Applicant's Environmental Report – Operating License Renewal Stage
Brunswick Steam Electric Plant
Progress Energy

Unit 1
Docket No. 50-325
License No. DPR-71

Unit 2
Docket No. 50-324
License No. DPR-62

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

List of Appendices

TABLE OF CONTENTS (Continued)

List of Tables

TABLE OF CONTENTS (Continued)

List of Figures

ACRONYMS AND ABBREVIATIONS

AQCR	Air Quality Control Region
BSEP	Brunswick Steam Electric Plant
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CP&L	Carolina Power & Light Company
CWA	Clean Water Act
DSM	demand-side management
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FES	Final Environmental Statement
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm	gallons per minute
IPA	Integrated Plant Assessment
kV	kilovolt
LCFWSA	Lower Cape Fear Water and Sewer Authority
MOTSP	Military Ocean Terminal Sunny Point
msl	mean sea level
MW	megawatt
MWe	megawatts-electrical
NCDENR	North Carolina Department of Environment and Natural Resources
NEPA	National Environmental Policy Act
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
ROW	right-of-way
SAMA	Severe Accident Mitigation Alternatives
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SO_x	oxides of sulfur

1.0 INTRODUCTION

1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Progress Energy operates the Brunswick Steam Electric Plant Units 1 and 2 (BSEP), pursuant to NRC Operating Licenses DPR-71 and DPR-62, respectively. The Unit 1 license will expire September 8, 2016, and the Unit 2 license will expire December 27, 2014. Progress Energy has prepared this environmental report in conjunction with its application to NRC to renew the BSEP Units 1 and 2 operating licenses, as provided by the following NRC regulations:

> Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and
>
> Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

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

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

The renewed operating licenses would allow an additional 20 years of plant operation beyond the current BSEP licensed operating periods of 40 years.

1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

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

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

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

1.3 BRUNSWICK STEAM ELECTRIC PLANT LICENSEE AND OWNERSHIP

CP&L is the NRC licensee for BSEP, as well as the H. B. Robinson Nuclear Plant and the Shearon Harris Nuclear Power Plant. CP&L, now doing business as Progress Energy Carolinas, Inc., will submit the BSEP license renewal application to the NRC. Progress Energy Carolinas, Inc., which serves more than 1.3 million customers in North and South Carolina, is a wholly owned subsidiary of Progress Energy, Inc., a diversified energy services company headquartered in Raleigh, North Carolina.

BSEP is co-owned by Progress Energy (81.7 percent) and North Carolina Eastern Municipal Power Agency (18.3 percent) but Progress Energy (CP&L is the licensee) has sole responsibility for management and operation of the plant.

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

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

TABLE 1-1
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS (Continued)

Regulatory Requirement		Responsive Environmental Report Section(s)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(3)(iv)	6.2	Mitigation
	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low-Income Populations

1.4 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 109. June 5.

NRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." Federal Register. Vol. 61, No. 147. July 30.

NRC (U.S. Nuclear Regulatory Commission). 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 244. December 18.

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

NRC (U.S. Nuclear Regulatory Commission). 1996e. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1996f. Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule." Federal Register. Vol. 64, No. 171. September 3.

NRC (U.S. Nuclear Regulatory Commission). 1999b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Section 6.3, "Transportation" and Table 9-1, "Summary of findings on NEPA issues for license renewal of nuclear power plants." NUREG-1437. Volume 1, Addendum 1. Washington, DC. August.

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 LOCATION AND FEATURES

Brunswick Steam Electric Plant (BSEP) is located in Brunswick County in southeastern, North Carolina, near the mouth of the Cape Fear River. The city limits of the nearest major metropolitan area, Wilmington, North Carolina, are approximately 15 miles north of the BSEP site. Myrtle Beach, South Carolina, a major regional tourist destination, lies approximately 50 miles to the southwest. Figures 2-1 and 2-2 are the 50-mile and 6-mile vicinity maps, respectively.

The Plant is situated on approximately 1,200 acres of land (CP&L 2001, Rev. 17B, pg. 1-1). The facility includes the powerblock area and support facilities, the nuclear exclusion zone, a buffer zone, a 3-mile-long intake canal that is used to withdraw cooling water from the Cape Fear River, and a 6-mile-long discharge canal that conveys heated effluent to the Atlantic Ocean (Figure 2-2).

Figure 3-1 shows the general plant layout. Major facilities in the central industrial portion of the plant include two reactor buildings, the turbine building, the control building, the radwaste building, and the diesel generator building. All of these facilities lie within the Protected Area, which is surrounded by a perimeter fence. The main (off-gas) stack stands in the southeast corner of the Protected Area, adjacent to the intake canal. Major administrative and support facilities including the Technical Administrative Control (TAC) Building, Technical Training Center, and Operator Training Building lie just outside the Protected Area, but within the larger Nuclear Exclusion Zone (Figure 2-3), which is posted and patrolled by security personnel.

Figure 2-3 shows the BSEP site boundary. The area within the site boundary, the Nuclear Exclusion Zone, totals 962 acres (AEC 1974, Table II-2). Approximately 130 acres of this total are occupied by generating facilities, support facilities, warehouses, parking areas, construction laydown areas, equipment storage areas, and roads. An open area of approximately 10 acres northeast of Warehouse H was used as a landfill for office wastes (mainly paper), but was closed in 1997 (see Figure 3-1). The remaining acreage consists of woodlands (mostly pine forests in upland areas), open (old) fields, wetlands, or marshlands, depending on their soils, their elevation, and their historic use.

The area immediately surrounding the plant is a mix of agricultural lands, woodlands, swamps, and marshes. Military Ocean Terminal Sunny Point (MOTSP), a 16,000-acre facility owned and operated by the U.S. Army, lies immediately north of the BSEP site. Although MOTSP's primary mission is the shipment of munitions and materiel for the Department of Defense (Global Security 2001), it has received recognition from state resource agencies and the Army for its conservation efforts, including enhancement of habitat for several endangered species (USAEC 1998).

The nearest incorporated community to BSEP is the town of Southport, located approximately 2.5 miles south of the BSEP site, which has a year-round population of

2,351. The area within a 6-mile radius includes the town of Southport; the resort communities of Caswell Beach, Oak Island, and Bald Head Island; and the community of Boiling Spring Lakes (Figure 2-2). Aside from these villages and several small communities that have grown up around crossroads of major thoroughfares, the area is rural in character, with privately-owned tracts of forestland, forested wetlands, and agricultural lands dominating the landscape.

Section 3.1 describes key features of BSEP, including reactor and containment systems, cooling water system, and transmission system.

2.2 AQUATIC COMMUNITIES

BSEP operations have been scrutinized by state and federal resource agencies since Unit 2 came on line in 1974, focusing on potential impacts of the plant's cooling water systems on the Cape Fear estuary. Background information on the aquatic communities of the Cape Fear estuary can be found in the Final Environmental Statement (AEC 1974), Brunswick Steam Electric Plant Cape Fear Studies Interpretive Reports (CP&L 1980; CP&L 1985), annual biological monitoring reports prepared by CP&L and Progress Energy since 1981, and numerous "gray literature" monographs (e.g., EPRI reports) and journal articles.

The Lower Cape Fear River below Wilmington, North Carolina, ranges from one to two miles wide and is mostly shallow, except for a shipping channel dredged and maintained by the U.S. Army Corps of Engineers that extends from the mouth of the river to the Port of Wilmington (CP&L 1980, pp. 4-3 and 4-4). The Corps of Engineers is deepening the shipping channel by four feet (to a depth of 42 feet) to accommodate larger cargo ships (USACE 2003). This project, officially referred to as the Wilmington Harbor Project, was authorized in 1998 and is expected to be completed in 2005.

The estuary includes 22,000 acres of salt marshes and 18,000 acres of tidal flats and small tidal streams. The Cape Fear estuary is a "partially mixed estuary," meaning its water shows a gradual increase in salinity and density with depth (CP&L 1980, pg. 4-3). It has a net seaward displacement in its surface waters and a net landward displacement in its deeper waters, which has implications with respect to the transport of plankton and other organisms in and out of the estuary.

The average daily freshwater flow into the Cape Fear estuary is around 10,000 cubic feet per second, but there is considerable variability. The distribution and quantity of rainfall in the watershed are the main determinants of annual and seasonal variation (CP&L 1980, pg. 4-5). Flows in the Cape Fear River are highest in late winter and lowest in late-summer and fall. During periods of average freshwater inflow (after the ebb tide) surface salinities range from 8 parts per thousand (Sunny Point) to 24 parts per thousand (Bald Head), while bottom salinities range from 15 parts per thousand (Sunny Point) to 29 parts per thousand (Bald Head) (CP&L 1980, pg. 4-20).

Tidal height (amplitude) decreases as the tidal pulse moves up-river. The average tidal amplitude in the lower river, (near its mouth) is approximately four feet (CP&L 1980, pg. 4-5). Tidal currents in the estuary average 3.4 feet per second, thus the movement of water in the channel during a six-hour ebb or flood tide is approximately 14 miles. This tidal excursion is large compared to the length of the estuary, and as a result water and associated organisms can be moved through the system in a few days.

The portion of the estuary seaward of Sunny Point, in which BSEP is located (essentially the first tidal reach), is characterized by complex water circulation patterns, vigorous tidal action, turbulence, fluctuating salinity levels, and high exchange ratios with the ocean. In many respects, this reach of the estuary acts as an extension of the nearby coastal zone. The distribution and abundance of aquatic organisms in the lower

Cape Fear estuary are determined largely by these highly variable physical and chemical factors.

The major categories of aquatic biota found in the Cape Fear estuary are phytoplankton (microscopic plants), zooplankton (microscopic animals), planktonic or semiplanktonic larvae and postlarvae of fish and shellfish (growth stages between the egg and juvenile stage), and nekton (juvenile and adult fish and shellfish). Planktonic organisms are waterborne and are found in both the estuary and the adjacent ocean. The nekton consists of a mixture of (a) sea-spawned species, (b) a few anadromous species, and (c) resident (estuary-spawned) species.

Most of the important Cape Fear nektonic organisms are the sea-spawned type. These organisms are spawned in great numbers over large areas offshore (frequently many miles offshore) for an extended period (3-6 months in most cases). Currents carry the resulting larvae and postlarvae into the nursery grounds of various estuaries, including those of the Cape Fear estuary. Nursery areas in the Cape Fear estuary include the marshes, shallow fringe areas, and tidal creeks (and, in the case of some species, the open waters of the river). All of these early life stage organisms are subject to high natural mortality rates that decrease over time; that is, at each life stage the survivors to that point have a better chance of survival than do younger life stages (e.g., juvenile natural mortality is less than larval natural mortality).

In the Cape Fear estuary, there are two periods of larval abundance each year associated with the spawning of nearshore marine and estuarine species. A summer peak is associated with the presence mostly of anchovies and gobies. Seatrout also spawn during this period, and large numbers of pink and white shrimp are recruited to the estuary. A second peak of seasonal abundance usually occurs in winter and early spring, coincident with the spawning of spot, menhaden, striped mullet, croaker, brown shrimp, and flounders. Maximum abundance of these taxa within the estuary is usually observed in March and early April.

Species spawned in the ocean face the task of reaching the mouth of the estuary and then migrating to primary nursery zones. During the oceanic phase of migration, the swimming ability of the larvae is limited and transport inshore occurs primarily through wind action and current patterns. Natural mortality is believed to be very high during this period, and consequently survivors of the inshore migration reaching the Cape Fear estuary and other estuaries constitute only a small fraction of the eggs spawned in the ocean. It is noteworthy that the Cape Fear estuary is an “open system” with regard to the origin of recruits. That is, many individuals arriving at the mouth of the estuary probably do not originate from spawning Cape Fear populations. The migratory phase for these young organisms continues inside the estuary until suitable nursery habitat is found.

The two Brunswick Steam Electric Plant Cape Fear Studies Interpretive Reports (CP&L 1980; CP&L 1985) are perhaps the most comprehensive and useful sources of information on the distribution and abundance of important aquatic species at all life stages (larvae, juveniles and adults) in the Cape Fear estuary. These reports,

supplemented by CP&L and Progress Energy annual biological monitoring reports prepared since 1981, provide a detailed record of population trends of numerically dominant and commercially and recreationally important species (e.g., spot, croaker, Atlantic menhaden, bay anchovy, Southern flounder, striped mullet, gobies, three shrimp species, and blue crab) at all life stages over an almost 30 year period.

Beginning in 1994, CP&L reduced the biological monitoring with the approval of the North Carolina Department of Environment and Natural Resources (CP&L 2002). Based on almost two decades of BSEP operation with no adverse impact on fish and shellfish populations in the Cape Fear estuary, the monitoring program was modified to focus on impingement and entrainment of organisms. Although Progress Energy no longer monitors fish and shellfish populations in the Cape Fear estuary (limited population data were collected in 1999, 2001, and 2002), monitoring of these populations continues under the auspices of the Lower Cape Fear River Program. The Lower Cape Fear River Program is a large-scale water quality and environmental assessment program focused on the lower Cape Fear River watershed and the Cape Fear estuary (Lower Cape Fear River Program 2003). The Program is administered by the Center for Marine Science at the University of North Carolina at Wilmington and has its offices there. The Program prepares an annual report on the state of the Cape Fear River system that includes results of water quality and fisheries monitoring in the Lower Cape Fear River (Lower Cape Fear River Program 2003).

2.3 GROUNDWATER RESOURCES

BSEP is located approximately 9,000 feet west of the lower Cape Fear River (Cape Fear estuary) in the Atlantic Coastal Plain. The upper layers of geologic strata underlying the site consist of argillaceous sands and sandy clays; plastic clay; well-compacted sand; and Oligocene deposited limestone. These layers extend to a depth of approximately 115 feet below the surface and overlie the Castle Hayne formation. The Castle Hayne is approximately 115 feet thick and overlies hard calcareous clay and Cretaceous rocks extending down to crystalline basement at a depth of approximately 1,500 feet. (CP&L 2001, Rev. 17B, pg. 1-2). The upper portion of the Castle Hayne formation consists of well-consolidated shell limestone. The lower portion consists of a well-compacted to semi-consolidated sandstone (CP&L 1971, pg. 9.3-4). The Castle Hayne formation outcrops at the ground surface approximately 7 miles northwest of the plant. This outcrop area acts as a recharge area for the aquifer. East of the outcrop the aquifer dips toward the Cape Fear River and the Atlantic Ocean (AEC 1974, pp. II-9 to II-10).

Water from wells is used for consumptive use throughout the Cape Fear region. In the vicinity of the site, shallow wells in the surficial deposits are adequate for small potable water supplies, but for larger water yields the Castle Hayne formation is the most important aquifer (AEC 1974, pp. II-9 to II-10).

The Castle Hayne aquifer provides water to the Sunny Point Military Ocean Terminal and to the municipalities of Long Beach and Southport (AEC 1974, pg. II-9). Southport, the larger of the two municipalities, uses three groundwater wells capable of producing a total of up to 180 gallons per minute. Other water wells installed in the Castle Hayne aquifer in the Southport area yield groundwater at rates of 12 to 416 gallons per minute (CP&L 1971, pg. X.1-20).

Residents of New Hanover County get their drinking water primarily from water wells with the exception of the City of Wilmington that gets its water from the lower Cape Fear River. Wells in New Hanover County used for domestic purposes are in the surficial sand aquifer and for larger yields, are located in the Castle Hayne (AEC 1974, pg. II-9).

In 2000 Brunswick County Public Utilities provided 11.6 million gallons per day (MGD) of treated water to its customers (NCDENR 2002b, page 35). Of this, approximately 8.2 MGD of raw water comes from the Cape Fear River via the Lower Cape Fear Water and Sewer Authority (LCFWSA 2002a). Brunswick County Public Utilities also treats and uses approximately 3.4 MGD of groundwater from the Castle Hayne formation (Brunswick County 2001).

BSEP currently has four water wells (Wells 2, 4, 5 and a well that serves the biology laboratory) in the Castle Hayne aquifer (Gunter 2002a). Wells 2 and 4 were installed in 1972 and Well 5 was installed in 1974. Wells 2, 4, 5 were used until the early 1980s when they were capped and removed from service after the plant began receiving water from Brunswick County Public Utilities (Gunter 2002b). The biology laboratory well was installed when the laboratory was constructed in 1983. This well has a pumping

capacity of 30 gallons per minute (gpm). Due to the intermittent use of the biology laboratory by a limited number of people, the actual production of this well is probably much less than the pump capacity.

2.4 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

The BSEP site (Figure 2-3) covers approximately 1,200 acres (CP&L 2001, Rev. 17B, pg. 1-1). The industrial portion of the site comprises approximately 130 acres and consists of generating facilities, office buildings, warehouses, parking lots, and equipment storage areas.

Most upland portions of the BSEP site consist of planted loblolly pine (*Pinus taeda*) forest. Other habitats at the site include pine-hardwood forests, longleaf pine-wiregrass communities, pine savannas, pocosins, dune-strand communities, and salt marshes. The following discussion on the habitats and representative species is taken from the Final Environmental Statement for the Brunswick Plant (AEC 1974).

Pine-hardwood forests at BSEP are mixtures of loblolly pine with hardwoods such as sweet gum (*Liquidamber styraciflua*), blackgum (*Nyssa sylvatica*), hickory (*Carya* spp.) and oak (*Quercus* spp.). Forests dominated by longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), and wiregrass (*Aristida stricta*) occur in well drained areas such as along ancient dunes. A few remnants of pine savannas occur in periodically flooded areas. Pine savannas are characterized by an open canopy of longleaf pine or pond pine (*Pinus serotina*) with a dense ground cover of herbs and shrubs. Pocosins are wetland depressions characterized by thickets of various evergreen shrubs and small trees such as red bay (*Persea borbonia*) and sweet bay (*Magnolia virginiana*).

Dune-strand communities occur at the interface between the sea and land. Vegetation on the seaward side of dunes is typically sparse as a result of wind and salt spray. Sea oats (*Uniola paniculata*) is the major dune species. A variety of herbaceous shrubs tend to develop on the more-protected landward sides of dunes, creating maritime shrub thickets. The predominant trees in these thickets are sabal palm (*Sabal palmetto*) and live oak (*Quercus virginiana*).

Salt marshes at the BSEP site are composed primarily of cordgrass (*Spartina alterniflora*), with needlerush (*Juncus romerianus*) dominant in some areas. The marshes provide habitat for many aquatic organisms (see Section 2.2) that are preyed upon by a variety of wildlife species.

The habitats support a variety of wildlife species typical in the southeastern Coastal Plain. Pine-hardwood, pine-wiregrass, pine savannah, maritime forests, and pocosin communities support many species of birds, including hawks, woodpeckers, warblers, sparrows, and others. Animals in these habitats include white-tailed deer, opossums, raccoons, squirrels, skunks, bobcats, snakes, toads, frogs and lizards. Salt-marshes support three species of commercially valuable shrimp (white [*Litopenaeus setiferus*], brown [*Farfantepenaeus aztecus*], and pink [*F. duorarum*]), blue crab, spot, croaker, flounder, and numerous other fish species. They also provide habitat for American alligators, raccoons, otters, and many species of wading birds.

Section 3.1.3 describes the eight transmission lines that were constructed to connect BSEP to the transmission system. All eight lines share the first 1.3 miles of corridor. At

that point, the Whiteville, Delco East, Delco West and Weatherspoon lines veer to the northwest, and divide again with the Whiteville line traveling parallel to and south of the Weatherspoon and Delco lines which share a corridor to the Delco Substation and then the Weatherspoon lines continues to the Weatherspoon Substation (see Figure 3-2). The Whiteville line crosses several pocosins and the Green Swamp, which has been designated a National Natural Landmark. It passes about 2 miles south of Lake Waccamaw and approximately one mile west of Lake Waccamaw State Park. The Weatherspoon and Delco lines both cross the Little Green swamp. The Wallace, Jacksonville, Castle Hayne East and Wilmington Corning lines travel northeast from the split near BSEP (see Figure 3-2). The Jacksonville line crosses the Holly Shelter Game Land in the Holly Shelter swamp. The Wallace line crosses the B. W. Wells Savannah, a 117-acre remnant of wetland savannah, in northwest Pender County (NCCLT 2001). The tract supports 170 native plant species, some of which are rare (NCCLT 2001). Progress Energy has partnered with the N. C. Coastal Land Trust, the Conservation Trust for North Carolina, and the N. C. Wild Flower Preservation Society to preserve this unique property. The transmission corridors do not cross any federal or state parks.

The U.S. Fish and Wildlife Service (USFWS) has designated areas of Brunswick, New Hanover, Pender, and Onslow counties as “critical habitat” for the piping plover (66 FR 36038); however, all of the areas designated critical habitat are along Atlantic Ocean beaches. None occurs at BSEP or adjacent to associated transmission lines.

2.5 THREATENED OR ENDANGERED SPECIES

Species that are state- or federally-listed as threatened or endangered are known to occur, at least occasionally, on or near the BSEP site and transmission corridors. Table 2-1 lists the federally- and state-listed threatened and endangered species that are known to occur in the seven counties of interest (Bladen, Brunswick, Columbus, New Hanover, Onslow, Pender, and Robeson).

In 1998, CP&L conducted a self-assessment that evaluated more than 90 sensitive plant and animal species that could occur in the vicinity of BSEP (based on studies prepared by Pacific Northwest National Laboratory for the NRC, and lists prepared by the U.S. Fish and Wildlife Service and the North Carolina Natural Heritage Program) and evaluated potential threats to these species from activities at BSEP (CP&L 1998).

The self-assessment identified three federally listed terrestrial species (Table 2-2) that could potentially be affected by BSEP operations, future facility expansion, or other activities: the red-cockaded woodpecker (*Picoides borealis*), Cooley's meadowrue (*Thalictrum cooleyi),* and rough-leaved loosestrife (*Lysimachia asperulaefolia*). Red-cockaded woodpeckers, federally listed as endangered, are found in eastern North Carolina in mature pine forests (generally longleaf pine) with sparse understory vegetation. Suitable nesting habitat for this species is not found at BSEP, but birds may forage in the area. Rough-leaved loosestrife, a federally endangered species, is a perennial herb that occurs in pocosins in eastern North Carolina (Radford et al. 1968). Eight populations of rough-leaved loosestrife are known from Brunswick County; one occurs in a BSEP transmission corridor north of the plant in the Boiling Spring Lakes area (corridor that contains Castle Hayne East, Wilmington Corning, Wallace, and Jacksonville lines). Three more populations are associated with Progress Energy transmission corridors in Pender County (Wallace and Jacksonville lines). Cooley's meadowrue, a federally endangered species, is a perennial herb that occurs in pine savannahs in eastern North Carolina (Radford et al. 1968). Two populations have been found on a Progress Energy transmission corridor (Jacksonville line) in Onslow County.

A single population of golden sedge (*Carex lutea*) was recorded along a transmission corridor (Jacksonville line) in Onslow County in 1996, but the species did not receive federal protection until 2002 (Federal Register, Volume 67, No. 15, pg. 3120) and as a result was not one of the federally listed species evaluated in the 1998 CP&L self assessment. This federally endangered plant is a perennial found in coastal (wet) savannahs underlain by calcareous (limestone) deposits (USFWS 2002b). This rare species is found only in Pender and Onslow Counties in North Carolina.

In 1993, CP&L signed a Memorandum of Understanding with the North Carolina Department of Environment, Health, and Natural Resources to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission line rights of way (BSEP 2003, pg. 5). The company also maintains Best Management Practices for Management of Rare Plants on Progress Energy Rights-of-Way (BSEP 2002, pp. 10-14). Table 2-2 describes the protective measures taken by Progress Energy to protect these populations.

The 1998 self-assessment also identified three federally listed aquatic species that could potentially be affected by BSEP operations, future facility expansion, or other activities: the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonias mydas*), and the Kemp's Ridley sea turtle (*Lepidochelys kempi*). The loggerhead sea turtle, the sea turtle most commonly observed along the south Atlantic coast, nests as far north as Ocracoke Inlet, North Carolina in late spring and early summer (Martof et al. 1980). The Kemp's Ridley sea turtle is an uncommon visitor to the coast of North Carolina (immature and sub-adult individuals); it nests almost exclusively along the northern Gulf Coast of Mexico and on Padre Island, Texas (Martof et al. 1980, Ogren 1992). The green sea turtle migrates along the North Carolina coast and occasionally comes ashore to bask, but does not normally nest in the Carolinas (Martof et al. 1980).

BSEP has a permit issued annually by the North Carolina Wildlife Resources Commission for the capture, tagging and relocation to open ocean of sea turtles that occasionally move into the intake canal through breaches in the diversion structure. The permit imposes certain compliance provisions for handling endangered sea turtles. To mitigate potential impacts, Progress Energy has installed and maintains blocker panels in the diversion structure. Site personnel patrol the intake canal daily during the turtle season in order to find and return to the open ocean sea turtles that get past the diversion structure.

In compliance with the provisions of the Endangered Species Act that require Federal agencies to consult with the USFWS and NMFS when actions potentially jeopardize listed species, NRC in 1998 initiated a formal Section 7 consultation with the NMFS regarding the effects of BSEP operations on sea turtles. The NMFS reviewed data on incidental takes of sea turtles at BSEP and the operation of the cooling water intake system and issued a final Biological Opinion (with an incidental take statement) in January 2000 that concluded:

"…operation of the water intake system of the Brunswick Steam Electric Plant…is not likely to jeopardize the continued existence of the loggerhead, leatherback, green, hawksbill, or Kemp's ridley sea turtles. No critical habitat has been designated for these species in the action area; therefore, none will be affected. This conclusion is based on the proposed action's (operation of the cooling water intake system) anticipated effects on each of these species being limited to the incidental take, through death or injury, on a small number of immature sea turtles per year over the next 20 years." (NMFS 2000, pg. 25).

The 1998 CP&L self-assessment did not list the shortnose sturgeon (*Acipenser brevirostrum*) as a federally protected species with significant potential for being affected by BSEP operations, facility expansion, or other activities, but did note that "this species is known from the lower Cape Fear River and thus…could be vulnerable to plant impact during spawning in late winter to early spring" (CP&L 1998). The shortnose sturgeon was not included in the list of species requiring action to prevent impacts because the Cape Fear River population was known to be very small and to

inhabit portions of the river upstream of the BSEP intake canal. Further, no shortnose sturgeon had been collected in decades of sampling at BSEP.

The shortnose sturgeon was believed to be extremely rare or to have been extirpated from the Cape Fear River until 1987, when a gravid female was captured in the Brunswick River, a relatively undisturbed tributary of the lower Cape Fear River (Moser and Ross 1995). Researchers sampled the lower Cape Fear River drainage intensively from 1990 to 1992 and found small numbers of shortnose sturgeon in both the Brunswick River and the main stem of the Cape Fear River (Moser and Ross 1995). Some of these fish were fitted with sonic transmitters and showed directed upstream movement indicative of spawning migrations. Spawning appeared to be hindered or prevented by gill nets set by commercial fishermen (targeting striped bass and American shad) and by Lock and Dam No. 1, a low-head dam at River Kilometer 96. Because the population is small, probably less than 50 individuals, almost nothing is known of the population dynamics of the Cape Fear River population of shortnose sturgeon (NMFS 1998).

No other federally- or state-listed threatened or endangered species are known to occur at BSEP or along its transmission corridors. Progress Energy has procedures in place to protect endangered or threatened species, if they are encountered at the plant site or along transmission corridors, and provides training for employees on these procedures (BSEP 2002; BSEP 2003).

2.6 REGIONAL DEMOGRAPHY AND MINORITY AND LOW-INCOME POPULATIONS

2.6.1 GENERAL

The G*eneric Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

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

Source: NRC 1996.

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

Demographic Categories Based on Proximity

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

Source: NRC 1996.

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

GEIS Sparseness and Proximity Matrix

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

Low Population Area | Medium Population Area | High Population Area

Source: NRC 1996.

Progress Energy used 2000 census data from the U.S. Census Bureau website (USCB 2001a) and geographic information system (GIS) software (ArcView®) to determine demographic characteristics in the BSEP vicinity. The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information.

As derived from 2000 Census Bureau information, 133,286 people lived within 20 miles of BSEP. Applying the GEIS sparseness measures, BSEP has a population density of 226 persons per square mile within 20 miles and falls into a least sparse category, Category 4 (greater than or equal to 120 persons per square mile within 20 miles). To determine accurate population densities Progress Energy used GIS software to exclude any area within the BSEP 50 mile radius which was covered by water.

Based on the 2000 Census Bureau information, 361,216 people lived within 50 miles of BSEP. This equates to a population density of 111 persons per square mile within 50 miles (excluding area covered by water). Applying the GEIS proximity measures, BSEP is classified as Category 2 (no city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the BSEP ranks of sparseness Category 4 and proximity Category 2 result in the conclusion that BSEP is located in a medium population area.

All or parts of seven North Carolina counties, one South Carolina county, the City of Wilmington (NC), and a small portion of the City of Myrtle Beach (SC) lie within the

50 mile radius of BSEP (Figure 2-1). Approximately 92 percent of the station employees reside within 2 counties in North Carolina: Brunswick and New Hanover. The remaining 8 percent are distributed across 15 other counties, with numbers ranging from 1 to 26 employees per county.

The Wilmington MSA, which contains both Brunswick and New Hanover Counties, is characterized by urban, suburban, and rural areas, with a total population of 233,450, making it the 154th largest MSA in the United States (USCB 2001b). The Wilmington MSA ranked 14th among U.S. Metropolitan areas in rate (percent) of population growth between 1990 and 2000 (USCB 2001b)

Both Brunswick and New Hanover Counties are growing at a faster rate than North Carolina as a whole. From 1990 to 2000, North Carolina's average annual population growth rate was 2.1 percent (USCB 2001c), while Brunswick County increased by 4.4 percent and New Hanover County increased by 3.3 percent (USCB 2001d).

In 2000, North Carolina reported a population count of approximately 8.0 million people, representing approximately 3 percent of the nation's population. North Carolina's population growth rate between 1990 and 2000 was the 9th highest among the 50 states and the District of Columbia (USCB 2001c).

Table 2-3 shows population estimates and annual growth rates for the two counties that have the greatest potential to be socioeconomically affected by license renewal activities at BSEP. Values for the State of North Carolina and are provided for comparison's sake. The table is based on U.S. Census Bureau (USCB) data for 1980, 1990, and 2000, North Carolina Office of State Budget and Management projections through 2030, and a Progress Energy projection to 2040 that is based on linear regression techniques.

2.6.2 MINORITY AND LOW-INCOME POPULATIONS

Background

When NRC performed environmental justice analyses for previous license renewal applications it used a 50-mile radius as the overall area that could contain environmental impact sites and the state as the geographic area for comparative analysis. Progress Energy has adopted this approach for identifying the BSEP minority and low-income populations that could be affected by BSEP operations.

Progress Energy used ArcView® geographic information system software to combine USCB TIGER line data with USCB 2000 census data to determine the minority characteristics on a block group level. Low-income demographic data is not available on a block group level; therefore, USCB TIGER line data is combined with USCB 2000 census tract level demographic data to determine the low-income characteristics. Progress Energy included all block groups or census tracts if any of their area lay within 50 miles of BSEP. The 50-mile radius includes 257 block groups and 82 census tracts.

Progress Energy defines the geographic area for BSEP as North and South Carolina independently, for block groups or tracts in the two states.

2.6.2.1 Minority Populations

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

1. The minority population of the census block or environmental impact site exceeds 50 percent.

2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent U.S. Census Bureau decennial census data. Progress Energy used 2000 census data from the USCB website (USCB 2000a; USCB 2000b) in determining the percentage of the total population within the two states for each minority category, and in identifying minority populations within 50 miles of BSEP.

Progress Energy divided USCB population numbers for each minority population within each block group by the total population for that block group to obtain the percent of the block group's population represented by each minority. For each of the 257 block groups within 50 miles of BSEP, Progress Energy calculated the percent of the population in each minority category and compared the result to the corresponding geographic area's minority threshold percentages to determine whether minority populations exist. Progress Energy defines the geographic area for BSEP as the entire State of North Carolina when the block group is contained within North Carolina and the entire State of South Carolina when the block group is contained within South Carolina.

North Carolina contains the largest portion of the geographic area, and approximately 84 percent of the block groups. USCB data (USCB 2000a) for North Carolina characterizes 1.2 percent as American Indian or Alaskan Native; 1.4 percent Asian; 0.00 percent Native Hawaiian or other Pacific Islander; 21.6 percent Black races; 2.3 percent all other single minorities; 1.3 percent multi-racial; 27.8 percent aggregate of minority races; and 4.7 percent Hispanic ethnicity. South Carolina comprises the remainder of the geographic area with approximately 16 percent of the block groups. USCB data (USCB 2000b) for South Carolina characterizes 0.3 percent as American Indian or Alaskan Native; 0.9 percent Asian; 0.00 percent Native Hawaiian or other Pacific Islander; 29.5 percent Black races; 1.0 percent all other single minorities; 1.0 percent multi-racial; 32.7 percent aggregate of minority races; and 2.4 percent Hispanic ethnicity.

Based on the "more than 20 percent" criterion, American Indian or Alaskan Native minority populations are found in a total of 2 block groups located in Columbus County, North Carolina (Table 2-4). Figure 2-4 displays the location of this minority block. This area is home to the Waccamaw-Siouan Tribe, whose 2,000 or so members live in small communities around Lake Waccamaw in eastern Columbus County and southeastern Bladen County, North Carolina (J. Smith 2002). Although not recognized by the Federal government, the Waccamaw-Siouan Tribe has received legal recognition from the North Carolina Commission of Indian Affairs (North Carolina Commission of Indian Affairs undated).

Based on the "more than 20 percent" criterion, Black Races minority populations occur in 44 block groups (Table 2-4), 41 of which are located in the state of North Carolina. These block groups are distributed among six North Carolina counties. The remaining three block groups are located in Horry County, South Carolina. Figure 2-5 displays the location of these minority block groups.

Based on the "more than 20 percent" criterion, the Aggregate of Minority Races populations exist in 41 block groups (Table 2-4), 38 of which are located in the state of North Carolina. The remaining three block groups are located in the state of South Carolina. The Aggregate of Minority Races minority block groups are displayed on Figure 2-6.

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no Asian, Native Hawaiian or other Pacific Islander or Multi-racial minorities exist in the geographic area. In addition, no populations defined as "All Other Single Minority Races" or Hispanic Ethnicity exceed these criteria. Table 2-4 presents the numbers of block groups within each county that exceed the threshold for determining the presence of populations.

2.6.2.2 Low-Income Populations

NRC guidance defines "low-income" by using U.S. Census Bureau statistical poverty thresholds (NRC 2001, Appendix D). U.S. Census Bureau (USCB 2000c) characterizes 12.4 percent of North Carolina and 14.2 percent of South Carolina households as low-income.

For each census tract within the 50-mile radius (see Section 2.6.2.1 for a discussion of how census tracts were selected), the number of low-income households was divided by the number of total households in that tract to obtain the percent of low-income households for that tract. A low-income population is considered to be present if:

The low-income population of the census tract or environmental impact site exceeds 50 percent, or

The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the “more than 20 percent” criterion, three census tracts in the Wilmington North Carolina area (New Hanover County) contain low-income populations (USCB 2002). Figure 2-7 identifies low-income household tracts.

2.7 TAXES

BSEP pays annual property taxes to Brunswick County. Taxes fund Brunswick County operations, including the school system, public safety, hospitals, human services, emergency management services, and recreation facilities (NC State Treasurer 2003). For the years 1997 to 2002, BSEP's property taxes provided 7.5 to 13.5 percent of Brunswick County's property tax revenues. The average contribution over the six-year period was 9.4 percent. If the operating license for BSEP was not renewed and the plant was decommissioned, then the tax base of the surrounding communities and their economic structures could experience some adverse impact, as discussed in Section 8.4.7 of the GEIS (NRC 1996).

BSEP's annual property taxes are expected to remain relatively constant through the license renewal period. With respect to deregulation, the North Carolina General Assembly took no action on restructuring during its 2001 session (EEI 2002). The Study Commission on the Future of Electric Service in North Carolina, which studied electric service choice for more than four years, decided in February 2002 to delay any action for the foreseeable future. Therefore, the potential effects of deregulation are not yet fully known. In the future, deregulation could affect utilities' tax payments to counties. However, any changes to BSEP tax rates due to deregulation would be independent of license renewal. Table 2-5 compares BSEP's property tax payments to Brunswick County property tax revenues.

2.8 LAND USE PLANNING

This section focuses on Brunswick and New Hanover Counties because the majority (approximately 90 percent) of the permanent BSEP workforce lives in these counties (see Section 3.4) and because Progress Energy pays property taxes in Brunswick County. Both counties have experienced rapid growth over the last several decades. From 1990 to 2000, Brunswick County's population growth rate averaged 4.4 percent per year and New Hanover County's population growth rate averaged 3.3 percent per year, while the population of the state of North Carolina grew an average of 2.1 percent per year (USCB 2001c; USCB 2001d). Over the same period, 1990 to 2000, the number of housing units in Brunswick County increased by 38.6 percent and the number of housing units in New Hanover County increased by 39.5 percent, while the total number of units in the state increased by 25.0 percent (USCB 1990; USCB 2000d).

Since both counties have experienced rapid growth, their respective comprehensive land use plans focus on growth-related issues and the implementation of future conservation efforts to protect natural resources. These plans reflect public involvement in the planning process and the desire to encourage growth while controlling patterns of development. Land use planning tools, such as zoning and population density limits, are used by both counties to control development. Both counties encourage growth in areas where public facilities, such as water and sewer systems, exist or are scheduled to be built in the future. Both plans promote the preservation of the communities' natural resources, resources that make the areas attractive to current and prospective residents.

North Carolina has issued guidelines for classifying land use within the state. Brunswick and New Hanover Counties have adopted these guidelines and the general categories are as follows: Developed, Urban Transition, Limited Transition, Community, Rural, Conservation and Resource Management (or Protection). The Developed classification is for areas already urbanized, while the Urban Transition and Limited Transition classifications are used to designate areas with future urban potential, but with controlled densities. The Rural classification is for areas not planned for urbanization within the next decade and is comprised mainly of agriculture, forestry, and other agrarian uses (Brunswick County 1997). The purpose of the Conservation and Resource Management Classification is to provide for the effective long-term management and protection of significant, limited, or irreplaceable land and resources (Brunswick County 1997). For the purposes of this section, there is a distinction made between a land classification and an actual land use. There may be more than one land use within one land use class designation. For example, in the Rural classification, low-density residential, agricultural, and forestry land uses are co-existent. In the remainder of this section, actual land uses are detailed. They should not be confused with land use classifications.

Brunswick County

Brunswick County occupies roughly 855 square miles of land area, making it the sixth largest of 100 North Carolina counties (USCB 2000d). The majority of the land in the

County is rural; classified either as rural, conservation, or transitional. The Brunswick County Planning Department does not currently maintain percentage breakdown data for current land uses within the County (Stewart 2003).

The City of Southport provides land use classification information in percentage form in its Comprehensive Plan. Approximately 45 percent of Southport's planning jurisdiction (the incorporated portions of the City plus the extraterritorial jurisdiction area) is developed. As a result, there are 1,879 acres in the planning jurisdiction that are vacant and potentially suitable for development. The presence of jurisdictional wetlands reduces the acreage that is actually available, however (City of Southport 2001). Of the total acreage in the Southport planning jurisdiction, approximately 18 percent is Single- and Multi-family Residential; 14 percent Transportation and Utility; 4 percent Industrial; 3 percent Commercial; 2 percent Public and Institutional; 3 percent Parks and Open Space; and 1 percent Water Dependent Commercial (City of Southport 2001).

Due to its large size, Brunswick County has implemented a "Geographic Areas of General Recognition" program. This program is used by administrators and the public to identify subsections of the County for planning purposes. Seven areas are delineated by their regional significance. These areas are: Area 1, Shallotte to the State Line; Area 2, Shallotte River to Lockwood Folly River; Area 3, Southport/Oak Island; Area 4, Belville-Leland-Navassa; Area 5, Town Creek/Winnabow/Mill Creek; Area 6, Ash/Waccamaw; and Area 7, Supply/Sunset Harbor (Brunswick County 1997).

- Area 1 is the fastest growing subsection of the County due to its close proximity to the Grand Strand/Myrtle Beach area. This subsection has numerous golf course communities ranging from 500 to 1,250 acres in size. Housing densities in these golf course communities are low, in the range of 1.5 to 2.0 housing units per acre, but their development has been accompanied by convenience stores, specialty shops, and small shopping centers anchored by chain grocery and drug stores. Large tracts of land have been developed as a result (Brunswick County 1997).

- Area 2, which includes Holden Beach, is the second fastest growing section of Brunswick and is comprised of inexpensive lots and homes, manufactured housing, and a predominance of vacation homes. Commercial activity in this area is mostly scattered, with the largest concentration of activity near Supply, an unincorporated village located at the intersection of US 17 and NC 211 (Brunswick County 1997).

- Area 3 is a mixed land use area with major industrial uses (BSEP, Archer Daniels Midland, Cogentrix Cogenerating Facility), a military installation (Military Ocean Terminal Sunny Point), commercial strip development, and permanent and seasonal housing. Permanent housing is concentrated in the City of Southport and the Town of Long Beach, while seasonal housing is found at Caswell Beach. Several "planned communities" are located in Area 3 (Brunswick County 1997).

- Area 4 has three municipalities which are primarily residential and serve as bedroom communities for New Hanover County. The area also hosts some manufacturing,

including the Dupont plant which employs a large number of residents from the Wilmington area (Brunswick County 1997).

- Area 5 has a few residential communities along US 17, a public golf course and little industrial, office, or retail development (Brunswick County 1997).

- Area 6 is dominated by farming and timber activities (Brunswick County 1997).

- Area 7 is predominantly residential. It includes the area south and east of Supply and the eastern side of the Lockwood Folly River, which has experienced significant growth in recent years that is predicted to continue. The growth is evidenced by the development of the large planned residential community, Winding River Plantation, and the approval of subdivisions along Sunset Harbor Road. Additionally, there is considerable interest in commercial development near the US 17/NC 211 intersection (Brunswick County 1997).

With respect to residential development, most of the neighborhood subdivisions have occurred along the coast, in beach and intracoastal waterway areas. Single-unit detached dwellings comprise 55.7 percent of the 51,431 housing units in the County. Manufactured housing comprises 35.9 percent (USCB 2000e).

The large influx of seasonal residents has a large impact on Brunswick's infrastructure, with the ratio of seasonal to permanent residences increasing to 3:1 in the summer months (Brunswick County 1997). Even with the widening of US 17, which relieved some of the congestion, secondary roads and bridges to the coastal beaches continue to be congested on peak weekends (Brunswick County 1997). The community is considering adding a second bridge to Oak Island to alleviate traffic congestion.

The Brunswick County Land Use Plan (1997) acknowledges that growth and development have increased in recent years, and continued growth is inevitable, "predominantly in the form of a growing tourism economy, rapidly rising seasonal and permanent populations, and related residential and commercial development." The Land Use Plan notes (pg. 8-28) that the County's overall land use policy "calls for continued efforts to diversify the local economy, protect area resources, and improve the quality of life. A particular point of emphasis for this plan is the desire to foster…a distinct 'town and county' development pattern." The intent of the County's land use policy is to allow for the preservation of open space and productive farm and timber land, to minimize costs of extending infrastructure and services, to avoid higher taxes, and minimize traffic congestion associated with urban sprawl (Brunswick County 1997, pg. 8-30).

New Hanover County

New Hanover County occupies approximately 199 square miles of land area, making it one of the smallest (99th of 100) counties in North Carolina (USCB 2000d). New Hanover County, which is dominated by the City of Wilmington and its suburbs, is one of the most urbanized counties in North Carolina (Wilmington-New Hanover County

1999). Among 100 North Carolina counties, only Mecklenburg County, which contains the city of Charlotte and its 540,000 residents, has higher population and housing densities than New Hanover County (USCB 2000d, f).

Currently, New Hanover County is 32 percent Developed. The land use breakdown percentages for the developed areas of the County are as follows: 17 percent Residential (single-family comprises 15 percent), 2 percent Office and Institutional, 1 percent Commercial, 4 percent Transportation and Utility, 5 percent Industrial, and 2 percent Recreation. The breakdown for the remainder of the county is as follows: 4 percent Agriculture, 50 percent Undeveloped, 2 percent Water, and 11 percent Other (O'Keefe 2003).

Developed, Urban Transition, and Limited Transition land classifications are areas of high-medium density in which the concentration of development and redevelopment is encouraged. Public services such as sewer and water are either in place or future extensions are planned for these services. Densities are greater in the Developed and Urban Transition areas and may exceed 2.5 housing units per acre while the Limited Transition area cannot exceed this limit. The City of Wilmington is primarily Developed (Wilmington-New Hanover County 1999).

Community and Rural land classifications are areas of low density and may not exceed the 2.5 units per acre limit. Currently, the only area designated as Community is Castle Hayne, which supports mixed land uses providing housing, retail shopping, employment, and public services for the rural areas in the County (Wilmington-New Hanover County 1999). The Rural areas include agricultural, forest management, and mineral extraction. Urban uses are discouraged in Rural areas. Land designated as Rural is generally located east of I-40 and west of NC 17 in the northern portion of the County and in selected areas near the Cape Fear River.

To protect the County from increased urbanization and to preserve its remaining resources of environmental, scenic, recreational and cultural importance, Conservation and Resource Protection classifications have been created. These areas have a density limit requirement of 2.5 units per acre or less, but may be as low as 1.0 unit per acre. Conservation areas encompass areas that are environmentally fragile and considered too important to endanger with development. These lands are usually defined by the State of North Carolina as estuarine Areas of Environmental Concern (AECs) and adjacent lands within the 100-year floodplain (Wilmington-New Hanover County 1999). The majority of these areas are located along the coastal wetlands and the banks of the Cape Fear River.

Future land use concerns for the County include conservation and preservation of the natural resources which contributed to the County's prosperity. These resources include the beaches, rivers, sounds, aquifers, and other natural areas. Also, the County would like to contain existing urban areas, preserve the rural lifestyle for residents while providing a strong economic base and affordable housing, maintain and enhance fiscal sustainability and community infrastructure supports, protect the area's historical

heritage, and ensure citizen protection against natural disasters such as hurricanes (Wilmington-New Hanover County 1999).

2.9 SOCIAL SERVICES AND PUBLIC FACILITIES

2.9.1 PUBLIC WATER SUPPLY

Most (92 percent) of the permanent employees of BSEP reside in Brunswick and New Hanover Counties (Ahern 2002, all); therefore, the discussion of public water supply systems will focus on these two counties.

Regional

The Lower Cape Fear Water and Sewer Authority (LCFWSA) was established in 1970 to supply raw surface water to local governments and industry in Bladen, Brunswick, Columbus, New Hanover, and Pender Counties. The LCFWSA currently supplies raw surface water to Brunswick County and to the City of Wilmington in New Hanover County. The LCFWSA also provides raw surface water to KoSa and Praxair, Inc., two industries located along US Highway 421 in New Hanover County. Raw surface water supplied by the LCFWSA is withdrawn from an intake located above Lock and Dam #1 on the Cape Fear River in Bladen County. The LCFWSA currently produces 13.7 million gallons per day (MGD) and has a production capacity of 45 MGD. Surface water use forecast for clients of the LCFWSA is projected to increase from 13.7 MGD for fiscal year 2001-02 to 28 MGD for the fiscal year 2009-10 (LCFWSA 2002b).

The City of Wilmington also has a raw water intake located above the lock and dam near the LCFWSA intake. The Cape Fear River at this location is capable of supplying 53 MGD of raw water at each of the two intakes (NCDENR 2002b, pg. 62).

Groundwater is also a major source of water for residents and municipalities within the region. The counties of Bladen, Columbus, Pender, and New Hanover (with exception of the City of Wilmington) use groundwater as the major source of potable water for their residents. The wells for New Hanover County are located primarily within the Castle Hayne, Pee Dee and other surficial aquifers (NHC 2002, all).

The State of North Carolina considers all systems that currently obtain water from Wilmington or from the LCFWSA and other local government water systems in New Hanover and Brunswick Counties as a regional group. The 27 systems included in this group have a combined projected 2050 average daily demand of 73.4 MGD. They currently have a 115.5 MGD available supply when the supply from existing wells is combined with the 106 MGD that is available at the Cape Fear River intakes. Therefore, there appears to be enough available water to meet the projected demands of these systems (NCDENR 2002b, pg. 62).

Brunswick County

In 2000, Brunswick County Public Utilities supplied 11.6 MGD of potable water (NCDENR 2002b, pg. 35) to its water clients. Brunswick County receives the majority of its potable water (8.2 MGD) from the LCFWSA (LCFWSA 2002a). Brunswick County receives raw surface water from the LCFWSA that it treats at the County's Northwest

Water Treatment Facility. This facility has a capacity of 24 MGD. The remainder of water supplied by Brunswick County, approximately 3.4 MGD, is groundwater produced from 15 deep wells that tap into the Castle Hayne aquifer (Brunswick County 2001). The wells have a total capacity of 3.4 MGD (NCDENR 2002b, pg. 62). Water from this groundwater source is treated at the 211 Water Treatment Facility. The facility has a capacity of 6 MGD and serves residents and businesses in the vicinity of Highway 211 (Brunswick County 2001, all).

Treated water from Brunswick County Public Utilities serves Carolina Shores, Caswell Beach, Holden Beach, Long Beach, North Brunswick Sanitary District, Ocean Isle Beach, Shallotte, Southport, Sunset Beach, and Yaupon Beach. Southport and Yaupon Beach also have wells that supply water to their systems (NCDENR 2002b, pg. 62).

BSEP receives water from Brunswick County Public Utilities. From 1996 through 2001, BSEP's water use ranged from approximately 0.22 million gallons per day (MGD) to approximately 0.25 MGD with an average consumption of 0.23 MGD (L. Smith 2002, all). The BSEP average use over the six-year period represents two percent of the total water supplied to customers by Brunswick County Public Utilities in 2000 and one percent of the utility's total production capacity over the same period.

New Hanover County

The public water supply system in New Hanover County, with the exception of the City of Wilmington, is a groundwater system (NHC 2002, all). The New Hanover County Water and Sewer District (NHCWSD) provides treated water through four water systems including the New Hanover County Water System, New Hanover County 421 Water System, Kings Grant Water System, and the Monterey Heights Water System (Blanchard 2002). The water is produced from 30 wells (Blanchard 2002, all) located within the Castle Hayne, Pee Dee, and other surficial aquifers (NHC 2002, all). The NHCWSD also provides service to county residents not supplied by a private or municipal supplier (NHC 2002). From November 2001 to October 2002, the county system provided treated water to its customers at a rate of approximately 2.4 MGD (Blanchard 2002, all).

The City of Wilmington is the largest supplier of treated water within the county and is considered part of the LCFWSA group because it received approximately 11.5 MGD of raw water in 2000 from the Cape Fear River from an intake located above Lock and Dam #1. The City of Wilmington also has a 53 MGD capacity available to it through its own river water intake located above Lock and Dam #1. The city has an available raw water capacity of 15 MGD supplied by the LCFWSA (NCDENR 2002b, all). Wilmington's daily use rate capacity is limited by its water treatment capacity. Wilmington's current water treatment capacity is 25 MGD (Wilmington 2002).

Tables 2-6 and 2-7 provide details of Brunswick and New Hanover Counties' respective water suppliers and capacities.

2.9.2 TRANSPORTATION

The entrance to BSEP is off N.C. 87 just north of Southport (Figure 2-2).

N.C. 133 crosses N.C. 87 so that access to N.C. 87 from N.C. 133 can be from the northeast or the southwest (Figure 2-2). Employees traveling to the site from the Wilmington area or points north access N.C. 87 via N.C. 133 or U.S. 17 (Figure 2-1). Employees from Oak Island, southwest of the site, access N.C. 87 from the southern end of N.C. 133. Employees traveling from the west access N.C. 87 from N.C. 211, via N.C. 133. Employees from Southport travel a short distance north on N.C. 211 to N.C. 87.

Traffic count data for each of these roads in the vicinity of BSEP is shown in Table 2-8. None of the roads listed have level-of-service determinations. The State of North Carolina does not make level-of-service determinations in rural, non-metropolitan areas unless it is deemed it necessary (Hensdale 2002).

2.10 METEOROLOGY AND AIR QUALITY

BSEP is located in Brunswick County, North Carolina, which is part of the Southern Coastal Plain Intrastate Air Quality Control Region (AQCR). All counties in the AQCR are designated as being in attainment for all criteria pollutants, as are all counties in North Carolina and South Carolina (40 CFR 81.152, 40 CFR 81.334 and 40 CFR 81.341). The nearest non-attainment area is the Northeastern Virginia Intrastate AQCR, approximately 350 miles northwest of BSEP, which is a one-hour ozone non-attainment area (40 CFR 81.347).

In July 1997, the U.S. Environmental Protection Agency (EPA) issued final rules establishing a new eight-hour ozone standard and a standard for particulate matter with a nominal size of less than 2.5 microns (PM-2.5). After several years of litigation, the PM-2.5 and 8-hour ozone standards have been upheld. EPA is taking steps to implement the new standards (e.g. collecting the data necessary to designate which areas are in non-attainment). Based on data collected between 1999 and 2001, several counties in South and North Carolina, including one (Wayne County, North Carolina) in the Southern Coastal Plain AQCR, could be designated as non-attainment areas under the new PM-2.5 and 8-hour ozone standards.

2.11 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Area History in Brief

Pre-History and History

PaleoIndians (10,000 BC), the first people known to the Carolina region, were well adapted, technologically and socially, to the Pleistocene, when the climate and plant and animal populations were very different from those of today. Wetter, cooler weather conditions were the general rule for areas like the Eastern Seaboard, which was some distance from the southern reaches of the glacial ice. PaleoIndians preyed on elephants (mastodons and mammoths), wild horses, ground sloths, camels, giant bison, moose, caribou, elk and porcupine, using their meat, skins and other parts for food, clothing, tools and other needs. They also devoted considerable time to gathering wild plant foods and likely fished and gathered shellfish in coastal and riverine environments (Claggett 1996).

Archaic Indians (9,000 to 2,000 BC), direct descendants of the PaleoIndians, improved the techniques of fishing, gathering, and hunting for post-glacial environments, which differed from the Pleistocene. Archaic people made a wide variety of basketry and used stone and wooden tools that reflect the varied subsistence patterns of fishing, gathering and hunting of the many different species of plants and animals that shared their post-glacial environments. Their camps and villages occur as archaeological sites throughout North Carolina, on high mountain ridges, along river banks, and across the Piedmont hills (Claggett 1996).

Woodland Indians (2,000 BC) continued to follow most of the subsistence practices of their Archaic forebears, hunting, fishing, and gathering during periods of seasonal abundance of deer, turkeys, shad, and acorns (Claggett 1996). Bow and arrow equipment was also an innovation of the Woodland stage, although the ultimate origin of that hunting technology is unknown (Claggett 1996). There was a tendency to settle in larger, semi-permanent villages along stream valleys, where soils were suitable for Woodland farming practices utilizing hoes and digging sticks (Claggett 1996). The house patterns, defensive walls (or palisades), and substantial storage facilities also demonstrate that Woodland Indians were more committed to settled village life than their Archaic predecessors (Claggett 1996). Woodland cultures dominated most of North Carolina well into the historic period. Most Indian groups met by early European explorers followed Woodland economic and settlement patterns (Claggett 1996).

Mississippian culture can be described neatly as an intensification of Woodland practices of pottery-making, village life, and agriculture. Mississippian societies were organized along strict lines of social hierarchies determined by heredity or exploits in war. Military aggressiveness was an important part of Mississippian culture, serving to gain and defend territories, enhance group prestige, and maintain favored trade and tribute networks. Pottery vessels were made in new and elaborate shapes, often as animal and human effigy forms; other artifacts of exotic copper, shell, wood and feathers mirror the emblematic needs of the noble classes to confirm their status.

Mississippian-type town centers typically included one or more flat-topped, earthen "temple" mounds, public areas and buildings ("council houses") used for religious and political assemblies. Wooden palisades, earthen moats or embattlements were placed around many villages for defensive purposes (Claggett 1996).

During the 1540s, Spanish explorers under the leadership of Hernando de Soto "discovered" several Indian groups occupying the interior regions of the Carolinas (Claggett 1996). Today, it is known that the coastal Indians were part of a larger group occupying the entire mid-Atlantic coastal area, identifiable by a shared language and culture called Algonkian (Claggett 1996). The Native Americans whom de Soto met included Siouan, Iroquoian and Muskogean speakers, whose descendants are now recognized as the historic tribes of the Catawba, Cherokee and Creek Indians. Within a very short period of time--some 50 years--after those first contacts, the early European explorers of North Carolina had met, interacted with, and begun the process of significant cultural displacement of all the major native groups in the state (Claggett 1996).

A number of modern Native American groups currently occupy North Carolina. State or Federally recognized groups include the Haliwa-Saponi, Coharie, Lumbee, Waccamaw-Siouan, Meherrin, and the Eastern Band of Cherokee Indians. Some 80,000 Native Americans now reside in North Carolina and are represented by tribal governments or corporate structures and through the North Carolina Commission of Indian Affairs (North Carolina Commission of Indian Affairs Undated).

The first known European exploration of North Carolina occurred during the early-to-mid-16th century. A Florentine navigator named Giovanni da Verrazano, in the service of France, explored the coastal area of North Carolina between the Cape Fear River area and Kitty Hawk. No attempt was made to colonize the area (State Library of North Carolina 1998).

From the mid-to-late-16th century several Spanish explorers from the Florida Gulf region explored portions of North Carolina, but again no permanent settlements were established (State Library of North Carolina 1998).

Coastal North Carolina was the scene of the first attempt to colonize America by English-speaking people. Two colonies were begun in the 1580s under a charter granted by Queen Elizabeth to Sir Walter Raleigh and both ended in failure (State Library of North Carolina 1998).

The first permanent English settlers in North Carolina were immigrants from the Tidewater area of southeastern Virginia. The first of these "overflow" settlers moved into the Albemarle area of northeast North Carolina around 1650 (State Library of North Carolina 1998).

In 1663, Charles II granted a charter to eight English gentlemen who had helped him regain the throne of England. The territory was called Carolina in honor of Charles the First. Until the Declaration of Independence in 1776 and the conclusion of the

Revolutionary War in 1783, North Carolina remained under England's control (State Library of North Carolina 1998).

Maritime History

Throughout the centuries the people of North Carolina have depended on the waters of the state. Indian inhabitants relied upon the rivers and sounds as a source of food, and a means of transportation and trade. The Indians built wooden dugout canoes and developed a variety of ways to catch fish. During the winter, many tribes would camp along the coastal sounds living off the readily available supply of oysters and other shellfish (North Carolina Division of Archives and History 1985).

Early European settlers used the water as a means to explore and settle the interior of the state. Down these rivers traveled the products of the new land: lumber, naval stores, tobacco and cotton. In exchange, ships from the other colonies, the West Indies and Europe brought to the major ports manufactured goods and other materials needed by the colonists (North Carolina Division of Archives and History 1985).

During the nineteenth century, paddlewheel steamboats came into use on the rivers of the state. Carrying passengers and cargo, often with a barge in tow, the steamers made their way well into the interior of the state on major rivers and their tributaries such as the Cape Fear, the Neuse, the Tar, the Roanoke, and the Chowan. Numerous shipwrecks and abandoned vessels have been located and studied. These include everything from dugout canoes, ferries, and fishing boats to coastal schooners and river steamboats (North Carolina Division of Archives and History 1985).

Coupled with this active maritime heritage, the unique and hazardous geography of the North Carolina coast has earned it the reputation as "Graveyard of the Atlantic." Three capes characterize North Carolina's coast: Cape Hatteras, Cape Lookout, and Cape Fear. The capes arc far into the Atlantic, with submerged shoals extending even further. Historical sources indicate that over 1,000 vessels have been lost off the North Carolina coast (North Carolina Division of Archives and History 1985). Naval warfare has also left a legacy of shipwrecks and other underwater archaeological sites. This is particularly true of the Civil War (North Carolina Division of Archives and History 1985).

Initial Operation

The Final Environmental Statement (FES) for the construction and operation of BSEP Units 1 and 2 (AEC 1974) listed 7 properties on the National Historic Register within the "vicinity" of BSEP. The FES notes that commenters on the Draft Environmental Statement evidenced concern that the proposed placement of the Brunswick to Barnard Creek dual 230 kV lines might impact cultural resources. They expressed concern that the route selected across the Cape Fear River might place these lines (the corridor) in close proximity to the "potentially rich archaeological site" of Old Town (AEC 1974). CP&L responded by contracting with the North Carolina Department of Archives and History to perform an archaeologic survey of the area. Upon completion of the survey, the Archaeologist, Survey Specialist, and State Historian concluded that the lines were

not likely to impact Old Town because (a) the Town's exact location was not known and (b) the surveyors did not find any archaeological remains near the proposed location. These statements were supported in letters from Stuart C. Schwartz, Archaeologist, Janet K. Seapker, Survey Specialist, and H. G. Jones, State Historian/Administrator, dated August 18, 1972, July 21, 1972, and November 17, 1972, respectively (AEC 1974). Likewise, the North Carolina Department of Art, Culture, and History did not object to the project (AEC 1974). As a result, NRC concluded that "the plant will not impose unacceptable impact upon National Register properties" (AEC 1974, pg. XII-5).

More recently, Progress Energy contracted with a research firm to conduct a marine remote sensing survey of a proposed realignment corridor of a power cable crossing in the Cape Fear River (to Bald Head Island) to determine if cultural resources were present. A total of five magnetic anomalies were recorded during the remote sensing survey. It was concluded that all five of the magnetic anomalies had only limited potential to be associated with significant submerged cultural resources. No additional mitigation or investigations were recommended (Mid-Atlantic Technology and Environmental Research, Inc. 2001).

Current Status

As of 2004, the National Register of Historic Places lists 12 locations in Brunswick County and 28 locations in New Hanover County, North Carolina (U.S. Department of the Interior 2004). Of these 40 locations, 13 fall within a 6-mile radius of BSEP. Table 2-9 lists the 13 National Register of Historic Places sites within the 6-mile radius of BSEP.

The Cape Fear Civil War Shipwreck Discontiguous District includes the wrecks of 21 Civil War vessels that lie along the coasts of Brunswick, New Hanover, and Pender counties and have been assigned one of five addresses by the National Park Service: Brunswick County --- Holden Beach vicinity, New Hanover County ---Wilmington Beach vicinity, New Hanover County --- Wrightsville Beach vicinity, New Hanover County --- Kure Beach vicinity, and Pender County --- Topsail Beach vicinity (Hall 1986; Philadelphia Architects and Buildings 2003). The New Hanover County --- Kure Beach site may lie within 6 miles of BSEP. The 21 sunken vessels associated with the Cape Fear Civil War Shipwreck District include 15 steam-powered and one (British) sail-powered blockade runners, four Union navy vessels, and one Confederate navy vessel (Hall 1986). Many of the blockade runners were lost when they ran aground on shoals at the mouth of the Cape Fear River and sank or were stranded in shallow water.

2.12 OTHER PROJECTS AND ACTIVITIES

BSEP is located in Brunswick County, North Carolina, near the mouth of the Cape Fear River. The 3-mile-long BSEP intake canal extends from the main channel of the Cape Fear River to the mainland, and then to the Plant. The Cape Fear River is regularly dredged by the U. S. Army Corps of Engineers, which maintains a ship channel from the mouth of the river to the Port of Wilmington (USACE 2003).

Military Ocean Terminal Sunny Point (MOTSP), a 16,000 acre facility owned and operated by the U.S. Army, lies immediately north of and adjacent to the BSEP site (Global Security 2001). MOTSP is the most important ammunition-handling port in the U.S., and the Army's main deep-water port on the east coast. In addition to world-wide transshipments of Department of Defense munitions, MOTSP supports Fort Bragg, North Carolina, home of the 82nd Airborne Division and other units (Global Security 2001). When the 82nd Airborne Division is mobilized, its heavy equipment and supplies are shipped out of MOTSP. Periodic dredging is required to keep this facility's basins and entrance channels accessible to the large, deep-draft vessels that it serves (USACE 2000; Global Security 2001).

An Archer Daniels Midland (ADM) chemical processing plant lies approximately one-half mile southeast of the BSEP site boundary. The Southport ADM facility is the largest producer of citric acid in the U.S. (Reed Business Information 1998). It is also Brunswick County's largest industrial (wholesale) water customer, purchasing more than 300 million gallons annually (Calhoun 2002). Citric acid is a preservative and stabilizer that is widely used in foods, pharmaceuticals, and cosmetics.

The Southport Cogeneration Plant, located approximately one-half mile south of the developed portion of the BSEP site, is owned and operated by Cogentrix Energy, Inc., one of the country's leading independent power producers. This 120 megawatt coal-fired facility sells electricity to Progress Energy and process steam to the nearby ADM processing plant (Cogentrix undated). The Southport Cogeneration Plant is Brunswick County's second largest industrial (wholesale) water customer (Calhoun 2002). The Cogentrix facility has an NPDES-permitted outfall that discharges to the BSEP discharge canal, just outside of the Nuclear Exclusion Zone at the point where the railroad trestle crosses the canal.

TABLE 2-1
ENDANGERED AND THREATENED SPECIES KNOWN TO OCCUR IN BRUNSWICK COUNTY OR IN COUNTIES CROSSED BY BSEP-ASSOCIATED TRANSMISSION LINES[a]

Scientific Name	Common Name	Federal Status[b]	State Status[b]
Mammals			
Neotoma floridana haematoreia	Eastern woodrat – Coastal Plain population	-	T
Puma concolor couguar	Eastern cougar	E	E
Trichechus manatus	Manatee	E	E
Birds			
Charadrius melodus	Piping plover	T	T
Falco peregrinus	Peregrine falcon	-	E
Haliaeetus leucocephalus	Bald eagle	T	E
Mycteria americana	Wood stork	E	E
Picoides borealis	Red-cockaded woodpecker	E	E
Sterna nilotica	Gull-billed tern	-	T
Reptiles and Amphibians			
Alligator mississippiensis	American alligator	T(S/A)	T
Ambystoma tigrinum	Tiger salamander	-	T
Caretta caretta	Loggerhead sea turtle	T	T
Chelonia mydas	Green sea turtle	T	T
Dermochelys coriacea	Leatherback sea turtle	E	E
Eretmochelys imbricate	Hawksbill sea turtle	E	E
Lepidochelys kempii	Kemp's ridley sea turtle	E	E
Rana capito	Carolina gopher frog	-	T
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	E
Elassoma boehlkei	Carolina pygmy sunfish	-	T
Etheostoma perlongum	Waccamaw darter	-	T
Menidia extensa	Waccamaw silverside	T	T
Invertebrates			
Anodonta couperiana	Barrel floater (mussel)	-	E
Catinella vermata	Suboval ambersnail	-	T
Elliptio marsupiobesa	Cape Fear spike (mussel)	-	T
E. roanokensis	Roanoke slabshell (mussel)	-	T
E. waccamawensis	Waccamaw spike (mussel)	-	T

TABLE 2-1
ENDANGERED AND THREATENED SPECIES KNOWN TO OCCUR IN BRUNSWICK COUNTY OR IN COUNTIES CROSSED BY BSEP-ASSOCIATED TRANSMISSION LINES[a] (Continued)

Scientific Name	Common Name	Federal Status[b]	State Status[b]
Fusconaia masoni	Atlantic pigtoe (mussel)	-	T
Lampsilis cariosa	Yellow lampmussel	-	T
L. fullerkati	Waccamaw fatmucket (mussel)		
Planorbella magnifica	Magnificent rams-horn (snail)	-	E
Toxolasma pullus	Savannah lilliput (mussel)	-	T
Triodopsis soelneri	Cape Fear threetooth (snail)	-	T
Plants			
Adiantum capillus-veneris	Venus hair fern	-	E
Amaranthus pumilus	Seabeach amaranth	T	T
Amorpha georgiana var *confusa*	Savanna indigo-bush	-	T
A. g. var *georgiana*	Georgia indigo-bush	-	E
Asplenium heteroresiliens	Carolina spleenwort	-	E
Astragalus michauxii	Sandhills milk-vetch	-	T
Calopogom multiflorus	Many-flowered grass-pink	-	E
Carex lutea	Golden sedge	E	E
Carya myristiciformis	Nutmeg hickory	-	T
Chrysoma pauciflosculosa	Woody goldenrod	-	E
Fimbristylis perpusilla	Harper's fimbry	-	T
Helenium brevifolium	Littleleaf sneezeweed	-	E
H. vernale	Dissected sneezeweed		E
Lindera melissifolia	Southern spicebush	E	E
L. subcoriacea	Bog spicebush	-	E
Lilaeopsis carolinensis	Carolina grasswort	-	T
Lophiola aurea	Golden crest	-	E
Lysimachia asperulaefolia	Rough-leaved loosestrife	E	E
Macbridea caroliniana	Carolina bogmint	-	T
Muhlenbergia torreyana	Pinebarren smokegrass	-	E
Myriophyllum laxum	Loose watermilfoil	-	T
Panicum hirstii	Hirsts' panic grass	C	E
Parnassia caroliniana	Carolina grass-of-parnassus	-	E
P. grandifolia	Large-leaved grass-of-parnassus	-	T

TABLE 2-1
ENDANGERED AND THREATENED SPECIES KNOWN TO OCCUR IN BRUNSWICK COUNTY OR IN COUNTIES CROSSED BY BSEP-ASSOCIATED TRANSMISSION LINES[a] (Continued)

Scientific Name	Common Name	Federal Status[b]	State Status[b]
Plantago sparsiflora	Pineland plantain	-	E
Plantanthera integra	Yellow fringeless orchid	-	T
P. nivea	Snowy orchid		T
Pteroglossapsis ecristata	Spiked medusa	-	E
Rhexia aristosa	Awned meadow-beauty	-	T
Rhus michauxii	Michaux's sumac	E	E
Rhynchospora thornei	Thorne's beaksedge	-	E
Schwalbea americana	American chaffseed	E	E
Solidago pulchra	Carolina goldenrod	-	E
Sporobolus teretifolius	Wireleaf dropseed	-	T
Stylisma pickeringii var *pickeringii*	Pickering's dawnflower	-	E
Thalictrum cooleyi	Cooley's meadowrue	E	E
Trillium pusillum var *pusillum*	Carolina least trillium	-	E
Utricularia olivacea	Dwarf bladderwort	-	T

Source: USFWS 2002a, CP&L 1998, NCDENR 2001, NCDENR 2002a

a. Bladen, Brunswick, Columbus, New Hanover, Pender, Onslow, and Robeson counties.

b. E = Endangered; T = Threatened; T(S/A) = Threatened due to similarity of appearance; a species which is protected because it is very similar in appearance to a listed species; - = Not listed.

TABLE 2-2
FEDERALLY-LISTED TERRESTRIAL SPECIES FOUND IN THE VICINITY OF BSEP OR IN THE VICINITY OF BSEP TRANSMISSION LINES

Species	Federal status	Reason for concern at BSEP	Protective measures taken by Progress Energy
Rough-leaved loosestrife	Endangered	Four populations occur on BSEP rights-of-way (offsite).	These populations are protected and managed by Progress Energy by agreement with NC Natural Heritage Program.
Cooley's meadowrue	Endangered	Two populations occur on BSEP rights-of-way (offsite).	These populations are protected and managed by Progress Energy by agreement with NC Natural Heritage Program.
Golden sedge	Endangered	A population occurs on a BSEP right-of-way	The population is protected and managed by Progress Energy by agreement with NC Natural Heritage Program.
Red-cockaded woodpecker	Endangered	Known to occur in mature pine forests in Brunswick County and regularly observed in Southport-Oak Island area.	Any facility expansion involving removal of mature longleaf pine would require surveys for this species to ensure that no red-cockaded woodpeckers or trees with their nest-cavities are harmed.

Source: CP&L 1998.

TABLE 2-3
ESTIMATED POPULATIONS AND ANNUAL GROWTH RATES

Population and Average Annual Growth Rate						
	New Hanover County		Brunswick County		North Carolina	
Year	Number	Percent	Number	Percent	Number	Percent
1980[a]	103,471	2.5	35,777	4.8	5,881,766	1.6
1990[a]	120,284	1.6	50,985	4.3	6,628,637	1.3
2000[b]	160,307	3.3	73,143	4.3	8,049,313	2.1
2010[c]	196,508	2.3	93,776	2.8	9,491,372	1.8
2020[c]	231,402	1.8	112,992	2.0	10,966,139	1.6
2030[c]	264,231	1.4	130,688	1.6	12,447,597	1.4
2040[d]	290,713	1.0	148,314	1.3	13,382,140	0.8

a. U.S. Census Bureau 1995.
b. U.S. Census Bureau 2001c,d.
c. North Carolina Office of State Budget and Management 2002.
d. Tetra Tech NUS 2002.

TABLE 2-4
MINORITY AND LOW-INCOME POPULATION CENSUS BLOCK GROUPS AND TRACTS

County	State	2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	2000 Tracts	2000 Tracts Low-Income
Bladen	NC	8	0	0	0	5	0	0	5	0	2	0
Brunswick	NC	49	0	0	0	2	0	0	2	0	11	0
Columbus	NC	33	2	0	0	9	0	0	9	0	11	0
New Hanover	NC	99	0	0	0	20	0	0	19	0	33	3
Onslow	NC	3	0	0	0	0	0	0	0	0	2	0
Pender	NC	22	0	0	0	4	0	0	2	0	7	0
Sampson	NC	1	0	0	0	1	0	0	1	0	1	0
Horry	SC	42	0	0	0	3	0	0	3	0	15	0
TOTALS		257	2	0	0	44	0	0	41	0	82	3

State Averages

States	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	Low-Income
North Carolina	1.2%	1.4%	0.0%	21.6%	2.3%	1.3%	27.9%	4.7%	12.4%
South Carolina	0.3%	0.9%	0.0%	29.5%	1.0%	1.0%	32.8%	2.4%	14.2%

TABLE 2-5
PROPERTY TAX REVENUES GENERATED IN BRUNSWICK COUNTY; PROPERTY TAXES PAID TO BRUNSWICK COUNTY BY BRUNSWICK STEAM ELECTRIC PLANT, 1997 – 2002

Year	Total Brunswick County Property Tax Revenues[a]	Property Tax Paid By BSEP	Percent of Total Property Taxes
1997	$42,384,960	$5,700,000	13.45
1998	$44,837,765	$4,500,000	10.04
1999	$45,270,251	$4,200,000	9.28
2000	$52,822,490	$4,200,000	7.95
2001	$55,689,742	$4,600,000	8.26
2002	$60,982,737	$4,600,000	7.54

a. N.C. Department of State Treasurer 2003.

TABLE 2-6
BRUNSWICK COUNTY PUBLIC WATER SUPPLIERS AND CAPACITIES

Water Supplier	Customer Average Daily Use (Million Gallons per Day)	Maximum Daily Capacity Supplied by Brunswick County[a] (Million Gallons per Day)
Brunswick County Water & Sewer Authority	11.628	30.0 [b]
City of Southport	0.660	0.418
Long Beach Water	0.822	1.321
Yaupon Beach	0.167	0.052
Town of Shallotte	0.217	0.180
Ocean Isle Beach Water System	0.490	0.386
Town of Sunset Beach	0.584	1.085
Town of Caswell Beach	0.169	0.260
Town of Holden Beach	0.411	0.822
Town of Navassa	0.047	0.133
North Brunswick Sanitary District	0.494	0.455

Source: NCDENR 2002b (pg. 35 and Appendix C).

a. Capacity based on water supplied by Brunswick County only. No data currently available for groundwater use by water supplier other than Brunswick County.

b. Groundwater and surface water capacity.

TABLE 2-7
NEW HANOVER COUNTY PUBLIC WATER SUPPLIERS AND CAPACITIES

Water Supplier	Average Daily Use (Million Gallons per Day)	Maximum Daily Capacity (Million Gallons per Day)
New Hanover County [a]	2.35	Not available
Wilmington [b]	11.543	25
Carolina Beach [b]	0.312	0.564
Kure Beach [b]	0.357	0.824
Figure Eight Island [b]	0.355	0.564
Wrightsville Beach [b]	1.005	1.222
Flemington [b]	0.312	0.432

a. Blanchard 2002.
b. NCDENR 2002b.

TABLE 2-8
TRAFFIC COUNTS FOR ROADS IN THE VICINITY OF BSEP

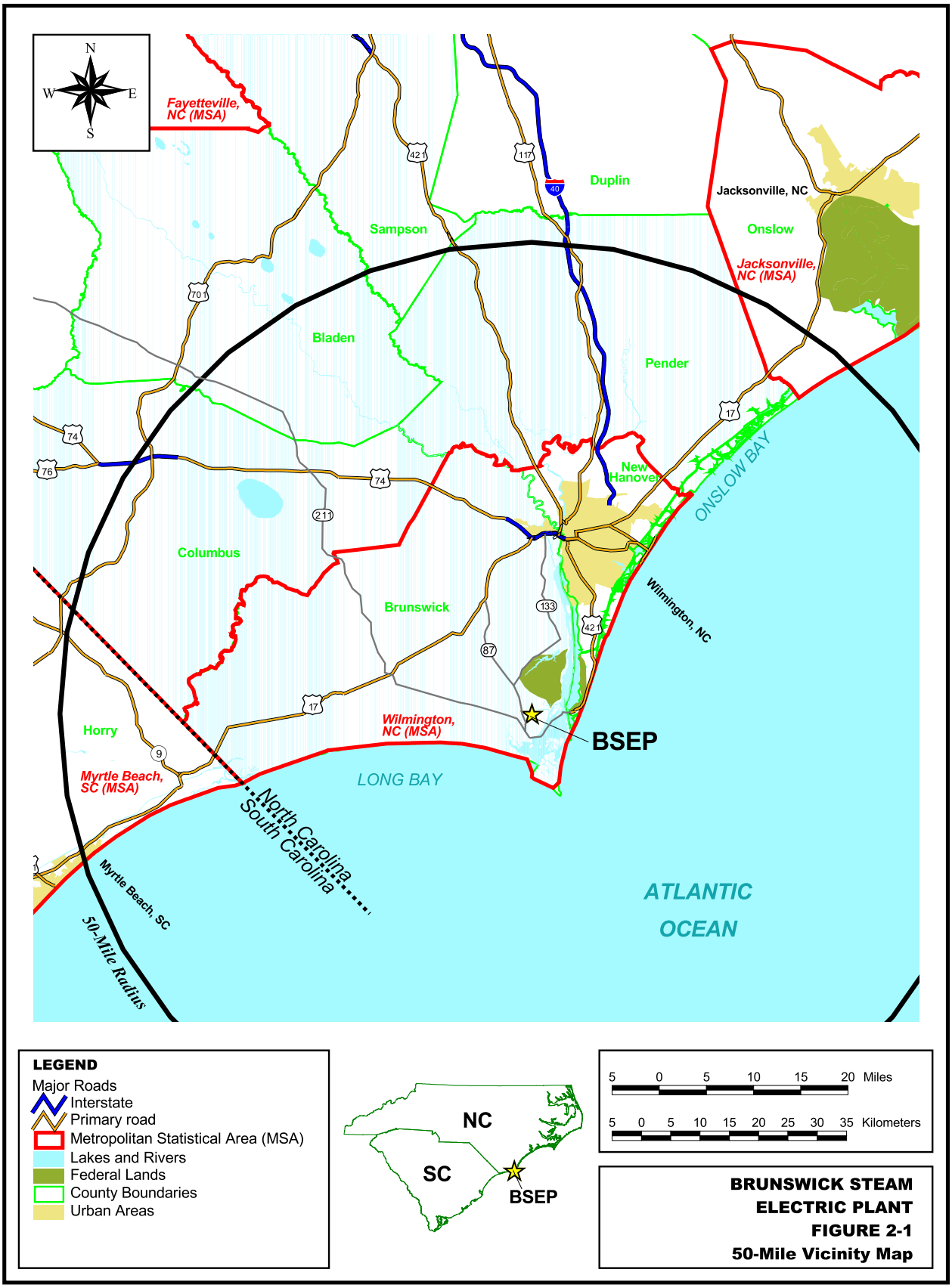
Route No.	Vicinity of	Est. AADT[a]	Location
N.C. 211	Southport to N.C. 87	16,000	Figure 2-2
N.C. 211	NC 87 to NC 133	17,000	Figure 2-2
N.C. 211	East of Long Beach Road	22,000	Figure 2-2
N.C. 133	Long Beach Road just south of N.C. 211	19,000	Figure 2-2
N.C. 133	N.C. 211 to N.C. 87	9,500	Figure 2-2
N.C. 87/N.C. 133	Just west of the merger of N.C 87 & N.C. 133	14,000	Figure 2-2
N.C. 87/N.C. 133	Just south of N.C 87/133 split	13,000	Figure 2-2
N.C. 87	From N.C. 87/133 split to Boiling Spring Lakes	6,900	Figure 2-2
N.C. 87	Just north of Boiling Spring Lakes	5,100	Figure 2-2
N.C. 133	U.S. Transportation Railroad	5,900	Figure 2-2
N.C. 133	Town of Orton	4,800	Figure 2-2

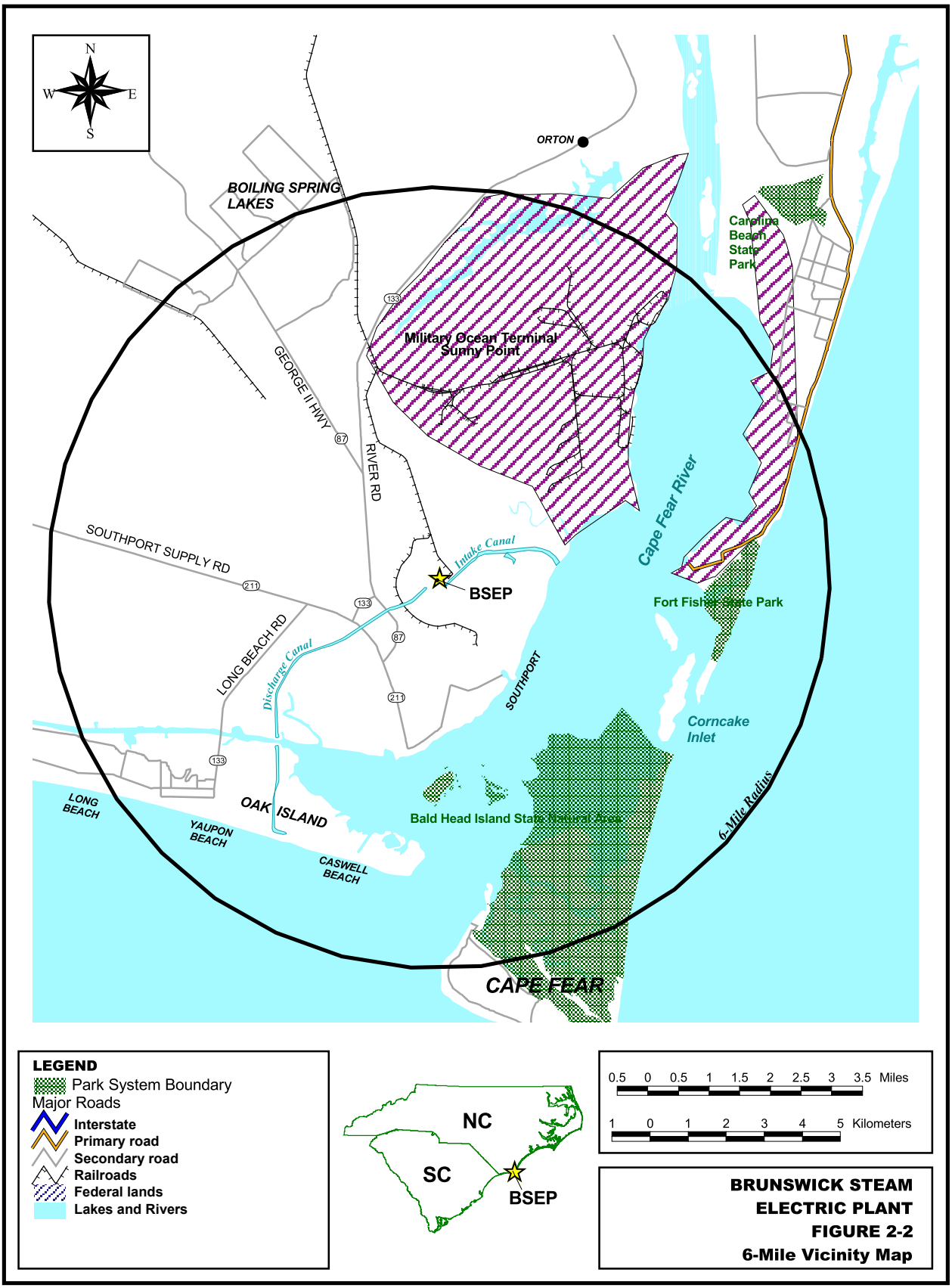
AADT = Annual Average Daily Traffic volumes, 2001.
SSR = Secondary State Route.
N.C. = State primary road.
U.S. = United States highway.
a. NCDOT 2002.

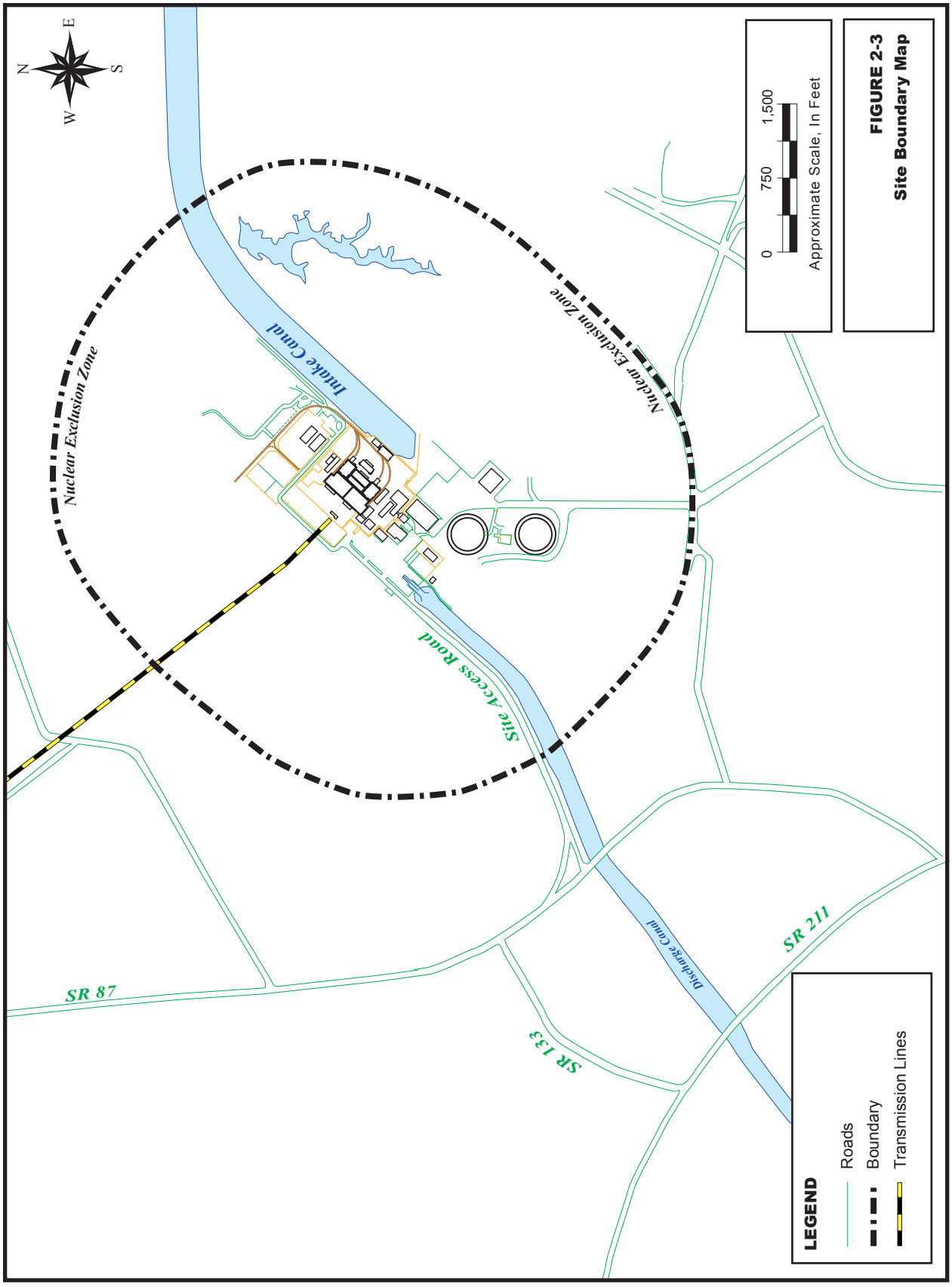
TABLE 2-9
SITES LISTED IN THE NATIONAL REGISTER OF HISTORIC PLACES THAT FALL WITHIN A 6-MILE RADIUS OF BSEP

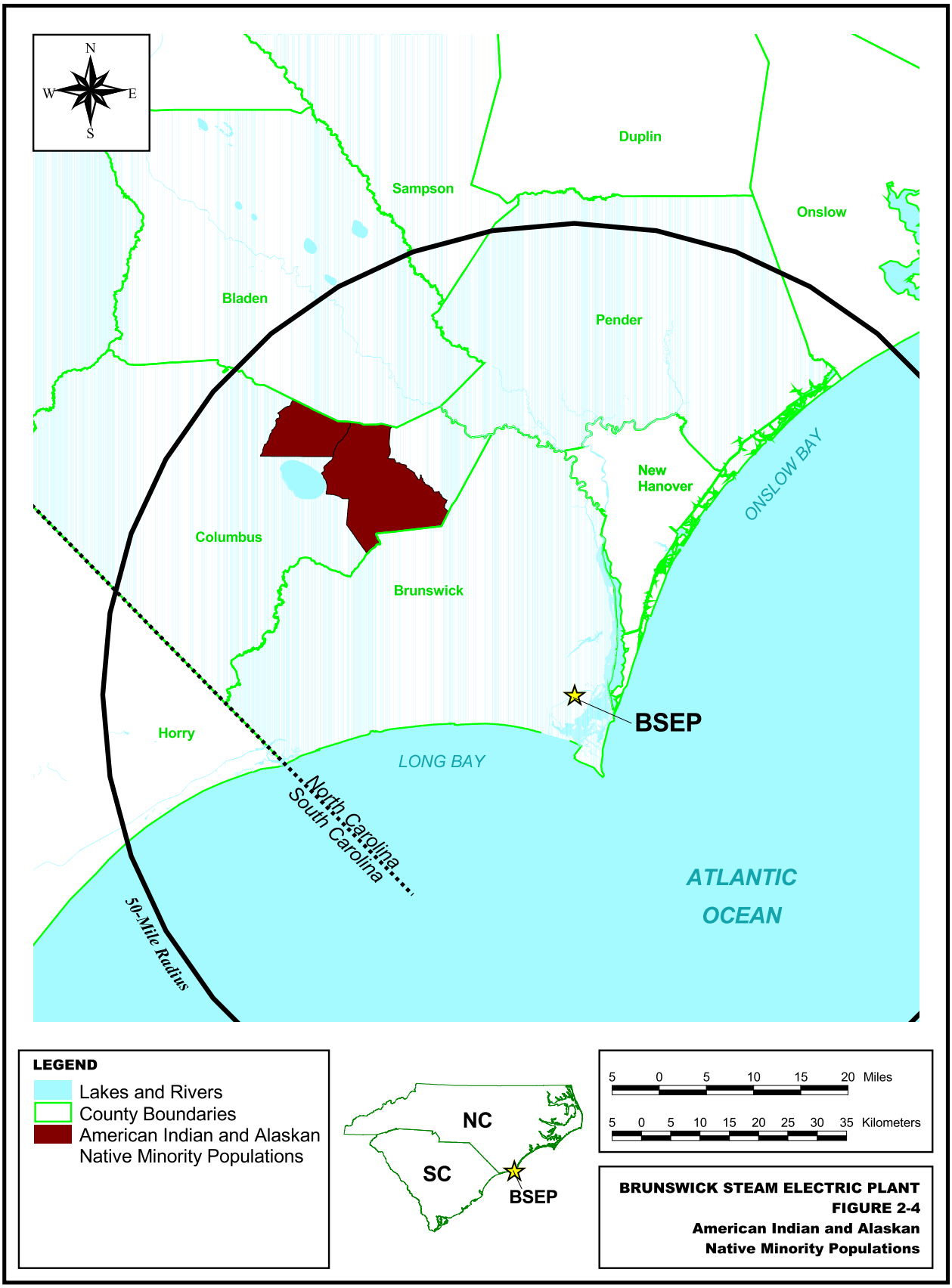
Site Name	Location
Brunswick County	
Bald Head Creek Boat House	Smith Island, mouth of the Cape Fear River
Bald Head Island Lighthouse	South of Southport on Smith Island at Bald Head
Brunswick County Courthouse	Davis and Moore Streets, Southport
Brunswick Town Historic District	North of Southport off of SR 133
Cape Fear Lighthouse Complex	South of Kure Beach, Kure Beach
Fort Johnston	Moore Street, Southport
Oak Island Life Saving Station	217 Caswell Beach Road, Caswell Beach
Orton Plantation	On Cape Fear River at junction of NC 1530 and 1529, Smithville Township
Southport Historic District	Roughly bounded by Cape Fear River, Rhett, Bay, Short, and Brown Streets, Southport
St. Philip's Church Ruins	South of Orton off of NC 1533, Orton
New Hanover County	
Cape Fear Civil War Shipwreck Discontiguous District	Address Restricted, Kure Beach
Fort Fisher	18 miles south of Wilmington on U.S. 421, Wilmington
U.S.S. Peterhoff	Address Restricted, Fort Fisher

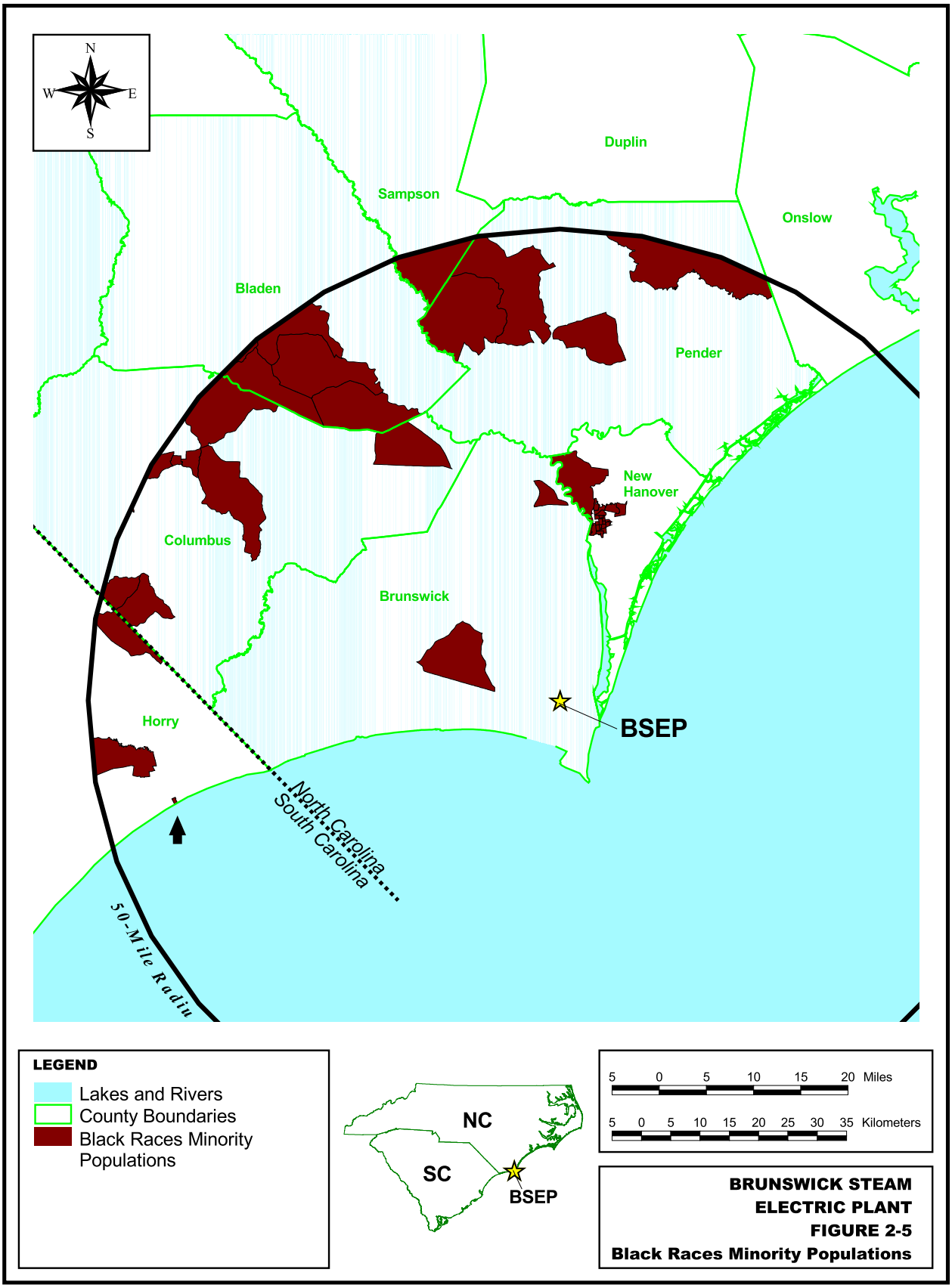
Source: U.S. Department of the Interior 2004.

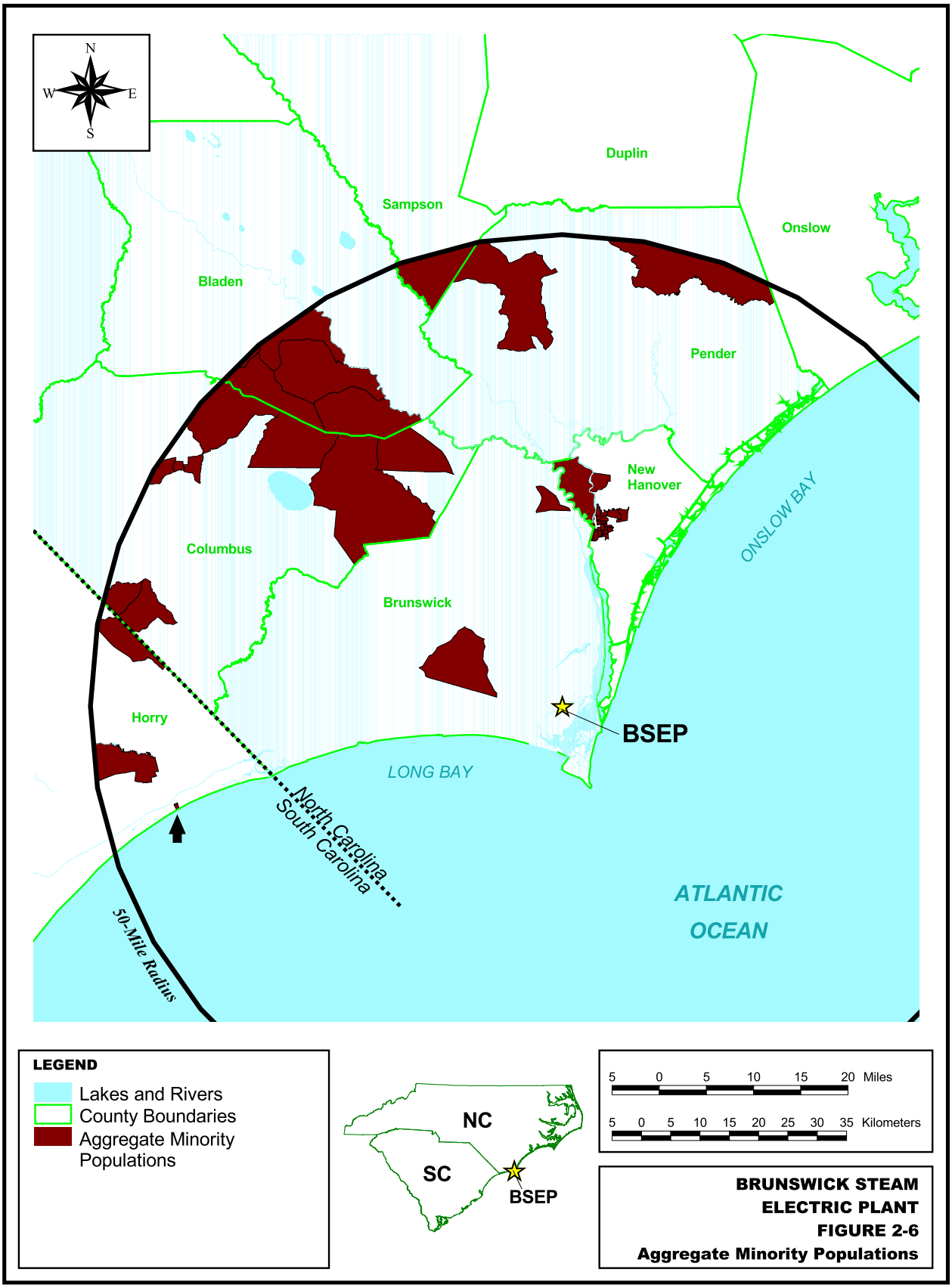

N
W
E
S
Fayetteville, NC (MSA)
Duplin
Jacksonville, NC
Sampson
Onslow
Jacksonville, NC (MSA)
Bladen
Pender
New Hanover
ONSLOW BAY
Columbus
Brunswick
Wilmington, NC
Wilmington, NC (MSA)
BSEP
Horry
Myrtle Beach, SC (MSA)
LONG BAY
North Carolina
South Carolina
Myrtle Beach, SC
50-Mile Radius
ATLANTIC
OCEAN
LEGEND
Major Roads
Interstate
Primary road
Metropolitan Statistical Area (MSA)
Lakes and Rivers
Federal Lands
County Boundaries
Urban Areas
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM
ELECTRIC PLANT
FIGURE 2-1
50-Mile Vicinity Map

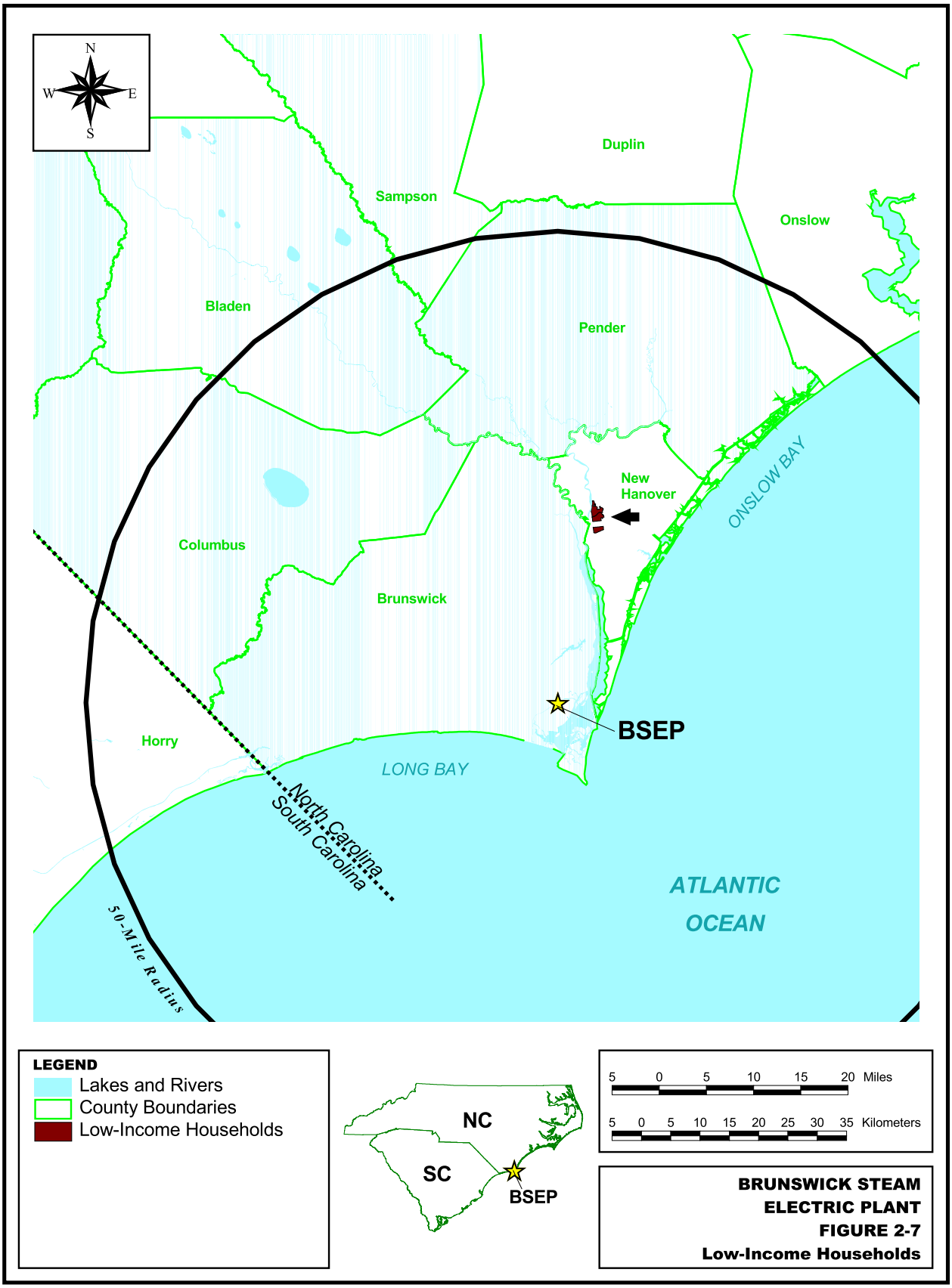

N
W
E
S
ORTON
BOILING SPRING LAKES
Carolina Beach State Park
Military Ocean Terminal Sunny Point
GEORGE II HWY
RIVER RD
SOUTHPORT SUPPLY RD
Intake Canal
BSEP
Cape Fear River
Fort Fisher State Park
LONG BEACH RD
Discharge Canal
SOUTHPORT
Corncake Inlet
LONG BEACH
OAK ISLAND
YAUPON BEACH
CASWELL BEACH
Bald Head Island State Natural Area
6-Mile Radius
CAPE FEAR
LEGEND
Park System Boundary
Major Roads
Interstate
Primary road
Secondary road
Railroads
Federal lands
Lakes and Rivers
NC
SC
BSEP
0.5 0 0.5 1 1.5 2 2.5 3 3.5 Miles
1 0 1 2 3 4 5 Kilometers
BRUNSWICK STEAM ELECTRIC PLANT
FIGURE 2-2
6-Mile Vicinity Map


N
E
S
W
0
750
1,500
Approximate Scale, In Feet
FIGURE 2-3
Site Boundary Map
Intake Canal
Nuclear Exclusion Zone
Nuclear Exclusion Zone
Site Access Road
Discharge Canal
SR 211
SR 87
SR 133
LEGEND
Roads
Boundary
Transmission Lines


N
W
E
S
Duplin
Sampson
Onslow
Bladen
Pender
New Hanover
ONSLOW BAY
Columbus
Brunswick
BSEP
Horry
LONG BAY
North Carolina
South Carolina
ATLANTIC OCEAN
50-Mile Radius
LEGEND
Lakes and Rivers
County Boundaries
American Indian and Alaskan Native Minority Populations
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM ELECTRIC PLANT
FIGURE 2-4
American Indian and Alaskan
Native Minority Populations


N
W
E
S
Duplin
Sampson
Onslow
Bladen
Pender
New Hanover
Columbus
Brunswick
Horry
BSEP
North Carolina
South Carolina
50-Mile Radius
LEGEND
Lakes and Rivers
County Boundaries
Black Races Minority Populations
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM ELECTRIC PLANT
FIGURE 2-5
Black Races Minority Populations


N
W
E
S
Duplin
Sampson
Onslow
Bladen
Pender
New Hanover
Columbus
Brunswick
Horry
BSEP
LONG BAY
ONSLOW BAY
North Carolina
South Carolina
ATLANTIC OCEAN
50-Mile Radius
LEGEND
Lakes and Rivers
County Boundaries
Aggregate Minority Populations
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM ELECTRIC PLANT
FIGURE 2-6
Aggregate Minority Populations


N
W
E
S
Duplin
Sampson
Onslow
Bladen
Pender
New Hanover
ONSLOW BAY
Columbus
Brunswick
BSEP
Horry
LONG BAY
North Carolina
South Carolina
ATLANTIC OCEAN
50-Mile Radius
LEGEND
Lakes and Rivers
County Boundaries
Low-Income Households
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM ELECTRIC PLANT
FIGURE 2-7
Low-Income Households

2.13 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in Progress Energy files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Progress Energy have been given for these pages, even though they may not be directly accessible.

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3.0 PROPOSED ACTION

NRC

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

Progress Energy proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating licenses for Brunswick Steam Electric Plant Units 1 and 2 (BSEP) for an additional 20 years. Renewal would give Progress Energy and the state of North Carolina the option of relying on BSEP to meet future electricity needs. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 GENERAL PLANT INFORMATION

General information about BSEP is available in several documents. In 1974, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared the Final Environmental Statement for continued construction and proposed issuance of an operating license for the BSEP Units 1 and 2 (AEC 1974). The NRC *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996) describes BSEP features and, in accordance with NRC requirements, Progress Energy maintains the Updated Final Safety Analysis Report for BSEP (CP&L 2001). Progress Energy has referred to each of these documents while preparing this environmental report for license renewal.

3.1.1 REACTOR AND CONTAINMENT SYSTEMS

BSEP is a two-unit plant as shown in Figure 3-1. Each unit uses a boiling water reactor (BWR) and steam-driven turbine generator manufactured by General Electric (GE). The architect/engineer for the Brunswick project was United Engineers and Constructors, Inc. The construction contractor was Brown and Root, Inc.

Each reactor's primary containment is a pressure suppression system consisting of a drywell, a pressure-suppression chamber storing a large volume of water, a connecting vent system between the drywell and the suppression pool, a vacuum relief system, isolation valves, containment cooling systems, and other service equipment. Together with its engineered safety features, each containment is designed to provide adequate radiation protection for both normal operation and postulated design-basis accidents, such as earthquakes or loss of coolant CP&L 2001, Rev. 17B, pg. 1-8).

Figure 3-1 shows the plant layout, including the location of the two reactor buildings, the turbine building, and the control building.

Construction permits for Units 1 and 2 were issued in February 1970 (Scientech 2003). The U.S. Atomic Energy Commission approved the Unit 2 operating license (DPR-62) in December 1974; commercial operation began on November 3, 1975. The Unit 1 operating license (DPR-71) was approved in September 1976; commercial operation began on March 18, 1977.

As originally built and operated, each of the BSEP units had a design rating of 2,436 megawatts-thermal (AEC 1974, p. III-7). Each electrical generator was rated at 847 megawatts-electrical, with a net output to the grid of 821 megawatts-electrical. Total plant output at the time the second unit became fully operational in March 1977 was therefore 4,872 megawatts-thermal and 1,694 megawatts electrical.

In November 1996, the NRC approved an increase in the licensed maximum core thermal level of BSEP Units 1 and 2 from 2,436 megawatts-thermal to 2,558 megawatts-thermal per unit, an increase of approximately 5 percent. The NRC determined in an Environmental Assessment (EA) prepared at that time that the uprate would not have a significant effect on human health and the environment and issued a Finding of No Significant Impact (Federal Register, Vol. 61, No. 209, pp. 55673-55675). The 5 percent power uprate for Unit 1 was carried out during the spring 1997 refueling outage, and the 5 percent power uprate for Unit 2 was carried out during the fall 1997 refueling outage.

In an application and supplements submitted to the NRC in the fall of 2001, Progress Energy sought approval to amend the BSEP facility operating licenses to allow an increase of approximately 15 percent in the licensed core thermal level of the two BSEP reactors, taking them to approximately 20 percent over the original licensed core thermal level of 2,436 megawatts-thermal. The NRC prepared an Environmental Assessment for this action that concluded that the issuance of the amendment would not have a significant effect on the quality of the human environment (Federal Register, Vol. 67, No. 99, pp. 36040-36046) and resulted in a Finding of No Significant Impact. The NRC issued Amendments Numbers 222 and 247 to Facility Operating License Numbers DPR-71 and DPR-62, respectively, revising the facility operating licenses and technical specifications for operation of BSEP on May 31, 2002 (Federal Register, Volume 67, No. 110, pg. 39445).

Progress Energy completed Phase One of the extended power uprate in April 2003, during a scheduled refueling outage for Unit 2 (Progress Energy 2003a). At the completion of Phase One of the uprate, Unit 1 was rated at approximately 2,755 megawatts-thermal and capable of generating 893 megawatts-electrical while Unit 2 was rated slightly higher than 2,755 megawatts-thermal and capable of generating 885 megawatts-electrical. Upon completion of the extended power uprate in the spring of 2005, each reactor will have a licensed core thermal level of approximately 2,923 megawatts-thermal and will be capable of generating 958 megawatts-electrical

(Unit 1) and 951 megawatts-electrical (Unit 2), respectively (Federal Register, Volume 67, No. 99, pg. 36040).

This is considered an Extended Power Uprate (EPU) because it follows the 5 percent "stretch" uprate, completed in 1997, that took both reactors to 2,558 megawatts-thermal from the original licensing basis of 2,436 megawatts-thermal. The operational goal of the EPU is a corresponding (approximately 14 percent) increase in each nuclear unit's electrical output, increasing Unit 1 from 841 to 958 megawatts-electric and increasing Unit 2 from 835 to 951 megawatts-electric.

Progress Energy has concluded that the fuel enrichment at BSEP will increase to approximately 4.4 percent as a result of the extended power uprate with burnup remaining at approximately 45,000 megawatt days per metric ton uranium. NRC has found that BSEP operation within these constraints would have no significant environmental impact (Federal Register, Volume 67, No. 99, pg. 36045).

Fuel removed from the reactors is placed in an onsite spent fuel storage pool and certain fuel elements that meet burnup and cooling criteria are shipped offsite for storage. The shipping is performed in Progress Energy-owned, NRC-licensed casks on dedicated railroad trains. The shipping routes are NRC-approved and Progress Energy provides notification to appropriate state officials, as required by the Code of Federal Regulations.

On April 30, 2003, Progress Energy announced it was considering building dry storage facilities for spent nuclear fuel at both BSEP and Robinson Nuclear Plant (Progress Energy 2003b). The company issued a Request for Proposal at that time "seeking solutions for on-site interim storage of spent nuclear fuel" in order to ensure that the company's spent fuel storage needs are met until the Yucca Mountain geologic repository opens in 2010. The Progress Energy press release noted that the Nuclear Waste Policy Act of 1982 and its amendments require the U.S. Department of Energy to locate, build, and operate a repository for high-level waste and to develop a transportation system that safely links U.S. nuclear power plants and the permanent repository. By law, the repository was to be in place by January 31, 1998, but the project is years behind schedule and continues to face court challenges.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

3.1.2.1 Surface Water

Under full power operation, as much as 1.05 million gallons per minute (2,335 cubic feet per second) of water are withdrawn from the Cape Fear River for condenser cooling. After passing through the plant's condensers, the heated water travels through a 6-mile-long discharge canal to Caswell Beach before being pumped 2,000 feet offshore through a pair of (13-foot diameter) underwater pipes that extend into the Atlantic Ocean along the bottom (Figure 2-3). Although some of the waste heat is radiated to the atmosphere from the surface of the discharge canal, the bulk of the heat is dissipated by mixing with cooler Atlantic Ocean water.

Circulating Water System Description

The BSEP circulating water system is a once-through heat dissipation system designed to remove waste heat from the two main condensers when both reactors are operating at full power. The circulating water system includes the intake canal, intake structure, condensers, discharge canal, Caswell Beach pumping station, and the discharge pipes that move the heated effluent into the Atlantic Ocean.

Cooling water is drawn from the Cape Fear River by way of a three-mile long intake canal. The intake canal consists of a cut through Snows Marsh and a more clearly-defined canal that runs across the mainland (high ground) to the plant. A fish diversion structure was built across the intake canal in 1982 at the mouth of the canal proper, the point at which Snows Marsh meets high ground. The fish diversion structure minimizes the number of fish entering the intake canal, and as a consequence reduces impingement of fish and shellfish on the plant's traveling screens (CP&L 2001, Rev. 17C, pg. 2-26).

The intake canal is subject to the same tidal fluctuations as the Cape Fear estuary. Consequently, water movements in the canal are complex and current velocities vary with circulating water pump rates, tides (both daily and seasonal variation), and location in the canal (CP&L 1980, pg. 3-4). Current velocities in the intake canal are generally around 0.6 feet per second (CP&L 2002).

The circulating water intake structure consists of eight separate intake bays (four bays per unit), each with a trash rack, vertical traveling screen, and vertical intake pump. Two of the four intake screens for each unit are fitted with 1-mm fine mesh. The other two are fitted with half fine mesh and half coarse mesh (3/8-in) screens. Each unit typically operates with three bays in service using two of the full fine mesh screens and one of the half fine mesh/half coarse mesh screens. As the screens rotate, they are pressure-washed, forcing fish and debris impinged on the screens into a collection trough leading to the nekton return system (also referred to as the fish return system). The screen wash water, carrying marine life and other materials, flows by gravity via the nekton return system to a holding pond (also referred to as the return basin). From this return basin, the organisms can move into Walden Creek and then the Cape Fear River.

A vertical circulating water pump is located behind the traveling screen in each intake bay. Each pump has a capacity of 156,000 gallons per minute, making the design system capacity approximately 1.25 million gallons per minute if all eight circulating water pumps were in operation (CP&L 2002).

However, the BSEP NPDES permit (NC0007064) limits cooling water flows to 922 cubic feet per second per unit (cfs/unit) over the December – March period and 1,105 cfs/unit over the April – November period, with the stipulation that one unit may increase its flow to 1,230 cfs during the months of July, August, and September. These NPDES permit limits translate into two-unit flows of 1,844 cfs (827,690 gallons per minute), 2,210 cfs

(991,848 gallons per minute), and 2,335 cfs (1,048,017 gallons per minute), respectively.

Chlorine gas is injected into the circulating water inlet piping to minimize fouling in the circulating water piping and condensers. When the chlorine gas system is being serviced or maintained, liquid sodium hypochlorite is injected as a substitute to control bio-fouling. Chlorine concentrations are monitored to ensure that no chlorine is discharged at the Atlantic Ocean outfall. Total residual chlorine is measured at the Caswell Beach pump station as a condition of the BSEP NPDES permit. In addition, a non-toxic, silicon-based elastomer has been used to coat much of the circulating water inlet piping and has significantly reduced the settlement and accumulation of macrofouling organisms. Chlorine is intended to control growth of microfouling organisms (e.g., bacterial slime) in the condenser tubes and larger fouling organisms in parts of the circulating water system that have not been coated with the silicon-based compound.

From the intake structure, circulating water is carried through eight 6-foot diameter pipes (4 per unit) to the condensers. Each unit uses a condenser consisting of two shells, each arranged in a single-pass, divided-water-box configuration.

After passing through the condensers, the circulating water from each unit moves through a concrete discharge tunnel and into the common discharge canal. The discharge canal, which is approximately 6 miles long, extends to the southwest for roughly half of its length (see Figure 2-3), then moves south to Oak Island.

At a point near the Intracoastal Waterway, the heated effluent enters a stilling basin, then moves under the Intracoastal Waterway in two 13-foot diameter pipes by way of an inverted siphon (water is “pulled” by pumps at Caswell Beach) to a second stilling basin which lies adjacent to the Caswell Beach pumping station. Eight discharge pumps (each rated at 166,000 gallons per minute) at the Caswell Beach pumping station move water from the second stilling basin via two discharge headers to a pair of 13-foot diameter pipes that extend 2,000 feet offshore from Caswell Beach along the ocean floor (CP&L 1980; CP&L 2002). At the point at which the two discharge pipes terminate, the tops of the pipes lie under approximately 10 feet of water (CP&L 1980; pg. 3-8). This configuration, in association with a high-momentum jet discharge, is intended to facilitate rapid mixing with ambient waters.

3.1.2.2 Groundwater

BSEP currently has four water wells (Wells 2, 4, 5 and a well that serves the biology laboratory) in the Castle Hayne aquifer (see Section 2.3, “Groundwater Resources”). Wells 2, 4, 5 were used until the early 1980s when they were capped and removed from service after the plant began receiving treated water from Brunswick County Public Utilities. The well used to supply water to the biology laboratory is still in use. The well has a pumping capacity of 30 gallons per minute (see Section 2.3). Due to the intermittent use of the biology laboratory by a limited number of people, the actual production of this well is known to be less than the pump capacity.

Since the early 1980s, BSEP has received treated water for potable/process use from the Brunswick County. From 1996 through 2001, BSEP's water use ranged from approximately 0.22 million gallons per day (MGD) to approximately 0.25 MGD with an average consumption of 0.23 MGD (Smith 2002).

3.1.3 TRANSMISSION FACILITIES

The Final Environmental Statement (FES) (AEC 1974) identifies eight 230-kilovolt transmission lines that were built to connect BSEP to the electric grid. Four lines connect to Unit 1, and four lines connect to Unit 2. The lines are grouped in common corridors to the extent practicable, with the first 1.3 miles of corridor containing all eight lines. The transmission line towers are generally of H-frame construction, with occasional steel towers as needed.

Subsequent to the publication of the FES, several changes were made to the transmission system.

- The 103-mile line to Fayetteville now terminates at the Whiteville Substation, approximately 49 miles from BSEP.

- The Barnard Creek East line has been renamed to indicate that the termination point is actually at the Castle Hayne Substation. No substantive physical changes have taken place. Although there is a substation at Barnard Creek, its connection to the grid is insufficient to represent a termination of this BSEP line.

- The Barnard Creek West line, which originally terminated at the Castle Hayne Substation, was connected in 2002 to the Wilmington Corning Switching Station approximately 25 miles from BSEP.

As a result of these system changes, the transmission lines of interest for this report are somewhat different than those described in the FES, as indicated below. Figure 3-2 is a map of the current transmission system of interest.

- Whiteville – Approximately four miles from BSEP, this line diverges from the common right-of-way for 45 miles in a 100-foot corridor. The line traverses northwest to complete the total 49-mile run to the Whiteville Substation near Whiteville, about 40 miles west of Wilmington, North Carolina.

- Weatherspoon – This circuit runs northwest with the two Delco lines to ultimately connect just west of the Delco Substation to an existing 230 kilovolt line to the Weatherspoon plant. Only the 31 miles of new transmission line from BSEP to the tap is under evaluation in this Environmental Report. The corridor width ranges from 170 feet to 240 feet wide, depending on the number of lines in the corridor.

- Delco East – Traversing a total of 31 miles, this line connects to the Delco Substation, approximately 15 miles west of Wilmington. Initially, the line runs with

the Delco West and Weatherspoon lines in a 240-foot wide corridor, but diverges 6.6 miles from the substation to enter from the east.

- Delco West – Traversing a total of 31 miles, this line connects to the Delco Substation, approximately 15 miles west of Wilmington. Initially, the line runs with the Delco East and Weatherspoon lines in a 240-foot wide corridor. It then runs with the Weatherspoon line to enter the Delco Substation from the west.

- Wallace – Connecting to the Wallace Substation 35 miles north of Wilmington and 35 miles west of Jacksonville, this line runs for 55 miles in a corridor ranging from 170 to 310 feet wide. The line shares the corridor with the Jacksonville line for much of the way.

- Jacksonville – The line to Jacksonville is 76 miles long, but 35 of those miles are in an existing corridor. The corridor width ranges from 100 to 310 feet wide.

- Castle Hayne East – Approximately 14 circuit-miles from BSEP, this line diverges from the common right-of-way for 3 miles in a 170-foot corridor shared with the Castle Hayne West line. After passing through the Barnard Creek Substation, the line continues through the City of Wilmington to a point where it diverges from the Castle Hayne West Line, taking an eastern route to Castle Hayne Substation just north of Wilmington.

- Wilmington Corning – Formerly known as the Castle Hayne West line, this transmission line shares the right-of-way with the Castle Hayne East line until just past the Barnard Creek Substation at which point it traverses through the City of Wilmington another 9 miles to the new Wilmington Corning Switching Station.

As currently configured, the transmission corridors of interest are approximately 220 miles long and occupy approximately 4,000 acres. The corridors pass through low population areas that are primarily forest, farm, and swamp lands. The lines cross numerous state and U.S. highways, the Cape Fear River, and Interstate 40. Four lines in a single 310-foot corridor make a short crossing of the Orton Plantation Waterfowl Impoundment, and the Jacksonville line makes a short crossing of the Holly Shelter Game Land. Corridors that pass through farm lands generally continue to be used as farm land. Progress Energy plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. These transmission lines will remain a permanent part of the transmission system after BSEP is decommissioned.

Progress Energy designed and constructed all BSEP transmission lines in accordance with the National Electrical Safety Code (for example, IEEE 1997) and industry guidance that was current when the lines were built. Ongoing right-of-way surveillance and maintenance of BSEP transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Section 4.13.

Progress Energy uses a variety of methods to control vegetation in transmission corridors. Because transmission corridors traverse areas with different kinds of terrain

and soils, Progress Energy employs an integrated vegetation management (IVM) approach that includes both mechanical and chemical control methods. Mechanical methods include pruning, felling, mowing, and hand trimming. Chemical controls include the use of tree growth regulators, which slow the growth of fast-growing trees under lines, and EPA-approved herbicides, which control undesirable woody vegetation that reseeds or resprouts after mowing. Over time, the use of herbicides results in the growth of low-growing, non-woody plants, such as grasses and herbaceous plants that provide wildlife with food and cover.

Progress Energy provides its residential customers in North Carolina with information on herbicide use in rights of ways, including dates (months) when herbicides will be used, method of application, and names of herbicides to be used (CP&L 1998). This information is normally provided in April, as an insert to power bills, because low-volume foliar application of herbicides begins in May in some transmission corridors (Progress Energy 2004). A point of contact at Progress Energy is also named, should customers have additional questions or should they require additional information, such as Material Safety Data Sheets. The Progress Energy website also contains information on herbicide use in transmission line rights of way and provides a phone number for customers with questions about the herbicide program (Progress Energy 2004).

3.2 REFURBISHMENT ACTIVITIES

NRC

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

"… The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: ... and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item…." NRC 1996

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

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

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

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

The BSEP IPA that Progress Energy conducted under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the BSEP license renewal period. Progress Energy has included the IPA as part of this application.

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

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

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals …." NRC 1996 (SMITTR is defined in NRC 1996 as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at BSEP. These programs are described in the *Brunswick Steam Electric Plant License Renewal Application, Appendix B, Aging Management Programs.*

3.4 EMPLOYMENT

Current Workforce

Progress Energy employs approximately 760 permanent employees and 300 long-term contract employees at BSEP, a two-unit facility (Ahern 2002a,b). The permanent staff at a nuclear plant with multiple reactors normally ranges between 800 and 2,400 employees, depending on the number of operating reactors at the site (NRC 1996, pg. 2-26). Approximately 90 percent of the employees live in Brunswick and New Hanover Counties. The remaining employees are distributed across 13 counties in North and South Carolina, with numbers ranging from 1 to 26 employees per county.

BSEP is on a 24-month refueling cycle (Trimble 1998). During refueling outages, the number of workers onsite increases substantially. In a recent (March 2002) outage, approximately 1,000 contractors and 190 "shared resources" (technical specialists from other Progress Energy power plants) were on site (Ahern 2002b). This falls within the range (200 to 900 workers per reactor unit) reported in the GEIS for additional maintenance workers (NRC 1996, pg. 2-27).

License Renewal Increment

Performing the license renewal activities described in Sections 3.2 and 3.3 would necessitate increasing BSEP staff workload by some increment. The size of this increment would be a function of the schedule within which Progress Energy must accomplish the work and the amount of work involved. Because Progress Energy has determined that no refurbishment is needed (Section 3.2), the analysis of license renewal employment increment focuses on programs and activities for managing the effects of aging (Section 3.3).

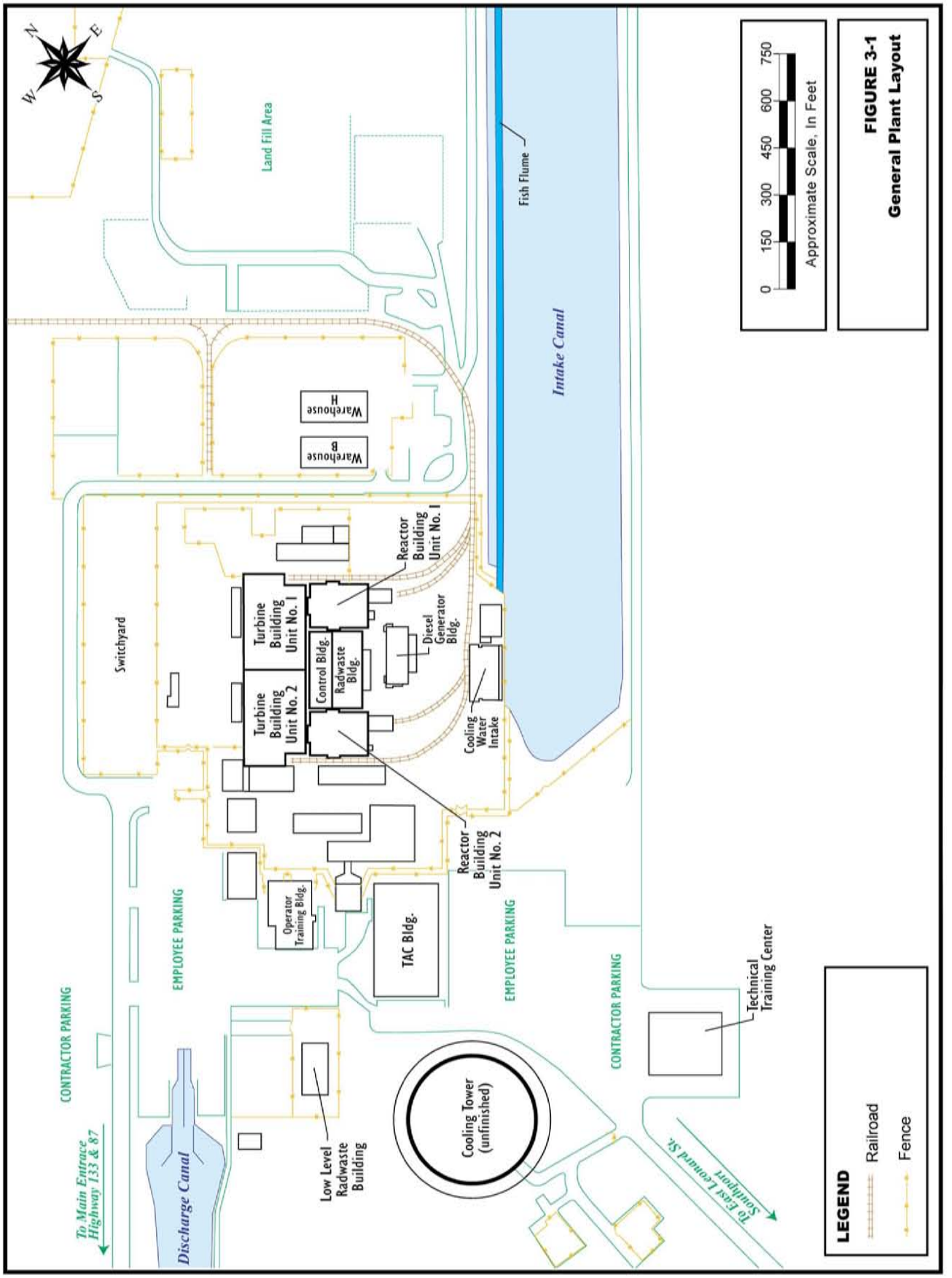
The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for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

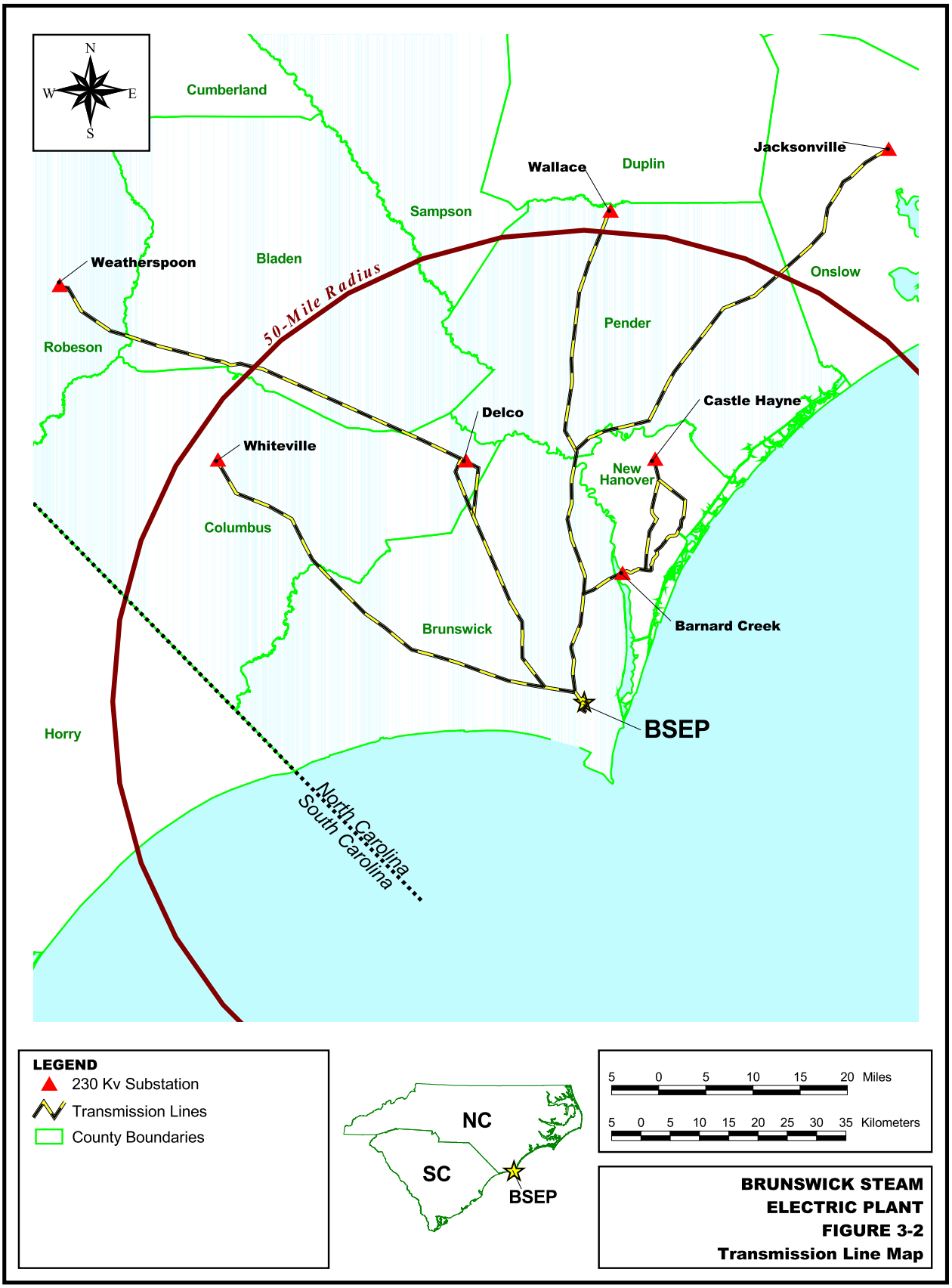
Progress Energy has determined that the GEIS scheduling assumptions are reasonably representative of BSEP incremental license renewal workload scheduling. Many BSEP license renewal SMITTR activities would have to be performed during outages. Although some BSEP license renewal SMITTR activities would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

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of

a 10-year in-service inspection and refueling outage. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

Progress Energy has identified no need for significant new aging management programs or major modifications to existing programs. Progress Energy anticipates that existing "surge" capabilities for routine activities, such as outages, will enable Progress Energy to perform the increased SMITTR workload without increasing BSEP staff. Therefore, Progress Energy has no plans to add non-outage employees to support BSEP operations during the license renewal term. In recent years, refueling and maintenance outages have typically lasted around 30 days and, as described above, result in a large temporary increase in employment at BSEP. Progress Energy believes that increased SMITTR tasks can be performed within this schedule and employment level. Therefore, Progress Energy has no plans to add outage employees for license renewal term outages.


N
E
S
W
Land Fill Area
Fish Flume
Intake Canal
0 150 300 450 600 750
Approximate Scale, In Feet
FIGURE 3-1
General Plant Layout
Warehouse H
Warehouse B
Reactor Building Unit No. 1
Turbine Building Unit No. 1
Diesel Generator Bldg.
Switchyard
Control Bldg.
Radwaste Bldg.
Turbine Building Unit No. 2
Cooling Water Intake
Reactor Building Unit No. 2
Operator Training Bldg.
TAC Bldg.
EMPLOYEE PARKING
EMPLOYEE PARKING
CONTRACTOR PARKING
CONTRACTOR PARKING
Technical Training Center
Cooling Tower (unfinished)
Low Level Radwaste Building
Discharge Canal
To Main Entrance Highway 133 & 87
To East Leonard St. Southport
LEGEND
Railroad
Fence


N
W
E
S
Cumberland
Wallace
Duplin
Jacksonville
Sampson
Weatherspoon
Bladen
50-Mile Radius
Onslow
Pender
Robeson
Castle Hayne
Delco
Whiteville
New Hanover
Columbus
Barnard Creek
Brunswick
BSEP
Horry
North Carolina
South Carolina
LEGEND
230 Kv Substation
Transmission Lines
County Boundaries
NC
SC
BSEP
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
BRUNSWICK STEAM
ELECTRIC PLANT
FIGURE 3-2
Transmission Line Map

3.5 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in Progress Energy files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Progress Energy have been given for these pages, even though they may not be directly accessible.

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4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

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

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

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

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

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

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;
- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues.

Finally, NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues.

NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51) as described in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996a). An applicant may reference the generic findings or GEIS analyses for Category 1 issues. Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

CATEGORY 1 AND NA LICENSE RENEWAL ISSUES

NRC

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

"…[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." (NRC 1996b, pg. 28483)

Progress Energy has determined that 11 of the 69 Category 1 issues do not apply to BSEP because they are specific to design or operational features that are not found at the facility. Because Progress Energy is not planning any refurbishment activities, seven additional Category 1 issues related to refurbishment do not apply. Appendix A, Table A-1 lists the 69 Category 1 issues, indicates whether or not each issue is applicable to BSEP, and if inapplicable provides the Progress Energy basis for this determination. Appendix A, Table A-1 also includes references to supporting analyses in the GEIS where appropriate.

Progress Energy has reviewed the NRC findings at 10 CFR 51 (Table B-1) and has not identified any new and significant information that would make the NRC findings, with respect to Category 1 issues, inapplicable to BSEP. Therefore, Progress Energy adopts by reference the NRC findings for these Category 1 issues.

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, Progress Energy included these issues in Table A-1. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). Progress Energy has included environmental justice demographic information in Section 2.6.2.

CATEGORY 2 LICENSE RENEWAL ISSUES

NRC

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

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

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 (Section 4.17 addresses 2 issues) address each of the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, six Category 2 issues apply to operational features that BSEP does not have. In addition, four Category 2 issues apply only to refurbishment activities. If the issue does not apply to BSEP, the section explains the basis for inapplicability.

For the 11 Category 2 issues that Progress Energy has determined to be applicable to BSEP, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for BSEP and, if applicable, discuss potential mitigative alternatives to the extent required. Progress Energy has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

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

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

In accordance with National Environmental Policy Act (NEPA) practice, Progress Energy 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).

4.1 WATER USE CONFLICTS (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A SMALL RIVER WITH LOW FLOW)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(c)(3)(ii)(A)

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

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

The issue of surface water use conflicts does not apply to BSEP because the plant does not use cooling towers or cooling ponds. As Section 3.1.2 describes, BSEP uses a once-through cooling system that withdraws water from the Cape Fear estuary by way of an intake canal and returns discharge water via a discharge canal to the Atlantic Ocean.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

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

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

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

As Section 3.1.2 describes, BSEP has a once-through heat dissipation system that withdraws water from the Cape Fear River estuary for condenser cooling and discharges offshore of Caswell Beach, in the Atlantic Ocean.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment through the condenser cooling system of fish and shellfish in early life stages is a potential adverse environmental impact that can be minimized by the best available technology. Progress Energy has monitored entrainment of fish and shellfish at BSEP since 1974 and has made a number of material and operational changes during that time to reduce entrainment, including the installation of 1-mm fine mesh screens and a fish return system at the plant's cooling water intake structure (see Section 3.1.2).

The 316(b) Demonstration for BSEP concluded that "operation of the plant has not adversely affected the fisheries in the estuary in any measurable way" (CP&L 1985, pg. 28). With respect to entrainment, the report acknowledged that "some entrainment of larvae still occurs" despite the mitigation measures but noted that "populations in the estuarine nurseries have not been affected" (CP&L 1985, pg. 30).

NPDES permits issued to BSEP after the 316(b) Demonstration was submitted in 1985 contained a requirement that a diversion structure be operated and maintained at the mouth of the intake canal and fine mesh screens be employed on the plant cooling water intake structure. These permits also required that:

> "a biological monitoring program shall be continued which will provide sufficient information to allow for a continuing assessment of the impact of the Brunswick Steam Electric Plant on the Cape Fear Estuary, with particular emphasis on the marine fisheries. Data shall be reported annually and shall include an interpretive summary report assessing the effectiveness of the diversion fence, and the effectiveness of flow minimization and fine mesh screens to curtail organism impingement and entrainment."

Thus the current BSEP NPDES permit, issued June 30, 2003, constitutes the current CWA Section 316(b) determination for BSEP. This permit became effective on August 1, 2003 and will expire on November 30, 2006. Appendix B contains portions of the permit, including the material quoted in the preceding paragraph. For this reason, and because of the mitigation measures already in place, Progress Energy concludes that impacts of entrainment of fish and shellfish at BSEP are SMALL and warrant no additional mitigation.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

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

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

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

As Section 3.1.2 describes, BSEP has a once-through heat dissipation system that uses water from the Cape Fear River for condenser cooling. Section 4.2 discusses the 1985 Cape Fear Interpretive Studies Report [i.e., the plant's 316(b) Demonstration] and on-going biological monitoring programs at BSEP.

As noted in Section 4.2, the 1985 Cape Fear Interpretive Studies Report concluded "operation of the plant has not adversely affected the fisheries in the estuary in any measurable way" (CP&L 1985, pg. 28). With respect to impingement, the report noted that the fish diversion structure completed in 1982 had been successful in preventing larger fish from entering the intake canal, thus had substantially reduced impingement of these fish (CP&L 1985, pg. 22 and pg. 30).

When CP&L installed the fine mesh (1 millimeter) screens in 1983, it also built a fish return system to return fish and other organisms washed from the screens to the Cape Fear River estuary via the Walden Creek system (CP&L 1985, pg. 5). Previously, CP&L transported impinged organisms to the Cape Fear estuary by boat (CP&L 1980, pg. 3-6). The 1985 Cape Fear Interpretive Studies Report evaluated survival of organisms washed from the intake screens and returned to the estuary via the fish return system. Survival rates of several commercially and recreationally important fish species, most notably striped mullet and flounder, were high (CP&L 1985, pg. 28). Survival of three species of Penaeid shrimp (pink, white, and brown) and blue crabs

was also high, depending on age, species, and screen speed (CP&L 1985, Table 18). Survival of fragile, schooling fish species such as menhaden and anchovy was low, however.

Appendix B contains relevant portions of the current NPDES permit. Because BSEP has a valid NPDES permit (NC0007064) which constitutes a Section 316(b) determination, Progress Energy concludes that impacts due to the impingement of fish and shellfish are SMALL and do not require mitigation measures beyond those already in place.

4.4 HEAT SHOCK

NRC

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

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

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

As Section 3.1.2 describes, BSEP has a once-through heat dissipation system that withdraws from the Cape Fear River and discharges to the Atlantic Ocean. The original NPDES permit for BSEP, issued in November 1974 by EPA Region IV, contained summer and winter limits on the temperature rise across the condenser during once-through operation but assumed cooling towers (then under construction) would be completed and operated (Cooke 2001). CP&L subsequently appealed the conditions of the 1974 permit and was granted approval to continue operating in a once-through mode providing the thermal plume was monitored and aquatic populations were not harmed. CP&L was ultimately able to show in a Clean Water Act Section 316(a) Demonstration that once-through operation of BSEP would not have a significant impact on the discharge area and would "assure the protection of a balanced, indigenous population of fish and shellfish…in the nearshore area" (CP&L 1979).

In the transmittal letter accompanying the 1981 NPDES permit, the EPA Administrator acknowledged that "the thermal plume does not cause significant harm to the aquatic community and the proposed effluent limitations…do protect the population" (Cooke 2001). The Administrator noted further that "the provisions of Section 316(a) for alternative thermal limitations are not applicable," meaning that the Plant's discharge

was in compliance with applicable water quality standards and the Plant could operate in the once-through mode without a thermal variance. The 1981 NPDES permit contained summer and winter limitations on the temperature rise across the condensers and required quarterly thermal plume monitoring (Cooke 2001). Subsequent NPDES permits were issued with reduced thermal plume monitoring requirements (twice annually rather than quarterly) and no limitation on temperature rise across the condensers (Cooke 2001).

Cooling water flow (withdrawal) rates and heat rejection rates (defined by water temperatures in the area of the ocean discharge) are currently limited by the provisions of NPDES permit number NC0007064, issued to Progress Energy on June 30, 2003 by the North Carolina Department of Environment and Natural Resources, Division of Water Quality. The permit became effective August 1, 2003 and will expire on November 30, 2006.

As noted earlier in this section, the NPDES permit for BSEP contains a requirement for semi-annual monitoring of water temperatures at the ocean discharge. Temperature monitoring is to be conducted once during the months of April – November and once during the months of December – March when both reactor power levels are 85 percent or greater.

BSEP is able to operate at or near full power in the once-through mode while still meeting State water temperature standards. Therefore, it has not sought a 316(a) variance in accordance with 40 CFR 125. Because it has an approved 316(a) Demonstration and an NPDES permit that requires conformance with State water temperature standards, Progress Energy concludes that heat shock impacts are SMALL and no further mitigation is necessary.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING > 100 GPM OF GROUNDWATER)

NRC

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

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

NRC made groundwater use conflicts a Category 2 issue because, at a withdrawal rate of more than 100 gpm, a cone of depression could extend offsite. This could deplete the groundwater supply available to offsite users, an impact that could warrant mitigation. Information to be ascertained includes: (1) BSEP groundwater withdrawal rate (whether greater than 100 gpm), (2) drawdown at offsite locations, and (3) impact on neighboring wells.

The issue of groundwater use conflicts at plants that pump more than 100 gallons per minute of groundwater does not apply to BSEP. BSEP, since the early 1980s, has used groundwater from only one site well. That well, as described in Section 2.3, is located at the Biology Laboratory, has a pumping capacity of 30 gpm, and is only intermittently used. BSEP obtains the remainder of its domestic water from Brunswick County Public Utilities. As Section 3.1.2 describes, the plant obtains all its cooling water from the Cape Fear River (estuary) by way of a three-mile long intake canal.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year...[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

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

NRC made this groundwater use conflict a Category 2 issue because consumptive use of withdrawals from small rivers could adversely impact aquatic life, downstream users of the small river, and groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create a cumulative impact due to upstream consumptive use. Cooling tower and cooling ponds lose flow due to evaporation, which is necessary to cool the heated water before it is discharged to the environment.

The issue of groundwater use conflicts does not apply to BSEP because the plant does not use cooling towers or cooling ponds and does not withdraw water from a small river. As Section 3.1.2 describes, BSEP uses a once-through cooling system that withdraws water from the Cape Fear estuary by way of an intake canal and discharges water to the Atlantic Ocean.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

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

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

NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

The issue of groundwater use conflicts does not apply to BSEP because the plant does not use Ranney wells. As Section 3.1.2 describes, BSEP uses a once-through cooling system that removes water from the Cape Fear estuary by way of an intake canal and discharges to the Atlantic Ocean.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

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

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

NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to BSEP because the plant is not located at an inland site and does not use cooling ponds. As Section 3.1.2 describes, BSEP uses a once-through cooling system that withdraws water from the Cape Fear estuary by way of an intake canal and discharges to the Atlantic Ocean.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

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

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

"…If no important resources would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." NRC 1996a

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996a). Aspects of the site and project to be ascertained are: (1) the identification of important ecological resources, (2) the nature of refurbishment activities, and (3) the extent of impacts to plant and animal habitats.

The issue of impacts of refurbishment on terrestrial resources is not applicable to BSEP because, as discussed in Section 3.2, Progress Energy has no plans for refurbishment or other license-renewal-related construction activities at BSEP.

4.10 THREATENED AND ENDANGERED SPECIES

NRC

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

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

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

Section 2.2 of this Environmental Report describes the ocean and estuarine communities at BSEP and discusses population trends in recreationally and commercially important populations. Section 2.4 describes important terrestrial habitats at BSEP and along the associated transmission corridors. Section 2.5 discusses threatened or endangered species that occur or may occur at BSEP and along associated transmission corridors, or in the Cape Fear River (estuary) in the vicinity of the plant's intake canal.

With the exception of the species identified in Section 2.5, Progress Energy is not aware of any threatened or endangered terrestrial species that could occur at BSEP or along the associated transmission corridors. Current operations of BSEP and Progress Energy vegetation management practices along transmission line rights-of-way do not adversely affect any listed terrestrial species or its habitat (see Section 2.5). Furthermore, plant operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Therefore, no adverse impacts to threatened or endangered terrestrial species from current or future operations are anticipated.

As noted in Section 2.5, two federally-threatened and one federally-endangered species of sea turtles have occasionally been found in the intake canal after passing through breaches in the fish diversion structure. The NRC consulted with National Marine Fisheries Service under Section 7 of the Endangered Species Act regarding the effect of BSEP operations on sea turtle populations. NMFS concluded that incidental takes at

BSEP are not likely to jeopardize the continued existence of these turtle species (NMFS 2000).

Progress Energy wrote to the North Carolina Department of Environment and Natural Resources, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service requesting information on any listed species or critical habitats that might occur on the BSEP site or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. Agency responses are provided in Appendix C and indicate that license renewal is unlikely to affect any listed species as long as current vegetation management practices, which benefit a number of rare plants, are followed.

As discussed in Section 3.2, Progress Energy has no plans to conduct refurbishment or construction activities at BSEP during the license renewal term. Therefore, there would be no refurbishment-related impacts to special-status species and no further analysis of refurbishment-related impacts is applicable. Furthermore, because Progress Energy has no plans to alter current operations and resource agencies contacted by Progress Energy evidenced no serious concerns about license renewal impacts, Progress Energy concludes that impacts to threatened or endangered species from license renewal would be SMALL and do not warrant mitigation.

4.11 AIR QUALITY DURING REFURBISHMENT (NON-ATTAINMENT AREAS)

NRC

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

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

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (NRC 1996a). Information needed would include: (1) the attainment status of the plant-site area, and (2) the number of additional vehicles as a result of refurbishment activities.

Air quality during refurbishment is not applicable to BSEP because, as discussed in Section 3.2, Progress Energy has no plans for refurbishment at BSEP.

4.12 MICROBIOLOGICAL ORGANISMS

NRC

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

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

Due to the lack of sufficient data for facilities using cooling ponds, lakes, or canals that discharge to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be ascertained is: (1) whether the plant discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms.

This issue does not apply to BSEP because, as indicated in Section 3.1.2, BSEP does not use cooling ponds, lakes, or canals (as defined in the GEIS and used in the regulation) and does not discharge to a small river.

4.13 ELECTRIC SHOCK FROM TRANSMISSION-LINE-INDUCED CURRENTS

NRC

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

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

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

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

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop of which the magnitude depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry

- the size of the object on the ground
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground.[1] The clearance must limit the induced current[2] due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

As described in Section 3.1.3, there are eight 230-kilovolt lines that were specifically constructed to distribute power from BSEP to the electric grid. Progress Energy's analysis of these transmission lines began by identifying the limiting case for each line. The limiting case is the configuration along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, Progress Energy calculated the electric field strength for each transmission line, then calculated the induced current.

Progress Energy calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute (EPRI 1991). The results of this computer program have been field-verified through actual electrostatic field measurements by several utilities. The input parameters included the design features of the limiting-case scenario, the NESC requirement that line sag be determined at 120ºF conductor temperature, and the maximum vehicle size under the lines as a tractor-trailer.

The analysis determined that none of the transmission lines has the capacity to induce as much as five milliamperes in a vehicle parked beneath the lines. Therefore, the BSEP transmission line designs conform to the NESC provisions for preventing electric shock from induced current. The results for each transmission line are provided in Table 4-1. Details of the analysis, including the input parameters for each line's limiting case, can be found in Connor (2002).

Progress Energy surveillance and maintenance procedures provide assurance that design ground clearances will not change. These procedures include routine aerial inspection approximately every six months, which include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections conducted once every two years include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the

1 Part 2, Rules 232C1c and 232D3c.
2 The NESC and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.

transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organization(s) for corrective action.

Progress Energy's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance for the BSEP transmission lines. Due to the small significance of the issue, mitigation measures, such as installing warning signs at road crossings or increasing clearances, are not warranted.

4.14 HOUSING IMPACTS

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(l)

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

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996a)

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

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

Sections 2.6 and 2.8 indicate that BSEP is located in a medium population area that is not subject to growth control measures that limit housing development. Using the NRC regulatory criteria, BSEP license renewal housing impacts would be expected to be small. Continued operations could result in housing impacts due to increased staffing. However, Progress Energy estimates that no additional workers would be needed to support BSEP operations during the license renewal term (Section 3.4). Progress Energy concludes that since there is no increase in staffing, no housing impacts would be experienced and, therefore, the appropriate characterization of BSEP license renewal housing impacts is SMALL.

4.15 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

NRC

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

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

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

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

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. At this time, BSEP uses approximately one percent of the total treated water production capacity of Brunswick County Public Utilities and two percent of actual production. Usage does not stress system capacity (Section 2.9.1 describes the public water supply systems in the area, their production capacities, and current demands) and is not currently an issue. As discussed in Section 4.14, Progress Energy has no plans to increase BSEP staffing due to refurbishment or plant aging management activities. Progress Energy has identified no operational changes during the BSEP license renewal term that would increase plant water use.

Because Progress Energy has no plans to increase plant municipal water usage or increase employment for license renewal purposes, Progress Energy concludes that impacts on public water supply would be SMALL and not require mitigation.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(l)

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

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

NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996a). Local factors to be ascertained include: (1) project-related enrollment increases and (2) status of the student/teacher ratio.

The issue of education impacts from refurbishment is not applicable to BSEP because, as discussed in Section 3.2, Progress Energy has no plans for refurbishment or other license-renewal-related construction activities at BSEP.

4.17 OFFSITE LAND USE

4.17.1 OFFSITE LAND USE - REFURBISHMENT

NRC

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

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

"…[l]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles…." (NRC 1996a)

NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land-use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include: (1) plant-related population growth, (2) patterns of residential and commercial development, and (3) proximity to an urban area with a population of at least 100,000.

This issue is not applicable to BSEP because, as discussed in Section 3.2, Progress Energy has no plans for refurbishment due to license renewal at BSEP.

4.17.2 OFFSITE LAND USE - LICENSE RENEWAL TERM

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…land-use…." 10 CFR 51.53(c)(3)(ii)(l)

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

"…[I]f plant-related population growth is less than five percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996a, Section 3.7.5)

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

NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and detrimental by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996a, Section 4.7.4.2). Site-specific factors to consider in an assessment of land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996a, Section 4.7.4.1).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller "percentage of the local area's" total population than the percent change represented by operations-related growth (NRC 1996a, Section 3.7.3). Progress Energy agrees with the NRC conclusion that population-driven land use impacts would be SMALL. Mitigation would not be warranted.

Tax-Revenue-Related Impacts

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

- Small - very little new development and minimal changes to an area's land-use pattern
- Moderate - considerable new development and some changes to land-use pattern
- Large - large-scale new development and major changes in land-use pattern.

Table 2-5 provides a comparison of tax payments made by BSEP to Brunswick County and the County's annual property tax revenues. NRC has determined that the significance of tax payments as a source of local government revenue would be small, if the payments are less than 10 percent of revenue (NRC 1996a, Section 4.7.2.1). For the six-year period from 1997 through 2002, BSEP's property tax payments represented approximately 9 percent of the County's annual property tax revenues. In 2002, BSEP's property tax payments represented 7.5 percent of the County's annual property tax revenues and 4.0 percent of the County's total annual tax revenues.

As described in Section 3.2, Progress Energy does not anticipate refurbishment or construction during the license renewal period. Therefore, Progress Energy does not anticipate any increase in the assessed value of BSEP due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land-use and development patterns. Using the NRC methodology would lead to the conclusion that BSEP operations has, and license renewal would have, SMALL tax-driven land use impacts.

From 1990 to 2000, Brunswick County's population growth rate averaged 4.4 percent per year, while the population of the state of North Carolina grew an average of 2.1 percent per year (USCB 2001 a,b). Over the same period, the number of housing units in Brunswick County increased by 38.6 percent, while the total number of units in the state increased by 25.0 percent (USCB 1990; USCB 2000).

The Brunswick County Land Use Plan (1997) acknowledges that growth and development have increased in recent years, and continued growth is inevitable, "predominantly in the form of a growing tourism economy, rapidly rising seasonal and permanent populations, and related residential and commercial development." The Land Use Plan notes (pg. 8-28) that the County's overall land use policy "calls for continued efforts to diversify the local economy, protect area resources, and improve the quality of life. A particular point of emphasis for this plan is the desire to foster…a distinct 'town and county' development pattern." The intent of the County's land use policy is to allow for the preservation of open space and productive farm and timber land, to minimize costs of extending infrastructure and services, to avoid higher taxes, and minimize traffic congestion associated with urban sprawl (Brunswick County 1997, pg. 8-30).

Conclusion

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

4.18 TRANSPORTATION

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

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

"Small impacts would be associated with a free flowing traffic stream where users are unaffected by the presence of other users (level of service A) or stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished (level of service B)." (NRC 1996a)

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

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated. As described in Section 3.4, no additional license renewal employment increment is expected. Therefore, Progress Energy expects license-renewal impacts to transportation to be SMALL and believes no mitigation would be necessary.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

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

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

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

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (NRC 1996a).

The Final Environmental Statement (FES) for the construction and operation of BSEP Units 1 and 2 (AEC 1974) listed 7 properties on the National Historic Register within the "vicinity" of BSEP. In the FES for BSEP, the AEC concluded that BSEP's construction and operation activities would not have unacceptable impacts on National Register properties (AEC 1974, pg. XII-5). This conclusion was supported in letters from Stuart C. Schwartz, Archaeologist, Janet K. Seapker, Survey Specialist, and H. G. Jones, State Historian/Administrator, dated August 18, 1972, July 21, 1972, and November 17, 1972, respectively (AEC 1974). Similarly, the North Carolina Department of Art, Culture, and History voiced no objections to the project (AEC 1974).

As of February 2004, the National Register of Historic Places listed 12 locations in Brunswick County and 28 locations in New Hanover County, North Carolina (U.S. Department of the Interior 2004). Of these 40 locations, 13 fall within a 6-mile radius of BSEP.

As discussed in Section 3.2, Progress Energy has no refurbishment plans and no refurbishment-related impacts are anticipated. Progress Energy is not aware of any historic or archaeological resources that have been affected to date by BSEP operations, including operation and maintenance of transmission lines. Progress Energy has no plans to change transmission line inspection and maintenance practices or right-of-way vegetation management practices over the license renewal term. Based on the fact that current practices are not expected to change significantly (there may well be minor changes in inspection and surveillance procedures, vegetation management procedures, etc.), Progress Energy concludes that operation of these same generation and transmission facilities over the license renewal term would not impact cultural resources; hence, no mitigation would be warranted.

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES

NRC

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

"…The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

Section 4.20 summarizes Progress Energy's analysis of alternative ways to mitigate the impacts of severe accidents. Appendix F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

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

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

Progress Energy maintains a probabilistic safety assessment (PSA) model to use in evaluating the most significant risks of radiological release from BSEP fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, Progress Energy used the PRA model output as input to an NRC-approved model that calculates economic costs and dose to the public from hypothesized releases from the containment structure into the environment. Then, using NRC regulatory analysis techniques, Progress Energy calculated the monetary value of the unmitigated BSEP

severe accident risk. The result represents the monetary value of the base risk of dose to the public and worker, offsite and onsite economic costs, and replacement power. This value became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base risk value could be rejected as being not cost-beneficial.

Progress Energy used industry, NRC, and BSEP-specific information to create a list of approximately 43 SAMAs for consideration. Progress Energy analyzed this list and screened out SAMAs that would not apply to the BSEP design, that Progress Energy had already implemented at BSEP, or that would achieve results that Progress Energy had already achieved at BSEP by other means. Progress Energy prepared preliminary cost estimates for the remaining SAMAs and used the base risk value to screen out SAMAs that would not be cost-beneficial.

Progress Energy calculated the risk reduction that would be attributable to each candidate SAMA (assuming SAMA implementation) and re-quantified the risk value. The difference between the base risk value and the SAMA-reduced risk value became the averted risk, or the value of implementing the SAMA. Progress Energy prepared more detailed cost estimates for implementing each SAMA and repeated the cost/benefit comparison.

Progress Energy performed two additional analyses to evaluate how the SAMA analysis would change if certain key parameters were changed. The results of the uncertainty analysis are discussed in Appendix F.

Based on the results of the BSEP SAMA analysis, Progress Energy concludes that several cost-beneficial options exist to reduce plant risk that could be examined further, but none are related to plant aging.

TABLE 4-1
RESULTS OF INDUCED CURRENT ANALYSIS

Transmission Line	Voltage (kilovolts)	Limiting Case Induced Current[a] (milliamperes)
Castle Hayne East	230	<2.8
Delco East	230	<3.2
Delco West	230	<3.1
Jacksonville	230	<3.0
Wallace	230	<3.7
Weatherspoon	230	<2.9
Whiteville	230	<2.9
Wilmington Corning	230	<3.3

a. "Less-than" values are reported because the calculation was performed for a 200-degree Fahrenheit sag instead of the prescribed 120-degree sag. The limiting case for each line was the lowest point on the line without regard to whether a road existed at that location, adding more conservatism to the calculation. Evaluations at road locations had lower values.

4.21 REFERENCES

Note to reader: Hard copies of cited web pages are available in Progress Energy files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Progress Energy have been given for these pages, even though they may not be directly accessible.

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Brunswick County. 1997. Brunswick County Land Use Plan. 1997 Update. Brunswick County Planning Board, Brunswick County, North Carolina. Adopted October 5 and, as revised, December 7, 1998.

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

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5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

5.1 DISCUSSION

NRC

"…The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations, 10 CFR 51, prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically and only requires an applicant's analysis of the remaining issues.

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) conclusions (NRC 1996).

Progress Energy expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses and that leads to an impact finding different from that codified in the regulation.

NRC does not specifically define the term "significant." For the purpose of its review, Progress Energy used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare

environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). Progress Energy expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of "moderate" and "large" impacts.

The new and significant assessment process that Progress Energy used during preparation of this license renewal application included: (1) interviews with Progress Energy subject experts on the validity of the conclusions in the GEIS as they relate to Brunswick Steam Electric Plant (BSEP), (2) an extensive review of documents related to environmental issues at BSEP, (3) correspondence with state and federal agencies to determine if the agencies had concerns not addressed in the GEIS, (4) a review of internal procedures for reporting to the NRC events that could have environmental impacts, and (5) credit for the oversight provided by inspections of plant facilities by state and federal regulatory agencies.

Progress Energy is aware of no new and significant information regarding the environmental impacts of BSEP license renewal.

5.2 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. Public Comments on the Proposed 10 CFR 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

Progress Energy has reviewed the environmental impacts of renewing the Brunswick Steam Electric Plant Units 1 and 2 (BSEP) operating licenses and has concluded that impacts would be small and would not require mitigation. This environmental report documents the basis for Progress Energy's conclusion. Chapter 4 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 52 Category 1 issues that apply to BSEP, all of which have impacts that are small (Table A-1). The rest of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be small. Table 6-1 identifies the impacts that BSEP license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

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

"The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.45(c)

Impacts of license renewal are small and would not require mitigation. Current operations include monitoring activities that would continue during the license renewal term. Progress Energy performs routine monitoring to ensure the safety of workers, the public, and the environment. These activities include the biological monitoring program, radiological environmental monitoring program, continuous emissions monitoring, effluent chemistry monitoring, and effluent toxicity testing. These monitoring programs ensure that the plant's permitted emissions and discharges are within regulatory limits and any unusual or off-normal emissions/discharges would be quickly detected, mitigating potential impacts.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss any "...adverse environmental effects which cannot be avoided should the proposal be implemented..." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table A-1). Progress Energy examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Waste heat from plant operations is discharged to the Atlantic Ocean.
- Because the land surrounding the plant is flat, some structures (most notably the off-gas stack) are visible from offsite. This visual impact will continue during the license renewal term.
- Procedures for the disposal of sanitary, chemical, and radioactive wastes are intended to reduce adverse impacts from these sources to acceptably low levels. A small impact will be present as long as the plant is in operation. Solid radioactive wastes are a product of plant operations and long-term disposal of these materials must be considered.
- Operation of BSEP results in a very small increase in radioactivity in the air and water. However, fluctuations in natural background radiation may be expected to exceed the small incremental increase in dose to the local population. Operation of BSEP also establishes a very low probability risk of accidental radiation exposure to inhabitants of the area.
- Some adult and juvenile fish and shellfish are impinged on the traveling screens at the circulating water intake structure.
- Some larval fish and shellfish are entrained at the circulating water intake structure.

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

The environmental report shall discuss any "...irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented…" 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Continued operation of BSEP for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is used in the reactor and is converted to radioactive waste;
- land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations; and sanitary wastes generated from normal industrial operations;
- elemental materials that will become radioactive; and
- materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

The environmental report shall discuss the "...relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the BSEP site was established when the plant began operating in 1974. The Final Environmental Statement (AEC 1974) evaluated the impacts of constructing and operating BSEP in rural Brunswick County, North Carolina. Short-term use of natural resources would include land and water. The area surrounding the plant site is chiefly rural, with much undeveloped land. Approximately 130 acres of the 962-acre site are devoted to the production of electrical energy. This includes the area occupied by BSEP facilities (buildings, parking lots, roadways) and landscaped areas around the BSEP facilities. Approximately 117 acres of marsh were required for the intake and discharge canals, and an additional approximately 1,000 acres of marsh were modified by dredging and spoil piles, loss of freshwater inflow, sedimentation, and other reasons. The loss of marsh resulted in loss of wildlife habitat, and may have produced local changes in salinity, tidal patterns, sedimentation, and nutrient flux patterns. Most of the upland areas of the BSEP site not required for plant operations are pine forests, managed for timber production and wildlife habitat. Transmission line construction required over 3,500 acres of new land that resulted in the alteration of natural wildlife habitats (AEC 1974). An estimated 4 to 5 cubic feet per second of fresh water from the Castle Hayne aquifer is lost through upwelling into the unlined canal system. One cubic foot per second of brackish water may enter the Yorktown – Castle Hayne aquifer from the discharge canal (AEC 1974).

After decommissioning, many environmental disturbances would cease and some restoration of the natural habitat would occur. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent. However, the lost marshland and any saltwater intrusion into the freshwater aquifer can not be restored easily.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement, will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impact. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an

additional 20 years would not increase the short-term productivity impacts described here.

TABLE 6-1
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT BSEP

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	**None.** This issue does not apply. BSEP does not use cooling ponds or cooling towers that withdraw makeup water from a small river with low flow.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	**Small.** Progress Energy has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize entrainment.
26	Impingement of fish and shellfish	**Small.** Progress Energy has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize impingement.
27	Heat shock	**Small.** The BSEP discharge meets state WQ standards and has very little effect on local marine life.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**None.** BSEP uses less than 100 gpm of groundwater per minute.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	**None.** This issue does not apply because BSEP does not use cooling ponds or cooling towers that withdraw makeup water from a small river.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because BSEP does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None**. This issue does not apply because BSEP is not located at an inland site and does not use cooling ponds.
	Terrestrial Resources	
40	Refurbishment impacts	**None.** No impacts are expected because BSEP will not undertake refurbishment.
	Threatened or Endangered Species	
49	Threatened or endangered species	**Small.** NMFS has concluded that incidental takes of sea turtles at the BSEP intake have not jeopardized the continued existence of these species.
	Air Quality	
50	Air quality during refurbishment (non-attainment and maintenance areas)	**None.** No impacts are expected because BSEP will not undertake refurbishment.

TABLE 6-1
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT BSEP (Continued)

No.	Issue	Environmental Impact
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**None.** BSEP does not have cooling canals, cooling towers, or cooling ponds that discharge to a small river.
59	Electromagnetic fields, acute effects (electric shock)	**Small.** The largest modeled induced current under the BSEP lines is substantially less than the 5-milliampere limit. Therefore, the BSEP transmission lines conform to the National Electrical Safety Code provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	**Small.** BSEP anticipates no additional employment, thus negligible housing impacts.
65	Public services: public utilities	**Small.** BSEP anticipates no additional plant water use or employment, thus little impact on public utilities.
66	Public services: education (refurbishment)	**None.** No impacts are expected because BSEP will not undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because BSEP will not undertake refurbishment.
69	Offsite land use (license renewal term)	**Small.** No plant-induced changes to offsite land use are expected from license renewal. Impacts from continued operation would be positive.
70	Public services: transportation	**Small.** BSEP anticipates no additional employment, thus no increase in traffic.
71	Historic and archeological resources	**Small.** Continued operation of BSEP would not require construction at the site or new transmission lines. Therefore, license renewal would have little or no effect on historic or archeological resources.
		Postulated Accidents
76	Severe accidents	**Small.** Progress Energy identified potentially cost-beneficial SAMAs that offer a level of risk reduction. However, as these SAMAs do not relate to aging management during the license renewal term, they need not be implemented as part of license renewal.

6.6 REFERENCES

AEC (U.S. Atomic Energy Commission). 1974. Final Environmental Statement related to the continued construction and proposed issuance of an operating license for the Brunswick Steam Electric Plant Units 1 and 2. Carolina Power and Light Company. Docket No. 50-324 and 50-325. Directorate of Licensing. January. Washington, DC.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

The environmental report shall discuss "Alternatives to the proposed action.…" 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2).

"...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2).

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (NRC 1996a).

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996b).

Chapter 7 evaluates alternatives to Brunswick Steam Electric Plant (BSEP) license renewal. The chapter identifies actions that Progress Energy might take, and associated environmental impacts, if the U.S. Nuclear Regulatory Commission (NRC) chooses not to renew the plant's operating licenses. The chapter also addresses actions that Progress Energy has considered, but would not take, and identifies Progress Energy bases for determining that such actions would be unreasonable.

Progress Energy divided its alternatives discussion into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, Progress Energy relied on the NRC decision-making standard for license renewal:

"…the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable." [10 CFR 51.95(c)(4)].

Progress Energy has determined that the environmental report would support NRC decision making as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). Progress Energy believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, Progress Energy has used the same definitions of “small,” “moderate,” and “large” that are presented in the introduction to Chapter 4.

7.1 NO-ACTION ALTERNATIVE

Progress Energy uses "no-action alternative" to refer to a scenario in which NRC does not renew the BSEP operating licenses. Components of this alternative include replacing the generating capacity of BSEP and decommissioning the facility, as described below.

Progress Energy supplies as much as 57.5 terawatt hours of electricity to its 1.3-million customer base in North and South Carolina (Progress Energy 2003). A terawatt hour is one billion kilowatt hours. BSEP provides approximately 14.2 terawatt hours or about 24 percent of the electricity Progress Energy provides to its customers in the Carolinas (EIA 2003a). Progress Energy believes that any alternative would be unreasonable that did not include replacing this capacity. Replacement could be accomplished by (1) building new generating capacity, (2) purchasing power from the wholesale market, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The *Generic Environmental Impact Statement* (GEIS) (NRC 1996a) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement (DECON), and safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, Progress Energy would continue operating BSEP until the current license expires, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of a larger reactor (the "reference" boiling-water reactor is the 1,155-megawatt electric [MWe] Energy Northwest's Columbia Plant). This description is comparable to decommissioning activities that Progress Energy would conduct at BSEP for each unit.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include: occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. NRC indicated in the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1* (NRC 2002, Section 4.3.8) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. Progress Energy adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

Progress Energy notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. Progress Energy will have to decommission BSEP regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years.

NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. Progress Energy adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of generation replacement options to be part of the no-action alternative. Section 7.2.2 analyzes the impacts from these options.

Progress Energy concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (NRC 1996a) and in the decommissioning generic environmental impact statement (NRC 2002). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

Although BSEP is in North Carolina, about 11 percent of Progress Energy's electrical energy generation is in South Carolina (EIA 2003a). Therefore, power generation in both states is of interest for this evaluation. The current mix of power generation options in the Carolinas is one indicator of what have been considered to be feasible alternatives within the Progress Energy service area.

North Carolina's electric utility industry had a total generating capacity of 23,652 MWe in 2002. As Figure 7-1 indicates, this capacity includes units fueled by coal (52.6 percent); nuclear (20.0 percent); dual-fired (9.2 percent); hydroelectric (6.9 percent); gas (9.6 percent); and petroleum (1.7 percent). Approximately 3,023 MWe (11.3 percent of the State's generating capacity) was from non-utility sources in 2002 (EIA 2004). North Carolina's non-utility generators also use a variety of energy sources.

In 2002, South Carolina's electric utility industry had a total generating capacity of 19,101 MWe. As Figure 7-2 indicates, this capacity includes units fueled by nuclear (34.0 percent); coal (31.0 percent); hydroelectric (18.7 percent); dual-fired (8.8 percent); gas (4.0 percent) and petroleum (3.5 percent). Approximately 1,262 MWe (6.2 percent of the State's generating capacity) was from non-utility sources (EIA 2004). South Carolina's non-utility generators also use a variety of energy sources.

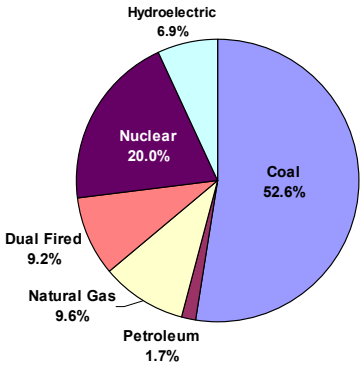

FIGURE 7-1. NORTH CAROLINA UTILITY GENERATING CAPACITY, 2002

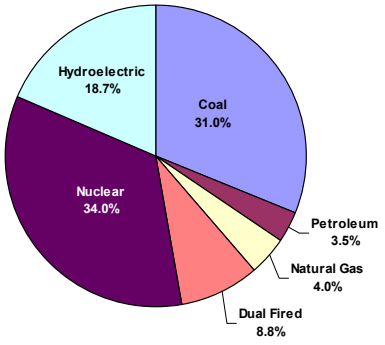

FIGURE 7-2. SOUTH CAROLINA UTILITY GENERATING CAPACITY, 2002

Based on 2002 generation data, North Carolina utility companies produced about 116 terawatt hours of electricity. As shown in Figure 7-3, utilities' generation by fuel type in North Carolina was dominated by coal (61.6 percent), followed by nuclear

(34.3 percent), hydroelectric (2.1 percent), gas (1.7 percent), and petroleum (0.3 percent) (EIA 2004).

Based on 2002 generation data, utility companies in South Carolina produced about 94 terawatt hours of electricity. As Figure 7-4 depicts, utilities' generation by fuel type in South Carolina was dominated by nuclear (56.9 percent), followed by coal (38.9 percent), gas (3.7 percent), hydroelectric (0.2 percent) and petroleum (0.2 percent) (EIA 2004).

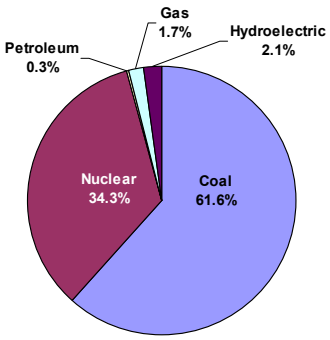

FIGURE 7-3. NORTH CAROLINA UTILITY GENERATION BY FUEL TYPE, 2002

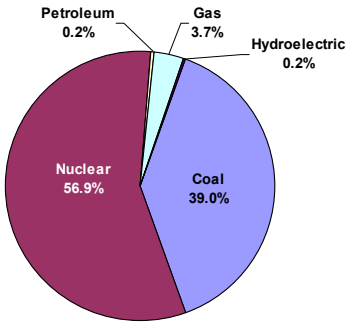

FIGURE 7-4. SOUTH CAROLINA UTILITY GENERATION BY FUEL TYPE, 2002

The difference between capacity and utilization is the result of optimal usage. For example, in North Carolina, nuclear energy represented 20.0 percent of utilities' installed capacity, but produced 34.3 percent of the electricity generated by utilities (EIA 2004). This reflects North Carolina's reliance on nuclear energy as a base-load generating source. South Carolina also shows a preference for reliance on nuclear energy as a base-load generating source, with nuclear energy representing 33.9 percent of utilities' installed capacity and 56.9 percent of the electricity generated by utilities (EIA 2004).

Progress Energy summer generation capability (in North and South Carolina), including jointly owned capacity, was 12,248 MWe in 2002. Figure 7-5 illustrates the Progress Energy summer capacity mix in the Carolinas. Forty-three (43) percent of Progress Energy's capacity was from coal, 26 percent from nuclear, 29 percent from combustion turbines, and 2 percent from hydroelectric (NCUC 2003). The Progress Energy share of energy supplied by these units in 2002 was 57.5 terawatt hours. Figure 7-6 illustrates the Progress Energy generation by fuel type in the Carolinas. Coal power generated

49.4 percent of the total electricity produced, nuclear 46.4 percent, combustion turbines generated 3.4 percent, and hydroelectric generated 0.8 percent (EIA 2003a).

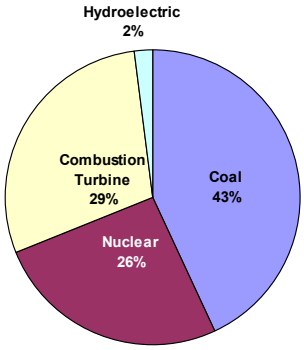

FIGURE 7-5. PROGRESS ENERGY GENERATING CAPACITY IN NORTH AND SOUTH CAROLINA, 2002

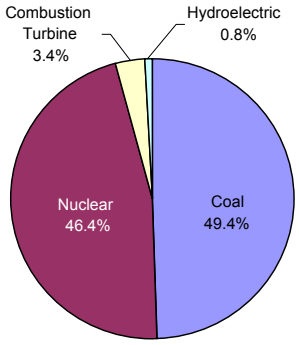

FIGURE 7-6. PROGRESS ENERGY GENERATION BY FUEL TYPE IN NORTH AND SOUTH CAROLINA, 2002

Figures 7-5 and 7-6 illustrate Progress Energy's reliance on nuclear capacity as a base-load generating source in North and South Carolina. Nuclear energy represented 26 percent of Progress Energy's 2002 installed capacity in the Carolinas, but produced 46.4 percent of the electricity generated (NCUC 2003 and EIA 2003a).

7.2.1 ALTERNATIVES CONSIDERED

Technology Choices

Progress Energy routinely conducts evaluations of alternative generating technologies. The most recent study evaluated 16 technologies: of these, 12 are commercially available and 8 are mature, proven technologies (CP&L 2002a). Based on this review, Progress Energy identified candidate technologies that would be capable of replacing the net base-load capacity (1,909 MWe) of the nuclear units at BSEP. BSEP is undergoing an extended power uprate that will increase the original capacity of 1,676 MWe to 1,909 MWe, which is planned for completion in the year 2005 (CP&L 2001).

A cost-benefit analysis revealed that simple-cycle combustion turbines are the most economical commercially available technology for peaking service. For base-load service (like BSEP), the most economical commercially available technology is combined-cycle combustion turbines, followed by units fired by pulverized coal (CP&L 2002a). Based on these evaluations, Progress Energy has concluded that feasible new plant systems that could replace the capacity of the BSEP nuclear units are limited to pulverized coal and combined-cycle units. Progress Energy would use gas as the primary fuel in its combined-cycle turbines because of its economical and

environmental advantages over petroleum. Approximately 92 percent of Progress Energy combustion turbine capacity is fired primarily by gas (CP&L 2000 and CP&L 2002a). Manufacturers now produce large standard-size combined-cycle gas turbines that are economically attractive and suitable for high-capacity base-load operation.

Mixture

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy, given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996a). Consistent with the NRC determination, Progress Energy has not evaluated mixes of generating sources. The impacts from coal- and gas-fired generation presented in this chapter would bound the impacts from any generation mixture of the two technologies.

Deregulation

Nationally, the electric power industry has been undergoing a transition from a regulated monopoly to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (NEI 2000).

Over the past few years, deregulation of the electric utility industry has received considerable attention in the Carolinas. The legislatures of both North and South Carolina have been studying the issue of electric power industry restructuring, or deregulation, but are taking a cautious approach to deregulation in light of the recent energy crisis in California (CP&L 2002b and EEI 2002).

If the electric power industry in the Carolinas is deregulated, retail competition would replace the electric utilities' mandate to serve the public, and electricity customers in the area would be able to choose among competing power suppliers, including those located outside the region. As such, electric generation would be based on the customers' needs and preferences, the lowest price, or the best combination of prices, services, and incentives.

This potential major source of competition from non-utility generators would affect the selection of alternatives for BSEP license renewal. With the prospect of many suppliers being licensed to sell electricity in the Carolinas, Progress Energy could not control demand and would not remain competitive if it offered extensive conservation and load modification incentives. North and South Carolina would ensure that electricity generation by incumbent utilities would not inhibit the development of competition.

Therefore, it is not clear whether Progress Energy or another supplier would construct new generating units to replace those at BSEP, if its licenses were not renewed. Regardless of which entities would construct and operate the replacement power supply source, certain environmental impacts would be constant among these alternative power sources. Therefore, Chapter 7 discusses the impacts of reasonable alternatives to BSEP without regard to whether they would be owned by Progress Energy.

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1) and purchased power (Section 7.2.1.2) as reasonable alternatives to license renewal. Section 7.2.1.3 discusses reduced demand and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.4 discusses other alternatives that Progress Energy has determined are not reasonable and Progress Energy bases for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

Progress Energy analyzed locating hypothetical new coal- and gas-fired units at the existing BSEP site and at an undetermined greenfield site. Progress Energy concluded that BSEP is the preferred site for new construction because this approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads and parking areas, office buildings, and components of the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

For comparability, Progress Energy selected gas- and coal-fired units of equal electric power capacity. One unit with a net capacity of 1,909 MWe could be assumed to replace the 1,909-MWe BSEP net capacity. However, Progress Energy's experience indicates that, although custom size units can be built, using standardized sizes is more economical. For example, a manufacturer's standard-sized units include a gas-fired combined-cycle plant of 365-MWe net capacity (Siemens 2002). Five 365-MWe plants would provide 1825-MWe net capacity. For comparability, Progress Energy set the net power of the coal-fired unit equal to the gas-fired plants (1,825 MWe). Although this provides less capacity than the existing units, it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods (see Mixture in Section 7.2.1).

It must be emphasized, however, that these are hypothetical scenarios. Progress Energy does not have plans for such construction at BSEP.

Coal-Fired Generation

NRC evaluated coal-fired generation alternatives for the Calvert Cliffs Nuclear Power Plant (NRC 1999a) and for the Oconee Nuclear Station (NRC 1999b). For Oconee, NRC analyzed 2,500 MWe of coal-fired generation capacity. Progress Energy has

reviewed the NRC analysis, believes it to be sound, and notes that it analyzed more generating capacity than the 1,825 MWe discussed in this analysis. In defining the BSEP coal-fired alternative, Progress Energy has used site- and North Carolina-specific input and has scaled from the NRC analysis, where appropriate.

Table 7-1 presents the basic coal-fired alternative emission control characteristics. Progress Energy based its emission control technology and percent control assumptions on alternatives that the U.S. Environmental Protection Agency (EPA) has identified as being available for minimizing emissions (EPA 1998a). For the purposes of analysis, Progress Energy has assumed that coal and lime (calcium hydroxide) would be delivered via the existing rail line.

Gas-Fired Generation

Progress Energy's current emphasis on combined-cycle units fueled primarily by gas for base- and intermediate-load operation is evidenced by its bringing online more than 620 MWe of gas-fired combined-cycle capacity in Richmond County, North Carolina (CP&L 2002c). Progress Energy has chosen to evaluate gas-fired generation using combined-cycle turbines because it has determined that the technology is mature, economical, and feasible. As indicated, a manufacturer's standard unit size (365 MWe net) is available and economical. Therefore, Progress Energy has analyzed 1,825 MW of net power, consisting of five 365-MWe net capacity gas-fired combined cycle plants, to be located on BSEP property. Table 7-2 presents the basic gas-fired alternative characteristics.

7.2.1.2 Purchase Power

Progress Energy has evaluated conventional and prospective power supply options that could be reasonably implemented before the current BSEP licenses expire in 2014 and 2016. Progress Energy has entered into long-term purchase contracts with several utilities to provide firm capacity and energy. Progress Energy presumes that this capacity might be available for purchase after the year 2014 to meet future demand. Because these contracts are part of Progress Energy's current and future capacity, however, Progress Energy does not consider these power purchases a feasible option for the purchase power alternative.

In 2000, South Carolina exported 61.8 terawatt-hours of electricity (EIA 2003b). North Carolina, on the other hand, exported 9.5 terawatt-hours of electricity in 2000 (EIA 2003b). Therefore, approximately 71.3 terawatt-hours of electricity were exported from the Carolinas in 2000. Some of the exported power may be the result of purchase contracts, which would prevent Progress Energy from using this power to replace BSEP generation. However, Progress Energy cannot rule out the possibility that power would be available for purchase as an alternative to BSEP license renewal. Therefore, Progress Energy has analyzed purchased power as a reasonable alternative.

Progress Energy assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, Progress Energy is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchase power alternative. Of these technologies, facilities fueled by coal and combined-cycle facilities fueled by natural gas are the most cost effective for providing base-load capacity. Given the amount of electricity generated by BSEP, Progress Energy believes that it is reasonable to assume that new capacity would have to be built for the purchased-power alternative.

7.2.1.3 Reduce Demand

In the past, Progress Energy has offered demand-side management (DSM) programs that either conserve energy or allow the company to reduce customers' load requirements during periods of peak demand. Progress Energy's DSM programs fall into three categories (CP&L 2002d):

Conservation Programs

- Educational programs that encourage the wise use of energy

Energy Efficiency Programs

- Discounted residential rates for homes that meet specific energy efficiency standards
- Incentive programs that encourage customers to replace old, inefficient appliances or equipment with new high-efficiency appliances or equipment

Load Management Programs

- Standby Generator Program – encourages customers to let Progress Energy switch loads to the customer's standby generators during periods of peak demand
- Interruptible Service Program – encourages customers to allow blocks of their load to be interrupted during periods of peak demand
- Time-of-Use Pricing – encourages customers to discontinue usage during specific times

Progress Energy annually projects both the summer and winter peak power (in MW) and annual energy requirements (in gigawatt-hours) impacts of DSM. Future projections anticipate substantial decreases from the DSM initiatives that were in effect during past years. The market conditions which provided initial support for utility-sponsored conservation and load management efforts during the late 1970s and early 1980s can be broadly characterized by:

- increasing long-term marginal prices for capacity and energy production resources;

- forecasts projecting increasing demand for electricity across the nation;
- general agreement that conditions (1) and (2) would continue for the foreseeable future;
- limited competition in the generation of electricity;
- the use of average embedded cost as the basis for setting electricity prices within a regulated context.

These market and regulatory conditions would undergo dramatic changes in a deregulated market. Changes that have significantly impacted the cost effectiveness of utility-sponsored DSM can be described as follows:

- a decline in generation costs, due primarily to technological advances that have reduced the cost of constructing new generating units (e.g., combustion turbines);
- national energy legislation that has encouraged wholesale competition through open access to the transmission grid, as well as state legislation designed to facilitate retail competition.

The utility planning environment features shorter planning horizons, lower reserve margins, and increased reliance on market prices to direct utility resource planning. The changes occurring in the industry have greatly reduced the number of cost-effective DSM alternatives.

Other significant changes include:

- The adoption of increasingly stringent national appliance standards for most major energy-using equipment and the adoption of energy efficiency requirements in state building codes. These mandates have further reduced the potential for cost-effective utility-sponsored measures.
- In states that are currently transitioning into deregulation, third parties are increasingly providing energy services and products in competitive markets at prices that reflect their value to the customer. Market conditions can be expected to continue this shift among providers of cost-effective load management.

For these reasons, Progress Energy determined that the remaining DSM programs, which are primarily directed toward load management, are not an effective substitute for any of its large base-load units operating at high-capacity factors, including BSEP.

7.2.1.4 Other Alternatives

This section identifies alternatives that Progress Energy has determined are not reasonable and the Progress Energy bases for these determinations. Progress Energy accounted for the fact that BSEP is a base-load generator and that any feasible

alternative to BSEP would also need to be able to generate base-load power. In performing this evaluation, Progress Energy relied heavily upon NRC's GEIS (NRC 1996a).

Wind

Wind power, by itself, is not suitable for large base-load generation. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

Wind power is not a technically feasible alternative in the Carolinas. According to the Wind Energy Resource Atlas of the United States (NREL 1986), areas suitable for wind energy applications must be wind power class 3 or higher. North Carolina and South Carolina do not have sufficient wind resources for wind energy applications (NREL 1986). Nearly 87 percent of the land area in North Carolina is less than wind power class 3. Areas in North Carolina that are wind power class 3 or higher are confined to exposed ridge crests and mountain summits in western North Carolina and the barrier islands along the Atlantic coast. While some exposed ridge crests and mountain summits in the extreme northwestern part of South Carolina are wind power class 3 or higher, more than 99 percent of the land area in the State has a wind power class of 1. The geography of these wind power class 3 areas makes them unsuitable for utility-scale wind energy applications (NREL 1986).

The GEIS estimates a land-use requirement of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of BSEP generating capacity (1,909 MWe net) with wind power, even assuming ideal wind conditions, would require dedication of about 450 square miles. Based on the lack of sufficient wind speeds and the amount of land needed to replace BSEP, the wind alternative would require a large greenfield site, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

Progress Energy has concluded that, due to the lack of area in the Carolinas having suitable wind speeds and the amount of land needed (approximately 450 square miles), wind power is not a reasonable alternative to BSEP license renewal.

Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity (NRC 1996a).

Solar power is not a technically feasible alternative for baseload capacity in the Carolinas. North and South Carolina receive about 3.3 kilowatt hours of solar radiation per square meter per day, compared with 5 to 7.2 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (NRC 1996a).

Finally, according to the GEIS, land requirements for solar plants are high, at 35,000 acres per 1,000 MWe for photovoltaic and 14,000 acres per 1,000 MWe for solar thermal systems. Therefore, replacement of BSEP generating capacity with solar power would require dedication of about 100 square miles for photovoltaic and 42 square miles for solar thermal systems. Neither type of solar electric system would fit at the BSEP site, and both would have large environmental impacts at a greenfield site.

Progress Energy has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 42 to 100 square miles), solar power is not a reasonable alternative to BSEP license renewal.

Hydropower

A portion (about 5,000 MW) of utility generating capacity in the Carolinas is hydroelectric (EIA 2004). As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. From 1993 to 2002, utilities reduced hydroelectric production by about 8.1 percent annually in North Carolina and 25.6 percent annually in South Carolina (EIA 2004). According to the *U.S. Hydropower Resource Assessment for North Carolina* (INEEL 1997a), there are no remaining sites in North Carolina that would be environmentally suitable for a large hydroelectric facility. Similarly, the *U.S. Hydropower Resource Assessment for South Carolina* (INEEL 1997b), indicates that there are no environmentally suitable sites remaining in South Carolina for a large hydroelectric facility.

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of BSEP generating capacity would require flooding more than 3,050 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 communities.

Progress Energy has concluded that, due to the lack of suitable sites in the Carolinas and the amount of land needed (approximately 3,050 square miles), hydropower is not a reasonable alternative to BSEP license renewal.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs

are prevalent. However, because there are no high-temperature geothermal sites in North or South Carolina, Progress Energy concludes that geothermal is not a reasonable alternative to BSEP license renewal.

Wood Energy

As discussed in the GEIS (NRC 1996a), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. According to the U.S. Department of Energy, North and South Carolina are considered to have excellent wood resource potential (Walsh et al. 2000). The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. However, the largest wood waste power plants are 40 to 50 MW in size.

Further, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for base-load applications. It is also difficult to handle and has high transportation costs.

While wood resources are available in the Carolinas, Progress Energy has concluded that, due to the lack of an environmental advantage, low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to BSEP license renewal.

Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS, the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

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. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts

would be moderate, but still larger than the environmental effects of BSEP license renewal.

Progress Energy has concluded that, due to the high costs and lack of environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to BSEP license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as BSEP.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

Progress Energy has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to BSEP license renewal.

Petroleum

Both North and South Carolina have several petroleum (oil)-fired power plants; however, they produce less than 1 percent of the total power generated in the Carolinas (EIA 2004). Petroleum-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in petroleum prices are expected to make petroleum-fired generation increasingly more expensive than coal-fired generation.

Also, construction and operation of a petroleum-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS estimates that construction of a 1,000-MWe petroleum-fired plant would require about 120 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.

Progress Energy has concluded that, due to the high costs and lack of obvious environmental advantage, petroleum-fired generation is not a reasonable alternative to BSEP license renewal.

Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. While more than two hundred turnkey plants have been installed, the global stationary fuel cell electricity generating capacity was just 75 MW in 2001 (Hemberger 2001). Recent estimates suggest that a company would have to produce about 100 MW of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt (Kenergy 2000). However, the production capability of the largest stationery fuel cell manufacturer is 50 MW per year (CSFCC 2002). Progress Energy believes that this technology has not matured sufficiently to support production for a facility the size of BSEP. Progress Energy has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to BSEP license renewal.

Delayed Retirement

Progress Energy currently has no plans for retiring any of its generating plants and expects to need additional new capacity in the near future. Therefore, there are no unit retirements that could be delayed as an alternative to BSEP license renewal.

7.2.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This section evaluates the environmental impacts of alternatives that Progress Energy has determined to be reasonable alternatives to BSEP license renewal: coal-fired generation, gas-fired generation, and purchased power.

7.2.2.1 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996a). NRC concluded that 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 that Progress Energy has defined in Section 7.2.1.1 would be located at BSEP.

Air Quality

A coal-fired plant would emit oxides of sulfur (SO_x) and nitrogen (NO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, Progress Energy has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Progress Energy estimates the coal-fired alternative emissions to be as follows:

SO_x = 4,778 tons per year

NO_x = 1,479 tons per year

Carbon monoxide = 1,479 tons per year

Particulates:

Total suspended particulates = 308 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 71 tons per year

Table 7-3 shows how Progress Energy calculated these emissions.

In 2002, emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) from North Carolina's generators ranked 9th and 11th nationally, respectively (EIA 2004). In 1998, the EPA promulgated the NO_x SIP (State Implementation Plan) Call regulation that required 22 states, including North Carolina, to reduce their NO_x emissions by over 30 percent to address regional transport of ground-level ozone across state lines (EPA 1998b). The NO_x SIP Call imposes a NO_x "budget" to limit the NO_x emissions from each state. Implementation of the NO_x SIP Call rule was delayed while lawsuits against the EPA were being argued. On March 26, 2002 the U.S Court of Appeals for the D.C. Circuit issued a ruling largely upholding the NO_x SIP Call (ATA 2002). To operate a fossil-fuel-fired plant at the BSEP site, Progress Energy would need to obtain enough NO_x credits to cover annual emissions either from the set-aside pool or by buying NO_x credits from other sources.

NRC did not quantify coal-fired emissions, but implied that air impacts would be substantial. NRC noted that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. Progress Energy concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_2 emission allowances, NO_x emission offsets, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are regulatorily imposed mitigation measures. As such, Progress Energy concludes that the coal-fired alternative would have moderate impacts on air quality; the impacts would be noticeable, but would not destabilize air quality in the area.

Waste Management

Progress Energy concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 5,920,000 tons of coal having an ash content of 10.4 percent (Tables 7-3 and 7-1, respectively). After combustion, most (99.9 percent) of this ash, approximately 615,000 tons per year, would be collected and disposed of onsite. In addition,

approximately 261,000 tons of scrubber sludge would be disposed of onsite each year (based on annual calcium hydroxide usage of nearly 88,000 tons). Progress Energy estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 487 acres (a square area with sides of approximately 4,600 feet). Table 7-4 shows how Progress Energy calculated ash and scrubber waste volumes. The BSEP site is approximately 1,200 acres. While only half this waste volume and acreage would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

Progress Energy believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the BSEP property for this disposal but it would be necessary to clear several hundred acres of woodlands. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, Progress Energy believes that waste disposal for the coal-fired alternative would have moderate impacts; the impacts of increased waste disposal would be noticeable, but would not destabilize any important resource, and further mitigation would be unwarranted.

Other Impacts

Progress Energy estimates that construction of the powerblock and coal storage area would affect 520 acres of land and associated terrestrial habitat. Because most of this construction would require the clearing of several hundred acres of woodlands, impacts at the BSEP site would be moderate to large, but would be somewhat less than the impacts of using a green field site. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of onsite. Socioeconomic impacts from the construction workforce would be minimal, because worker relocation would not be expected, due to the site's proximity to Wilmington, North Carolina, 15 miles from the site. Progress Energy estimates an operational workforce of only 150 for the coal-fired alternative. The reduction in workforce would result in adverse socioeconomic impacts. Progress Energy believes these impacts would be small, due to BSEP's proximity to Wilmington.

Impacts to aquatic resources and water quality would be similar to impacts of BSEP, due to the plant's use of the existing cooling water system that withdraws from the Cape Fear River and discharges to the Atlantic Ocean, and would be offset by the concurrent shutdown of BSEP. The additional stacks, boilers, and rail deliveries would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

Progress Energy notes the EPA has revised requirements (EPA 2003) that could affect the design of cooling water intake structures for new facilities. This could require constructing a natural draft cooling tower or mechanical cooling towers. Recirculation would reduce cooling water intake volume by approximately 90 percent.

Progress Energy 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. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.2 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents Progress Energy's reasons for defining the gas-fired generation alternative as a combined-cycle plant on the BSEP site. Land-use impacts from gas-fired units on BSEP would be less than those from the coal-fired alternative. Reduced land requirements, due to a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources. A smaller workforce could have adverse socioeconomic impacts. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generators.

NRC has evaluated the environmental impacts of constructing and operating four 440-MW combined-cycle gas-fired units as an alternative to a nuclear power plant license renewal (NRC 1999a). This analysis is for a generating capacity approximately the same as the BSEP gas-fired alternatives analysis, because Progress Energy would install 1825 MW of net power. Progress Energy has adopted the rest of the NRC analysis with necessary North Carolina- and Progress Energy-specific modifications noted.

Air Quality

Natural gas is a relatively clean-burning fossil fuel; 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 NO_x emissions. Progress Energy estimates the gas-fired alternative emissions to be as follows:

SO_x = 149 tons per year

NO_x = 478 tons per year

Carbon monoxide = 99 tons per year

Filterable Particulates = 83 tons per year (all particulates are PM_{10})

Table 7-5 shows how Progress Energy calculated these emissions.

The Section 7.2.2.1 discussion of regional air quality is applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are

less stringent, the emissions are still substantial. Progress Energy concludes that emissions from the gas-fired alternative at BSEP would noticeably alter local air quality, but would not destabilize regional resources (i.e., air quality). Air quality impacts would therefore be moderate, but substantially smaller than those of coal-fired generation.

Waste Management

Gas-fired generation would result in almost no waste generation, producing minor (if any) impacts. Progress Energy concludes that gas-fired generation waste management impacts would be small.

Other Impacts

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on the existing BSEP site would reduce construction-related impacts. A new gas pipeline would be required for the five 365-MW gas turbine generators in this alternative. To the extent practicable, Progress Energy would route the pipeline along existing, previously disturbed, right-of-way to minimize impacts. Approximately 114 miles of new pipeline construction would be required to connect BSEP to the existing pipeline network. A 30-inch diameter pipeline would necessitate a 100-foot-wide corridor, resulting in the disturbance of as much as 1,382 acres. This new construction may also necessitate an upgrade of the State-wide pipeline network. Progress Energy estimates that 122 acres would be needed for a plant site; this much previously disturbed acreage is available at BSEP, reducing loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Socioeconomic impacts of construction would be minimal. However, Progress Energy estimates a workforce of 66 for gas operations. The reduction in work force would result in adverse socioeconomic impacts. Progress Energy believes these impacts would be moderate and would be mitigated by the site's proximity to the metropolitan area of Wilmington.

7.2.2.3 Purchased Power

As discussed in Section 7.2.1.2, Progress Energy assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. Progress Energy is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in the Carolinas. Progress Energy believes that imports from outside the Carolinas would not be required.

The purchased power alternative would include constructing more than 200 miles of high-voltage (i.e., 500-kilovolt) transmission lines to get power from the remote locations in the Carolinas to the Progress Energy network. Progress Energy believes most of the transmission lines could be routed along existing rights-of-way. Progress Energy assumes that the environmental impacts of transmission line construction would be moderate. As indicated in the introduction to Section 7.2.1.1, the environmental impacts

of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously undisturbed greenfield site would exceed those of a coal- or gas-fired alternative located on the BSEP site.

TABLE 7-1
COAL-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 913 MW ISO rating net[a]	Calculated to be ≤ BSEP net capacity – 1909 MW
Unit size = 967 MW ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 2	
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998a)
Fuel type = bituminous, pulverized coal	Typical for coal used in North Carolina
Fuel heating value = 12,415 Btu/lb	1999 value for coal used in North Carolina (EIA 2002)
Fuel ash content by weight = 10.4 percent	1999 value for coal used in North Carolina (EIA 2002)
Fuel sulfur content by weight = 0.85 percent	1999 value for coal used in North Carolina (EIA 2002)
Uncontrolled NO_x emission = 10 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998a)
Heat rate = 10,200 Btu/Kwh	Typical for coal-fired, single-cycle steam turbines (EIA 2002)
Capacity factor = 0.85	Typical for large coal-fired units
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (EPA 1998a)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998a)
SO_x control = Wet scrubber – lime (95 percent removal efficiency)	Best available for minimizing SO_x emissions (EPA 1998a)

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 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
Kwh = kilowatt hour
NSPS = New Source Performance Standard
Lb = pound
MW = megawatt
NO_x = nitrogen oxides
SO_x = oxides of sulfur
≤ = less than or equal to

TABLE 7-2
GAS-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 365 MW ISO rating net:[a] One 365-MW combustion turbine	Manufacturer's standard size gas-fired combined-cycle plant that is ≤ BSEP net capacity - 1909 MW
Unit size = 380 MW ISO rating gross:[a] One 380-MW combustion turbine	Calculated based on 4 percent onsite power
Number of units = 5	
Fuel type = natural gas	Assumed
Fuel heating value = 1,032 Btu/ft^3	1999 value for gas used in North Carolina (EIA 2002)
Fuel sulfur content = 0.0034 lb/MMBtu	Used when sulfur content is not available (EPA 2000)
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions (EPA 2000)
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas fired units with water injection (EPA 2000)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas fired units (EPA 2000)
Heat rate = 6,204 Btu/Kwh	Progress Energy experience
Capacity factor = 0.85	Progress Energy experience

a. The difference between "net" and "gross" is electricity consumed onsite.

Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
Kwh = kilowatt hour
MM = million
MW = megawatt
NO_x = nitrogen oxides
≤ = less than or equal to

TABLE 7-3
AIR EMISSIONS FROM COAL-FIRED ALTERNATIVE

Parameter	Calculation	Result
Annual coal consumption	$2\,\text{units} \times \frac{967\,\text{MW}}{\text{unit}} \times \frac{10{,}200\,\text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\,\text{kW}}{\text{MW}} \times \frac{\text{lb}}{12{,}415\,\text{Btu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times 0.85 \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365\,\text{day}}{\text{yr}}$	5,917,186 tons of coal per year
SO_x[a,c]	$\frac{38 \times 0.85\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 95/100) \times \frac{5{,}917{,}186\ \text{tons}}{\text{yr}}$	4,778 tons SO_x per year
NO_x[b, c]	$\frac{10\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 95/100) \times \frac{5{,}917{,}186\ \text{tons}}{\text{yr}}$	1,479 tons NO_x per year
CO[c]	$\frac{0.5\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{5{,}917{,}186\ \text{tons}}{\text{yr}}$	1,479 tons CO per year
TSP[d]	$\frac{10 \times 10.4\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 99.9/100) \times \frac{5{,}917{,}186\ \text{tons}}{\text{yr}}$	308 tons TSP per year
PM_{10}[d]	$\frac{2.3 \times 10.4\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 99.9/100) \times \frac{5{,}917{,}186\ \text{tons}}{\text{yr}}$	71 tons PM_{10} per year

a. EPA 1998a, Table 1.1-1.
b. EPA 1998a, Table 1.1-2.
c. EPA 1998a, Table 1.1-3.
d. EPA 1998a, Table 1.1-4.

CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = oxides of sulfur
TSP = total suspended particulates

TABLE 7-4
SOLID WASTE FROM COAL-FIRED ALTERNATIVE

Parameter	Calculation	Result
Annual SO_x generated[a]	$\frac{5{,}917{,}186\ \text{ton coal}}{\text{yr}} \times \frac{0.85\ \text{ton S}}{100\ \text{ton coal}} \times \frac{64.1\ \text{ton } SO_2}{32.1\ \text{ton S}}$	100,542 tons of SO_x per year
Annual SO_x removed	$\frac{100{,}542\ \text{ton } SO_2}{\text{yr}} \times (95/100)$	95,515 tons of SO_x per year
Annual ash generated	$\frac{5{,}917{,}186\ \text{ton coal}}{\text{yr}} \times \frac{10.4\ \text{ton ash}}{100\ \text{ton coal}} \times (99.9/100)$	614,772 tons of ash per year
Annual lime consumption[b]	$\frac{100{,}542\ \text{ton } SO_2}{\text{yr}} \times \frac{56.1\ \text{ton CaO}}{64.1\ \text{ton } SO_2}$	87,994 tons of CaO per year
Calcium sulfate[c]	$\frac{95{,}515\ \text{ton } SO_2}{\text{yr}} \times \frac{172\ \text{ton } CaSO_4 \bullet 2H_2O}{64.1\ \text{ton } SO_2}$	256,296 tons of $CaSO_4 \cdot 2H_2O$ per year
Annual scrubber waste[d]	$\frac{87{,}994\ \text{ton CaO}}{\text{yr}} \times \frac{(100-95)}{100} + 256{,}296\ \text{ton } CaSO_4 \bullet 2H_2O$	260,695 tons of scrubber waste per year
Total volume of scrubber waste[e]	$\frac{260{,}695\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{144.8\ \text{lb}}$	144,062,469 ft^3 of scrubber waste
Total volume of ash[f]	$\frac{614{,}772\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{100\ \text{lb}}$	491,817,562 ft^3 of ash
Total volume of solid waste	144,062,469 ft^3 + 491,817,562 ft^3	635,880,031 ft^3 of solid waste
Waste pile area (acres)	$\frac{635{,}880{,}031\ \text{ft}^3}{30\ \text{ft}} \times \frac{\text{acre}}{43{,}560\ \text{ft}^2}$	487 acres of solid waste
Waste pile area (ft x ft square)	$\sqrt{(635{,}880{,}031\ \text{ft}^3/30\text{ft})}$	4,604 feet by feet square of solid waste

Based on annual coal consumption of 5,917,186 tons per year (Table 7-3).

a. Calculations assume 100 percent combustion of coal.
b. Lime consumption is based on total SO_2 generated.
c. Calcium sulfate generation is based on total SO_2 removed.
d. Total scrubber waste includes scrubbing media carryover.
e. Density of $CaSO_4 \cdot 2H_2O$ is 144.8 lb/ft^3.
f. Density of coal bottom ash is 100 lb/ft^3 (FHA 2000).

S = sulfur
SO_x = oxides of sulfur
CaO = calcium oxide (lime)
$CaSO_4 \cdot 2H_2O$ = calcium sulfate dihydrate

TABLE 7-5
AIR EMISSIONS FROM GAS-FIRED ALTERNATIVE

Parameter	Calculation	Result
Annual gas consumption	$5\ \text{units} \times \frac{380\ \text{MW}}{\text{unit}} \times \frac{6{,}204\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1{,}032\ \text{Btu}} \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{da}}{\text{yr}}$	84,959,379,488 ft^3 per year
Annual Btu input	$\frac{84{,}959{,}379{,}488\ \text{ft}^3}{\text{yr}} \times \frac{1{,}032\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MM Btu}}{10^6\ \text{Btu}}$	87,678,080 MMBtu per year
SO_x[a]	$\frac{0.0034\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{87{,}678{,}080\ \text{MMBtu}}{\text{yr}}$	149 tons SO_x per year
NO_x[b]	$\frac{0.0109\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{87{,}678{,}080\ \text{MMBtu}}{\text{yr}}$	478 tons NO_x per year
CO[b]	$\frac{0.00226\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{87{,}678{,}080\ \text{MMBtu}}{\text{yr}}$	99 tons CO per year
TSP[a]	$\frac{0.0019\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{87{,}678{,}080\ \text{MMBtu}}{\text{yr}}$	83 tons filterable TSP per year
PM_{10}[a]	$\frac{83\ \text{tons TSP}}{\text{yr}}$	83 tons filterable PM_{10} per year

a. EPA 2000, Table 3.1-1.
b. EPA 2000, Table 3.1-2.
CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = oxides of sulfur
TSP = total suspended particulates

7.3 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in Progress Energy files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Progress Energy have been given for these pages, even though they may not be directly accessible.

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8.0 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

**"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..."
10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)**

Chapter 4 analyzes environmental impacts of Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) license renewal and Chapter 7 analyzes impacts from renewal alternatives. Table 8-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, for comparison purposes. The environmental impacts compared in Table 8-1 are those that are either Category 2 issues for the proposed action, license renewal, or are issues that the *Generic Environmental Impact Statement* (GEIS) (NRC 1996) identified as major considerations in an alternatives analysis. For example, although the U. S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. Table 8-2 is a more detailed comparison of the alternatives.

TABLE 8-1
IMPACTS COMPARISON SUMMARY

Impact	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	SMALL to MODERATE	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

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.

TABLE 8-2
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Alternative Descriptions				
BSEP license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current BSEP license. Adopting by reference, as bounding BSEP decommissioning, GEIS description (NRC 1996, Section 7.1)	New construction at the BSEP site.	New construction at the BSEP site.	Would involve construction of new generation capacity in the state. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
		Use existing rail spur	Construct 114 miles of gas pipeline in a 100-foot-wide corridor. May require upgrades to existing pipelines.	
		Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Construct more than 200 miles of transmission lines
		Two 913-MW (net) tangentially-fired, dry bottom unit; capacity factor 0.85	Five 365 MW of net power (Combined-cycle turbines to be used)	
		Existing BSEP intake/ discharge canal system	Existing BSEP intake/ discharge canal system	
		Pulverized bituminous coal, 12,415 Btu/pound; 10,200 Btu/kWh; 10.4% ash; 0.85% sulfur; 10 lb/ton nitrogen oxides; 5,917,186 tons coal/yr	Natural gas, 1,032 Btu/ft^3; 6,204 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0109 lb NO_x/MMBtu; 84,959,379,488 ft^3 gas/yr	

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	**With Gas-Fired Generation**	**With Purchased Power**
		Low NO_x burners, overfire air and selective catalytic reduction (95% NO_x reduction efficiency). Wet scrubber – lime/limestone desulfurization system (95% SO_x removal efficiency); 87,994 tons limestone/yr Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)	Selective catalytic reduction with steam/water injection	
760 permanent and 300 long term contract workers		150 workers (Section 7.2.2.1)	66 workers (Section 7.2.2.2)	
		Land Use Impacts		
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	MODERATE – 520 acres required for the powerblock and associated facilities. (Section 7.2.2.1)	SMALL to MODERATE – 122 acres for facility at BSEP location; 1,382 acres for pipeline (Section 7.2.2.2). New gas pipeline would be built to connect with existing gas pipeline corridor.	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3) Adopting by reference GEIS description of land use impacts from alternate technologies (NRC 1996)

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 4, 7, 9-12, 32, and 37). Five Category 2 groundwater issues not applicable (Section 4.1, Issue 13; Section 4.6, Issue 34; Section 4.7, Issue 35; and Section 4.8, Issue 39).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts minimized by use of the existing cooling water system that withdraws from Cape Fear River and discharges to ocean. (Section 7.2.2.1)	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996)
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). Category 2 issue not applicable (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88)	MODERATE – 4,778 tons SO_x/yr 1,479 tons NO_x/yr 1,479 tons CO/yr 308 tons TSP/yr 71 tons PM_{10}/yr (Section 7.2.2.1)	MODERATE – 149 tons SO_x/yr 478 tons NO_x/yr 99 tons CO/yr 83 tons PM_{10}/yr[a] (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996)

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 15-24, 45-48). One Category 2 issue not applicable (Section 4.9, Issue 40). BSEP holds a current NPDES permit, which constitutes compliance with Clean Water Act Section 316(b) (Section 4.2, Issue 25; Section 4.3, Issue 26).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90)	MODERATE – 243 acres of forested land could be required for ash/sludge disposal over 20-year license renewal term. (Section 7.2.2.1)	SMALL to MODERATE – Construction of the pipeline could alter habitat. (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996)
Threatened or Endangered Species Impacts				
SMALL – With the exception of occasional sea turtle sightings, no threatened or endangered species are known at the site or along the transmission corridors. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Human Health Impacts				
SMALL – Adopting by reference Category 1 issues (Table A-1, Issues 54-56, 58, 61, 62). The issue of microbiological organisms (Section 4.12, Issue 57) does not apply. Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996)
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67, 91). Two Category 2 issues are not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Location in medium population area with limited growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Plant property tax payment represents 4 percent of county's total tax revenues (Section 4.17.2, Issue 69).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91)	SMALL – Reduction in permanent work force at BSEP could adversely affect surrounding counties, but would be mitigated by BSEP's proximity to Wilmington (Section 7.2.2.1).	SMALL to MODERATE – Reduction in permanent work force at BSEP could adversely affect surrounding counties, but would be mitigated by BSEP's proximity to Wilmington (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996)

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)				
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87)	MODERATE – 614,772 tons of coal ash and 260,695 tons of scrubber sludge would require 243 acres over 20-year license renewal term. Industrial waste generated annually (Section 7.2.2.1)	SMALL – Almost no waste generation (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996)
Aesthetic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – The coal-fired power blocks and the exhaust stacks would be visible from a moderate offsite distance (Section 7.2.2.1)	SMALL to MODERATE – Steam turbines and stacks would create visual impacts comparable to those from existing BSEP facilities (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996)

TABLE 8-2
IMPACTS COMPARISON DETAIL (Continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Cultural Resource Impacts				
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site (Section 7.2.2.1)	SMALL – 114 miles of pipeline construction in southeastern NC could affect some cultural resources (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996)

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.

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_x = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_x = sulfur dioxide
TSP = total suspended particulates
yr = year

a. All TSP for gas-fired alternative is PM_{10}.

8.1 REFERENCES

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

9.0 STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9-1 lists environmental authorizations that Progress Energy has obtained for current Brunswick Steam Electric Power (BSEP) operations. In this context, Progress Energy uses "authorizations" to include any permits, licenses, approvals, or other entitlements. Progress Energy expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license renewal period. Preparatory to applying for renewal of the BSEP license to operate, Progress Energy conducted an assessment to identify any new and significant environmental information (Chapter 5). The assessment included interviews with Progress Energy subject experts, review of BSEP environmental documentation, and communication with state and federal environmental protection agencies. Based on this assessment, Progress Energy concludes that BSEP is in compliance with applicable environmental standards and requirements.

Table 9-2 lists additional environmental authorizations and consultations related to NRC renewal of the BSEP license to operate. As indicated, Progress Energy anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 THREATENED OR ENDANGERED SPECIES

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed, proposed for listing as endangered, or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS)

for marine species, or both. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, Progress Energy has chosen to invite comment from federal and state agencies regarding potential effects that BSEP license renewal might have. Appendix C includes copies of Progress Energy correspondence with FWS and the North Carolina Department of Environment and Natural Resources (NCDENR) and a letter to NMFS, which has jurisdiction over marine species. The FWS response noted that license renewal was unlikely to adversely affect any federally listed species or its habitat as long as Progress Energy continues to be an active participant in a 1993 Memorandum of Understanding between Carolina Power and Light and the North Carolina Natural Heritage Program that addresses the management of federally protected plants in transmission line rights-of-way in southeastern North Carolina. The NCDENR response also noted the importance of these transmission corridors to rare plants and recommended that Progress Energy continue to employ vegetation management practices (e.g., mowing during the non-growing season on a three-year cycle) that benefit rare species and habitats.

9.1.3 COASTAL ZONE MANAGEMENT PROGRAM COMPLIANCE

The federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone (NRC 2001). BSEP, located in Brunswick County, is within the North Carolina Coastal Management Area (NCDENR 2002). Therefore, certification from the North Carolina Coastal Resource Commission is necessary. The certification prepared by Progress Energy is in Appendix E.

9.1.4 HISTORIC PRESERVATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for the State Historic Preservation Officer (SHPO) having a consultative role (35 CFR 800.2). Although not required of an applicant by federal law or NRC regulation, Progress Energy has chosen to invite comment by the North Carolina SHPO. Appendix D contains a copy of Progress Energy's letter to the North Carolina State Historic Preservation Office.

9.1.5 WATER QUALITY (401) CERTIFICATION

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). NRC has indicated in its

Generic Environmental Impact Statement for License Renewal (NRC 1996) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification by the state. Progress Energy is applying to NRC for license renewal to continue BSEP operations. Appendix B contains excerpts from the BSEP NPDES permit. Consistent with the GEIS, Progress Energy is providing BSEP's NPDES permit as evidence of state water quality (401) certification.

9.2 ALTERNATIVES

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The coal, gas, and purchased power alternatives discussed in Section 7.2.1 probably could be constructed and operated to comply with applicable environmental quality standards and requirements. Progress Energy notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. Progress Energy also notes that the U.S. Environmental Protection Agency has revised requirements for design and operation of cooling water intake structures at new and existing facilities (40 CFR 125 Subparts I and J). These requirements could necessitate construction of cooling towers for the coal- and gas-fired alternatives if surface water were used for cooling.

TABLE 9-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT BSEP UNITS 1 AND 2 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal Requirements to License Renewal					
U. S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	Unit 1: DPR-71 Unit 2: DPR-62	Issued 11/12/1976 Expires 9/8/2016 Issued 12/27/74 Expires 12/27/2014	Operation of Units 1 and 2
U.S. Fish and Wildlife Service	16 USC 703-712	Federal Fish and Wildlife Permit, Depredation	MB789112-0	Issued 04/01/03; Expires 03/31/04	Removal and relocation of migratory bird nests
U.S. Department of Transportation	49 USC 5108	Registration	050603550001L	Issued 5/6/03; Expires 6/30/04	Hazardous materials shipments
North Carolina Department of Environment and Natural Resources	Clean Water Act (33 USC 1251 et seq.), NC General Statute 143-215.1	National Pollutant Discharge Elimination System Permit	NC0007064	Issued 06/30/03; Expires 11/30/06	Wastewater discharges to Atlantic Ocean (Part I) and stormwater discharges to waters of the State (Part II).

TABLE 9-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT BSEP UNITS 1 AND 2 OPERATIONS (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
North Carolina Department of Environment and Natural Resources	NC General Statutes 143-215.95 et. Seq., Part 3 of the NC Oil Pollution and Hazardous Substances Control Act	Certificate of Registration of Oil Terminal Facility	104021005	Issued 2/29/00 updated as necessary to reflect changes in facilities/operations /organizations	PE operation of an oil terminal supplying fuel to emergency diesel generator and lubrication oils
North Carolina Department of Environment and Natural Resources	Clean Air Act Title V (42 USC 7661 et seq.); NC General Statutes Article 21B of Chapter 143	Air Permit	5556R13	Issued 12/17/03; Expires 12/01/08	Air emissions for boilers and emergency generators source operation
North Carolina Department of Environment and Natural Resources and Coastal Commission	Federal Coastal Zone Management Act (16 USC 1451 et seq; NC General Statutes 113-229	Dredging Permit	293	Issued 10/20/03; Expires 12/31/06	Maintenance dredging of existing cooling water intake canal
North Carolina Wildlife Resources Commission	Endangered Species act of 1973 (16 USC 1531-1544)	Endangered Species Permit - Sea Turtles	04ST49	Issued 1/15/04; Expires 12/31/04	Tagging, Possession and Disposition of Entrained or Stranded Sea Turtles
North Carolina Wildlife Resources Commission	NC Statutory Authority 113-274(c)(1)(a) NC Administrative Code Title 15A, Subchapter 10B.0106	Special Migratory Bird Permit	No Number	Issued 1/30/03; Expires 12/31/03	Removal and relocation of migratory bird nests

TABLE 9-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT BSEP UNITS 1 AND 2 OPERATIONS (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
South Carolina Department of Health and Environmental Control – Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	South Carolina Radioactive Waste Transport Permit	0041-32-04	Issued 11/20/03; Expires 12/31/04	Transportation of radioactive waste into the State of South Carolina
Utah Department of Environmental Quality Division of Radiation Control	Utah Division of Radiation Control Rule R313-26	Utah Radiation Control Generator Site Access Permit	0109000007	Issued 9/30/01; Expires 6/30/04	Transportation of radioactive waste into the State of Utah
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation Rule 1200-2-10.32	Tennessee Radioactive Waste License-for-Delivery	T-NC001-L04	Issued 1/1/04; Expires 12/31/04	Transportation of radioactive waste into the State of Tennessee

TABLE 9-2
ENVIRONMENTAL AUTHORIZATIONS FOR BSEP UNITS 1 AND 2 LICENSE RENEWAL[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the U.S. Fish and Wildlife Service (Appendix C)
North Carolina Department of Environment and Natural Resources	Clean Water Act Section 401 (33 USC 1341)	Certification	State issuance of NPDES permit (Section 9.1.5) constitutes 401 certification (Appendix B)
North Carolina Division of Coastal Management	Federal Coastal Zone Management Act (16 USC 1452 et seq.)	Certification	Requires applicant to prove certification to Federal agency issuing the license that license renewal would be consistent with the Federally approved State Coastal Zone Management program. Based on its review of the proposed activity, the State must concur with or object to the applicant's certification (Appendix E).
North Carolina Department of Cultural Resources	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). SHPO must concur that license renewal will not affect any sites listed or eligible for listing (Appendix D)

a. No renewal-related requirements identified for local or other agencies.

9.3 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in Progress Energy files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Progress Energy have been given for these pages, even though they may not be directly accessible.

NCDENR (North Carolina Department of Environment and Natural Resources). 2002. North Carolina Division of Coastal Management, Coastal Area Management Act. Available at http://dcm2.enr.state.nc.us/cama_counties.htm. Accessed October 29, 2002.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Volume 1, Section 4.2.1.1, page 4-4. NUREG-1437. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 2001. *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issue*s. NRR Office Instruction No. LIC-203. June 21.