered small when increases in traffic do not result in delays or other operational problems, moderate when increases in traffic begin to cause delays or other operational problems. With implementation of some traffic control measures (*i.e.*, staggering shift changes), the construction and operation of new nuclear power facilities at the SRS site would result in minimal impacts on existing traffic patterns, workforce commute traffic, and rail/truck delivery of materials (Dominion 2002). Therefore, impacts of the workforce from the proposed project on transportation would be SMALL.

9.3.3.1.6.6 Aesthetics and Recreation

SRS is an approximately circular tract of land occupying 310 square miles in Aiken, Barnwell, and Allendale counties in southwestern South Carolina. All of the area within 5 miles from the center of SRS is government-owned property. The SRS is not open to the public, but specific access is permitted for guided tours, controlled deer hunts, and environmental studies.

Recreational areas within 50 miles of SRS include Sumter National Forest, Santee National Wildlife Refuge, and Thurmond Lake. State, county, and local parks include Redcliffe Plantation, Rivers Bridge, Barnwell and Aiken County State Parks in South Carolina, and Mistletoe State Park in Georgia. The Crackerneck Wildlife Management Area, which includes a portion of SRS along the Savannah River, is open to the public for fishing (U.S. NRC 2005).

The attractiveness of the Savannah River for sport fishing and other recreational uses could be impacted during construction of intake and discharge structures. Other recreational facilities would be affected by increased traffic on area roads during peak travel periods, but impacts would be minimal. During the operating period, it is expected that some employees and their families would use the recreational facilities in the region. However, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

The site for the proposed project at SRS is more than 6 miles from the nearest SRS boundary. With the exception of the intake structure on the Savannah River, all facility structures would be located at the project site. The intake would be visible from the Savannah River immediately upstream or downstream of the facilities but, from most points, the structure would be hidden by river bends, elevated terrain, and vegetation. Other facility structures would not be visible from offsite locations. The proposed project would be built in an established industrial area and the size and appearance of facility structures would be similar to those of existing buildings in adjacent areas. Mechanical draft cooling towers would be required and would be similar in design to the cooling towers for the proposed reactors at VCSNS. The additional plumes would resemble cumulus clouds when seen from a distance. Impacts on aesthetic resources are considered to be small if there are no complaints about diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the proposed project on aesthetics would be SMALL and would not warrant mitigation.

9.3.3.1.6.7 Housing

SCE&G estimates that 2,340 workers would move from outside the region of influence to one of the counties inside the region of influence. All 2,340 workers would need housing. Some of the workers would require permanent housing, generally owner-occupied, and others would elect to rent housing. Still others would elect to reside in transitional housing such as residential hotels, motels, rooms in private homes, or to bring their own housing in the form of campers and mobile homes.

Based on 2000 census data, within the region of influence, there are 187,811 housing units of which 18,163 are vacant (9.7%). In 2000, the number of vacant housing units within each of the counties was 6,400 (10.3%) in Aiken County, 1,170 (11.5%) in Barnwell County, 8,392 (10.2%) in Richmond County, and 2,201 (6.6%) in Columbia County (USCB 2000b). In 2006, approximately 3,000 permits were issued for construction of new housing units in the Augusta-Aiken, Georgia-South Carolina metropolitan statistical area (Housing Economics 2007).

SCE&G estimates that, in absolute numbers, the available housing would be sufficient to house the construction workforce. In-migrating workers could secure housing from the existing stock, in any of the four counties within the region, have new homes constructed, or bring their own housing to the region. Construction employment would increase gradually, reaching the peak of 3,600 workers after 4 to 5 years allowing time for market forces to anticipate and accommodate the influx of workers and their families.

Because Aiken and Barnwell Counties have smaller populations, their housing markets would likely be the most impacted. If all in-migrating workers to Aiken County were demanding housing from the existing stock, the impact would be 2.3% of the 2000 inventory or 22.2% of the vacant units available that year. If all in-migrating workers to Barnwell County were to demand housing from the existing stock, the impact would be 1.6% of the inventory in 2000 or 14.3% of the vacant housing available that year. The Richmond and Columbia County housing markets would experience a small impact on housing—0.6% and 0.8% of the 2000 inventory, respectively.

In summary, the four counties where most of the construction workforce would seek housing have adequate housing resources for the entire workforce. Impacts on housing are considered to be small when a small and not easily discernible change in housing availability occurs. SCE&G concludes that the potential impacts of construction on housing would be SMALL throughout the region of influence and mitigation would not be warranted.

SCE&G estimates that approximately 800 workers would be needed for operation of two nuclear power facilities at the SRS site. Most of these workers would be expected to come from within the region of influence. Any employees relocating to the region would most likely settle in the region of influence with the same proportions as the current SRS workforce. If all 800 workers came from outside the region of influence, the Aiken, Barnwell, Columbia, and Richmond County housing markets would experience a small impact on housing, 0.8%, 0.6%, 0.3%, and 0.2% of the 2000 inventory, respectively.

SCE&G concludes that the potential impacts of operations on housing would be SMALL throughout the region of influence and mitigation would not be warranted.

In summary, the area where most of the construction and operations workforce would seek housing would have adequate housing resources for the entire workforce. The gradual influx of construction workers and developers responding to increases in population would mitigate impacts. SCE&G concludes that the potential impacts of construction and operations on housing would be SMALL and that additional mitigation would not be warranted.

9.3.3.1.6.8 Public Services

Public services include water supply and wastewater treatment facilities, police, fire and medical facilities, and social services.

New construction or operations employees relocating from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities within the region of influence provide medical care to much of the population within the 50-mile region and the small increases in the regional population would not materially impact the availability of medical services.

The proposed project and the associated population influx would likely economically benefit the disadvantaged population served by the South Carolina Department of Human Resources. The additional direct jobs would increase indirect jobs that could be filled by currently unemployed workers, thus removing them from social services client lists.

The following table reflects the 2002 person-per-police and persons-per-firefighter ratios for Aiken, Barnwell, Columbia, and Richmond Counties, as well as for the state of South Carolina (USCB 2004):

	Persons-Per-Police Officer Ratio	**Persons-Per-Firefighter Ratio**
Aiken County	402:1	190:1
Barnwell County	350:1	250:1
Columbia County	440:1	427:1
Richmond County	374:1	518:1
State of South Carolina	422:1	282:1

Ratios are in part, dependent on population density. Fewer public safety officers are necessary for the same population if the population resides in a smaller area. The population increase in the region of influence from construction or operations employees relocating from outside the region could result in the need to hire additional emergency personnel. However, increased tax revenues would be adequate to pay the salaries of any additional emergency personnel hired.

As discussed above, it is not expected that public services would be materially impacted by new construction or operations employees relocating from outside the region. Impacts on public services are considered to be small if there is little or no need for changes in the level of service provided to the community. Therefore, impacts of construction and operation of the proposed project on public services would be SMALL and mitigation would not be warranted.

9.3.3.1.6.9 Education

Based on data for the 2004–2005 school year, Aiken County has 40 pre-kindergarten through 12 (PK-12) schools with a total enrollment of 25,299 students; Barnwell County has 11 PK-12 schools with a total enrollment of 4,721 students; Richmond County has 59 PK-12 schools with a total enrollment of 34,141 students; and Columbia County has 29 PK-12 schools with a total enrollment 20,570 students (NCES 2006a, 2006b).

Based on 2000 census data, 20.59% of the population in South Carolina and 21.68% of the population in Georgia is enrolled in PK-12 schools (USCB 2002a, 2002b). SCE&G estimates that approximately 1,800 in-migrating construction workers would bring their families, which would increase the school-aged population within the region of influence by approximately 938 students. Approximately 60.7% would settle in Aiken County, 7.1% in Barnwell County, 20.2% in Richmond County, and 11.9% in Columbia County. The student populations in Aiken, Barnwell, Richmond, and Columbia counties would increase by 2.3%, 1.4%, 0.6%, and 0.5%, respectively. Small impacts on local school systems are generally associated with project-related enrollment increases of up to 3%. These project-related enrollment increases would constitute a SMALL impact on the education systems in the region of influence.

Most of the operations workforce would be expected to come from within the region of influence where their educational requirements are already being met. As such, the school systems in these areas would not experience any major influx of students from operation of the proposed project at the SRS site. If all 800 employees and their families were to come from outside the region, the school-aged population within the four counties would increase by approximately 484 students. The student populations in Aiken, Barnwell, Richmond, and Columbia counties would increase by 1.0%, 0.6%, 0.2%, and 0.2%, respectively. These project-related enrollment increases would constitute a SMALL impact on the education systems in the region of influence.

9.3.3.1.7 Historic and Cultural Resources

The Savannah River Archaeological Research Program of the South Carolina Institute of Archaeology and Anthropology, University of South Carolina, has been conducting archaeological investigations at the SRS since 1973. Over a period of more than 25 years, the Savannah River Archaeological Research Program has recorded more than 850 archaeological sites at the SRS. Although most of these sites have not been formally evaluated for eligibility for listing on the National Register of Historic Places (NRHP), 67 sites have been identified as potentially eligible. In general terms, prehistoric sites within the SRS consist of village sites, base camps, limited-activity sites, quarries, and workshops. Nearly 800 prehistoric sites have been recorded at the SRS. Historic sites at the SRS include farmsteads, tenant dwellings, mills, plantations, slave quarters, rice farm dikes, dams, cattle pens, ferry locations, churches, schools, towns, cemeteries, commercial buildings, and roads. About 400 historic sites have been recorded to date at the SRS (U.S. NRC 2005).

Archaeologists have assigned areas of the SRS to one of three zones, based on the likelihood of archaeological sites. The site for the proposed project is in Zone 3, which includes areas of low archaeological site density. Activities in this zone have a low probability of encountering archaeological sites and virtually no chance of encountering large sites with more than three prehistoric components; the need for site preservation is low. In May 2002, the SRS staff stated that no archaeological resources were found within the site boundary for the proposed project. The site for the proposed project is more than 278 feet above MSL, well above any recorded exposures of paleontological materials at SRS. (Dominion 2002)

SCE&G conducted a historical and archaeological records search on the National Park Service's National Register Information System (NRHP). The NRHP identifies 103 sites in the five counties surrounding the SRS, including 35 sites in Aiken County, 6 sites in Barnwell County, 12 sites in Allendale County, 43 sites in Richmond County, and 7 sites in Burke County (Georgia) (NPS 2006a). None of these sites are located within 6 miles of the proposed project site at SRS.

Siting the proposed project at SRS would require that a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction of the proposed project. Mitigative measures would be performed to prevent permanent damage and ensure that any impacts to cultural resources from construction or operation at SRS would be SMALL.

9.3.3.1.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance

(U.S. NRC 2004). Subsection 2.5.4.1 describes the methodology SCE&G used to establish locations of minority and low-income populations.

The 2000 census block groups were used for ascertaining minority and low-income populations in the area. There are 528 block groups within 50 miles of SRS. The Census Bureau data for South Carolina and Georgia is shown in the following table:

	Data for South Carolina	Data for Georgia
Black races	29.5%	28.7
American Indian or Alaskan Native	0.3%	0.3%
Asian	0.9%	2.1%
Native Hawaiian or other Pacific Islanders	.04%	0.1%
All Other Single Minorities	1.0%	2.4%
Multiracial	1%	1.4%
Aggregate of Minority Races	32.8%	34.9%
Hispanic	2.4%	5.3%

If any block group minority percentage exceeded 50%, the block group was identified as containing a minority population. If any block group percentage exceeded its corresponding state percentage by more than 20%, the block group was identified as having minority population. Black minority populations exist in 195 block groups; there are 209 block groups with threshold “Aggregate of Minority Races” populations; and “Hispanic Ethnicity” minority populations exist in two block groups. No other minority populations exist in the geographic area. The locations of the minority populations within 50 miles of SRS are shown in Figure 9.3-4.

The Census Bureau data characterize 14.1% of South Carolina households and 12.6% of Georgia households as low-income. Based on the “more than 20 percent” criterion, 67 block groups out of a possible 528 contain a low-income population. The locations of the low-income populations within 50 miles of SRS are shown in Figure 9.3-5. Construction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the SRS site. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the proposed project at SRS would not have a disproportionate impact on minority or low-income populations.

SCE&G concludes that environmental justice impacts of the construction and operation of the proposed project at SRS would be SMALL and mitigation would not be warranted.

9.3.3.2 Evaluation of the Cope Generating Station Site

The Cope Generating Station is a 430 MWe coal-fired facility located in a sparsely populated, largely rural area of Orangeburg County, South Carolina, approximately 1.5 miles southwest of the town of Cope (Figure 9.3-6). Other communities near the site include:

- Cordova (7 miles northeast)
- Orangeburg (13 miles northeast)
- Rowesville (10 miles east)
- Bamberg (3 miles south)
- Denmark (5 miles southwest)
- Norway (7 miles northwest)

The approximately 3,200-acre Cope Generating Station site is located between Roberts Swamp Creek to the southwest and Sam Branch to the east. The South Fork Edisto River flows through the site, approximately 1 mile south of the existing power plant.

9.3.3.2.1 Land Use Including Site and Transmission Line Rights-of-Way

The Cope Generating Station site encompasses approximately 3,200 acres. Undeveloped areas of the site consist of old fields in various stages of succession, upland, pine or mixed pine and hardwood stands, wetland mixed hardwood forest, and cypress-gum swamplands. The South Fork Edisto River crosses the SCE&G property approximately 1 mile south of the generating station. Cope Generating Station is located between Roberts Swamp Creek to the southwest and Sam Branch to the east (SCE&G 1991). Facilities for the existing power plant occupy approximately 550 acres and comprise (SCE&G 1991):

- Approximately 130 acres for the fenced power plant
- 20 acres for the intake and discharge corridor
- 340 acres for the ash-scrubber waste area
- 40 acres for the rail loop outside the fenced power plant
- 20 acres for roads and miscellaneous access

The fenced site includes the boiler buildings, turbine buildings, coal pile, switchyard, flue gas cleaning equipment, cooling towers, water basins, storage tanks, rail lines and other associated plant facilities (SCE&G 1991).

The land in the site region is rural. Most of the land in Orangeburg and the adjacent county, Bamberg, is wooded. In 2002, the total land acreage devoted to farming was 274,332 acres and 105,277 acres in Orangeburg and Bamberg Counties, respectively (USDA 2006). All properties adjacent to the Cope Generating Station are privately owned with the exception of the public boat ramp to the South Fork Edisto River (Bobcat Landing). Landholdings range from less than 1 to 843 acres (SCE&G 1991).

No land would be acquired for additional facilities at Cope Generating Station. The proposed project could be configured to fit within the existing, previously disturbed area of the site. Land use impacts associated with site preparation, construction, and operation of the proposed project at Cope Generating Station would be SMALL.

Two transmission lines in two transmission corridors connect the Cope Generating Station to the state transmission system. These include approximately 55 miles of lines that occupy approximately 1,135 acres of corridor. The Cope-Orangeburg corridor passes through lands that are primarily agricultural, consisting of row crops and pine plantations. The Cope-Canadys corridor crosses eight vegetation types (SCE&G 1991):

- Planted pines
- Carolina bays
- Agricultural fields
- Hardwood forests
- Pine-hardwood forests
- Bottomland hardwood forests
- Hardwood-pine forests
- Freshwater marshes

The transmission corridors are mostly in remote areas with low population densities.

It is assumed that each nuclear unit would necessitate the addition of three 230kV transmission lines, requiring a 170-foot-wide transmission corridor. The additional transmission lines could be installed via expansion of existing rights-of-way, or they could follow a new right-of-way. The procedures for adding new transmission lines to connect the proposed project at Cope Generating Station to the transmission grid are similar to those described in Subsection 4.1.2. Assuming that any transmission system modifications would be a combination of a new right-of-way and expanding the existing right-of-way, the land use impacts associated with the addition of six 230kV transmission lines would be SMALL to MODERATE, but would be mitigated by careful siting to avoid sensitive land uses.

The Cope Generating Station site is not subject to the South Carolina Coastal Zone Management Act because the plant is not located within one of the designated South Carolina coastal zone counties (SCDHEC 1995). However, the Cope-Canadys transmission corridor extends into Colleton County, which is one of South Carolina's coastal zone counties. Expanding the Cope-Canadys transmission corridor to accommodate new lines would require review and certification under the South Carolina Coastal Zone Management Act.

9.3.3.2.2 Air Quality

Cope Generating Station is located in Augusta (Georgia)-Aiken (South Carolina) Interstate Air Quality Control Region (40 CFR 81.114), which is designated as being unclassified or in attainment of the NAAQS (40 CFR 81.341). The nearest non-attainment areas are Richland and Lexington Counties (the Columbia, South Carolina metropolitan area), which are classified as non-attainment areas due to exceedances of the 8-hour ozone standard (40 CFR 81.341). These counties are approximately 31 miles north and 22 miles northwest of the Cope Generating Station, respectively.

Air quality impacts from construction and operation of the proposed project at Cope Generating Station would be similar to those at the VCSNS site as described in Subsections 4.4.1.3 and 5.8.1.2, respectively. Construction impacts would be temporary, and would be similar to any large-scale construction project. Construction emissions would include dust from disturbed land, roads, and construction activities and emissions from construction equipment. Mitigation measures similar to those described in Subsection 4.4.1.3 would be taken. During station operation, standby diesel generators would be used for auxiliary power. It is expected that these generators would see limited use and, when used, they would operate for short time periods. The proposed project would be subject to a Conditional Major Operating Permit to ensure that the facility operations would not interfere with attaining or maintaining Primary and Secondary NAAQS (SCDHEC 2006a). Therefore, air pollutant emissions from the standby diesel generators and auxiliary power systems are expected to be minimal and would not result in any violation of NAAQS.

The Cape Romain National Wildlife Refuge, approximately 80 miles southeast of the Cope Generating Station, is the closest mandatory Class I federal area in which visibility is an important value (40 CFR 81, Subpart D). Because there are no mandatory Class I federal areas within 50 miles of the site, any potential visibility impacts from the proposed nuclear power facilities on Class I areas would be negligible. The air quality impacts from construction and operation of the proposed project at the Cope Generating Station would be SMALL.

9.3.3.2.3 Hydrology, Water Use, and Water Quality

The Cope Generating Station uses groundwater from four onsite wells as the primary source of water for the plant (SCE&G 2006). Groundwater is withdrawn from the Black Creek and Middendorf Aquifers to provide makeup water to the cooling tower and plant service water system (SCE&G 2006). The Cope Generating Station also withdraws groundwater for potable use (SCE&G 1991). Water from the plant is discharged to the South Fork Edisto River (SCE&G 2006).

The South Fork Edisto River (a small river with average flow of 726 cfs) (USGS 2006) is used as a backup source of water for the Cope Generating Station (SCE&G 2006). When used, water is withdrawn from the river to provide makeup water to the cooling tower and plant service water (SCE&G 1991). The amount of water consumed from the river, when needed, is about 4% of the normal river flow (SCE&G 2006).

SCE&G assumed that the proposed project at the Cope Generating Station would withdraw makeup water from onsite wells with the South Fork Edisto River used as a backup water supply. In 2004, the Cope Generating Station withdrew approximately 3,161 gpm (7.04 cfs) (SCDHEC 2005). In 2005, the Cope Generating Station withdrew approximately 3,172 gpm (7.07 cfs) (SCDHEC 2006b). The two-year average withdrawal rate for the existing unit is approximately 3,166 gpm (7.05 cfs). The Cope Generating Station is permitted to discharge water to the South Fork Edisto River at a rate of 396 gpm (0.881 cfs) (SCDHEC 2004a) for a net consumption rate of 2,771 gpm (6.17 cfs). As discussed in Subsection 5.2.1, the average withdrawal rate for the proposed nuclear power facilities, including makeup for the cooling towers, would be 37,200 gpm (83 cfs) and the maximum withdrawal rate would be 61,800 gpm (138 cfs). Consumptive loss of water during normal operations would be 27,800 gpm (62 cfs) and 31,100 gpm (69 cfs) during maximum use operations. The cumulative evaporative loss for the proposed project and existing coal-fired unit consumption rate would average 30,471 gpm (68.2 cfs) and the maximum would be 33,671 gpm (75.2 cfs). The Middendorf aquifer has high transmissivities and wells in the Middendorf aquifer locally yield 500 to 2,000 gpm (SCDHEC 2002; SCDNR 2004). The Black Creek aquifer is hydraulically similar to the Middendorf aquifer and yields over 1000 gpm are quite common (SCDHEC 2002).

Several groundwater issues have been documented in the South Carolina coastal plain. These issues include (Spignor and Ransom 1979; SCDHEC 2001; Hockensmith 2001):

- Regional water-level declines (loss of artesian pressure) throughout large areas of the South Carolina coastal plain geographic province and adjacent counties in Georgia
- Saltwater contamination of the Tertiary Limestone (Floridan) and Middendorf Aquifers in the coastal area

- Local well interference, where water levels have been lowered below some intakes
- Interaquifer transfer, resulting in artesian pressure losses and/or water quality impairment

In an effort to ensure the long-term integrity of groundwater resources in the South Carolina coastal plain geographic province and to mitigate the effects of saltwater intrusion, groundwater withdrawals in 14 coastal counties (Beaufort, Berkeley, Charleston, Colleton, Darlington, Dillon, Dorchester, Florence, Georgetown, Horry, Jasper, Marion, Marlboro, Williamsburg) are regulated by the SCDHEC under the Capacity Use Area program. SCDHEC requires permitting of all wells in the 14 coastal counties with a pumping capacity of 3 million gallons per month or more. In coastal plain counties, including Orangeburg County, that are outside of a Capacity Use Area, the intention to install any well that will withdraw 3 million gallons or more of groundwater in any month must be placed on public notice 30 days before drilling. SCDHEC also monitors water quality in the coastal aquifers for saltwater intrusion. The Cope Generating Station is not located in one of the 14 capacity use area counties, therefore, a permit is not required to withdraw groundwater. However, because the proposed project would withdraw more than 3 million gallons per month, public notice is required before any wells can be developed.

Because groundwater availability is an issue in coastal South Carolina, siting nuclear power facilities at the Cope Generating Station may cause public concern with respect to groundwater availability. Also, withdrawal of an additional 87.8 mgd could draw down the aquifer, resulting in local well interference. Therefore impacts as a result of operation would be MODERATE to LARGE and mitigation measures such as the use of dry cooling towers would be considered.

Based on the assumption that, when used, the Cope Generating Station surface water consumption would be equal to the average groundwater consumption rate of approximately 3.99 mgd (6.17 cfs), the cumulative net loss to the South Fork Edisto River would be 47.49 mgd (73.48 cfs). For water years 1991–2005, the annual mean and lowest annual mean flows for the South Fork Edisto River near Cope, South Carolina (Station 02173030) were 726 cfs and 304 cfs, respectively (USGS 2006). The cumulative evaporative loss for the proposed project and existing coal-fired unit would represent 10.4% of the annual mean flow and 24.7% of the lowest annual mean flow for the South Fork Edisto River. Therefore, impacts of surface water use would be MODERATE to LARGE, and mitigation measures such as the use of dry cooling towers would be considered.

The Cope Generating Station currently operates under a NPDES permit issued by the SCDHEC. As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating discharges into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not harm water quality or human health. Any releases of contaminants to South Fork Edisto River (or other South Carolina waters) as a result of construction or operation of the proposed project at the Cope Generating Station would be regulated by the SCDHEC through the NPDES permit process to ensure that water quality is protected. Therefore, impacts to water quality would be SMALL.

9.3.3.2.4 Terrestrial Resources Including Protected Species

The Cope Generating Station site is approximately 1.5 miles southwest of the town of Cope, South Carolina, and 3 miles north of Bamberg, South Carolina. The site encompasses approximately 3,200 acres, and is situated in Orangeburg County, directly across the river from Bamberg County. Habitats on the Cope site are predominantly cypress-gum swamp, wetland mixed hardwoods, pine plantations, and formerly cultivated agricultural lands. Game species found on lands in the vicinity of the Cope Generating Station include whitetail deer (*Odocoileus virginianus)*, wild turkey *(Meleagris gallopavo)*, gray squirrel *(Sciurus carolinsis)*, eastern cottontail *(Sylvilagus floridanus)*, raccoon *(Procyon lotor)*, northern bobwhite *(Colinus virginianus)*, mourning dove *(Zenaida macroura)*, red fox *(Vulpes vulpes)*, gray fox *(Urocyon cinereoargenteus)*, wood duck (*Aix sponsa)*, mink (*Mustela vison)*, otter (*Lontra Canadensis),* and beaver *(Castor Canadensis)*. Of the foregoing, upland species such as bobwhite, squirrel, mourning dove, foxes, and whitetail deer are widely distributed in the region, with population densities varying in response to availability and quality of habitat, active habitat management practices, and hunting pressure (SCE&G 1991).

The three counties (Bamberg, Orangeburg, and Colleton) crossed by the transmission line routes lie in the South Carolina coastal plain. In general, the land can be characterized as moderate to gently sloping. Most of the original forests have been removed and replanted with pine trees or row crops (SCE&G 1991).

SCE&G is not aware of any known occurrences of federally listed threatened or endangered species on the Cope Generating Station site. Table 9.3-3 indicates federally listed plant and animal species recorded in Orangeburg, Bamberg, and Colleton counties. Terrestrial species in Table 9.3-3 consists of four bird species, four reptile species, one amphibian species, and two plant species.

The U.S. Fish and Wildlife Service identified two bird species, one amphibian species, and one plant species, which could reside in the terrestrial habitats in Orangeburg County. These are the now delisted bald eagle (*Haliaeetus leucocephalus*), the endangered red-cockaded woodpecker (*Picoides borealis*), the threatened flatwoods salamander (*Ambystoma cingulatum*), and the endangered canby's dropwort (*Oxypolis canbyi*) (USFWS 2007). Limited numbers of bald eagles are present and breed in certain areas of the South Carolina coastal plain, associated with reservoirs and coastal marsh and rice field habitats. Such habitats do not exist at the Cope site. Use of the rather narrow water surface of the South Fork Edisto River by bald eagles is unlikely. The red-cockaded woodpecker requires mature, open understory, pine stands with trees 60 years of age and older. Such stands do not occur at the Cope site (SCE&G 1991). The flatwoods salamander inhabits mesic longleaf pine-wiregrass flatwoods and savannas having little to no midstory and an open overstory of widely scattered longleaf pine (NatureServe 2006). Such habitat does not exist at the Cope site. The canby's dropwort is native to the coastal plain of South Carolina, where it occupies pond cypress savannas, the shallows and edges of cypress/pond-pine sloughs, and wet pine savannas (USFWS 1990a). Such habitat does not exist at the Cope site.

Only two endangered bird species were reported in the transmission line routes. The wood stork (*Mycteria american*) had been reported in Colleton County, but not in the area crossed by the Cope-Canadys transmission line route. The red-cockaded woodpecker (*Picoides borealis*) has been reported in Orangeburg County in the Santee State Park (SCE&G 1991). A population of Canby's dropwort (*Oxypolis canbyi*) was identified in the center of an existing SCE&G right-of-way where a Carolina bay was converted to a pine plantation, near the crossing of US-178 (SCE&G 1991). The four reptiles in Table 9.3-3 are all sea turtles, which would not be affected by construction and operation at an inland site, but are included for completeness.

Land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing SCE&G and Santee Cooper procedures, good construction practices, and established best management practices. With this in mind, and because the proposed project and any new transmission line would not require extensive land clearing, impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed project at the Cope Generating Station site would be SMALL.

9.3.3.2.5 Aquatic Resources Including Protected Species

The South Fork Edisto River accepts drainage from Shaw Creek, Dean Swamp Creek, Goodland Creek, and Roberts Swamp before merging with the North Fork Edisto River to form the Edisto River. Downstream from the confluence, the Edisto River tributaries include Cattle Creek, Indian Field Swamp, and Four Hole Swamp. Downstream from Four Hole Swamp, the Dawho River enters the Edisto River, and their confluence forms the South Edisto River and the North Edisto River, which drain into the Atlantic Ocean through the ACE (Ashepoo-Combahee-Edisto) Basin. The South Fork Edisto River watershed is located in Barnwell, Orangeburg, and Bamberg Counties. (SCDHEC 2004a)

Several species of fish are known to reside in the South Fork Edisto River: the blackbanded darter (*Percina nigrofasciata*), tessellated darter (*Etheostoma olmstedi*), sailfin shiner (Pteronotropis hypselopterus), dusky shiner (*Notropis cummingsae*), coastal shiner (*Notropis petersoni*), bannerfin shiner (*Cyprinella leedsi*), pugnose minnow (*Opsopodedus emeiliae*), chain pickerel (*Esox niger*), redfin pickerel (*Esox americanus*), largemouth bass (*Micropterus salmoides*) and margined madtom (*Noturus insignus*) (NANFA 2002).

Since 1967, 87 species from 25 families have been identified from the freshwater portion of the Edisto River Basin. Although diversity is high, production is low in the Edisto River, especially in the area below Orangeburg. A long-term trawl survey begun in 1993 collected 54,714 individual and 80 species of fish during the first five years. The Edisto Rivers yielded 67 species (SCDNR 2000).

The shortnose sturgeon (*Acipenser brevostrum*) (listed as federal and state endangered) (SCDNR 2006) has been reported from the North Fork Edisto River near Orangeburg on the transmission lines route (SCE&G 1991). Shortnose sturgeons were incidentally collected during American shad studies in the Ashepoo and Edisto Rivers in the 1970s and early 1980s (NMFS 1998). Sub-yearling sturgeons have been captured in the Hudson, Cape Fear, Edisto, and Savannah Rivers but in all cases the catch rates were low (NMFS 2000).

The existence of a spawning stock of shortnose sturgeon in the ACE Basin is yet to be determined. Literature indicates that the shortnose sturgeon migrate from the estuary into rivers to spawn. Spawning in South Carolina occurs from February to April over gravel or rubble bottoms. High current velocity and adequate substrate for the attachment of eggs are important factors in spawning selection (SCDNR 2000).

The construction of a cooling water intake and discharge structure would probably be necessary if nuclear power facilities were sited at the Cope Generating Station. The design of the intake structure would comply with the requirements of Section 316(b) of the Clean Water Act, thereby reducing the potential impacts of entrainment and impingement to sensitive species. The design of the new discharge system would comply with the requirements of Section 316(b) of the Clean Water Act, thereby reducing the potential impacts of increased thermal discharge temperatures on sensitive species.

Based on review of the available information, potential impacts to aquatic resources, including federally and state-listed species, are expected to be SMALL from the construction of the proposed project at the Cope Generating Station site. A MODERATE to LARGE impact may be created by the increased volume of water displaced from the river if river water is used for the operation of the nuclear power facilities. Additional analysis of river volume withdrawal effects would be required. Consultations would be held with the U.S. Fish and Wildlife Service and SCDHEC to determine how to operate the proposed project to create the fewest impacts to aquatic resources.

9.3.3.2.6 Socioeconomics

This subsection evaluates the social and economic impacts to the surrounding region as a result of constructing and operating the proposed project at the Cope Generating Station site. The evaluation assesses impacts of construction, station operation, and demands placed by the construction and operation workforce on the surrounding region.

9.3.3.2.6.1 Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways and railways would be necessary to transport construction materials and equipment. It is assumed that all construction activities would occur within the existing Cope Generating Station site. Offsite areas that would support construction activities (*e.g.*, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the proposed project would be small, incremental impacts associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. The proposed project would produce noise from the operation of pumps, fans, transformers, turbines, generators, and switchyard equipment. Traffic at the site would also be a source of noise. However, noise attenuates quickly so that ambient noise levels would be minimal at the site boundary. Also, the Cope Generating Station is located in a rural area surrounded by forests and agricultural land and residents in the area are sparse. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the Cope Generating Station site.

The proposed project would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the proposed project would not use a significant quantity of chemicals that could generate odors that exceed threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

Construction activities would be temporary and would occur mainly within the boundaries of the Cope Generating Station site. Offsite impacts would represent small incremental changes to offsite services. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators, and chemical use would be limited, which would limit odors. Therefore, the physical impacts of construction and operation would be SMALL.

9.3.3.2.6.2 Demography

The Cope Generating Station site is located in Orangeburg County, South Carolina. The site currently meets the population definition of 10 CFR 100 for low density. The population distribution near the site is low with typical rural characteristics.

Most of the current Cope Generating Station workforce (90%) live in Orangeburg, Bamberg, Lexington, Colleton, Aiken, and Barnwell Counties. Therefore, these six counties comprise the region of influence and are the focus of this study.

SCE&G assumed that the construction and operations workforce would be distributed within the region of influence in approximately the same proportion as the existing Cope Generating Station workforce.

Based on the 2000 census, the total population of the region of influence is 528,548. The 2000 population within the counties was 16,658 in Bamberg County, 91,582 in Orangeburg County, 216,014 in Lexington county, 38,264 in Colleton County, 142,552 in Aiken County, and 23,478 in Barnwell County (USCB 2000e). The nearest population center, as defined in 10 CFR 100, is Columbia, South Carolina (population 116,278); to the north-northwest of the Cope Generating Station site (USCB 2000f). The distance between the site and the Columbia city limits is approximately 35 air miles, with the distance to the center of the city being approximately 44 miles. Based on the sparseness and proximity matrix in NUREG-1437, the Cope Generating Station site is located in a medium population area.

SCE&G estimates that the peak construction workforce for the proposed project at the Cope Generating Station site would be 3,600 (Table 3.10-2). Approximately 70% of the required workforce would be skilled crafts labor and approximately 30% of the workforce is expected to be management or related administrative support. SCE&G estimates that 50% of the skilled crafts workers (1,260 people) would be drawn from within the six-county region, with the remainder of skilled crafts workers (1,260 workers) and 100% of the managerial/administrative support personnel (about 1,080 individuals) residing outside the region of influence.

Of the 2,340 construction workers in-migrating to the region of influence, 1,800 would bring their families and 540 would relocate without families. The average household size in South Carolina is 2.53 people (USCB 2002a). Therefore, construction would increase the population in the region of influence by 5,094 people, which is approximately 1.0% of the region's population in 2000. SCE&G assumed that the in-migrating construction workforce and their families would settle in Aiken, Bamberg, Barnwell, Colleton, Lexington, and Orangeburg Counties in the same proportion as the current Cope Generating Station workforce. Based on 2000 census data, the addition of the new employees and their families would increase the population in Aiken County by 0.3%, Bamberg County by 7.0%, Barnwell County by 1.7%, Colleton County by 1.2%, Lexington County by 0.3%, and Orangeburg County by 2.2%. Impacts are considered to be small if plant-related population growth is less than 5% of the study area's total population and moderate if growth is between 5% and 20%. Therefore, the potential increases in population during construction of the proposed project at the Cope Generating Station site would represent a MODERATE impact in Bamberg County and a SMALL impact on the total population for the remainder of the region of influence.

SCE&G estimates that 930 workers including 800 operations personnel (Subsection 3.10.3) and 130 site support personnel would be required for the operation of two nuclear power facilities at the Cope Generating Station site. Most of these workers would be expected to come from within the region of influence. Any employees relocating to the region would most likely settle in the same proportion as the current Cope Generating Station workforce. If all 930 employees and their families were to come from outside the region, the potential increase in population in the most affected counties would not be substantial. For example, the 930 employees would translate into an additional 2,353 people (assuming an average household size of 2.53 people). Based on 2000 census data, the addition of the new employees and their families, in a distribution similar to that of the existing Cope Generating Station workforce, would increase the population in Aiken County by 0.1%, Bamberg County by 3.2%, Barnwell County by 0.8%, Colleton County by 0.6%, Lexington County by 0.1%, and Orangeburg County by 1.0%. Overall, the small potential increase in population from operation of the proposed project at the Cope Generating Station site would represent a SMALL impact to the total population for the entire region of influence.

9.3.3.2.6.3 Economy

Based on 2000 census data, within the region of influence, there are 256,295 people in the labor force. Of those people in the labor force, 99.6% are in the civilian labor force and 0.4% is in the armed forces. Of the civilian labor force, 94.4% are employed and 5.6% are unemployed (USCB 2000g). The overall unemployment rate for the six-county region is higher than that of the state, which is 5.9% (USCB 2002a).

The following table lists the 2000 civilian labor force and unemployment rates for the six-county region (USCB 2000g):

County	Civilian Labor Force	Unemployment Rate
Orangeburg County	40,265	8.5%
Bamberg County	6,743	11.6%
Aiken County	67,969	5.9%
Barnwell County	10,204	7.7%
Colleton County	16,004	6.4%
Lexington County	115,110	3.7%

The six counties in the region of influence have different economies. Aiken, Bamberg, Colleton, and Lexington counties have a dominant service base, while Barnwell and Orangeburg counties have a dominant manufacturing base. Relative to Orangeburg and Barnwell counties, Bamberg and Colleton counties have smaller economies and Aiken and Lexington counties have larger economies (USCB 2000g).

An influx of 2,340 construction workers migrating into the region would have positive economic impacts in the region. Assuming a multiplier of 1.34 jobs (direct and indirect) for every construction job (U.S. BEA 2007b), an influx of 2,340 construction workers would create 785 indirect jobs, permanent or temporary, for a total of 3,125 new jobs in the region of influence. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries, including the housing industry. Workers would be expected to spend most of their earnings in the county of permanent residence; hence most of the indirect jobs related to Cope Generating Station site construction activities would be in those counties in proportion to the residential distribution patterns. However, Orangeburg County could receive a disproportionately high number of these indirect jobs because the large onsite workforce would likely purchase fuel, food, and other incidentals in the greater Cope/Orangeburg County area. The three smaller counties in the region of influence—Bamberg, Barnwell, and Colleton—would experience the greater socioeconomic impacts because of their relatively small population and employment bases. In the two larger counties, Aiken and Lexington, the socioeconomic impacts would be less.

SCE&G concludes that the impacts from construction on the economy or labor force in the region of influence would be SMALL in Aiken, Bamberg, Barnwell, Colleton, and Lexington County. Changes to population and employment baselines would result in a MODERATE impact in Orangeburg County. Because the impacts enhance the economic viability of the county specifically and the region of influence generally, mitigation would not be warranted.

As discussed in Subsection 9.3.3.2.6.2, about 930 workers would be required for the operation of two nuclear power facilities at the Cope Generating Station site, and, for the purpose of analysis, SCE&G conservatively assumes that all the new operations direct employees would migrate into the region. Assuming a multiplier of 1.70 jobs (direct and indirect) for every operations job at the new units (U.S. BEA 2007b), an influx of 930 workers would create 655 indirect jobs for a total of approximately 1,585 new jobs in the region of influence. SCE&G concludes that the impacts of operation of the proposed project on the economy would be beneficial and SMALL everywhere in the region of inteest.

9.3.3.2.6.4 Taxes

Taxes collected as a result of constructing and operating the proposed project at the Cope Generating Station would be of benefit to the state and local taxing jurisdictions. Corporate and personal income taxes and sales and use taxes would be collected during both the construction and operation of a new unit at the Cope Generating Station. Based on the analysis in Subsection 4.4.2.2.2, SCE&G anticipates that the Cope Generating Station would not pay annual property taxes on the new units during construction. Property taxes on the new units would be applicable only after they are in-service.

During the operating life of the new units, SCE&G would pay property taxes to Orangeburg County. In 2004, Orangeburg County had property tax revenues of $76,679,486 (SCORS 2005). As discussed in Subsection 5.8.2.2.2, SCE&G has negotiated a fee-in-lieu-of-taxes agreement with Fairfield County for the construction of Units 2 and 3 at VCSNS that includes an assessment ratio of 4.0% and a special revenue credit of 20.0% of the fee-in-lieu-of-taxes payments on the project during the first 20 years that fee-in-lieu-of-taxes payments are made. For the years 2020 through 2034, when the assessed value of the new units would peak, SCE&G estimates annual fee-in-lieu-of-taxes payments for Units 2 and 3 at VCSNS would range from $13.7 million to $24.6 million (Table 5.8.2-1). Assuming that SCE&G would enter into a similar fee-in-lieu-of-taxes agreement with Orangeburg County for nuclear power facilities at the Cope Generating Station site, tax payments for the two units could represent 15% to 24% of the tax revenue for the county. The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10% of total revenues for local jurisdictions and large when new tax payments represent more than 20% of total revenues. Therefore, SCE&G concludes that the potential beneficial impacts of taxes collected during construction and operation of the proposed project would be MODERATE to LARGE in Orangeburg County and SMALL in the remainder of the region of influence.

9.3.3.2.6.5 Transportation

The primary access route to the Cope Generating Station follows US-301/601, SC 193, and the plant entrance road. US-301/601 is the major north-south highway route bisecting Orangeburg and Bamberg counties. US-301/601 is a four-lane divided highway in the vicinity of the plant. SC 193 is a two-lane paved road that has been upgraded between the plant entrance road and US-301/601 to accommodate truck traffic associated with the plant (SCE&G 1991). In 2005, the annual average daily traffic count for the US-301/601 was 7,800 vehicles south of the Cope Generating Station site and 7,600 vehicles north of the site (SCDOT 2006a).

A secondary access route to the plant follows state road SC 332, state road SC 1144, and the plant entrance road (SCE&G 1991). SC 332 is a two-lane, paved road that runs in a general east-west direction north of the Cope Generating Station site. In 2005, the annual average daily traffic count for SC 332 in the vicinity of the Cope Generating Station site was 500 vehicles (SCDOT 2006a).

Assuming construction shifts as described in Subsection 4.4.2.2.4, an additional 1,800 cars could be using these roads during shift change, causing potential congestion. Also, the traffic of hauling construction materials (100 trucks per day) to the site could cause additional congestion on SC 193 and US-301/601 between Orangeburg and Bamberg during certain times of the day. Transportation impacts are small when increases in traffic do not result in delays or other operational problems; impacts are moderate when increases in traffic begin to cause delays or other operational problems. Overall, impacts of construction on transportation would be SMALL to MODERATE and mitigating actions such those described in Subsection 4.4.2.2.4 would be needed.

With respect to operation of the facility, adding an additional 930 cars (assuming a single occupant per car) to the existing 500 cars per day on SC 332 would not materially congest the highway. Shift changes for the current unit and the proposed project at the Cope Generating Station could be staggered so that the traffic increase would not cause congestion. Impacts of the operations workforce on transportation would be SMALL and mitigation would not be warranted.

9.3.3.2.6.6 Aesthetics and Recreation

The Cope Generating Station site encompasses approximately 3,200 acres and is characterized by low, rolling hills that are predominantly forested. The upper portions of the stacks are visible from most of the surrounding area, and other Cope Generating Station facilities are visible from portions of US-301/601 and SC 193, SC 1144, and SC 332, and from the adjacent reach of the South Fork Edisto River. The adjacent forested communities offer a substantial visual buffer to the site (SCE&G 1991).

The construction of the proposed project at the Cope Generating Station could be viewed from offsite at certain locations, but the addition of two nuclear power facilities would not substantially change the view which results from the current coal-fired unit. There could be a need to construct cooling water intake and discharge structures at the site. Additional mechanical draft cooling towers would be required. The operation of the proposed project probably would have visual impacts similar to those of the existing Cope Generating Station unit, with the addition of more cooling tower plumes. Impacts on aesthetic resources are considered to be small if there are no complaints about diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the proposed project on aesthetics would be SMALL and would not warrant mitigation.

There are no national or state landmarks for natural, scenic, or cultural significance within 6 miles of the Cope Generating Station except the South Fork Edisto River. The North and South Fork Edisto River flow on approximately parallel courses from northwest to southeast and merge approximately 10 miles southeast of the Cope Generating Station to form the Edisto River. These rivers provide recreational opportunities for fishing, hunting, boating, and nature study (SCE&G 1991).

Within 50 miles of Cope Generating Station are a large number of parks, forests, lakes, rivers, wetlands, and other areas of interest. The 22,000 acre Congaree National Park is approximately 31 miles northeast of the Cope Generating Station site. Nine of the 47 state parks in South Carolina are located with 50 miles of the site (Aiken, Barnwell, Colleton, Givhans Ferry, Poinsett, Redcliffe Plantation, Rivers Bridge, Santee, and Sesquicentennial State Parks) (SCE&G 1991). There are no recreational facilities located within the boundaries of the Cope Generating Station site.

The attractiveness of the South Fork Edisto River for sport fishing and other recreational uses could be impacted during construction of intake and discharge structures. During the operating period, it is expected that some employees and their families would use the recreational facilities in the region. However, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.2.6.7 Housing

SCE&G estimates that 2,340 workers would move from outside the region of influence to one of the counties inside the region of influence. All 2,340 workers would need housing. Some of the workers would require permanent housing, generally owner-occupied, and others would elect to rent housing. Still others would elect to reside in transitional housing such as residential hotels, motels, rooms in private home, or to bring their own housing in the form of campers and mobile homes.

Based on 2000 census data, there are 227,719 housing units of which 25,160 are vacant. The following table provides vacancy data for the counties within the region of influence (USCB 2000e):

County	Housing Units	Number of Vacant Housing Units	Percent Vacant Housing Units
Orangeburg County		5,186	13.2%
Bamberg County		1,007	14.1%
Lexington County		7,738	8.5%
Colleton County		3,659	20.2%
Aiken County		6,400	10.3%
Barnwell County		1,170	11.5%
Total		25,160	11.0%

SCE&G estimates that, in absolute numbers, the available housing would be sufficient to house the construction workforce. In-migrating workers could secure housing from the existing stock, in any of the six counties within the region, have new homes constructed, or bring their own housing to the region. Construction employment would increase gradually, reaching the peak of 3,600 workers after 4 to 5 years allowing time for market forces to anticipate and accommodate the influx of workers and their families.

Because Bamberg, Barnwell, and Orangeburg Counties have smaller populations and fewer vacant units, their housing markets would likely be the most impacted. If all in-migrating workers to Bamberg County were demanding housing from the existing stock, the impact would be 7.5% of the 2000 inventory or 53.4% of the vacant units available that year. If all in-migrating workers to Barnwell County were to demand housing from the existing stock, the impact would be 1.8% of the inventory in 2000 or 16.0% of the vacant housing available that year. If all in-migrating workers to Orangeburg County were to demand housing from the existing stock, the impact would be 2.4% of the inventory in 2000 or 18% of the vacant housing available that year. The Aiken, Colleton, and Lexington County housing markets would experience a small impact on housing—0.3%, 1.2%, and 0.3% of the 2000 inventory, respectively. Impacts on housing are considered to be small when a small and not easily discernible change in housing availability occurs, and impacts are considered to be moderate when there is a discernible but short-lived reduction in the availability of housing units. SCE&G concludes that the potential impacts of construction on housing could be MODERATE in Bamberg County and would be SMALL in the remainder of the region of influence. Mitigation would not be warranted where the impacts are SMALL. Mitigation of the moderate impacts would occur as developers and builders anticipated the arrival of the workforce and constructed additional housing. In addition, the planning and permitting process for the nuclear power facilities would provide a long lead time before housing is needed, allowing new housing to be constructed before workers arrive at the project site. Additional mitigation would not be warranted.

SCE&G estimates that approximately 930 workers would be needed for operation of two nuclear power facilities at the Cope Generating Station site. Most of these workers would be expected to come from within the region of influence. Any employees relocating to the region would most likely settle in the region of influence with the same proportions as the current Cope Generating Station workforce. If all 930 workers came from outside the region of influence, the Aiken, Bamberg, Barnwell, Colleton, Lexington, and Orangeburg County housing markets would experience a small impact on housing—0.1%, 3.0%, 0.7%, 0.5%, 0.1%, and 0.9% of the 2000 inventory, respectively.

SCE&G concludes that the potential impacts on housing from operation of the proposed project at the Cope Generating Station site would be SMALL for all six counties in the region of influence and would not warrant mitigation.

9.3.3.2.6.8 Public Services

Public services include water supply and wastewater treatment facilities, police, fire and medical facilities, and social services.

New construction or operations employees relocating from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the six-county region provide medical care to much of the population within the 50-mile region and the small increases in the regional population would not materially impact the availability of medical services.

The proposed project and the associated population influx would likely economically benefit the disadvantaged population served by the South Carolina Department of Human Resources. The additional direct jobs will increase indirect jobs that could be filled by currently unemployed workers, thus removing them from social services client lists.

The following table lists 2002 persons-per-police-officer and persons-per firefighter ratios for the six-county area and the state of South Carolina (USCB 2004):

County/State	Persons-Per-Police- Officer Ratios	Persons-Per-Firefighter Ratios
Aiken County	402:1	190:1
Bamberg County	463:1	149:1
Barnwell County	350:1	250:1
Colleton County	322:1	110:1
Lexington County	476:1	893:1
Orangeburg County	409:1	260:1
South Carolina	422:1	282:1

Ratios are in part, dependent on population density. Fewer public safety officers are necessary for the same population if the population resides in a smaller area. The population increase in the region of influence from construction or operations employees relocating from outside the region could result in the need to hire additional emergency personnel. However, increased tax revenues would be adequate to pay the salaries of any additional emergency personnel hired.

As discussed above, it is not expected that public services would be materially impacted by new construction or operations employees relocating from outside the region. Impacts on public services are considered to be small if there is little or no need for changes in the level of service provided to the community. Therefore, impacts of construction and operation of the proposed project on public services would be SMALL and mitigation would not be warranted.

9.3.3.2.6.9 Education

Based on data for the 2004–2005 school year, Orangeburg County has 30 PK-12 schools with a total enrollment of 15,449 students and Bamberg County has 7 PK-12 schools with a total enrollment of 2,744 students. Aiken, Barnwell, Colleton, and Lexington Counties have 40, 11, 12 and 66 PK-12 schools, with a total enrollment of 25,299, 4,721, 6,592, and 51,276, students, respectively (NCES 2006a).

Based on 2000 census data, 20.59% of the population in South Carolina is enrolled in PK-12 schools (USCB 2002a). SCE&G estimates that approximately 1,800 in-migrating construction workers would bring their families, which would increase the school-aged population within the region of influence by approximately 938 students. The student populations in Aiken, Bamberg, Barnwell, Colleton, Lexington, and Orangeburg counties would increase by 0.3%, 7.9%, 1.6%, 1.3%, 0.2%, and 2.4%, respectively. Small impacts are generally associated with project-related enrollment increases of up to 3% and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3% to 8%. Therefore, projected increases in the total student population of Bamberg County would have a MODERATE impact on the education systems and mitigation would be warranted. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and tax revenues as a result of the increased population, would fund additional teachers and facilities. No additional mitigation would be warranted. Projected increases in the student population elsewhere in the region of influence would be minor and, hence, the impact of these increases would be SMALL.

Most of the operations workforce would be expected to come from within the region of influence where their educational requirements are already being met. As such, the school systems in these areas would not experience any major influx of students from operation of the proposed project at the Cope Generating Station site. If all 930 employees and their families were to come from outside the region, the school-aged population within the six-county region would increase by approximately 484 students. The student populations in Aiken, Bamberg, Barnwell, Colleton, Lexington, and Orangeburg counties would increase by 0.2%, 4.1%, 0.8%, 0.7%, 0.1%, and 1.3%, respectively. These project-related enrollment increases would constitute a SMALL impact on the education systems everywhere in the region of influence.

9.3.3.2.7 Historic and Cultural Resources

Before building the coal-fired unit at the Cope Generating Station, SCE&G conducted historical and archaeological records searches and a formal cultural resources survey of the site. A review of the records held by the South Carolina Institute of Archeology and Anthropology and the South Carolina Department of Archives and History revealed two archeological sites within 5 miles of the Cope Generating Station. The first site, located near the South Fork Edisto River floodplain west of US-301/601 in Bamberg County, contained sparse ceramic artifacts. The second site was located near the CSX railroad bridge, west of the South Fork Edisto River in Bamberg County. Artifacts found at that site include several un-typed point fragments, a stemmed snub-nosed scraper, and various ceramic pieces. Neither site is located on the Cope Generating Station property nor were they identified as significant. (SCE&G 1991)

Standing structures within the SCE&G project area were examined and recorded on South Carolina Statewide Survey Forms. These field forms were completed and submitted to the State Historical Preservation Office for review and final completion, in accord with State Historical Preservation Office policy. Each structure was photographed and its location was recorded on USGS Quadrangle maps. Eight main standing structures on the project were examined. Three of these were “non-historic” (less than 50 years old). The remaining five structures include remnants of a house, a barn, a store or filling station, and two craftsman bungalows, all dating from the early 20th century. None of the structures were eligible for inclusion in the NRHP (SCE&G 1991).

The closest historical sites listed in the NRHP include 36 sites in Orangeburg County and 11 sites in Bamberg County. In Orangeburg County, 28 historic sites are located in Orangeburg, three in Eutawville, and one each in Branchville, Rowesville, Springfield, North, and Cope. In Bamberg County, five historic sites are located in Bamberg, three in Ehrhardt, two in Denmark, and one in Olar. The Cope Depot, which was listed in March 2001, is the only property in the NHRP that is located within 6 miles of the Cope Generating Station (NPS 2006b).

Siting the proposed project at Cope Generating Station would require that a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Mitigative measures would be performed to prevent permanent damage and ensure that any impacts to cultural resources from construction or operation of the proposed project at the Cope Generating Station would be SMALL.

9.3.3.2.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC 2004). Subsection 2.5.4.1 describes the methodology SCE&G used to establish locations of minority and low-income populations.

The 2000 census block groups were used for ascertaining minority and low-income populations in the area. There are 655 block groups within 50 miles of the Cope Generating Station. The 2000 Census Bureau data is provided in the following table:

	Data for South Carolina
Black Races	29.5%
American Indian or Alaskan Native	0.3%
Asian	0.9%
Native Hawaiian or other Pacific Islanders	0.04%
All Other Single Minorities	1.0%
Multiracial	1.0%
Aggregate of Minority Races	32.8%
Hispanic	2.4%

If any block group minority percentage exceeded 50%, the block group was identified as containing a minority population. If any block group percentage exceeded its corresponding state percentage by more than 20%, the block group was identified as having minority population. Black minority populations exist in 257 block groups; "aggregate of minority races" populations exist in 279 block groups; and Asian minority populations exist in 1 block group. No other minority populations exist in the geographic area. The locations of the minority populations within 50 miles of the Cope Generating Station site are shown in Figure 9.3-7.

The Census Bureau data characterize 14.11% of South Carolina households as low-income. Based on the "more than 20%" criterion, 57 block groups contain a low-income population. The locations of the low-income populations within 50 miles of the Cope Generating Station site are shown in Figure 9.3-8.

Construction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the Cope Generating Station construction site. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the proposed project at the Cope Generating Station is also unlikely to have a disproportionate impact on minority or low-income populations.

SCE&G concludes that environmental justice consequences of the construction and operation of the proposed project at the Cope Generating Station would be SMALL, and that mitigation would not be warranted.

9.3.3.3 Evaluation of the Saluda Site

The Saluda site is an approximately 850-acre undeveloped property owned by SCE&G, in Saluda County on the Saluda River arm of Lake Murray at the confluence with Mill Creek (Figure 9.3-9). It is about 42 miles northwest of Columbia, 10 miles southwest of Newberry, 12 miles north-northwest of Saluda, 3.5 miles south-southwest of Silverstreet, and 7.5 miles east of Chappells. The site is bordered by Newberry County on its northeastern edge.

9.3.3.3.1 Land Use Including Site and Transmission Line Rights-of-Way

The Saluda site is predominantly forested, and is characterized by moderately rolling hills with maximum local relief of about 150 feet occurring between the river and nearby hill tops.

The Saluda site is in the Saluda River/Lake Murray watershed. Land in the watershed is predominately rural and comprises 62.5% forested land, 0.7% forested wetland, 27% agricultural land, 4.7% barren land, 3.4% urban land, and 1.7% water (SCDHEC 2004b).

Construction of the power plant and transmission lines would alter land use at the site from vacant to industrial use. The footprint of a new plant would be approximately 240 acres including switchyard, parking lots, temporary facilities, laydown yards, and spoil storage. Because the site is undeveloped, additional acreage would be required for roads. The entire 850 acres would be excluded from future agricultural and recreational use for the estimated 40-year life of the plant.

SC 121 passes approximately 0.2 miles east of the Saluda site at its closest point. A portion of SC 121, approximately 1.5 miles in length, would be rerouted to meet exclusion zone requirements. The new route would require approximately 50 acres. A one-mile paved road with a 100-foot right-of-way would be constructed to provide vehicle access from SC 121 to the Saluda site. Development of the access road would require approximately 13 acres. The Norfolk-Southern Railway passes approximately 1.2 miles northwest of the site at its closest point. A connecting rail spur and bridge crossing the Saluda River would have to be constructed to transport materials and equipment to the site. The new rail spur would require approximately 12 acres of land. A makeup water intake line, approximately 9 miles long, would be constructed along the Saluda River Valley from the site to a location near the confluence of the Bush River and Lake Murray. Construction of the pipeline would temporarily disturb approximately 55 acres. A discharge structure on the south bank of the Saluda River would be constructed on the project site.

Land use impacts associated with site preparation, construction, and operation of the proposed project at the Saluda site would be MODERATE.

SCE&G assumed that each nuclear unit would necessitate the addition of three 230kV transmission lines, requiring a 170-foot-wide transmission corridor. It is assumed that the transmission lines would connect to the Ward substation, approximately 18 miles south of the Saluda site near the town of Ward. Routing the new transmission lines would require about 370 acres of transmission corridor. Although the most direct route would, in general, be used between terminations, consideration would also be given to avoiding possible conflicts with any natural or man-made areas where important environmental resources are located. Route selection would also avoid populated areas and residences to the extent possible. The use of lands that are currently used for forests or timber production would be altered. Trees would be replaced by grasses and other low-growing types of ground cover. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect residents along the right-of-way. Given the rural setting and low population density along the transmission corridors, impacts to land use along the rights-of-way would be SMALL.

The region surrounding the Saluda site is not within the South Carolina Coastal Zone and the route for the new transmission lines would not pass through any portion of the South Carolina Coastal Zone (SCDHEC 1995).

9.3.3.3.2 Air Quality

The Saluda site is located in the Greenwood Intrastate Air Quality Control Region (40 CFR 81.107), which is designated as being unclassified or in attainment of the NAAQS (40 CFR 81.341). The nearest non-attainment areas are Richland and Lexington Counties (the Columbia, South Carolina metropolitan area), which are classified as non-attainment areas due to exceedances of the 8-hour ozone standard (40 CFR 81.341). These counties are approximately 23 miles east and 17 miles southeast of the Saluda site, respectively.

Air pollutant emissions from construction and operation of the proposed project at the Saluda site would be similar to those at the VCSNS site as described in Subsections 4.4.1.3 and 5.8.1.2, respectively. Construction impacts would be temporary, and would be similar to any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.3 would be taken. Air pollutants would be emitted from the exhaust systems of construction vehicles and equipment and from vehicles used by construction workers to commute to the site. The amount of pollutants emitted in this way would be small compared to total vehicular emissions in the region. It is not expected that construction-related emissions would result in any violation of the NAAQS.

The proposed project would have standby diesel generators and auxiliary power systems. Emissions from those sources are described in Subsection 3.6.3. It is expected that generators would see limited use and, when used, would operate for short time periods. The proposed project would be subject to a Conditional Major Operating Permit to ensure that the facility operations would not interfere with attaining or maintaining Primary and Secondary NAAQS (SCDHEC 2006a). Therefore, air pollutant emissions from the standby diesel generators and auxiliary power systems are expected to be minimal and would not result in any violation of NAAQS.

The closest area to the Saluda site that is designated in 40 CFR 81, Subpart D as a mandatory Class I federal area, in which visibility is an important value, is the Shining Rock Wilderness Area in western North Carolina. The Shining Rock Wilderness Area is approximately 100 miles northwest of the site. Because there are no mandatory Class I federal areas within 50 miles of the site, any potential visibility impacts from the proposed nuclear power facilities on Class I areas would be negligible.

The air quality impacts from construction and operation of the proposed project at the Saluda site would be SMALL.

9.3.3.3.3 Hydrology, Water Use, and Water Quality

The Saluda site is located within the Piedmont Province. The Piedmont Province is underlain by a two-component aquifer system that is composed of a fractured, crystalline-rock aquifer characterized by little or no primary porosity or permeability; and the overlying regolith, which generally behaves as a porous-media aquifer. Rock type, structural features, and regolith thickness vary locally and affect the storage capacity and hydraulic conductivity of an aquifer. The volume of water in storage is controlled by the porosity of the regolith and to a lesser degree by the amount of fracturing of the rock. Because of the limited storage in fractures, water levels in these aquifers respond rapidly to pumping and seasonal changes in rainfall. Yields from wells completed in fractured crystalline-rock aquifers generally range from 15 to 20 gpm (Miller 1990).

As discussed above, the aquifer underlying the site has low permeability; wells developed on the property would probably have low yields. Therefore, SCE&G assumed that all water needed to support the proposed project at the Saluda site would be withdrawn from Lake Murray through a pipeline approximately 9 miles long. The pipeline would be constructed along the Saluda River Valley from Lake Murray to the site.

Lake Murray is a large reservoir, approximately 41 miles long and 14 miles at its widest point. It is located on the Saluda River and extends upstream from Saluda Dam to the Lake Greenwood Dam through Lexington, Columbia, Newberry, and Saluda Counties. It has a surface area of approximately 48,000 acres and a shoreline of approximately 691 miles, including islands. Lake Murray Reservoir contains approximately 2,200,000 acre-feet of gross storage and has a usable storage capacity of 1,056,000 acre-feet of water. The annual mean inflow to Lake Murray is 2,595 cfs. Lake Murray is used for hydroelectric generation, limited storage for power generation, navigation flow augmentation, maintenance of downstream water quality, industrial and municipal water supply, irrigation, recreational opportunities and serves as habitat for fish and wildlife (Kleinschmidt 2005).

For the water years 1927 to 2005, the annual mean and lowest annual mean flows for the Saluda River at Chappells, South Carolina (Station 02167000) were 1,869 cfs and 732 cfs, respectively (USGS 2006). For the water years 1997 to 2005, the annual mean and lowest annual mean flows for Lake Greenwood Tailrace near Chappells, South Carolina (Station 02166501) were 1,457 cfs and 688 cfs, respectively (USGS 2006). As discussed in Subsection 5.2.1, the average withdrawal rate for the proposed nuclear power facilities, including makeup for the cooling towers, during normal operations would be approximately 37,200 gpm (83 cfs) and 61,800 gpm (138 cfs) during maximum use operations. Consumptive loss of water during normal operations would be 27,800 gpm (62 cfs) and 31,100 gpm (69 cfs) during maximum use operations. The maximum loss attributable to the proposed project would represent 2.7% of the annual mean inflow to Lake Murray, and 4.7% of the annual mean and 10% of the lowest annual mean flow in the Saluda River.

Lake Murray is governed by the Federal Energy Regulatory Commission license for the Saluda Hydroelectric Project (FERC Project No. 516). The withdrawal of water from Lake Murray to support the proposed project at the Saluda site would require an order from the Federal Energy Regulatory Commission authorizing such use of project lands and waters.

The water withdrawal from Lake Murray would represent a small percentage of the Saluda River flow. The amount of water from the Saluda River that would be required by the proposed project is small and impacts to Saluda River as a result would be SMALL.

The Saluda site would operate under an NPDES permit issued by the SCDHEC. As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating discharges into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or human health. Any releases to Lake Murray (or other South Carolina waters) as a result of construction or operation of the proposed project at the Saluda site would be regulated by the SCDHEC through the NPDES permit process to ensure that water quality is protected. Therefore, impacts to water quality would be SMALL.

9.3.3.3.4 Terrestrial Resources Including Protected Species

The Saluda site is located approximately 42 miles northwest of Columbia, South Carolina, along the west end of Lake Murray, which is an impoundment of the Saluda River. The site encompasses approximately 850 acres, and is situated in Saluda County, directly across the river from Newberry County. The terrain is moderately rolling, with a maximum relief of 150 feet between Lake Murray and nearby hilltops. Most of the site is forested, and consists of hardwoods, pines, and mixed hardwood/pine. Based on Google Earth imagery from 2007 (GoogleEarth 2007), forested habitats (including clearcuts & pine plantations) occupy the area for about 2 miles surrounding the site, and land beyond 2 miles of the site is predominately a mixture of forest and agriculture. Animal species that reside on the Saluda site are those typically found in similar habitats in the Piedmont Region of South Carolina, such as the opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinsis*), raccoon (*Procyon lotor*), whitetail deer (*Odocoileus virginianus*), and various reptiles, amphibians, and birds. Construction of the proposed project at the Saluda site would require clearing approximately 500 acres. Also, approximately 1.5 miles of SC 121 would have to be shifted about 0.2 miles to meet exclusion zone requirements, a makeup water intake line from the site to a location near the confluence of the Bush River and Lake Murray would have to be constructed, and a connecting rail spur and bridge crossing the Saluda River would have to be constructed.

SCE&G is not aware of any known occurrences of federally or state-listed threatened or endangered species on the Saluda site, but formal surveys of the site have not been conducted. Table 9.3-4 indicates federally listed plant and animal species recorded in Saluda and Newberry Counties, which are the counties where the Saluda site is located and through which transmission lines and the water intake pipeline to the Saluda site would presumably pass (See Subsection 9.3.3.3.1). Terrestrial species in Table 9.3-4 consists of three bird and two plant species. The recently delisted bald eagle (*Haliaeetus leucocephalus*) has nested in nearby Lake Murray for decades, but is not known to nest in the proposed Saluda site area. Eagles may forage in the Saluda River near the site, but these activities should not be disrupted by site construction and/or operation. The wood stork (*Mycteria americana*) has been documented to reside in Newberry County in the late summer months, presumably foraging in shallow Lake Murray coves isolated during reservoir water level declines during that season. These storks are likely post-breeding dispersal birds in that there is no confirmed breeding of this species this far inland in South Carolina (USFWS 2007). Site-related construction and operations should not impair the ability of storks to forage in these sites. There are historical records of red-cockaded woodpeckers (*Picoides borealis*) in Saluda County (SCDNR 2005), but they should not exist at the Saluda site due to the absence of habitat for this species (mature pines with minimal hardwoods). Harperella (*Ptilimnium nodosum*) is a wetlands plant that is typically found on rocky shoals, the edges of clear, fast-flowing streams, or edges of ephemeral coastal plain ponds (USFWS 1990b). One population exists at the High Ponds site in eastern Saluda County. The pool sprite, or little amphianthus (*Amphianthus pusillus*), is found in vernal pools on granite outcrops in the Piedmont physiographic region (USFWS 1993). One population is known to exist at the Flat Rock site in eastern Saluda County, immediately west of Batesburg, South Carolina. Field surveys would be conducted for federally listed and state-protected species as part of the permitting process before any clearing or construction activities at the site or along associated transmission or pipeline corridors.

As mentioned in Subsection 9.3.3.3.1, SCE&G assumed that six 230kV transmission lines requiring a 170-foot-wide transmission corridor would be needed to connect the proposed project to the state's transmission system. The new lines would most likely connect to the Ward substation, which is approximately 18 miles south of the Saluda site near Ward, South Carolina. Routing the new transmission lines to the Ward Substation would require about 370 acres of transmission corridor. Although the most direct route would generally be used between terminations, consideration would also be given to avoiding possible conflicts with natural areas where important environmental resources are located, such as the endangered plant population locations in eastern Saluda County and any known populations of red-cockaded woodpeckers. Land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing SCE&G procedures, good construction practices, and established best management practices (*e.g.*, directed drainage ditches, silt fencing). With this in mind, SCE&G concludes that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed project at the Saluda site would be SMALL. Given the brevity of the transmission corridor needed to the substation and the low number of sensitive species in Saluda and Newberry counties, impacts to terrestrial resources from construction and operation of transmission lines would also be SMALL.

9.3.3.3.5 Aquatic Resources Including Endangered Species

The Saluda site is located on the Saluda River arm of Lake Murray. Lake Murray is a multipurpose reservoir formed by the Saluda Dam, which is on the Saluda River. Lake Murray extends 41 miles upstream from the Saluda Dam to the Lake Greenwood Dam and is about 14 miles wide at its widest point. The lake has approximately 691 miles of shoreline, including islands, and a surface area of approximately 48,000 acres. The maximum depth of the lake is 180 feet. The lake has a 2,420-square-mile drainage area and is used for hydroelectric generation, maintenance of downstream water quality, industrial and municipal water supply, irrigation, recreation, and as habitat for fish and wildlife. (Kleinschmidt 2005)

Lake Murray varies substantially in habitat from shallow coves and wetlands to vast open water with an abundance of diverse structure. This varied habitat supports a diverse fish population of approximately 40 species and a valuable sport fishery. Common sport fish species include largemouth bass (*Micropterus salmoides)*, striped bass (*Morone saxatilis)*, threadfin shad (*Dorosoma petenense*), gizzard shad (*Dorosoma cepedianum*), blueback herring (*Alosa aestivalis*), bluegill (*Lepomis macrochirus*), and redear sunfish (*Lepomis microlophus)*. (Kleinschmidt 2005)

Water from Lake Murray would be expected to provide cooling for the proposed project constructed at the Saluda site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction, they would be expected to recolonize the area after construction is complete. No federally listed aquatic species are known to occur in Lake Murray (Kleinschmidt 2005). Field surveys would be conducted for federally listed and state-protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing SCE&G procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Saluda site would be SMALL.

The most likely aquatic impact from nuclear operations at the Saluda site would be entrainment and impingement of aquatic organisms in Lake Murray. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Saluda site would be SMALL.

9.3.3.3.6 Socioeconomics

This subsection evaluates the social and economic impacts to the surrounding region as a result of constructing and operating the proposed project at the Saluda site. The evaluation assesses impacts of construction, station operation, and demands placed by the construction and operation workforce on the surrounding region.

9.3.3.3.6.1 Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, and railways would be necessary to transport construction materials and equipment. Most construction activities would occur within the boundaries of the Saluda site. However, an access road and a connecting rail spur (requiring about 30 acres) would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas. Offsite areas that would support construction activities (*e.g.*, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the proposed project would be small incremental impacts associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. The proposed project would produce noise from the operation of pumps, fans, transformers, turbines, generators, and switchyard equipment. Traffic at the site would also be a source of noise. However, noise attenuates quickly so that ambient noise levels would be minimal at the site boundary. Also, the Saluda site is located in a rural area surrounded by forests and agricultural land, with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the workforce commuting to the site.

The proposed project would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the proposed project would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values.

Construction activities would be temporary and would occur mainly within the boundaries of the Saluda site. Offsite impacts would represent small incremental changes to offsite services supporting the construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the proposed project at the Saluda site would be SMALL.

9.3.3.3.6.2 Demography

The Saluda site is located in Saluda County, South Carolina. The site currently meets the population requirements of 10 CFR 100. The population distribution near the site is low with typical rural characteristics.

Because of the nearness of the Saluda site to VCSNS, SCE&G assumed that the construction and operations workforce would be distributed (in approximately the same proportion as the existing VCSNS workforce) nearly 95% reside in Lexington, Newberry, Richland, and Saluda. Therefore, these four counties comprise the region of influence and are the focus of this analysis. The remaining 5% of the new workforce maintain a permanent address elsewhere. Approximately 36.8% would settle in Lexington County, 18.9% in Newberry Count, 34.7% in Richland County, and 9.5% Saluda County.

Based on the 2000 census, the total population of the four most affected counties is 591,980 persons. The 2000 population within the counties was 216,014 in Lexington County, 36,108 in Newberry County, 320,677 in Richland County, and 19,181 in Saluda County (USCB 2000h). The population within 50 miles of the site was 3,920,674 people (499.2 people per square mile), and the population within 20 miles of the site was 518,119 people (412.3 persons per square mile) (U.S. NRC 2003). The nearest population center, as defined in 10 CFR 100 is Columbia, South Carolina (population 116,278), located to the southeast of the Saluda site (USCB 2000f). The distance between the Saluda site and the Columbia city limits is approximately 34 air miles, with the distance to the center of the city being approximately 42 miles. Based on the sparseness and proximity matrix in NUREG-1437 the Saluda site is located in a high population area.

SCE&G estimates that the peak construction workforce for the proposed project at Saluda site would be 3,600 construction workers (Table 3.10-2). Approximately 70% of the required workforce would be skilled crafts labor and approximately 30% of the workforce is expected to be management or related administrative support personnel. SCE&G estimates that 50% of the skilled crafts workers (1,260 people) would be drawn from within the four county-region, with the remainder of skilled crafts workers (1,260 workers) and 100% of the managerial/administrative support personnel (about 1,080 individuals) residing outside the region of influence.

Approximately 85% (918 people) of the managerial/administrative in-migrating workers and 70% (882 people) of the in-migrating skilled crafts workers are expected to move into the region of influence with families. The remaining 15% of managerial/administrative workers and 30% of skilled crafts workers would relocate to the region of influence without families. The average household size in South Carolina is 2.53 people (USCB 2002a). Therefore, construction would increase the population in the region of influence by 5,094 people, which is approximately 0.9% of the region's population in 2000. SCE&G assumed that the in-migrating construction workforce and their families (7,753 people) would settle in Lexington, Newberry, Richland, and Saluda counties in the proportions described above. Based on 2000 census data, the addition of the new employees and their families would increase the population in Lexington County by 0.9%, Newberry County by 2.7%, Richland County by 0.6%, and Saluda County by 2.5%. SCE&G is adopting the NRC definition of impacts as small if plant-related population growth is less than 5% of the study area's total population. Therefore, the potential increases in population during construction of the proposed project at the Saluda site would represent a slight increase in the total population for all four counties, thus making the impact SMALL.

SCE&G estimates that 930 workers including 800 operations personnel (Subsection 3.10.3) and 130 site support personnel would be required for the operation of two nuclear power facilities at the Saluda site. Most of these workers would be expected to come from within the region of influence. Most employees relocating to the region would most likely choose to live in Lexington, Newberry, Richland or Saluda counties. If all 930 employees and their families were to come from outside the region, the potential increase in population in the most affected counties would not be substantial. For example, the 930 employees would translate into an additional 2,353 people (assuming an average household size of 2.53 people). Based on 2000 census data, the addition of the new employees and their families, in a distribution similar to that of the existing VCSNS workforce, would increase the population in Lexington County by 0.4%, Newberry County by 1.2%, Richland County by 0.3%, and Saluda County by 1.2%. Overall, the small, potential increase in population from operation of the proposed project at the Saluda site would represent a SMALL impact on the total population of the region of influence.

9.3.3.3.6.3 Economy

Based on 2000 census data, within the four most affected counties near the Saluda site, there are 312,242 people in the labor force. Of those people in the labor force, 96.7% are in the civilian labor force and 3.3% are in the armed forces. Of the civilian labor force, 94.4% are employed and 5.6% are unemployed (USCB 2000i). The overall unemployment rate for the four-county region is lower than that of the state, which is 5.9% (USCB 2002a).

In 2000, Saluda County had a civilian labor force of 9,156 people and an unemployment rate of 5.0%. Newberry County had a civilian labor force of 17,203 people and an unemployment rate of 7.8%. Lexington County had a civilian labor force of 114,600 people and an unemployment rate of 3.7%. Richland County had a civilian labor force of 160,969 people and an unemployment rate of 6.7%. (USCB 2000i)

The four-county area is characterized by two different economies. Saluda and Newberry counties have relatively small economies with a dominant manufacturing base followed by the service and retail sectors. Lexington and Richland counties have larger economies with a dominant service base followed by the retail trade, and manufacturing (Lexington County) and government (Richland County) sectors. Lexington and Richland counties also have the most people employed. (USCB 2000i)

An influx of 2,340 construction workers migrating into the region would have positive economic impacts in the region. Assuming a multiplier of 2.02 jobs (direct and indirect) for every construction job (U.S. BEA 2007c), an influx of 2,340 construction workers would create 2,379 indirect jobs, for a total of 4,719 new jobs in the region of influence. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries, including the housing industry. Workers would be expected to spend most of their earnings in the county of permanent residence; hence, most of the indirect jobs related to Saluda site construction activities would be in those counties in proportion to the residential distribution patterns. However, Newberry and Saluda counties could receive a disproportionately high number of these indirect jobs because the large onsite workforce would likely purchase fuel, food, and other incidentals in these counties. Newberry and Saluda counties would also experience greater socioeconomic impacts because of their relatively small population and employment base. In the two larger counties, Lexington and Richland, the socioeconomic impacts would be less.

SCE&G concludes that the impacts from construction on the economy or labor force in the region of influence would be SMALL in Newberry, Lexington, and Richland counties. The impact in Saluda County would be LARGE because the proposed project is located in the county and because the county currently has such a small labor pool and population base. Because the impacts enhance the economic viability of the county specifically and the region of influence generally, mitigation would not be warranted.

As discussed in Subsection 9.3.3.3.6.2, about 930 workers would be required for the operation of two nuclear power facilities at the Saluda site, and SCE&G assumes that all the new employees would migrate into the region. Assuming a multiplier of 3.34 jobs (direct and indirect) for every operations job at the new units (U.S. BEA 2007c), an influx of 930 workers would create 2,181 indirect jobs for a total of approximately 3,111 new jobs in the region. SCE&G concludes that the impacts of operation of two nuclear power facilities on the economy would be beneficial and SMALL in the region of influence and mitigation would not be warranted.

9.3.3.3.6.4 Taxes

Taxes collected as a result of constructing and operating the proposed project at the Saluda site would be of benefit to the state and local taxing jurisdictions. Corporate and personal income taxes and sales and use taxes would be collected during both the construction and operation of a nuclear power facility at the Saluda site. Based on the analysis in Subsection 4.4.2.2.2, SCE&G anticipates that the Saluda site would not pay annual property taxes on the new units during construction. Property taxes on the new units would be applicable only after they are in-service.

During the operating life of the new units, SCE&G would pay property taxes to Saluda County.

In 2004, Saluda County had property tax revenues of $9,929,062 (SCORS 2005). As discussed in Subsection 5.8.2.2.2, SCE&G has negotiated a fee-in-lieu-of-taxes agreement with Fairfield County for the construction of Units 2 and 3 that includes an assessment ratio of 4.0% and a special revenue credit of 20.0% of the fee-in-lieu-of-taxes payments on the project during the first 20 years that fee-in-lieu-of-taxes payments are made. For the years 2020 through 2034, when the assessed value of the new units would peak, SCE&G estimates annual fee-in-lieu-of-taxes payments for Units 2 and 3 could range from $13.7 million to $24.6 million (Table 5.8.2-1). Assuming that SCE&G would enter into a similar fee-in-lieu-of-taxes agreement with Saluda County for nuclear power facilities at the Saluda site, tax payments for the two units could represent 58% to 71% of the tax revenue for the county. The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10% of total revenues for local jurisdictions and large when new tax payments represent more than 20% of total revenues. Therefore, SCE&G concludes that the potential beneficial impacts of taxes collected during construction and operation of the proposed project would be LARGE in Saluda County and SMALL in the remainder of the region of influence.

9.3.3.3.6.5 Transportation

Road access to the Saluda site would be via SC 121, which has a general north-south orientation. Employees traveling from the Saluda area would travel north on SC 121. Employees traveling from the Newberry area would travel south on SC 121. Employees coming from other areas, using various other roads, would still use SC 121 during their trip coming either from the north or the south. Employees traveling from the Columbia metropolitan area and the Laurens area would use I-26 to access SC 121 from the north. Employees from Batesburg-Leesville would initially travel west on US-178. Ridge Spring-Monetta employees would travel north on SC 39 and Greenwood employees would travel east on SC 34. All roads on these travel routes are two-lane paved roads.

In 2005, the annual average daily traffic count for SC 121 between Saluda and Newberry was 4,000 vehicles (SCDOT 2006b). Other road use would be minimal due to low employee numbers, with the exception of I-26, which would easily handle the anticipated vehicle numbers.

Transportation impacts are considered to be SMALL when increases in traffic do not result in delays or other operational problems; impacts are MODERATE when increases in traffic begin to cause delays or other operational problems.

Assuming construction shifts as described in Subsection 4.4.2.2.4, an additional 1,800 cars on a two-lane highway during shift changes could cause potential congestion. Also, the traffic of hauling construction materials (100 trucks per day) to the site could bring additional congestion during certain times of the day. Impacts of construction on transportation would be SMALL on I-26, US-178, SC 39, and SC 34. However impacts of construction on transportation would be SMALL to MODERATE on SC 121 and some mitigating actions such as those described in Subsection 4.4.2.2.4 would be needed.

With respect to the operations of the facility, adding at most an additional 930 cars (assuming a single occupant per car) to the existing 4,000 cars per day on the SC 121 would not materially congest the highway. Shift changes for the proposed project at the Saluda site could be staggered so that the traffic increase would not cause congestion. Impacts of the operations workforce on transportation would be SMALL and mitigation would not be warranted.

9.3.3.3.6.6 Aesthetics and Recreation

The Saluda site is an undeveloped property on the Saluda River arm of Lake Murray. Lake Murray and the four surrounding counties (Lexington, Newberry, Richland, and Saluda,) make up a tourism region defined as Capital City/Lake

Murray Country by the South Carolina Department of Parks, Recreation and Tourism. The region includes:

- Portions of the Sumter National Forest
- Billy Dreher Island State Park, which is located on an island in Lake Murray
- Sesquicentennial State Park, located in the City of Columbia
- Harbison State Forest, located in the City of Columbia
- Congaree National Park, which is located in Richland County.

Numerous trails and state heritage preserves are also located near the Saluda site. Lake Murray offers excellent opportunities for wildlife viewing, hunting, camping, boating, fishing, and other recreation. (Kleinschmidt 2005)

Lake Greenwood is located about 4.5 miles upstream of the Saluda site in Greenwood County, South Carolina. Like Lake Murray, Lake Greenwood offers excellent opportunities for wildlife viewing, hunting, camping, boating, fishing, and other recreation.

The construction and operation of the proposed project on the Saluda site would exclude the entire 850 acres from recreational use for the life of the plant. The attractiveness of the Saluda River arm of Lake Murray for sport fishing and other recreational uses could be impacted during construction of intake and discharge structures. Other recreational facilities would be affected by increased traffic on area roads during peak travel periods, but impacts would be minimal. During the operating period, it is expected that some employees and their families would use the recreational facilities in the region. However, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

The construction and operation of the proposed project at the Saluda site would have minimal impacts on aesthetic and scenic resources. The developed areas at the site would be located near the center of the property, with the area immediately adjacent to the Saluda River mostly undeveloped. The remainder of the site would consist of forested areas, ponds, and open fields. The intake structure would be located on the south bank of the Saluda River just above the confluence with Bush River, approximately 9 miles southeast of the Saluda site. The outfall would be located on the east bank of the Saluda River just northeast of the nuclear power facilities. From the Saluda River and Lake Murray, the plant, including the intake and outfall, may be visible from certain angles, although from most points the structures would be hidden by elevated terrain or vegetation. The upper portions of facility structures may be visible from elevated areas near the site. There would be occasional visible plumes associated with the cooling towers.

The visibility of the plumes would depend on the weather and wind patterns, and the location of the viewer within the general topography of the area. Impacts on aesthetic resources are considered to be moderate if there are some complaints about diminution in the enjoyment of the physical environment and measurable impacts that do not alter the continued functioning of socioeconomic institutions and processes. Construction and operation of an industrial facility on a previously undeveloped site would likely result in some complaints from the affected public regarding diminution in the enjoyment of the physical environment. Therefore, impacts of construction and operation of the proposed project on aesthetics would be MODERATE and could warrant mitigation.

9.3.3.3.6.7 Housing

SCE&G estimates that 2,340 workers would move from outside the region of influence to one of the counties inside the region of influence. All 2,340 workers would need housing. Some of the workers would require permanent housing, generally owner-occupied, and others would elect to rent housing. Still others would elect to reside in transitional housing such as residential hotels, motels, rooms in private home, or to bring their own housing in the form of campers and mobile homes.

Based on 2000 census data, within the four counties near the Saluda site, there are 246,119 housing units of which 21,625 are vacant (8.8%). In 2000, the number of vacant housing units within each of the counties was 7,738 (8.5%) in Lexington County, 2,779 (16.5%) in Newberry County, 9,692 (7.5%) in Richland County, and 1,416 (16.6%) in Saluda County (USCB 2000h).

SCE&G estimates that, in absolute numbers, the available housing would be sufficient to house the construction workforce. In-migrating workers could secure housing from the existing stock, in any of the four counties within the region, have new homes constructed, or bring their own housing to the region. Construction employment would increase gradually, reaching the peak of 3,600 workers after 4 to 5 years allowing time for market forces to anticipate and accommodate the influx of workers and their families.

Because Newberry and Saluda Counties have small populations, their housing markets would likely be the most impacted. If all in-migrating workers to Newberry County were demanding housing from the existing stock, the impact would be 2.6% of the 2000 inventory or 16.0% of the vacant units available that year. If all in-migrating workers to Saluda County were to demand housing from the existing stock, the impact would be 2.6% of the inventory in 2000 or 15.7% of the vacant housing available that year. The Lexington and Richland County housing markets would experience a small impact on housing—0.6% and 0.9% of the 2000 inventory, respectively.

In summary, the four counties where most of the construction workforce would seek housing have adequate housing resources for the entire workforce. Impacts on housing are considered to be small when a small and not easily discernible change in housing availability occurs. SCE&G concludes that the potential impacts of construction on housing would be SMALL throughout the region of influence and mitigation would not be warranted.

SCE&G estimates that approximately 930 workers would be needed for operation of two nuclear power facilities at the Saluda site. Most of these workers would be expected to come from within the region of influence. Any employees relocating to the region would most likely settle in the region of influence with the same proportions as the current VCSNS workforce. If all 930 workers came from outside the region of influence, the Lexington, Newberry, Richland, and Saluda County housing markets would experience a small impact on housing—0.4%, 1.0%, 0.2%, and 1.0% of the 2000 inventory, respectively.

SCE&G concludes that the potential impacts on housing from operation of the proposed project at the Saluda site would be SMALL for all four counties in the region of influence and would not warrant mitigation.

9.3.3.3.6.8 Public Services

Public services include water supply and wastewater treatment facilities; police, fire and medical facilities; and social services.

New construction or operations employees relocating from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county region provide medical care to much of the population within the 50-mile region and the small increases in the regional population would not materially impact the availability of medical services.

The proposed project and the associated population influx would likely economically benefit the disadvantaged population served by the South Carolina Department of Human Resources. The additional direct jobs will increase indirect jobs that could be filled by currently unemployed workers, thus removing them from social services client lists.

The following table provides 2002 data for the person-per-police-officer and persons-per-firefighter within the four-county region as well as the state of South Carolina (USCB 2004):

County/State	Persons-Per-Police- Officer Ratios	Persons-Per-Firefighter Ratios
Lexington County	476:1	893:1
Newberry County	415:1	182:1
Richland County	361:1	593:1
Saluda County	391:1	143:1
State of South Carolina	422:1	282:1

Ratios, in part, depend on population density. Fewer public safety officers are necessary for the same population if the population resides in a smaller area. The population increase in the four counties from construction or operations employees relocating from outside the region could result in the need to hire additional emergency personnel. This is most likely to happen in Saluda and Newberry Counties. However, increased tax revenues would be adequate to pay the salaries of any additional emergency personnel hired.

As discussed above, it is not expected that public services would be materially impacted by new construction or operations employees relocating from outside the region. Impacts on public services are considered to be small if there is little or no need for changes in the level of service provided to the community. Therefore, impacts of construction and operation of the proposed project on public services would be SMALL and mitigation would not be warranted.

9.3.3.3.6.9 Education

Based on data for the 2004–2005 school year, Lexington County has 66 PK-12 schools with a total enrollment of 51,276 students, Newberry County has 14 PK-12 schools with a total enrollment of 5,948 students, Richland County has 93 PK-12 schools with a total enrollment of 50,159 students, and Saluda County has 5 PK-12 schools with a total enrollment of 2,149 students (NCES 2006a).

Based on 2000 census data, 20.59% of the population in South Carolina is enrolled in PK-12 schools (USCB 2002a). SCE&G estimates that approximately 1,800 in-migrating construction workers would bring their families, which would increase the school-aged population within the region of influence by approximately 938 students. The student populations in Lexington, Newberry, Richland, and Saluda counties would increase by 0.7%, 3.0%, 0.6%, and 4.1%, respectively. Small impacts are generally associated with project-related enrollment increases of up to 3% and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3% to 8%. Therefore, projected increases in the student populations of Lexington, Newberry, and Richland Counties would have a SMALL impact on the education systems and mitigation would not be warranted. In Saluda County, the projected increase in the student population would constitute a MODERATE impact. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and tax revenues as a result of the increased population would fund additional teachers and facilities. No additional mitigation would be warranted.

Most of the operations workforce would be expected to come from within the region of influence where their educational requirements are already being met. As such, the school systems in these areas would not experience any major influx of students from operation of the proposed project at the Saluda site. If all 930 employees and their families were to come from outside the region, the school-aged population within the region of influence of the Saluda site would increase by approximately 484 students. The student populations in Lexington, Newberry, Richland, and Saluda Counties would increase by 0.3%, 1.5%, 0.3%, and 2.1%, respectively. These increases in student population are below 4% of the total student populations in these counties, hence project-related enrollment increases would constitute a SMALL impact on the education systems and mitigation would not be warranted.

9.3.3.3.7 Historic and Cultural Resources

SCE&G conducted historical and archaeological records searches on the National Park Service's National Register Information System (NRHP) and reviewed information on historic and archeological sites provided in documents associated with the Saluda Hydro Relicensing Project.

The NRHP identifies 57 sites in the three counties surrounding the Saluda site including 16 sites in Greenwood County, 31 sites in Newberry County, and 10 sites in Saluda County. Two of these properties, the Webb-Coleman House (5.9 miles west-southwest) and the Moon-Dominick House (6.8 miles northwest), are located within 10 miles of the Saluda site (NPS 2006c).

Three recent archaeological and historical studies (one in 2001 and two in 2003) were conducted on lands adjacent to Lake Murray in association with construction of the backup dam to the Saluda Dam. These surveys identified 53 archeological and historic architectural and engineering resources. Twenty-two of these resources have not been assessed for their eligibility for inclusion in the NRHP. Of the remaining 31 resources, 8 have been determined to be eligible for the NRHP. The locations of these resources are not identified (Kleinschmidt 2005).

SCE&G is currently conducting a cultural resource investigation of the lands adjacent to Lake Murray in association with the Saluda Hydro Relicensing Project. Stage I of the investigation, a reconnaissance-level survey, was completed in 2005 and included a total of 620 miles of shoreline along Lake Murray as well as 25 miles of riverbank on the Saluda, Little Saluda, Lower Saluda rivers, and major tributaries. During the Stage I survey, 42 previously recorded archeological sites and 40 new sites were identified. Eight newly recorded historic structures were also identified during Stage I, with one site being eligible for the NRHP. Stage II of the investigation, an intensive survey, is ongoing and includes approximately 89 miles of shoreline and 135 islands. As of September 2006, the Stage II survey had identified 77 new archeological sites, including 30 prehistoric sites ranging from Early Archaic to Late Woodland (10,000 to 1,000 years ago), 32 historic home sites from 19th and early 20th century, and 5 historic cemeteries. The locations of these resources are not identified (CRCG 2005; CRCG 2006).

Siting the proposed project at the Saluda site would require a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Mitigative measures would be performed to prevent permanent damage and ensure that any impacts to cultural resources from construction or operation of the proposed project at the Saluda site would be SMALL.

9.3.3.3.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. 2004). Subsection 2.5.4.1 describes the methodology SCE&G used to establish locations of minority and low-income populations.

The 2000 census block groups were used for ascertaining minority and low-income in the area. There are 849 block groups within 50 miles of the Saluda site. The 2000 Census Bureau data for South Carolina is provided in the following table:

	Data for South Carolina
Black Races	29.5%
American Indian or Alaskan Native	0.3%
Asian	0.9%
Native Hawaiian or other Pacific Islanders	0.04%
All Other Single Minorities	1.0%
Multiracial	1.0%
Aggregate of Minority Races	32.8%
Hispanic	2.4%

If any block group percentage exceeded its corresponding state percentage by more than 20%, then the block group was identified as having minority population. Black minority populations exist in 192 block groups; Asian minority populations exist in one block group; “Aggregate of Minority Races” populations exist in three block groups; and “Hispanic Ethnicity” populations exist in 214 block groups. No other minority populations exist in the geographic area. The locations of the minority populations within the region of influence are shown in Figure 9.3-10.

The Census Bureau data characterize 14.11% of South Carolina households as low-income. Based on the “more than 20%” criterion, 53 block groups out of a possible 849 contain a low-income population. There are no minority or low income populations within 6 miles of the Saluda site. The locations of the low-income populations within 50 miles of the Saluda site are shown in Figure 9.3-11.

Construction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately impact minority populations because of their distance from the Saluda site. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs.

Operation of the proposed project at the Saluda site is also unlikely to have a disproportionate impact on minority or low-income populations.

SCE&G concludes that environmental justice consequences of the construction and operation of the proposed project at the Saluda site would be SMALL, and that mitigation would not be warranted.

9.3.4 SUMMARY AND CONCLUSIONS

The decision to colocate the two nuclear power facilities at VCSNS near Jenkinsville, South Carolina was based on a comparison of the one nuclear generating site (VCSNS) that supplies electric power to SCE&G and Santee Cooper customers, a federally owned nuclear site (SRS) located near Aiken, South Carolina, an existing nonnuclear generating site (Cope Generating Station near Cope, South Carolina), and a greenfield site (Saluda site, near Silverstreet, South Carolina). Unit 1 currently operates under an NRC license, and the proposed location for Units 2 and 3 has already been found acceptable under the requirements for that license. Further, operational experience at the existing facility has shown that the environmental impacts are generally SMALL, and operation of two new nuclear power facilities at the site should have similar environmental impacts.

SCE&G's evaluation of alternative sites focused on whether there are any sites that are obviously superior to the VCSNS site. The review process was consistent with the special case noted in NUREG-1555, Section 9.3(III)(8), and took into account the advantages already present at existing nuclear facilities within the region of interest. Initially, candidate sites, including federal facility sites, existing nuclear power plant sites, existing nonnuclear power plant sites, and greenfield sites, within the region of interest were identified and screened. During initial review, SCE&G determined that the advantages of colocating the new facility with an existing nuclear power facility outweighed the advantages of any other probable siting alternative. Therefore, consideration of alternative sites within the region of interest focused primarily on sites with an existing nuclear facility. The Cope Generating Station and Saluda sites were included in the evaluation to determine if nonnuclear generating or greenfield sites are obviously superior to an existing nuclear site.

Tables 9.3-5 and 9.3-6 compare the environmental impacts of construction and operation of the proposed project at each of the alternative sites with impacts at the VCSNS site. This site-by-site comparison did not result in identification of a site obviously superior to the VCSNS site.

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Table 9.3-1
Results of 1974 Nuclear Plant Siting Study

	Criteria								
Potential Site Name	**Cooling Water Supply**	**Flooding**	**Population**	**Quality & Diversity of Habitat**	**Endangered Species**	**Railroad Access**	**Transmission Access**	**Geology & Seismic**	**Land Use Conflicts**
Primary Sites									
Ne-1	Excellent	Very good	Low	Good	Few	Good	Very good	Very good	Some
Ne-2	Very good	Very good	Low	Good	Few	Good	Very good	Very good	Some
Saluda	Very good	Very good	Low	Very good	Few	Good	Very good	Very good	None
Al-1	Excellent	Good	Low	Very good	Several	Very good	Very good	Good	None
Br-1	Excellent	Excellent	Medium	Poor	Few	Good	Very good	Good	None
Mc-1	Excellent	Good	Medium	Excellent	Several	Good	Very good	Very good	Some
Secondary Sites									
Ja-2	Very good	Excellent	Low	Very good	Few	Very good	Very good	Fair	Some
Al-2	Excellent	Poor	Low	Excellent	Several	Very good	Good	Good	None
Mc-2	Excellent	Good	Medium	Excellent	Some	Excellent	Good	Very good	Some
CGS	Good	Good	Low	Good	Few	Excellent	Excellent	Fair	Some
WGS	Very good	Good	Medium	Good	Several	Excellent	Excellent	Fair	Some
Fa-1	Very good	Excellent	Low	Poor	Few	Very good	Excellent	Very good	None
Tertiary Sites									
Ja-1	Excellent	Poor	Low	Excellent	Some	Poor	Good	Fair	Some
Co-1	Fair	Poor	Low	Excellent	Some	Good	Good	Fair	Some
Ch-1	Good	Good	Low	Excellent	Some	Good	Good	Fair	Some
Ge-1	Poor	Poor	Medium	Very good	Several	Very good	Very good	Fair	Some
Wi-1	Poor	Good	Low	Excellent	Several	Very good	Good	Fair	Some
Wi-2	Poor	Poor	Low	Excellent	Several	Very good	Good	Fair	Some

Adapted from Dames & Moore 1974

Table 9.3-2
Site Screening Evaluation Ratings

EPRI Criteria											
Potential Site Name	**Cooling Water Supply**	**Flooding**	**Population**	**Hazard Land Uses**	**Ecology**	**Wetlands**	**Railroad Access**	**Transmission Access**	**Geology & Seismic**	**Land Acquisition**	**Composite Site Rating**
Weight Factor											
	9.3	4.4	8.6	5.9	5.6	5.6	6.7	7.4	9.8	6.3	
Site Ratings											
SRS	3.5	5	4	4	4	4	4.79	1	2	4.5	**246.6**
VCSNS	4	5	4	4	4	4	4.96	4.94	3	5	**294.7**

Table 9.3-3
Federally Listed Species Recorded in Bamberg, Colleton, and Orangeburg Counties, South Carolina

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County
Fish				
Acipenser brevirostrum	Shortnose Sturgeon	E	E	Bamberg, Colleton, Orangeburg
Birds				
Haliaeetus leucocephalus	Bald eagle	(c)	E	Colleton, Orangeburg
Mycteria Americana	Wood stork	E	E	Bamberg, Colleton
Picoides borealis	Red-cockaded woodpecker	E	E	Bamberg, Colleton, Orangeburg
Charadrius melodus	Piping plover	T	T	Colleton
Reptiles				
Lepidochelys kempii	Kemp's ridley sea turtle	E		Colleton
Dermochelys coriacea	Leatherback sea turtle	E		Colleton
Caretta caretta	Loggerhead sea turtle	T	T	Colleton
Chelonia mydas	Green sea turtle	T		Colleton
Amphibians				
Ambystoma cingulatum	Flatwoods salamander	T	E	Orangeburg
Plants				
Oxypolis canbyi	Canby's dropwort	E	E	Bamberg, Colleton, Orangeburg
Lindera melissifolia	Pondberry	E	E	Colleton

a) Source: USFWS (2007)
b) Source: SCDNR (2006)
c) Bald eagle was delisted in 2007.

Table 9.3-4
Federally Listed Species Recorded in Newberry and Saluda Counties, South Carolina

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Birds			
Haliaeetus leucocephalus	Bald eagle	[c]	E
Mycteria Americana	Wood stork	E	E
Picoides borealis	Red-cockaded woodpecker	E	E
Plants			
Amphianthus pusillus	Pool sprite	T	T
Ptilimnium nodosum	Harperella	E	E

a) Source: USFWS (2007)
b) Source: SCDNR (2006)
c) Bald eagle was delisted in 2007.

Table 9.3-5
Characterization of Construction Impacts at the VCSNS and Alternative Sites

Category	VCSNS	SRS	Cole Generating Station	Saluda
Land Use Impacts				
The Site and Vicinity	SMALL	SMALL	SMALL	MODERATE
Transmission rights-of-way	MODERATE	MODERATE	SMALL to MODERATE	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL
Water Related Impacts				
Water Use	SMALL	SMALL	MODERATE to LARGE	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL
Ecological Impacts				
Terrestrial Ecosystems	SMALL	SMALL	SMALL	SMALL
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL
Threatened and Endangered Species	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts				
Physical Impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL to MODERATE[(d)]	SMALL
Economy	SMALL to LARGE[(a)] (Beneficial)	SMALL (Beneficial)	SMALL to MODERATE[(e)] (Beneficial)	SMALL to MODERATE[(f)] (Beneficial)
Taxes	SMALL to LARGE[(b)] (Beneficial)	SMALL (Beneficial)	SMALL to MODERATE [(e)] (Beneficial)	SMALL to LARGE[(g)] (Beneficial)
Transportation	MODERATE to LARGE[(c)]	SMALL	SMALL to MODERATE[(f)]	SMALL to MODERATE[(h)]
Aesthetics	SMALL	SMALL	SMALL	MODERATE
Recreation	SMALL	SMALL	SMALL	SMALL
Housing	SMALL	SMALL	SMALL to MODERATE[(d)]	SMALL to MODERATE[(h)]
Public and Social Services	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL to MODERATE[(d)]	SMALL to MODERATE[(i)]
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL	SMALL

a) Impacts to Fairfield and Newberry Counties would be MODERATE to LARGE and beneficial. Impacts in the remainder of the region of influence would be SMALL.
b) Impacts in Fairfield County would be LARGE. Impacts in the remainder of the region of influence would be SMALL.
c) Impacts in Fairfield and Newberry Counties would be MODERATE to LARGE. Impacts in the remainder of the region of influence would be SMALL.
d) Impacts to Bamberg County would be MODERATE. Impacts in the remainder of the region of influence would be SMALL.
e) Impacts to Orangeburg County would be MODERATE. Impacts in the remainder of the region of influence would be SMALL.
f) Impacts to Newberry County and Saluda County would be MODERATE to LARGE and beneficial. Impacts in the remainder of the region of influence would be SMALL.
g) Impacts to Saluda County would be MODERATE to LARGE. Impacts in the remainder of the region of influence would be SMALL.
h) Impacts to Saluda and Newberry Counties would be MODERATE. Impacts in the remainder of the region of influence would be SMALL.
i) Impacts to Saluda County would be MODERATE. Impacts in the remainder of the region of influence would be SMALL.

Table 9.3-6
Characterization of Operation Impacts at the VCSNS and Alternative Sites

Category	VCSNS	SRS	Cole Generating Station	Saluda
Land Use Impacts				
The Site and Vicinity	SMALL	SMALL	SMALL	MODERATE
Transmission rights-of-way	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL
Water Related Impacts	SMALL			
Water Use	SMALL	SMALL	MODERATE to LARGE	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL
Ecological Impacts				
Terrestrial Ecosystems	SMALL	SMALL	SMALL	SMALL
Aquatic Ecosystems	SMALL	SMALL	MODERATE to LARGE	SMALL
Threatened and Endangered Species	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts				
Physical Impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL
Economy	SMALL to MODERATE (Beneficial)	SMALL (Beneficial)	SMALL (Beneficial)	SMALL (Beneficial)
Taxes	SMALL to LARGE (Beneficial)	SMALL (Beneficial)	SMALL to LARGE(b) (Beneficial)	SMALL to LARGE(d) (Beneficial)
Transportation	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Aesthetics	SMALL	SMALL	SMALL	MODERATE
Recreation	SMALL	SMALL	SMALL	SMALL
Housing	SMALL to MODERATE	SMALL to MODERATE(a)	SMALL	SMALL
Public and Social Services	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL to MODERATE(c)	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL to MODERATE	SMALL	SMALL	SMALL

a) Impacts in region of influence would be SMALL. Impacts to Barnwell County would be SMALL to MODERATE.
b) Impacts in region of influence would be SMALL. Impacts to Orangeburg County would be MODERATE to LARGE.
c) Impacts in region of influence would be SMALL. Impacts to Bamberg County would be MODERATE.
d) Impacts in region of influence would be SMALL. Impacts to Saluda County would be MODERATE to LARGE.

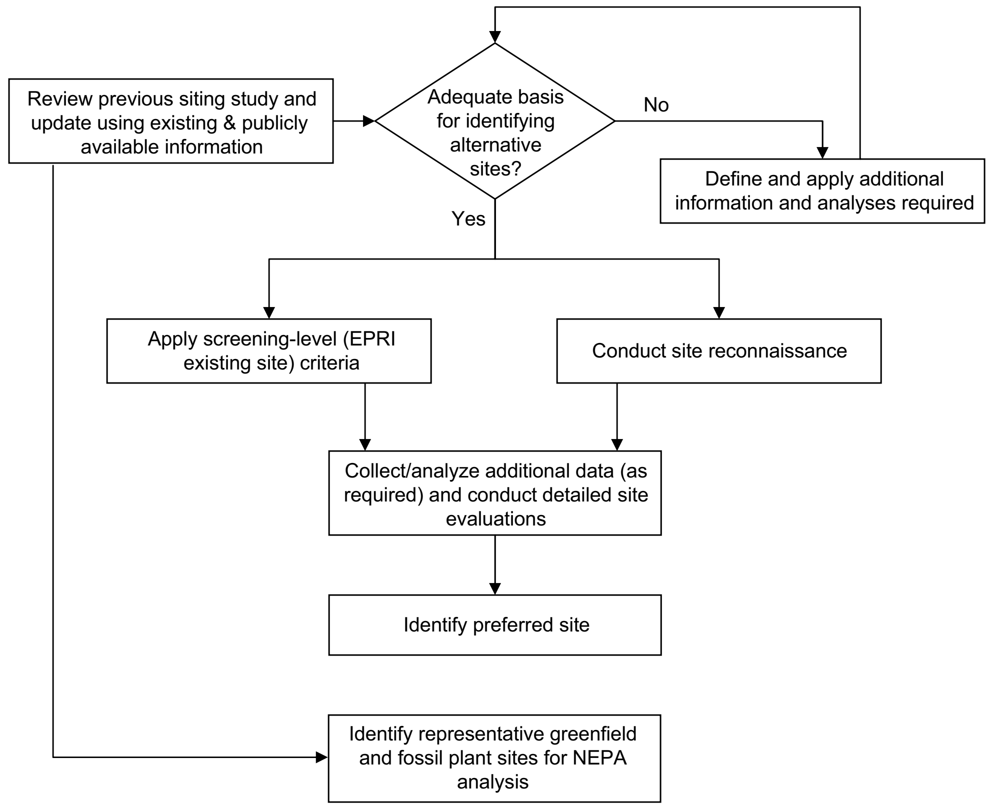

Figure 9.3-1. SCE&G 2005 Site Selection Process

Figure 9.3-2. **Potential Candidate Sites**

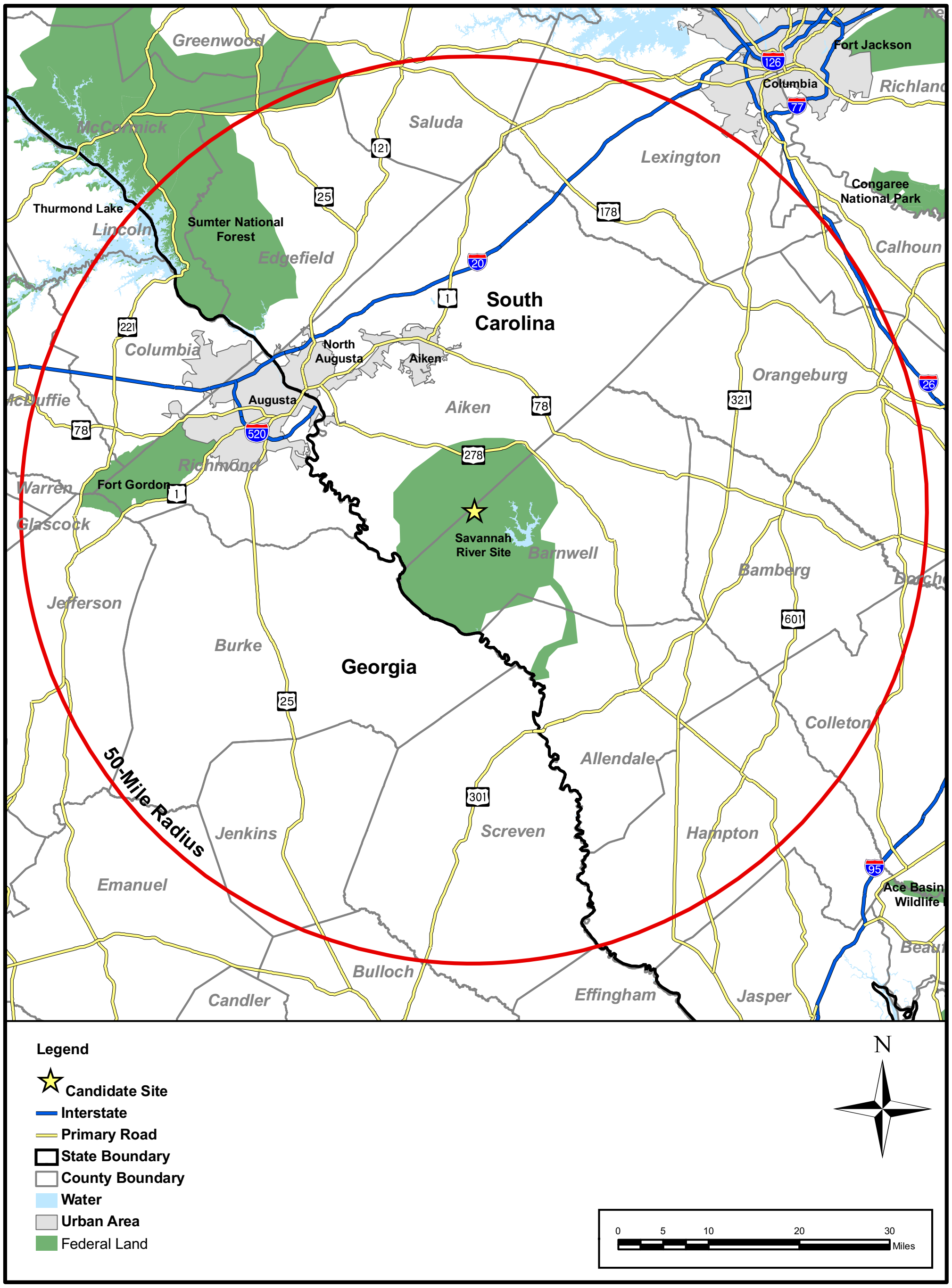

Figure 9.3-3. Savannah River Site

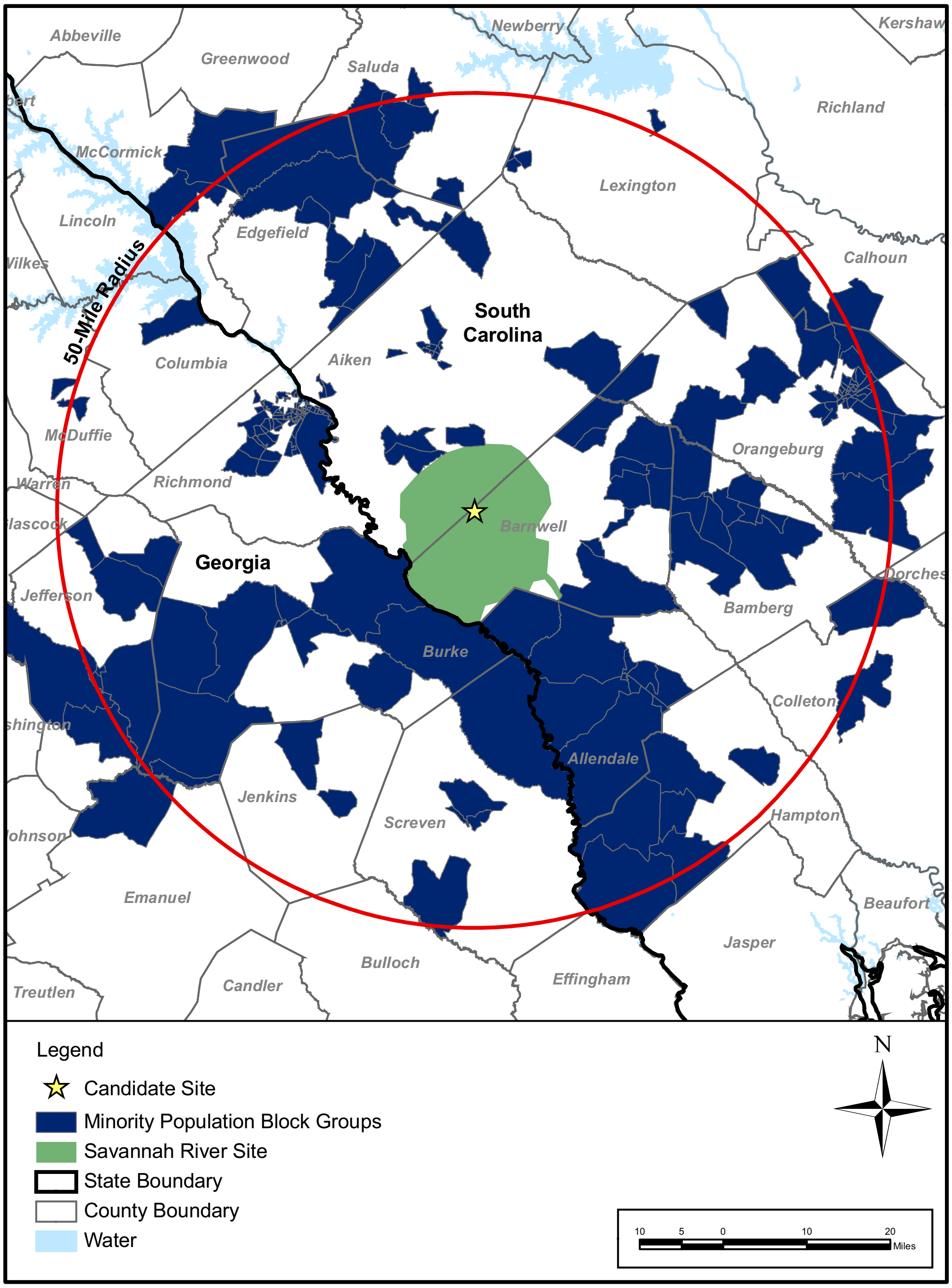

Figure 9.3-4. Minority Population Block Groups within 50 Miles of SRS

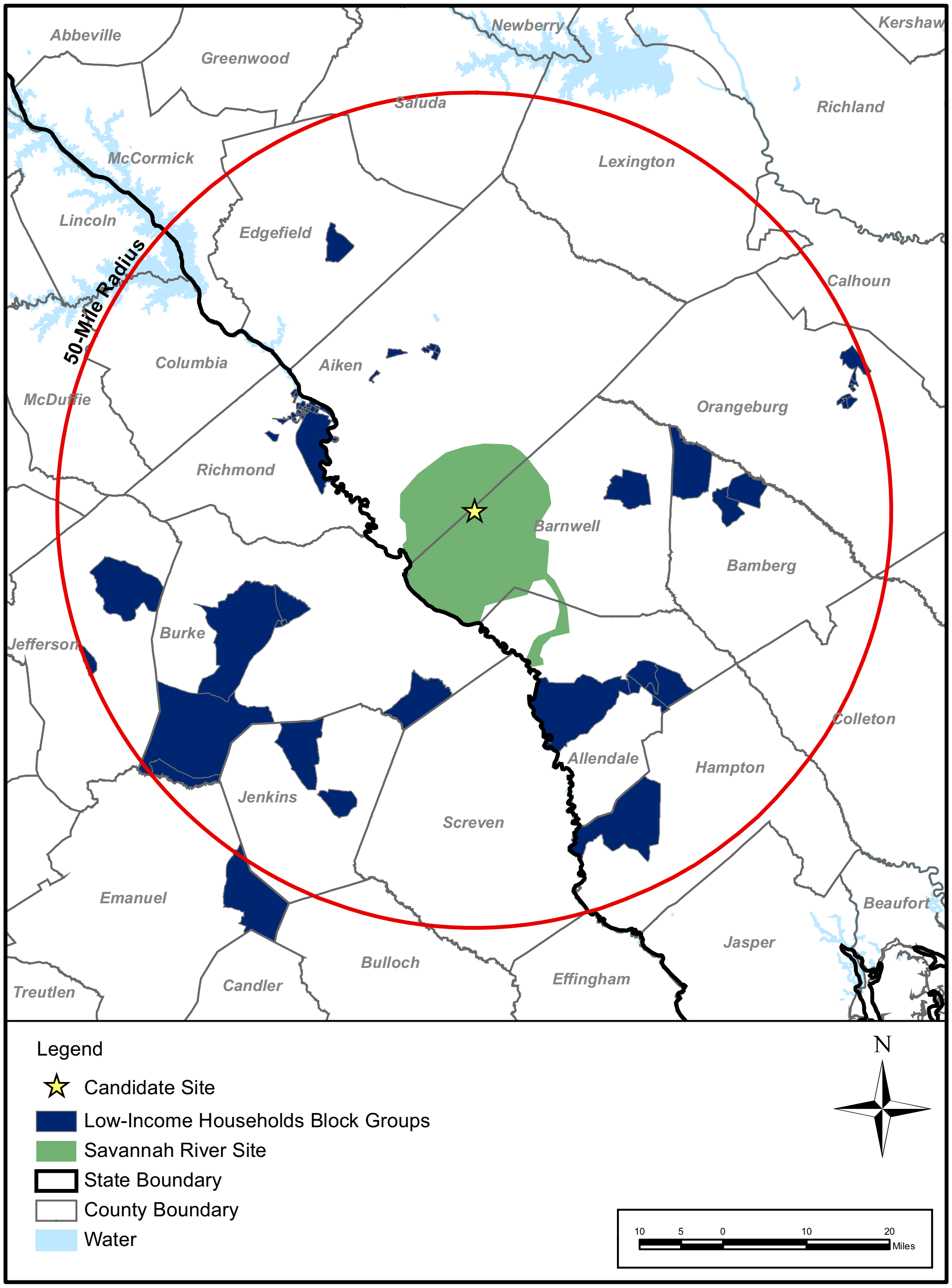

Figure 9.3-5. Low-Income Households Block Groups within 50 Miles of SRS

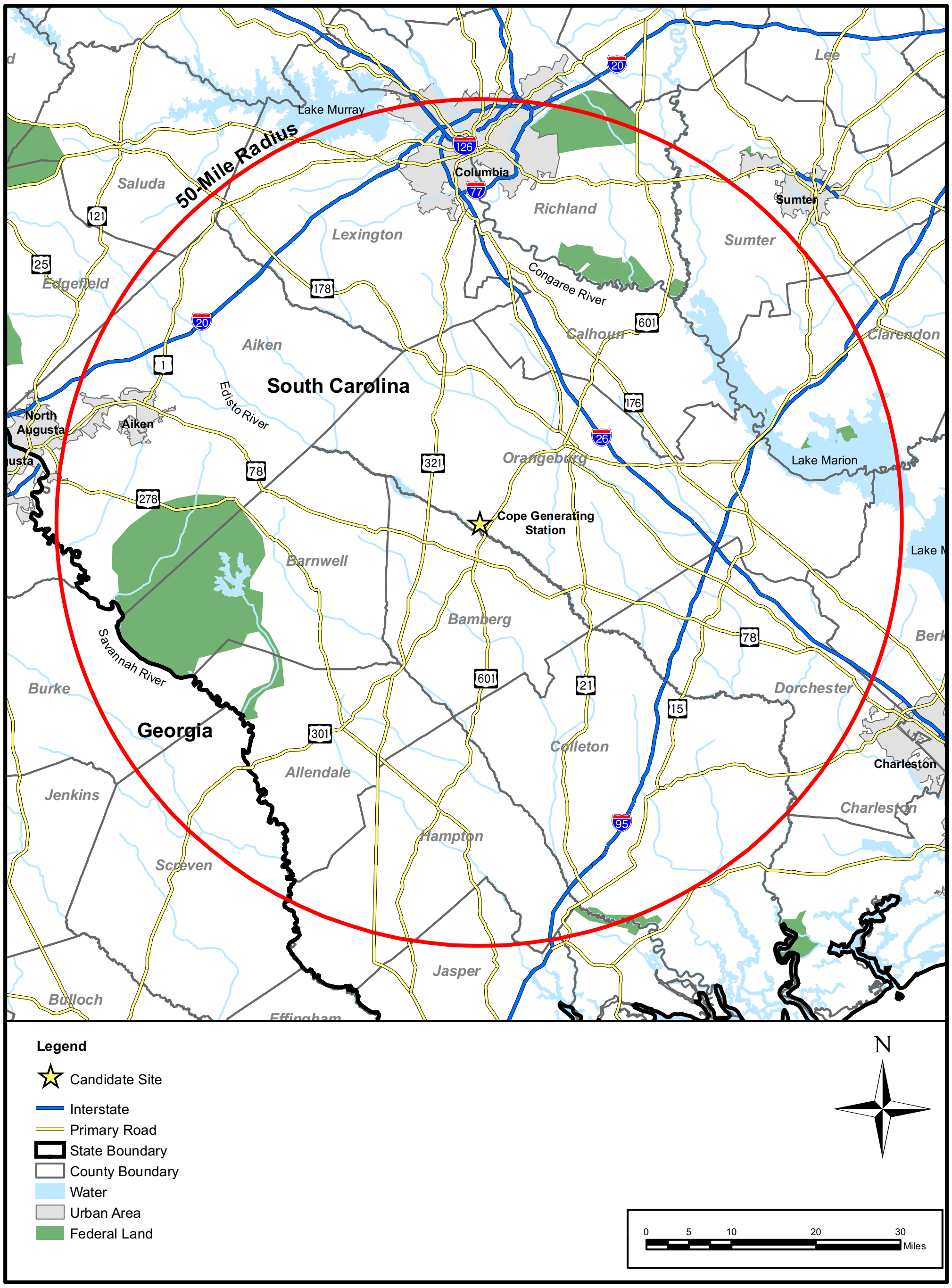

Figure 9.3-6. Cope Generating Station

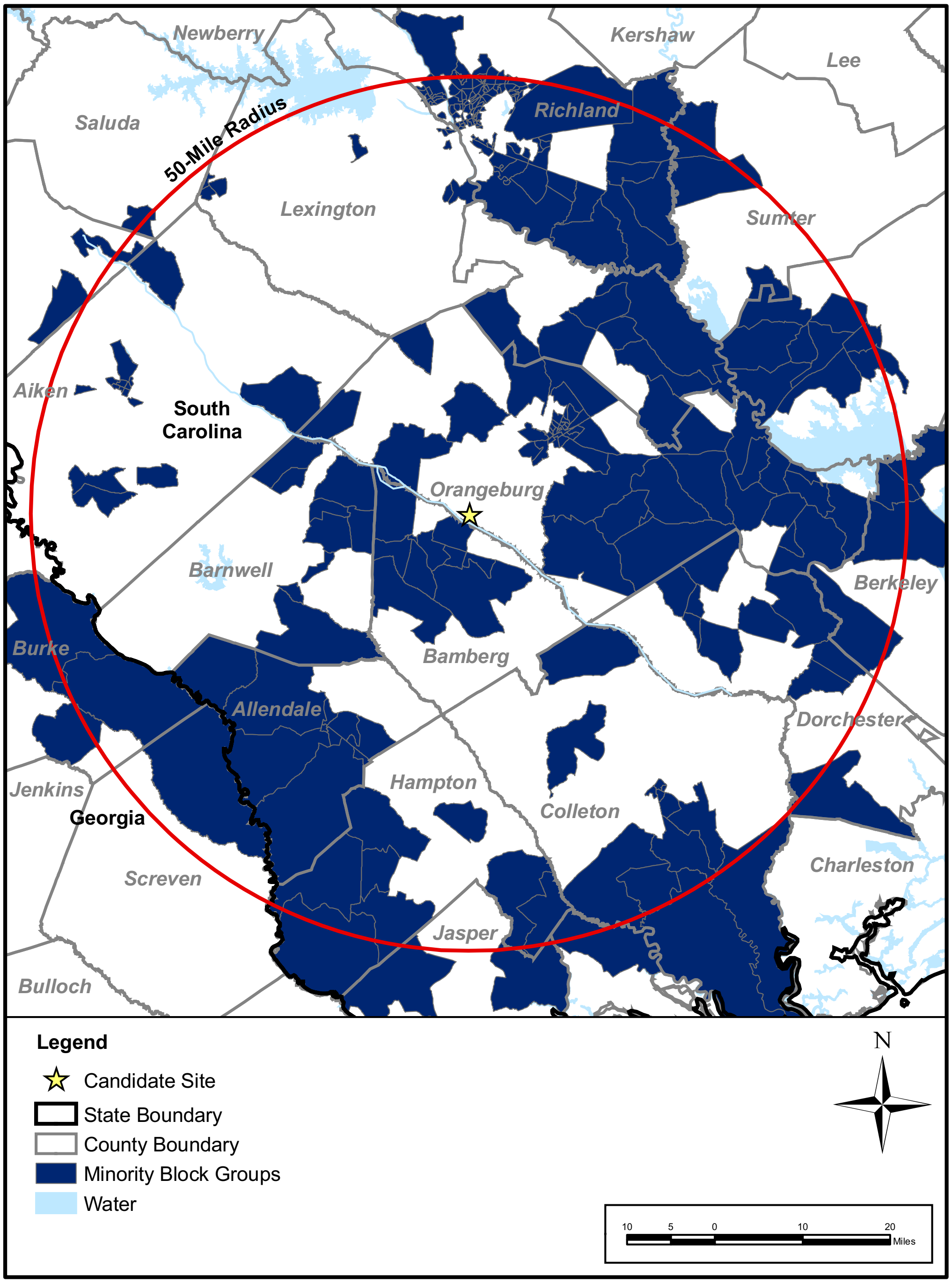

Figure 9.3-7. Minority Block Groups within 50 Miles of Cope Generating Station

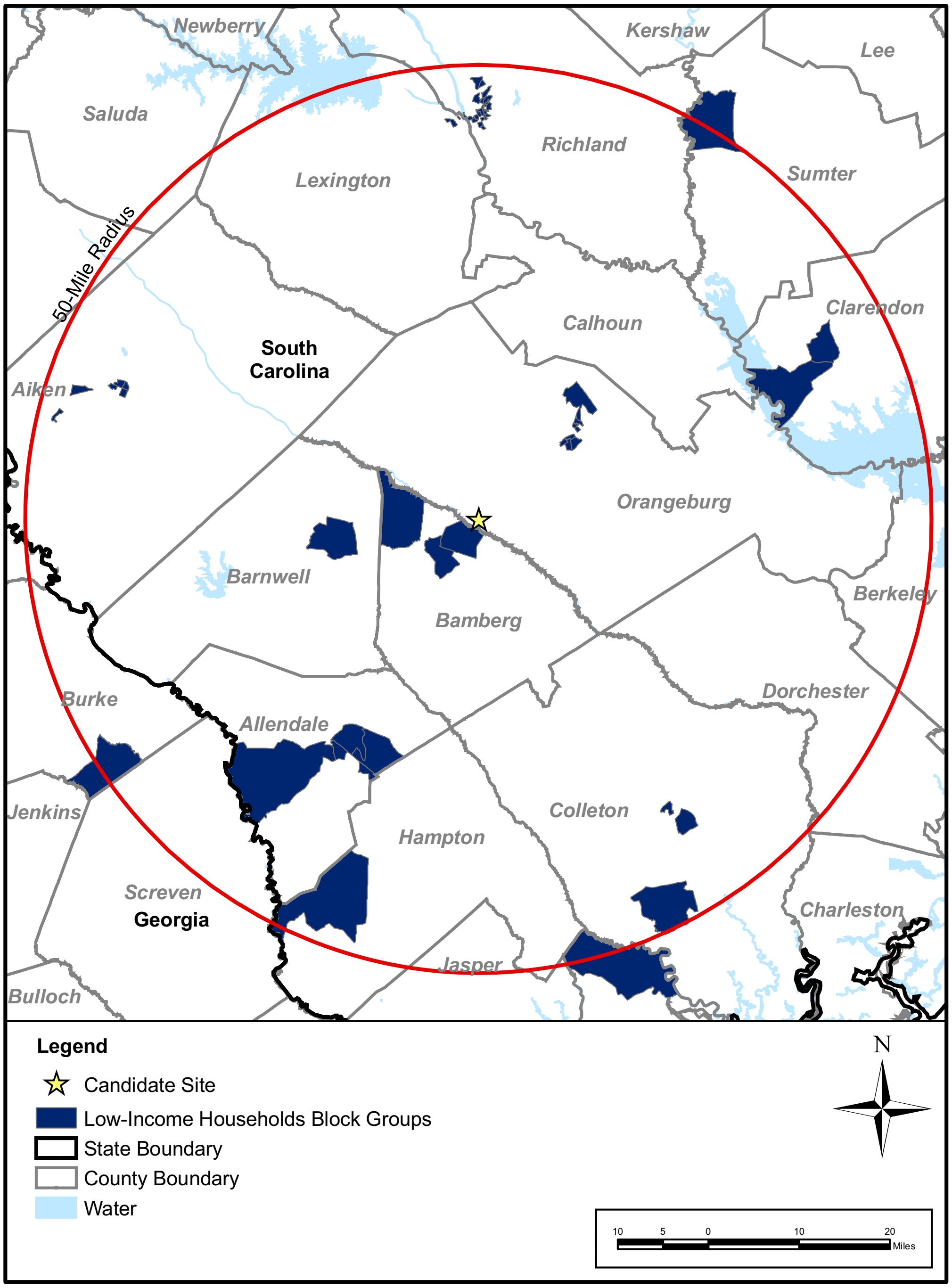

Figure 9.3-8. Low-Income Households Block Groups within 50 Miles of Cope Generating Station

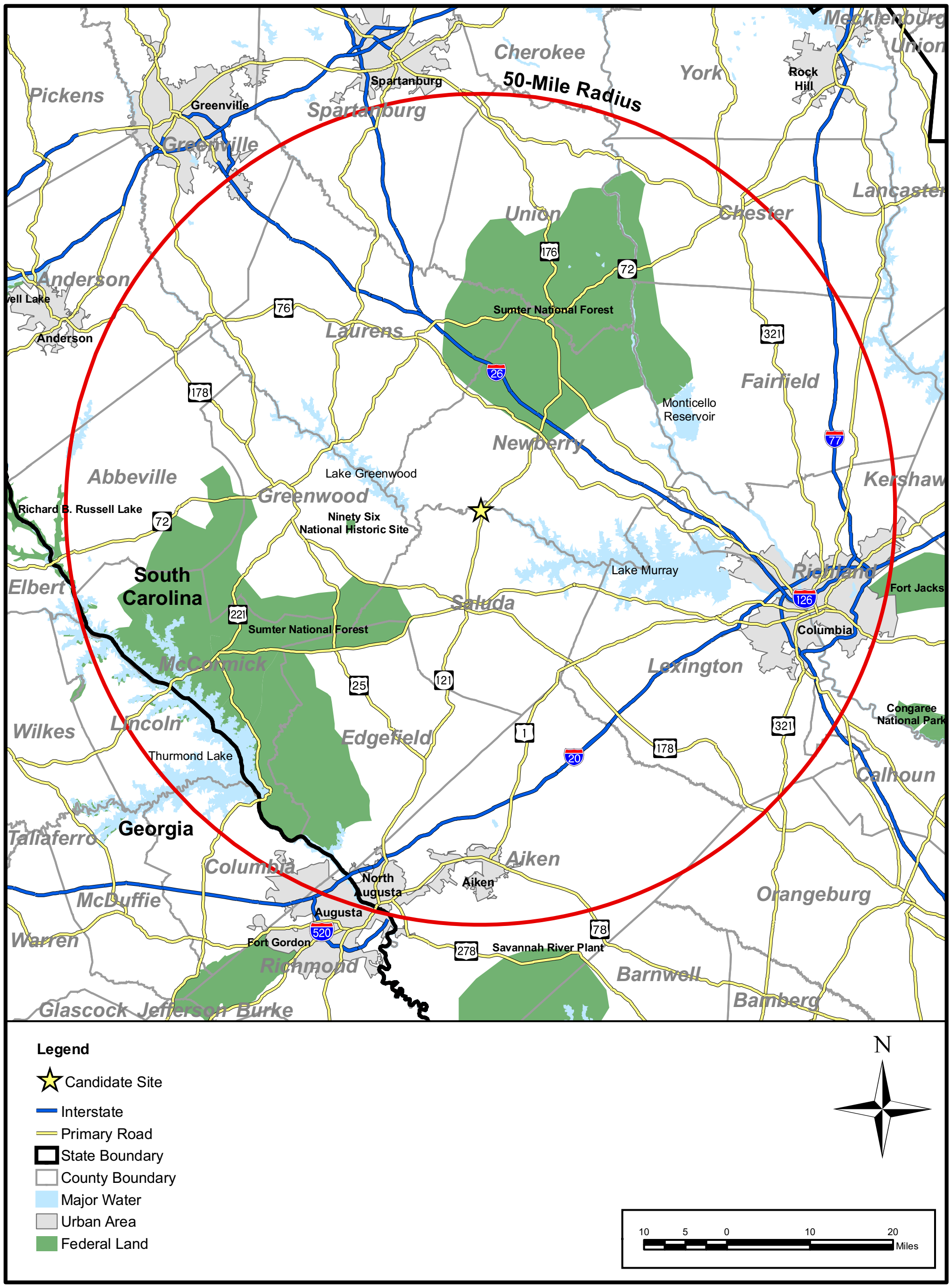

Figure 9.3-9. Saluda Site

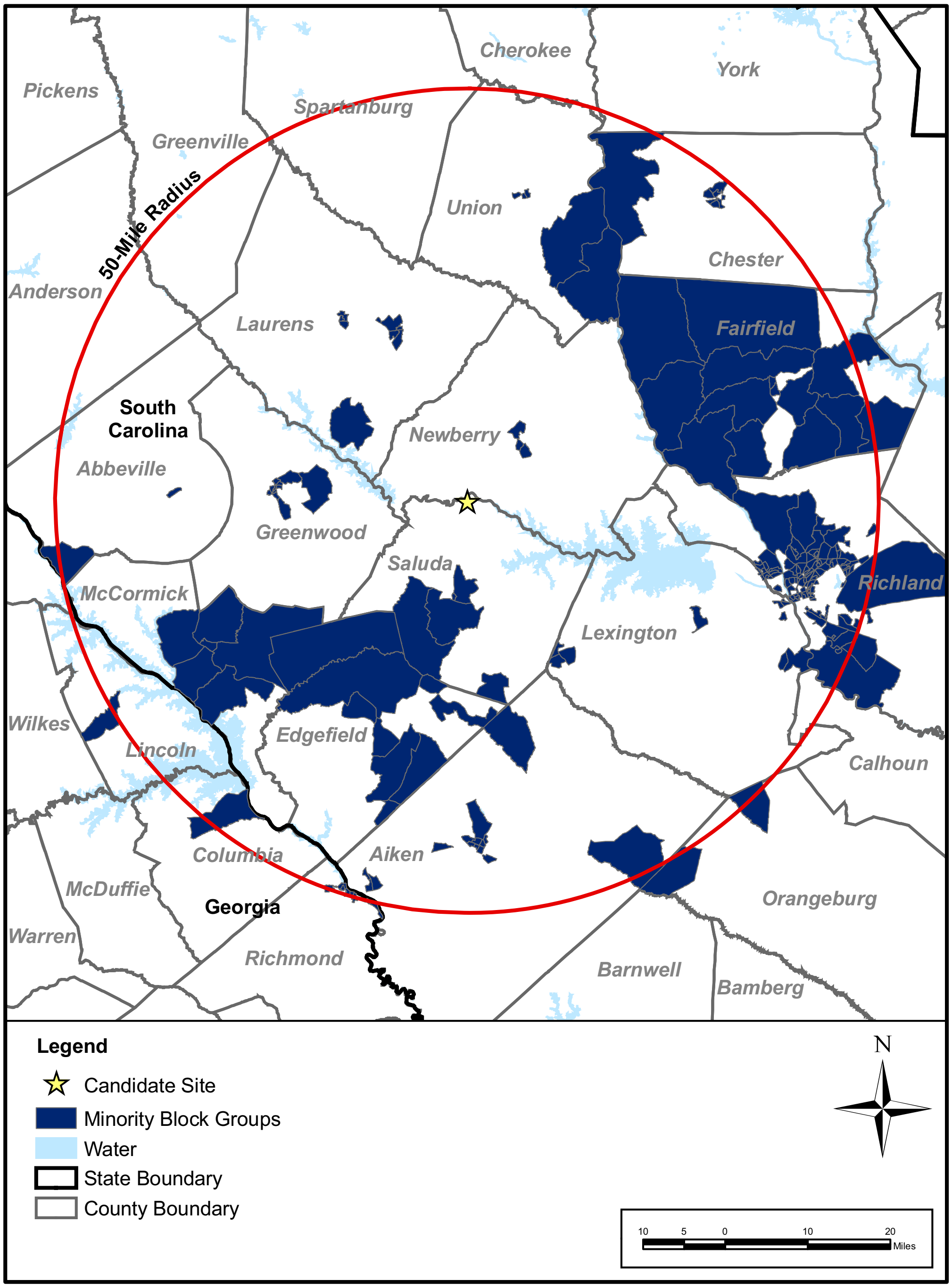

Figure 9.3-10. Minority Block Groups within 50 Miles of the Saluda Site

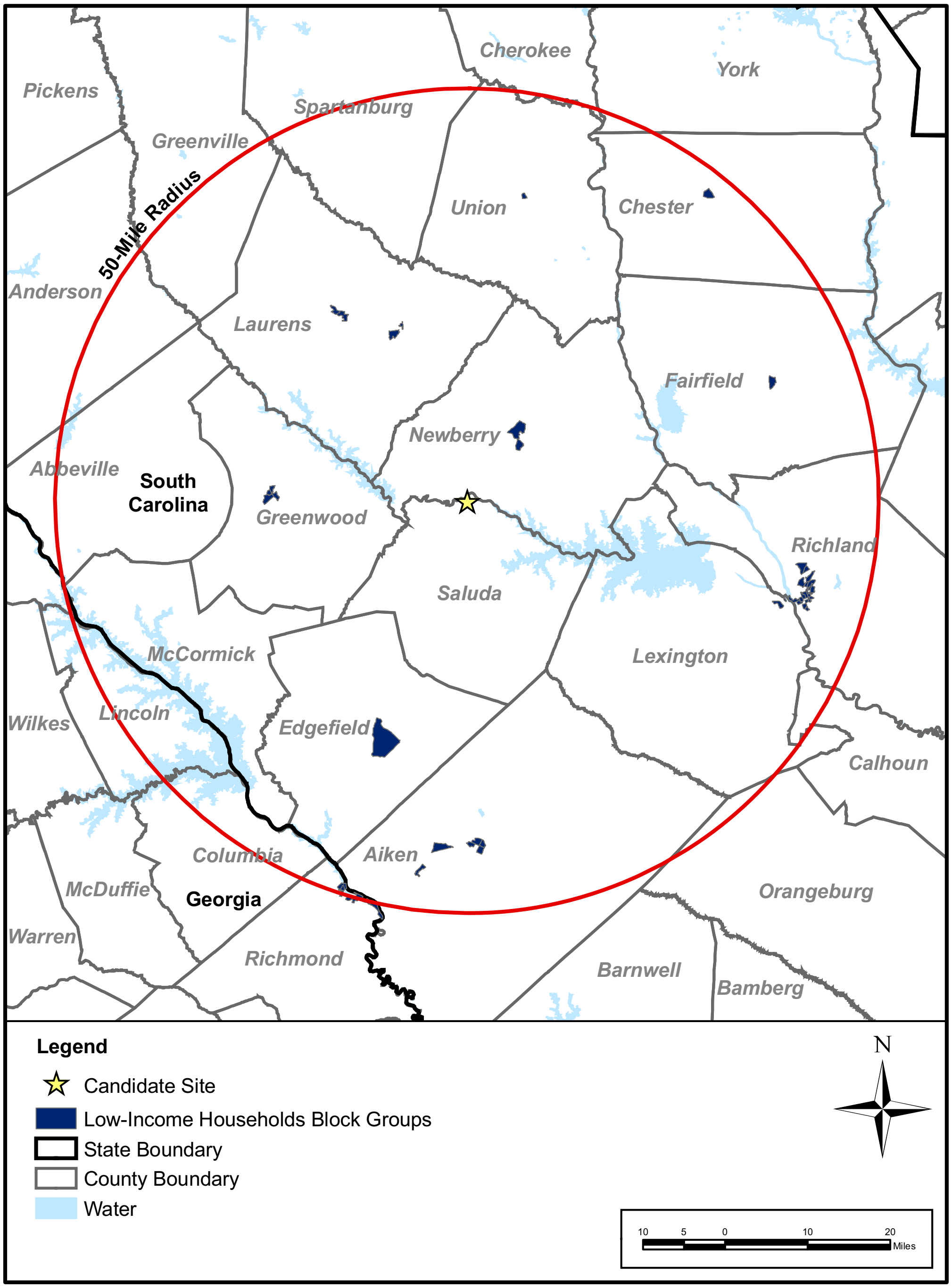

Figure 9.3-11. Low-Income Households Block Groups within 50 Miles of the Saluda Site

9.4 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS

This section discusses alternative systems for the proposed AP1000 reactors at the VCSNS site. Subsection 9.4.1 evaluates alternative heat dissipation systems, Subsection 9.4.2 alternative circulating water systems, and Subsection 9.4.3 alternative transmission systems.

9.4.1 HEAT DISSIPATION SYSTEMS

9.4.1.1 Screening of Alternative Heat Dissipation Systems

This section discusses alternatives to the proposed heat dissipation system (Section 3.4 and Subsection 5.3.3.1) based on the guidance provided in NUREG-1555. Alternatives considered are those generally included in the broad categories of “once-through” and “closed-cycle” systems. The closed cycle category includes the following types of heat dissipation systems:

- Mechanical draft wet cooling towers
- Natural draft wet cooling towers
- Wet-dry cooling towers
- Dry cooling towers
- Cooling ponds
- Spray canals

An initial environmental screening of the above alternative designs was done to eliminate those systems that are obviously unsuitable for use at the VCSNS site. The following alternatives were eliminated from further consideration.

9.4.1.1.1 Once-Through Cooling using Monticello Reservoir

Unit 1 operates with once-through cooling using the Monticello Reservoir as a cooling pond. The water requirements for a once-through cooing system for an AP1000 unit would be 850,000 gpm (Westinghouse 2003). The once-through water requirements for both Units 2 and 3 would be 1,700,000 gpm, or about 3,790 cubic feet per second (cfs). As discussed in Subsection 2.3.1, the lowest annual mean flow of the Broad River is 966,000 gpm (2,150 cfs) and the 7Q10 flow is 383,000 gpm (853 cfs) at the Alston Station. Based on the 7Q10 flow, once-through cooling directly from the Broad River is not practical. The Broad River is used as a source to replenish the Monticello Reservoir. Consumptive water use is estimated at 5,800 to 9,900 gpm (13 to 22 cfs) for Unit 1 (see evaporative loss discussion in Section 5.2) and 14,500 gpm (32 cfs) per AP1000 reactor (Westinghouse 2003), for an estimated surface water consumption of 34,800 to 38,900 gpm (78 to 87 cfs) for three units. The Monticello Reservoir provides storage capacity to meet the consumptive water requirements.

EPA regulations (40 CFR Part 125) governing cooling water intake structures under Section 316(b) of the Clean Water Act make it extremely difficult for steam electric generating plants to permit once-through cooling systems. For these reasons, once-through cooling was eliminated from further consideration.

9.4.1.1.2 Cooling Ponds

Unit 1 operates as a once-through cooling plant that withdraws from and discharges to a cooling pond, Monticello Reservoir, which also serves as the upper pool for the Fairfield Pumped Storage Facility. Once-through cooling using water withdrawn from Monticello Reservoir for Units 2 and 3 is discussed above. An alternative method would be to create an isolated small recirculating cooling pond within or near the Monticello Reservoir. Unit 1 (900 MWe) was estimated to require between 900 and 1,800 acres of cooling surface (U.S. AEC 1973). A similar surface area would be required for each AP1000 unit. Although there may be other valleys in the vicinity of the VCSNS site where a cooling pond of this size could be constructed, there is no advantage to withdrawing additional land for a new reservoir if the cooling capacity of the Monticello Reservoir/Parr Reservoir system is already available. As described in Section 5.3, the thermal impact to the reservoirs from the proposed cooling system for Units 2 and 3 would be SMALL. Consequently there is no advantage to isolating a portion of the 6,800-acre Monticello Reservoir for the cooling pond. Doing so would decrease the capacity of the Fairfield Pumped Storage Facility and increase operating costs (by requiring a means of providing makeup water to the pond) without reducing the environmental impacts relative to the proposed system. These issues are sufficient to preclude further consideration of cooling ponds for Units 2 and 3.

9.4.1.1.3 Spray Ponds

This alternative is similar to cooling ponds because it involves the creation of new surface water bodies. A small recirculating cooling pond would be created within or near the Monticello Reservoir. Unit 1 was estimated to require approximately 60 acres of spray pond, or approximately 1 acre per 15 MWe (U.S. AEC 1973). Using the same assumption, Units 2 and 3 would require approximately 150 acres of spray pond. Spray modules promote evaporative cooling in the pond, which reduces the land requirement relative to cooling ponds. However, this advantage is offset by higher operating and maintenance costs for the spray modules. This alternative would not reduce the environmental impacts relative to the proposed system and is considered unsuitable for the same reasons as cooling ponds.

9.4.1.1.4 Dry Cooling Towers

This alternative is not suitable for the reasons discussed in EPA's preamble to the final rule addressing cooling water intake structures for new facilities (66 FR 65256; December 18, 2001). Dry cooling carries high capital and operating and maintenance costs that are sufficient to pose a barrier to entry to the marketplace for some facilities. In addition, dry cooling has a detrimental effect on electricity production by reducing the efficiency of steam turbines. Dry cooling requires the facility to use more energy than would be required with wet cooling towers to produce the same amount of electricity. This energy penalty is most significant in the warmer southern regions during summer months when the demand for electricity is at its peak. The energy penalty would result in an increase in environmental impacts as replacement generating capacity would be needed to offset the loss in efficiency from dry cooling. EPA concluded that dry cooling is appropriate in areas with limited water available for cooling or where the source of cooling water is associated with extremely sensitive biological resources (e.g., endangered species, specially protected areas). The conditions at the VCSNS site do not warrant further consideration of dry cooling due to sufficient water supply and lack of extremely sensitive biological resources.

9.4.1.1.5 Wet-Dry Cooling Towers

These towers are used primarily in areas where plume abatement is necessary for aesthetic reasons or to minimize fogging and icing produced by the tower plume. Wet-dry cooling towers use approximately two-thirds to one-half less water than wet cooling towers (U.S. EPA 2001). Because of the rural setting of the VCSNS site, neither of these advantages is significant. Additionally, somewhat more land is required for the wet-dry cooling tower because of the additional equipment (fans and cooling coils) required in the tower assembly. The same disadvantages described above for dry cooling towers would apply to the dry cooling portion of the wet-dry cooling tower. The dry cooling process is not as efficient as the wet cooling process because it requires the movement of a large amount of air through the heat exchanger to achieve the necessary cooling. This results in less net electrical power for distribution. Consequently, there would be an increase in environmental impacts as replacement generating capacity would be needed to offset the loss in efficiency from dry cooling. This alternative could be used at the VCSNS site; however, it is not considered to be environmentally preferable to the proposed wet cooling towers.

9.4.1.1.6 Feasible Alternatives

Only mechanical draft and natural draft cooling towers are considered suitable heat dissipation systems for the VCSNS site and are evaluated in detail. Since mechanical draft cooling towers were selected as the primary heat dissipation system for the proposed action (Section 3.4 and Subsection 5.3.3.1), natural draft cooling towers are considered as an alternative heat dissipation system and evaluated further in Subsection 9.4.1.2. In accordance with NUREG-1555, the heat dissipation alternatives were evaluated for land use, water use, and other environmental requirements (Table 9.4-1).

9.4.1.2 Analysis of Natural Draft Cooling Tower Alternative

SCE&G modeled the impacts from natural draft cooling towers using the SACTI code described in Subsection 5.3.3.1. Engineering data for the AP1000 was used to develop input to the SACTI model. Two identical cooling towers (two AP1000 units with one cooling tower per unit) were modeled, each with a heat rejection rate of 7.65×10^9 Btus per hour and circulating water flows of 600,000 gpm. The tower height was set at 600 feet. Although the cooling towers could operate from two to four cycles of concentration, four cycles of concentration were assumed for the analysis. The meteorological data were from the VCSNS meteorological tower for the year 2004, which had the most complete data set, and from the National Climatic Data Center meteorological data for the Columbia Metropolitan Airport.

9.4.1.2.1 Length and Frequency of Elevated Plumes

The SACTI code calculated the expected plume lengths by season and direction for the combined effect of the two natural draft cooling towers. The longest average plume lengths would occur in the winter months while the shortest would be in the summer. The plumes would occur in all compass directions. No impacts other than aesthetic would result from the plumes. Although visible from offsite, the plumes resemble clouds and would not disrupt the aesthetic view.

Projected plume lengths, directions, and frequencies are provided in the table below.

	Winter	Summer
Average plume length (miles)	2.9	1.2
Median plume length (miles)	2.4	0.37
Predominant direction	East	East-Northeast
Frequency of time the plume heads in the predominant direction	15.7%	11.5%

9.4.1.2.2 Ground-Level Fogging and Icing

Fogging from the natural draft cooling towers is not expected because of their height. Therefore, icing would also not occur from these towers.

9.4.1.2.3 Solids Deposition

Water droplets drifting from the cooling towers would have the same concentration of dissolved and suspended solids as the water in the cooling tower basin. The water in the cooling tower basin is assumed to have concentrations four times that of the Monticello Reservoir, the source of cooling water makeup. As these droplets evaporate, either in the air or on the vegetation or equipment, they would deposit these solids. All solids deposited are assumed to be composed of salt, for comparison with the NUREG-1555 significance level, for visible impacts to vegetation of 8.9 pounds of salt deposition per acre per month.

The maximum predicted salt deposition rate from the combination of the two towers would be as follows:

The maximum predicted salt deposition is 0.073 pounds per acre per month. This is much less than the NUREG-1555 significance level for possible visible effects to vegetation of 8.9 pounds per acre per month.

- Maximum pounds per acre per month: 0.073
- Distance (miles) to maximum deposition: 0.43
- Direction to maximum deposition: East-Northeast
- Season of maximum deposition: Summer

The electrical switchyard for Units 2 and 3 is located to the northwest, approximately 3,500 feet from the proposed location of the cooling towers. A maximum predicted salt deposition of 0.02 pounds per acre per month would be expected at this location during the summer season. The electrical switchyard for Unit 1 is located to the north, approximately 4,000 feet from the proposed location of the cooling towers. The salt deposition at this location, 0.06 pounds per acre per month in the spring season, is slightly larger than the salt deposition at the Units 2 and 3 electrical switchyard, although it is farther away. This is due to the cooling tower alignment in a north-south direction, allowing impacts from cooling towers to sum in those directions. An existing transmission line parallels the cooling towers approximately 600 feet to the east. The SACTI code did not predict any salt deposition at this location.

The predicted salt deposition from the operation of the cooling towers would be much less than the NUREG-1555 significance level where visible effects may be observed. Salt deposition in other areas, including the Units 2 and 3 switchyard, are not expected to impact these facilities. The impact from salt deposition from the cooling towers would be SMALL and would not require mitigation.

9.4.1.2.4 Cloud Shadowing and Additional Precipitation

The SACTI code predicted that cloud shadowing would occur for a maximum of 11 hours at agricultural areas in the vicinity of the site during the summer season and a total of 97 hours annually.

The SACTI code predicted that precipitation would be expected from the natural draft cooling towers. The maximum precipitation would occur in the winter, with a seasonal total 0.0026 inch of precipitation at 4,600 feet east of the towers. This value is small compared to the precipitation of 38 inches from the year of the meteorological data used for this analysis. The average rainfall at Columbia is 47 inches (for the period 1948–2005) (see Subsection 5.3.3.1.4).

9.4.1.2.5 Other Impacts

The potential for increases in absolute and relative humidity exist where there are visible plumes.

9.4.1.2.6 Summary

The potential for fogging and salt deposition would be slightly greater for mechanical draft cooling towers than for natural draft cooling towers. Natural draft towers would pose somewhat greater aesthetic impact due to their height (600 feet versus 70 feet for mechanical draft cooling towers). These differences in impacts are not significant for the VCSNS site. These heat dissipation system alternatives are considered environmentally equivalent.

9.4.2 CIRCULATING WATER SYSTEMS

In accordance with NUREG-1555, this subsection considers alternatives to the following components of the plant circulating water system:

- Intake systems
- Discharge systems
- Water supply
- Water treatment

NUREG-1555 indicates that the applicant should consider only those alternatives that are applicable at the proposed site and are compatible with the proposed heat dissipation system. As discussed in Subsection 9.4.1, only mechanical draft and natural draft wet cooling towers are considered viable and feasible heat dissipation systems for the VCSNS site.

Heat dissipation with wet cooling towers relies on evaporation for heat transfer. The water from the cooling system lost to the atmosphere through evaporation must be replaced. In addition, this evaporation would result in an increase in the concentration of solids in the circulating water. To control solids, a portion of the recirculated water must be removed, or blown down, and replaced with fresh water. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling towers. Water pumped from the Monticello Reservoir (Subsection 9.4.2.1) intake structure would be used to replace water lost by evaporation, drift, and blowdown from the cooling towers. Blowdown water is returned to the Parr Reservoir via a discharge structure at the shoreline (Section 9.4.2.2).

9.4.2.1 Intake Systems

The raw water intake system consists of the intake approach channel, the intake structure, the raw water pumps, and the biofouling treatment system. The location of the circulating water intake and discharge for Unit 1 and the proposed locations for intake and discharge structures for Units 2 and 3 are shown on Figure 3.1-3. Details of the proposed raw water intake system are shown in Figures 3.4-2 and 3.4-3.

As described in Subsection 3.4.2.1, the proposed raw water intake structure would be a 60-foot-long by 75-foot-wide concrete structure equipped with six pump bays, three per nuclear unit, each with a raw water (makeup) pump. Each pump bay would have a trash rack and a dedicated traveling screen. The EPA promulgated regulations governing the location, design, construction, and capacity of cooling water intake structures at Phase I (new facilities that use waters of the United States for cooling) facilities in December 2001 (66 FR 65255) and Phase II (large, existing steam electric plants) facilities in July 2004 (69 FR 41575). SCDHEC has indicated it will amend the NPDES permit for existing Unit 1 to include proposed Units 2 and 3 or issue a new NPDES permit for Units 2 and 3. SCDHEC has not indicated whether the new facility will be subject to the Phase I (new facility) or Phase II (existing facility) regulation. In any case, the circulating water intake structure proposed for Units 2 and 3 will likely satisfy the requirements for new or existing facilities, by virtue of the fact that it will have a through-trash-rack and through-traveling screen velocity of less than 0.5 foot per second and an intake flow commensurate with that of a closed-cycle, recirculating cooling water system. However, EPA has suspended the Phase II Rule as the result of a U.S. Court of Appeals (Second Circuit) decision that remanded several provisions of the rule, including EPA's determination of Best Technology Available (72 FR 37107).

The most important elements of the intake system are its location and configuration. The following factors were considered in siting the intake system:

- Water availability including dependability
- Water quality
- Bathymetry and effect on water depth
- Sediment transport along shore
- Aquatic habitat protection
- Waves
- Intake hydraulics
- Constructability and cost
- Maintenance and dredging
- Operation and maintenance

Water availability and water quality considerations are addressed in Subsection 9.4.2.3. The proposed location for the intake structure was selected to avoid encroaching on the protected area surrounding Unit 1. The intake could not be located further west due to the Fairfield Pumped Storage Facility dam. Locations to the east would place the Units 2 and 3 intake on the same side of the jetty as the discharge of condenser cooling water from Unit 1, posing the risk of recirculation of the existing thermal plume. No alternative location was identified that would be environmentally preferable to the proposed site for the raw water intake.

The alternative raw water intake systems considered for the VCSNS site are the following:

Option 1 Shoreline pump intake using active screening

Option 2 Offshore intake with velocity cap with onshore pump intake with active screening

Option 3 Onshore pump intake using submerged passive screens such as wedge wire screens

SCE&G proposed a shoreline pump intake (Option 1), which is one of the most popular applications for lakes and reservoirs. As the name implies, the intake would be located at and parallel to the shoreline. Bathymetry survey results (Subsection 2.3.1) provided guidance in locating the intake with sufficient water depth under minimum reservoir water level. Bar screens with raking system and traveling water screens would be provided to actively filter out debris so the downstream pumps and systems are properly protected. An intake velocity of less than or equal to 0.5 foot per second would be provided to comply with Clean Water Act Section 316(b) requirements for aquatic habitat protection. Locating the intake at the shoreline enhances constructability. Unit 1 has successfully used a shoreline intake concept.

Option 2 would locate an intake offshore to an adequate water depth and deliver water through a submerged intake pipe to the pump station built onshore. This approach typically applies in a coastal environment where the bathymetry often indicates very shallow shoreline, the need to preclude interruption of beach uses, high seaweed loading condition, and active littoral drift. For the once-through application, this design also minimizes thermal recirculation that could adversely affect plant output. For a makeup water intake such as the proposed system, its use is limited since the cost to install an offshore facility is higher. Conditions at the VCSNS site do not warrant further consideration of this alternative.

Option 3 includes an onshore pump house using submerged passive screens such as wedge wire screen. Wedge wire screen is passive without the capability for debris cleaning. Its use relies upon the flow velocity or current speed to sweep the debris off the screen face. It is most applicable for river intakes. For a reservoir without active current such as the Monticello Reservoir, debris would potentially pile up against the screens causing reduced or disruption of flow toward screens. While wedge wire screens offer added protection to aquatic habitat, the proposed intake design with active screening offers adequate protection by ensuring that the 0.5 foot per second design intake velocity required for compliance with Section 316(b) of the Clean Water Act is not exceeded. This option would not be environmentally preferable to the proposed intake system.

9.4.2.2 Discharge Systems

As noted above, the circulating water system for Units 2 and 3 would be a closed loop system using wet cooling towers for heat dissipation. The final plant discharge, including cooling tower blowdown and other site wastewater streams, would be discharged to the Parr Reservoir. The discharge flow originates from the blowdown sump, which collects site nonradioactive wastewaters and tower blowdown for both units. The discharge system includes a discharge valve box, weir chamber, and discharge pipe via a new discharge structure to be built at the reservoir shoreline upstream of the Parr Shoals Dam. The discharge from the valve box would be gravity flow and enter the Parr Reservoir through a diffuser line. The diffuser line would begin 30 feet from the shoreline and extend 70 additional feet into the reservoir (Section 3.4).

The preliminary design for the discharge line called for a submerged 36-inch pipe with the diffuser sections at the end with four 16-inch nozzles. The nozzles would discharge in a downstream direction corresponding to the bulk reservoir flow. The Parr Reservoir is subject to flow reversals during the periods when the Fairfield Pumped Storage Facility is in pumping mode, transferring water from the Parr Reservoir to the Monticello Reservoir. The unusual hydraulics imposed constraints on the discharge/diffuser design. SCE&G used the CORMIX model to simulate the temperature distribution in the Parr Reservoir resulting from discharge of blowdown from Units 2 and 3 (Subsection 5.3.2). The CORMIX manual (Jirka, Doneker, and Hinton 1996) suggests an alternating diffuser design for fluctuating current flow (more typically tidal flow but imposed by the Fairfield Pumped Storage Facility operations in the case of the Parr Reservoir), with nozzles oriented both upstream and downstream in an alternating fashion. The preliminary design was modified to this diffuser arrangement (Figures 3.4-4 and 3.4-5).

Figure 3.1-3 shows the location of the proposed discharge structure. The location of the discharge outfall should be such that it has sufficient water depth for thermal mixing/dilution. Two outfall locations at the Parr Reservoir were considered for the VCSNS site. Bathymetry survey results indicated that one of the two sites is preferable because it has sufficient water depth to allow thermal mixing. Because of the overall shallowness of the Parr Reservoir, shoreline discharge was not acceptable because there would be negligible water depth available for mixing. As confirmed by the thermal modeling (Subsection 5.3.2), an offshore multi-port diffuser outfall with 20 ports would be required.

The location of the discharge was also influenced by the routing for the blowdown lines. SCE&G proposes to follow an existing SCE&G rail spur extending from the plant site to the Norfolk Southern railway that runs along the eastern shore of the Parr Reservoir. SCE&G also considered an alternative discharge location that corresponded to routing the blowdown lines along an existing transmission corridor. This alternative routing would have required traversing potential wetlands areas and, therefore, would not be environmentally preferable to the proposed routing of the blowdown lines and associated discharge location.

The release of the plant effluent through the new discharge line was determined to have minimal impact to aquatic biota in the reservoir (Subsection 5.3.2.2). If the mixing zone resulting from the proposed design were unreasonably large, additional alternatives would have been considered.

9.4.2.3 Water Supply

As discussed above, there would be a need for continuous makeup water to the closed-loop circulating water system. The maximum makeup water flow to the condenser/turbine auxiliary cooling water system is estimated at 58,800 gpm (Table 3.3-1) for two AP1000 units.

There are two potential sources of makeup water supply for the VCSNS site— the Monticello Reservoir and the Parr Reservoir. Both reservoirs derive their water supply from the Broad River. Groundwater wells (see Subsection 2.3.1) would not provide sufficient volume to support the makeup requirements of the circulating water system or other operational demands.

When the Fairfield Pumped Storage Facility is operating, up to 29,000 acre-feet of water are transferred between the Monticello Reservoir and the Parr Reservoir daily (see Figure 5.2-1). Whether the makeup water withdrawal is taken from the Parr Reservoir or the Monticello Reservoir, it is essentially the same source of water, the Broad River. Pumping costs from the Monticello Reservoir would be less due to the elevation difference between the proposed raw water intake structure and the plant site. The water level at the Parr Reservoir varies between approximately 256 and 266 feet in elevation, approximately 140 feet below the plant site elevation of 400 feet, while the water level in the Monticello Reservoir varies between approximately 420 and 425 feet elevation (NGVD29). Additionally, the turbidity (total suspended solids) increases in the Parr Reservoir during periods of high Broad River flows. Turbidity is much less of an issue for the Monticello Reservoir. The use of the Monticello Reservoir as the makeup water supply offers the benefits of reduced pumping costs and less potential for turbidity to affect the ability of the raw water supply to meet operating requirements.

9.4.2.4 Water Treatment

Evaporation of water from cooling towers leads to an increase in chemical and solids concentrations in the circulating water, which in turn increases the scaling tendencies of the water. The circulating water system for Units 2 and 3 would be operated so that the concentration of solids in the circulating water would be approximately four times the concentration in the makeup water (i.e., four cycles of concentration). The concentration ratio would be sustained through blowdown of the circulating water from the cooling towers to the Parr Reservoir and the addition of makeup water.

As described in Subsection 3.3.2.1, raw water from the Monticello Reservoir would be treated for use as cooling tower makeup, potable water, fire protection water, and demineralized water. The raw water for makeup to the circulating water cooling towers would receive treatment to prevent biofouling in the intake structure and raw water supply piping to the circulating water cooling towers. Raw water for makeup to the service water cooling towers and for supply to the potable water, fire protection, and demineralized water treatment systems would be pretreated to control biological growth and pH, disinfected, clarified, and filtered as necessary at the water treatment facility. Additional treatment for biofouling, scaling, and suspended matter with biocides, antiscalants, and dispersants would be performed as needed at the cooling tower basins. This treatment would normally occur through injection of chemicals into the system piping during circulation of the water withdrawn from the basins through the circulating water and service water systems. The cooling tower cycles of concentration would be adjusted to prevent scale formation or deposition from affecting tower performance.

The once-through circulating water system for Unit 1 does not require the addition of biocides. Sodium hypochlorite would likely be used to control biological growth in the circulating water system for Units 2 and 3. Alternative biocides could include hydrogen peroxide or ozone. The final choice of chemicals or combination of chemicals would be dictated by makeup water conditions, technical feasibility, economics, and discharge permit requirements. Since the discharges from the system would be subject to NPDES permit limitations that consider aquatic impacts, different water treatment chemicals would be environmentally equivalent.

9.4.3 TRANSMISSION SYSTEMS

Planning, siting, and constructing transmission lines is a multiyear process. Therefore, at the COL application stage, there is limited information on the proposed transmission system, and even less on alternatives to that system. Subsection 2.2.2 provides as much information as is available on the corridors for the proposed transmission system. Section 3.7 discusses the electrical and structural design characteristics of the proposed transmission lines. Subsection 4.1.2 discusses the SCE&G and Santee Cooper transmission line siting processes. This subsection provides the information available on alternatives to transmission system design.

9.4.3.1 Alternative Corridor Routes

SCE&G and Santee Cooper conducted feasibility studies that examine the need for new transmission capability for Units 2 and 3. These studies did not examine routing, but did identify the number of transmission lines, their voltage, and the termination point. Figure 2.2-4 identifies the intermediate and terminating substations to which the six new transmission lines would be connected. There has been no consideration of the routes for these transmission lines, except that existing corridors would be used to the extent feasible. Accordingly, there are no alternative corridor routes to consider in this subsection. As described in Subsection 4.1.2, alternative routes would be considered during the line siting process. Environmental and cultural resource values are included in the site selection process, which involves state oversight and public participation.

9.4.3.2 Alternatives to the Proposed Transmission System Design

SCE&G and Santee Cooper investigated transmission alternatives in two phases: first for Unit 2 and second for Unit 3. The first decision was to determine voltage of the new transmission lines. Both SCE&G and Santee Cooper historically use 230kV lines for their long-distance, high-capacity lines. Because of the large power output of Units 2 and 3 that needs to be transmitted for fairly long distances, 500kV lines were considered. However, given that operation of 500kV lines is outside the experience of both companies and that 230kV lines proved acceptable, 500kV lines were ultimately rejected for the Proposed Action.

For Unit 2, the SCE&G feasibility study assumed that Santee Cooper would have their proposed Winnsboro line constructed. In addition to the Santee Cooper line, the Unit 2 alternatives examined were:

1. No new transmission lines or refurbishment of existing lines
2. Refurbishment of highly loaded existing lines
3. Alternative 2 plus refurbishment of two additional lines serving the Columbia load center
4. Two new transmission lines serving the Columbia load center
5. Alternative 4 with additional improvements

Alternative 1 resulted in several overload conditions that were not acceptable. Alternative 2 resulted in several overload conditions that would occur during loss of up to two facilities on the transmission system. Alternative 3 also had overload conditions under loss of up to two facilities. Alternative 4 had similar overload conditions. Alternative 5 resulted in adequate transmission capabilities and was selected for the Proposed Action.

The SCE&G Unit 3 feasibility study assumed that the Unit 2 study results were implemented and that Santee Cooper would have their proposed Sandy Run line constructed. In addition to the Santee Cooper line, the Unit 3 alternatives examined were:

1. No new transmission lines or refurbishment of existing lines
2. Two new transmission lines serving the Charleston load center (double circuit)
3. Alternative 2 plus refurbishment of some existing lines

Alternative 1 resulted in several overload conditions that were not acceptable. Alternative 2 also resulted in several overload conditions. Alternative 3 resolved the overload conditions and was selected for the Proposed Action.

The environmental impacts of the proposed transmission system are presented in Sections 4.1, 4.3, and 5.6. No analysis of environmental impacts has yet to be performed for the 500kV system or 230kV alternatives identified in this subsection. During the siting and design process for the proposed new transmission lines, SCE&G would examine not only routing alternatives

(Section 9.4.3.1) but alternatives in tower designs. Environmental impacts would be considered during siting, design, and construction.

Section 9.4 References

1. Jirka, G. H., R. L. Doneker, and S. W. Hinton, 1996, *User's Manual for Cormix: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, Office of Science and Technology, U.S. EPA, Washington, D.C., September 1996.

2. U.S. AEC (U.S. Atomic Energy Commission) 1973, *Final Environmental Statement related to operation of Virgil C. Summer Nuclear Station Unit 1*, Directorate of Licensing, Washington, D.C., January. 1973.

3. U.S. EPA 2001,*Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities* (EPA-821-R-01-036), November 2001.

4. U.S. NRC 1981, *Final Environmental Statement related to the operation of Virgil C. Summer Nuclear Station Unit No. 1,* NUREG-0719, Office of Nuclear Reactor Regulation, Washington, D.C., May 1981

5. Westinghouse 2003. *AP1000 Siting Guide: Site Information for an Early Site Permit*, APP-0000-X1-001, Revision 3, April 24, 2003.

Table 9.4-1 (Sheet 1 of 2)
Screening of Alternative Heat Dissipation Systems

Factors Affecting System Selection	Mechanical Draft Wet Cooling Tower (MDCT)	Natural Draft Wet Cooling Tower (NDCT)
Land Use		
-Onsite land requirements	An MDCT system would require more land (25 acres per reactor unit). An MDCT system could be placed within the confines of the VCSNS site.	NDCT system would require 2.3 acres (excluding basin) per reactor unit. An NDCT system could be placed within the confines of the VCSNS site.
-Terrain considerations	Terrain features of the VCSNS site are suitable for a MDCT system.	Terrain features of the VCSNS site are suitable for an NDCT system.
Water Use	Raw water consumption of 28,900 gpm per reactor unit.	Raw water consumption of 28,900 gpm per reactor unit.
Atmospheric Effects	Impacts would be SMALL (see Subsection 5.3.3). MDCT present greater potential for fogging and salt deposition.	Impacts would be SMALL (see Subsection 9.4.1.2) and not warrant mitigation.
Thermal and Physical Effects	Discharges associated with MDCT would meet water quality standards. The volume of water affected by the mixing zone is less than 1% of the volume in the reservoir from the discharge to its furthest downstream extent. Because of the relatively low discharge velocities and rapid plume dilution, only minor scouring of the reservoir bottom is expected. (Section 5.3.3)	Discharges associated with NDCT would meet water quality standards. The volume of water affected by the mixing zone is less than 1% of the volume in the reservoir from the discharge to its furthest downstream extent. Because of the relatively low discharge velocities and rapid plume dilution, only minor scouring of the river bottom is expected.
Noise Levels	MDCT would emit broadband noise (up to 55 dBA at 1000 feet) that is unobtrusive at nearest residence (Section 5.3.4.2).	NDCT would emit broadband noise (up to 55 dBA at 1000 feet) that is unobtrusive at nearest residence.
Aesthetic and Recreational Benefits	Consumptive water use for an MDCT system would be consistent with minimum flow requirements for the Broad River and environmental maintenance, fish and wildlife water demand, and recreation. MDCT plumes resemble clouds and would not disrupt the view scape.	Consumptive water use for a NDCT system would be consistent with minimum flow requirements for the Broad River and environmental maintenance, fish and wildlife water demand, and recreation. NDCT plumes resemble clouds and would not disrupt the view scape; however, the towers themselves would be visible for many miles.

Table 9.4-1 (Sheet 2 of 2)
Screening of Alternative Heat Dissipation Systems

Factors Affecting System Selection	Mechanical Draft Wet Cooling Tower (MDCT)	Natural Draft Wet Cooling Tower (NDCT)
Legislative Restrictions	An intake structure for an MDCT system would meet Section 316(b) of the Clean Water Act and the implementing regulations, as applicable. Thermal discharge would be consistent with SCDHEC temperature standard and mixing zone regulations. These regulatory restrictions would not negatively impact application of this heat dissipation system.	An intake structure for an NDCT system would meet Section 316(b) of the Clean Water Act and the implementing regulations, as applicable. Thermal discharge would be consistent with SCDHEC temperature standard and mixing zone regulations. These regulatory restrictions would not negatively impact application of this heat dissipation system.
Is this a suitable alternative for the VCSNS site?	Yes	Yes

Source: Westinghouse (2003), Table 3.1-1