NUREG-1437
Supplement 25

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 25

Regarding
Brunswick Steam Electric Plant, Units 1 and 2

Draft Report for Comment

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

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Abstract

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

This supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by the Carolina Power & Light Company (CP&L) (now doing business as Progress Energy Carolinas, Inc.) to renew the OLs for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) for an additional 20 years under 10 CFR Part 54. This SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

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

Regarding the remaining issues, those that apply to BSEP are addressed in this SEIS. The staff concludes that the significance of the potential environmental impacts of renewal of the OLs is SMALL for each applicable issue with one exception. The magnitude of impact for the chronic effects of electromagnetic fields is "uncertain". The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

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

Abstract

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

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Executive Summary

On October 18, 2004, the Carolina Power and Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) for an additional 20-year period. If the OLs are renewed, State regulatory agencies and CP&L will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plant must be shut down at or before the expiration dates of the current OLs, which are September 8, 2016, for Unit 1 and December 27, 2014, for Unit 2.

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

Upon acceptance of the CP&L application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare an EIS and conduct scoping. The staff visited the BSEP site in January 2005 and held public scoping meetings on January 27, 2005, in Southport, North Carolina. In the preparation of this supplemental environmental impact statement (SEIS) for BSEP, the staff reviewed the CP&L Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal,* and considered the public comments received during the scoping process. The public comments received during the scoping process are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Southport, North Carolina, on October 18, 2005 to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating comments on this

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

SEIS. When the comment period ends, the staff will consider and disposition all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

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

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

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

The evaluation criterion for of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

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

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether the existing nuclear power plants continue to operate beyond the period of the current OLs.

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the

scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation–generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

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

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

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

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

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

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

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

This SEIS documents the staff's evaluation of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for BSEP) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration (DOE/EIA), gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from BSEP is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the BSEP site or some other unspecified alternate location in North Carolina.

CP&L and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither CP&L nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff review has identified any new issue applicable to BSEP that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to BSEP.

CP&L's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The staff reviewed the CP&L analysis for each issue and conducted an independent review of each issue. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at BSEP. Four Category 2 issues are not discussed in this SEIS, because they are specifically related to refurbishment. CP&L has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of BSEP for the license renewal term. In addition, any replacement of components or additional inspection activities that are within the bounds of normal plant operation are not expected to affect the environment outside the bounds of the plant operations evaluated in the *Final Environmental Statement Related to Operation of Brunswick Nuclear Steam Electric Plant Units 1 and 2,* issued by the U.S. Atomic Energy Commission in 1974.

Eleven Category 2 issues related to operational impacts and postulated accidents during the license renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the license renewal term and are only discussed in this SEIS in relation to operation during the license renewal term. For all 11 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs and the individual plant examination of external events report for BSEP and the plant improvements already made, CP&L identified 12 potentially cost-beneficial SAMAs. CP&L has committed to further evaluate these 12 SAMAs. The staffs concludes that three additional SAMAs are potentially cost-beneficial. However, none of the potentially cost-beneficial SAMAs identified relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

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

If the BSEP OLs are not renewed and the units cease operation on or before the expiration of the current OLs, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of BSEP. The impacts may, in fact, be greater in some areas.

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

Abbreviations/Acronyms

µm	micrometer(s)
ac	acre(s)
AC	alternating current
ACC	averted cleanup and decontamination costs
ADAMS	Agencywide Document Access and Management System
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOG	augmented off-gas
AOSC	averted onsite costs
APE	(cultural resources) area of potential effect (Section 2.2.9)
APE	(SAMA) present value of averted public exposure (Section 5.2)
ATWS	anticipated transient without scram
AQCR	air quality control region
Bq	becquerel(s)
BSEP	Brunswick Steam Electric Plant, Units 1 and 2
Btu	British thermal unit(s)
BWR	boiling water reactor
BWROG	Boiling Water Reactor Owners Group
°C	Degree Celsius
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
Ci	curie(s)
cm	centimeter(s)
COE	cost of enhancement
COPC	chemicals of potential concern
CP&L	Carolina Power & Light Company
CRD	control rod drive
CWA	Clean Water Act
DBA	design-basis accident(s)
DC	direct current
DCH	direct containment heating
DHR	decay heat removal
DOE	U.S. Department of Energy

DPR	demonstration project reactor
DSM	demand-side management
EA	environmental assessment
EDG	emergency diesel generator
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EOP	Emergency Operating Procedure
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPU	extended power uprate
EQ	equipment qualification
ER	Environmental Report
ESA	Endangered Species Act
ESRP	Environmental Standard Review Plan, NUREG-1555, Supplement 1, Operating License Renewal
°F	Degree Fahrenheit
FAA	U.S. Federal Aviation Administration
FES	final environmental statement
FONSI	finding of no significant impact
FR	Federal Register
FSAR	Final Safety Analysis Report
ft	foot/feet
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act of 1977)
FWS	U.S. Fish and Wildlife Service
g/d	gallons per day
gal	gallon(s)
GDC	general design criteria
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437
GIS	geographic information system
GL	Generic Letter
gpm	gallons per minute
ha	hectare(s)
HCLPF	high confidence of low probability of failure
HCTL	heat capacity temperature limit

HEP	human error probability
HHSI	high heady safety injection
HLW	high-level waste
hr	hour(s)
Hz	hertz
HIC	high-integrity container
HVAC	heating, cooling, and air-conditioning
in.	inch(es)
IPA	integrated plant assessment
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing systems loss-of-coolant accident
J	joule(s)
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kV/m	kilovolts per meter
kWh	kilowatt hour(s)
L	liter(s)
L/s	liters per second
lb	pound(s)
LERF	large early release frequency
LLW	low-level waste
LNG	liquefied natural gas
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LWR	light-water reactor
m	meter(s)
m/s	meters per second
m^3/d	cubic meters per day
m^3/s	cubic meters per second
mA	milliampere(s)
MAAP	Modular Accident Analysis Program
MACCS2	MELCOR Accident Consequence Code System 2
MACR	maximum averted cost risk

MCR	main control room
MGD	million gallons per day
mi	mile(s)
mL	milliliter(s)
MMACR	modified maximum averted cost risk
MOVs	motor-operated valves
mph	miles per hour
mrad	millirad
mrem	millirem
MSIV	main steam isolation valve
msl	mean sea level
MT	metric ton(s) (or tonne[s])
MTHM	metric tonnes heavy metal
MTU	metric ton(s)-uranium
MW	megawatt(s)
MWd/MTU	megawatt-days per metric ton of uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NA	not applicable
NAS	National Academy of Sciences
NCDENR	North Carolina Department of Environment and Natural Resources
NCNHP	North Carolina Natural Heritage Program
NCI	National Cancer Institute
NCSDC	North Carolina Statistical Data Center
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
ng/J	nanogram per joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NWPPC	Northwest Power Planning Council
ODCM	Offsite Dose Calculation Manual
OL	operating license

PAME	primary amoebic meningoencephalitis
$PM_{2.5}$	particulate matter, 2.5 microns or less in diameter
PM_{10}	particulate matter, 10 microns or less in diameter
ppt	parts per thousand
PSA	Probabilistic Safety Assessment
PSD	prevention of significant deterioration
RAI	request for additional information
RCIC	reactor core isolation cooling
RCS	reactor coolant system
REMP	radiological environmental monitoring program
RLE	review level earthquake
rms	root mean square
RPC	replacement-power cost
RRW	risk-reduction worth
s	second(s)
SAMA	Severe Accident Mitigation Alternative(s)
SAR	Safety Analysis Report
SBO	station blackout
SBLOCA	small break loss-of-coolant accident
SCR	selective catalytic reduction
SEIS	supplemental environmental impact statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
UAT	unit auxiliary transformer
UDB	urban development boundary
UFSAR	Updated Final Safety Analysis Report
U.S.	United States
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
USI	Unresolved Safety Issue
W	watt(s)
yr	year

1.0 Introduction

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

The Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., operates Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) in southeastern North Carolina under NRC OLs DPR-71 and DPR-62. The OL for Unit 1 will expire September 8, 2016, and the Unit 2 license will expire December 27, 2014. On October 18, 2004, CP&L submitted an application to the NRC to renew the BSEP OLs for an additional 20 years under 10 CFR Part 54. CP&L is a *licensee* for the purposes of its current OLs and an *applicant* for the renewal of the OLs. Pursuant to 10 CFR 54.23 and 51.53(c), CP&L submitted an Environmental Report (ER) (CP&L 2004) in which CP&L analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

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

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

1.1 Report Contents

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

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

Additional information is included in the appendixes. Appendix A contains public comments received at the scoping meetings on the environmental review for license renewal and staff responses to the public comments. Appendixes B through G, respectively, list the following:

- the preparers of the supplement

- the chronology of the NRC staff's environmental review correspondence related to this SEIS

- the organizations contacted during the development of this SEIS

- CP&L's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process)

- GEIS environmental issues that are not applicable to BSEP
- NRC staff evaluation of severe accident mitigation alternatives.

1.2 Background

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

1.2.1 Generic Environmental Impact Statement

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

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

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

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

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

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

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

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues and 21 qualified as Category 2 issues. Two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized and are addressed in plant-specific analyses. Environmental justice was not evaluated on a generic basis in the GEIS, and information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared. Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the license renewal term, and 8 apply to both refurbishment and operation during the license renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

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

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

- provide an analysis of the Category 2 issues identified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, in accordance with 10 CFR 51.53(c)(3)(ii)

- discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

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

- consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered or (2) relevant to mitigation

- consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives

- discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b)

- contain an analysis of any Category 1 issue unless there is significant new information on a specific issue – this is pursuant to 10 CFR 51.53(c)(3)(iii) and (iv).

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

In preparing to submit its application to renew the BSEP OLs, CP&L developed a process to ensure that (1) information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for BSEP would be properly reviewed before submitting the ER and (2) that such new and potentially significant information related to renewal of the licenses for Units 1 and 2 would be identified, reviewed, and assessed during the period of NRC review. CP&L reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to BSEP. This review was performed by personnel from CP&L and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER.

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

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

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the CP&L license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the *Federal Register* (69 FR 70471) on December 6, 2004. The staff published a notice of intent to prepare an EIS and conduct scoping (70 FR 2188) on January 12, 2005. Two public scoping meetings were held on January 27, 2005, in Southport, North Carolina. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Brunswick Steam Electric Plant, Units 1 and 2, Southport, North Carolina* (NRC 2005). These comments are also presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1, in the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff and contractors retained to assist the staff visited the BSEP site on January 25 and 26, 2005, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to BSEP were reviewed and are referenced.

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

A 75-day comment period to allow members of the public to comment on the preliminary results of the NRC staff's review will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS. During this comment period, two public meetings will be held in Southport, North Carolina, in October 2005. During these meetings, the staff will describe the preliminary results of the NRC environmental review and answer questions related to it to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for BSEP Units 1 and 2. BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. Wilmington, North Carolina, is approximately 15 miles north of the BSEP site, and Myrtle Beach, South Carolina, is approximately 50 miles to the southwest. BSEP uses boiling water reactors and steam-driven turbine generators manufactured by General Electric. Upon completion of the extended power uprate in the spring of 2005, each reactor will have a licensed core thermal level of approximately 2923 megawatts-thermal, and Units 1 and 2 will be capable of generating 958 and 952 megawatts-electrical, respectively. Plant cooling is provided by withdrawing water from the Cape Fear River. The current OL for Unit 1 expires on

September 8, 2016, and the OL for Unit 2 expires on December 27, 2014. By letter dated October 20, 2004, CP&L submitted an application to the NRC (CP&L 2004) to renew these OLs for an additional 20 years of operation (i.e., until September 2036, for Unit 1 and December 2034, for Unit 2).

1.4 The Purpose and Need for the Proposed Action

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

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

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

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

1.5 Compliance and Consultations

CP&L is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements in order to operate BSEP. In its ER, CP&L provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with the BSEP license renewal. Authorizations and consultations relevant to the proposed OLs renewal action are included in Appendix E of this SEIS.

The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that BSEP is in compliance with applicable environmental standards and requirements for BSEP. The staff has not identified any environmental issues that are both new and significant.

1.6 References

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

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

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

69 FR 70471. December 6, 2004. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for a Hearing Regarding Renewal of License Nos. DPR-71 and DPR-62 for an Additional 20-year Period." *Federal Register*, U.S. Nuclear Regulatory Commission.

70 FR 2188. January 12, 2005. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register.* U.S. Nuclear Regulatory Commission.

Atomic Energy Act of 1954. 42 USC 2011, et seq.

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report – Operating License Renewal Stage, Brunswick Steam Electric Plant, Units No. 1 and 2.* Docket Nos. 50-325 and 50-324, Southport, North Carolina.
National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report.* "Section 6.3 – Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2005. *Environmental Impact Statement Scoping Process: Summary Report – Brunswick Steam Electric Plant, Unit No. 1 and 2, Southport, North Carolina.* Washington, D.C.

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

The Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) is owned by Carolina Power & Light Company (CP&L), currently operating as Progress Energy Carolinas, Inc. The facility is located in Brunswick County in southeastern North Carolina near the mouth of the Cape Fear River. BSEP is a two-unit plant using boiling water reactors (BWRs) and steam-driven turbine generators manufactured by General Electric. The plants have been operating since 1974 (Unit 2) and 1976 (Unit 1). BSEP obtains its cooling water from the Cape Fear River and discharges into the Atlantic Ocean about 2000 ft offshore. The station and its environs are described in Section 2.1, and its interaction with the environment is presented in Section 2.2.

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

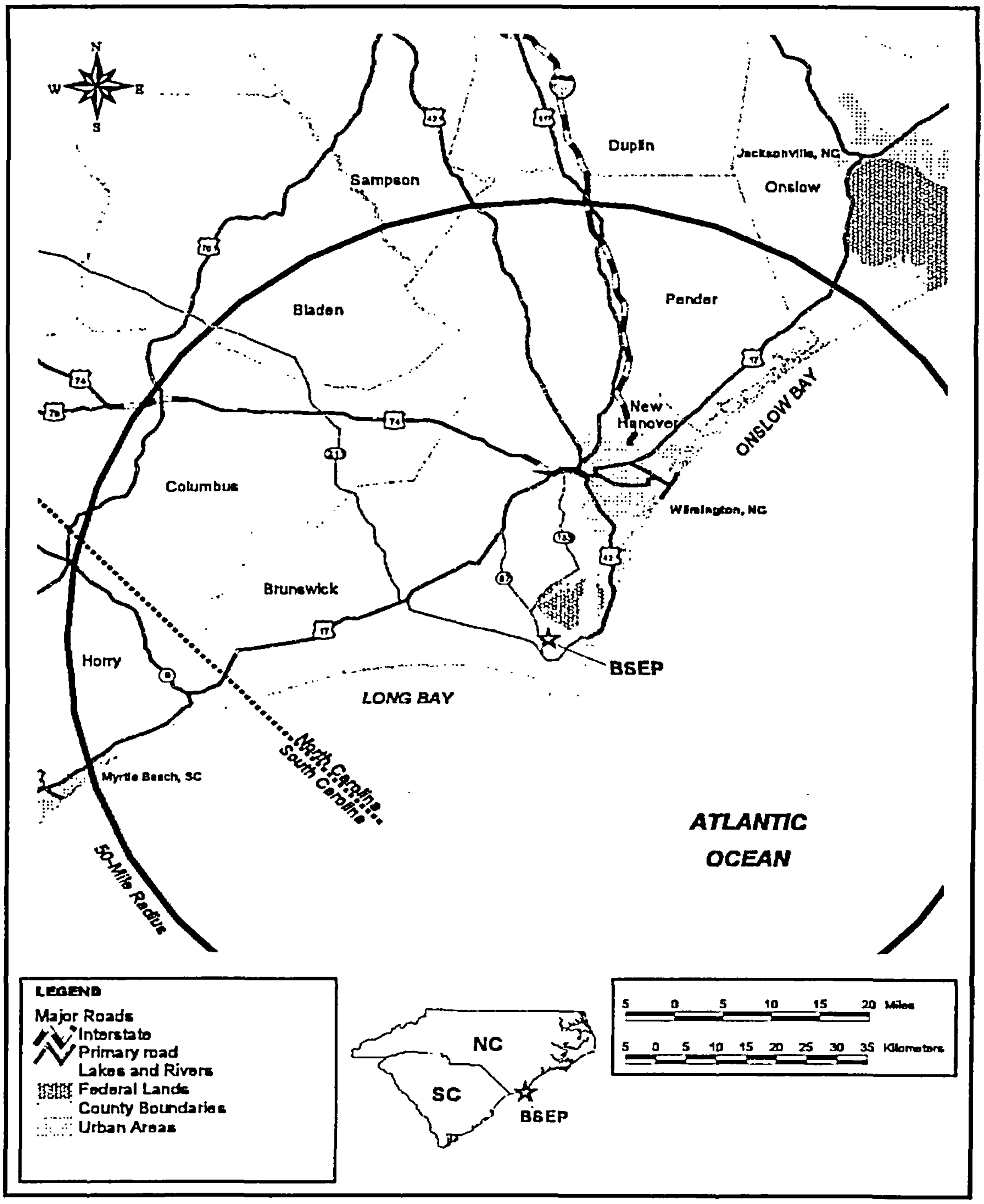
The BSEP site is 15 miles (mi) south of Wilmington, North Carolina, in Brunswick County and is 50 mi northeast of Myrtle Beach, South Carolina. The area within a 6-mi radius of the site includes the town of Southport, the community of Boiling Spring Lakes, and the resort communities of Caswell Beach, Oak Island, and Bald Head Island. The Military Ocean Terminal Sunny Point is situated immediately to the north of the BSEP site. Figures 2-1 and 2-2 show the site location and features within 50 and 6 mi, respectively.

Cooling water for BSEP is a once-through heat dissipation system in which water is drawn from the Cape Fear River and is transported to BSEP by way of a 3-mi-long intake canal from the river through Snows Marsh to the plant. After passing through the plant's condensers, the heated water travels through a 6-mi-long discharge canal to Caswell Beach where it is pumped 2000 ft offshore through underwater discharge pipes into the Atlantic Ocean.

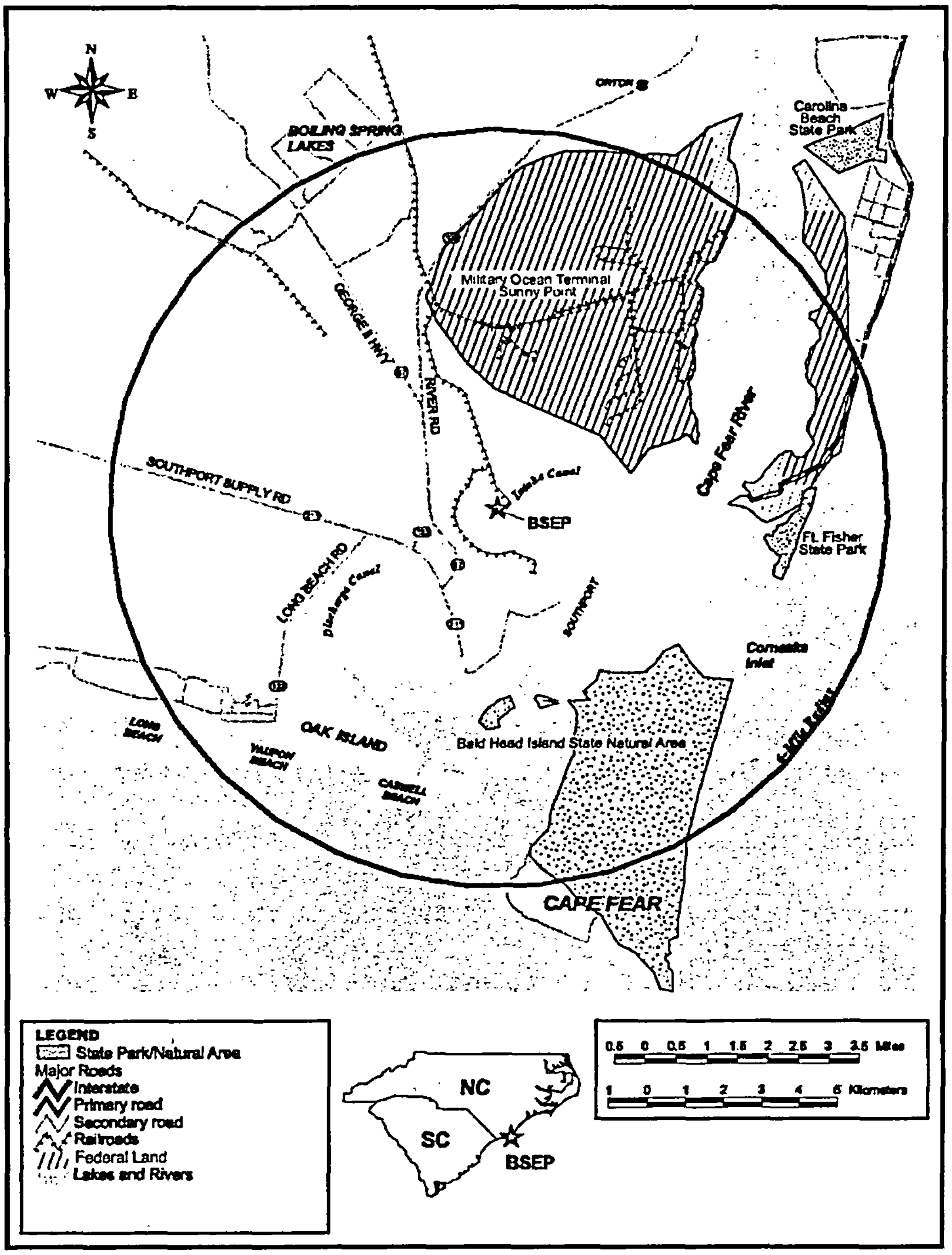
2.1.1 External Appearance and Setting

BSEP is situated on approximately 1200 ac of land near the mouth of the Cape Fear River. The site boundary is approximately 962 acres (Figure 2-3). The protected area is surrounded by a perimeter fence. It contains the two reactor buildings and the turbine, control, radwaste, and diesel generator buildings. The major administrative and support facilities cover about 130 acres. Figure 2-4 shows the general plant layout.

The intake canal runs from the Cape Fear River, through a fish diversion structure, and through Snows Marsh to the plant. A fish return system diverts many of the fish and other organisms that were impinged on the traveling screens back to the Cape Fear Estuary. Cooling water



1 **Figure 2-1.** Location of BSEP, 50-Mile Region



1 **Figure 2-2.** Location of BSEP, 6-Mile Region

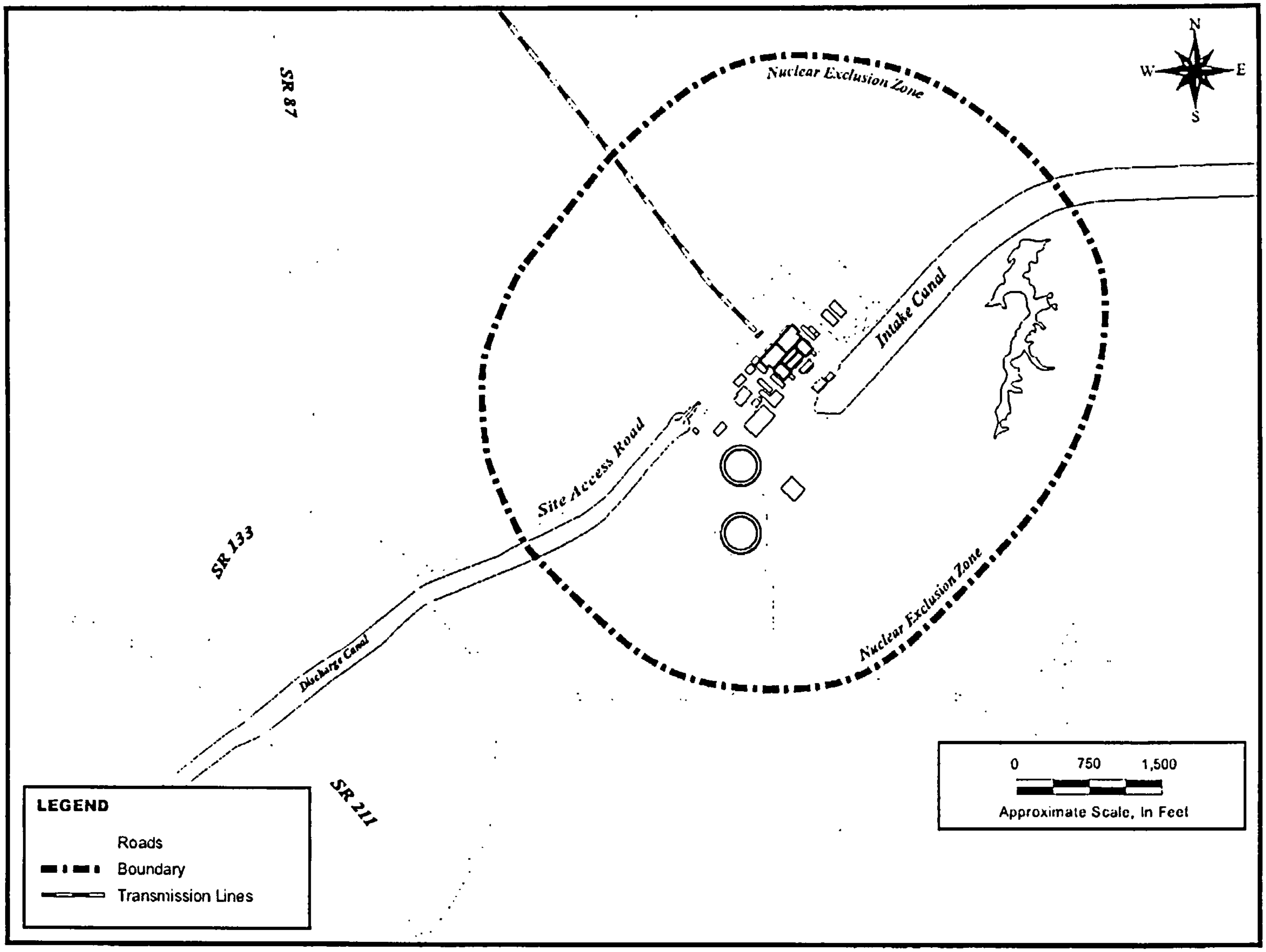


Figure 2-3. BSEP Site Boundary Map

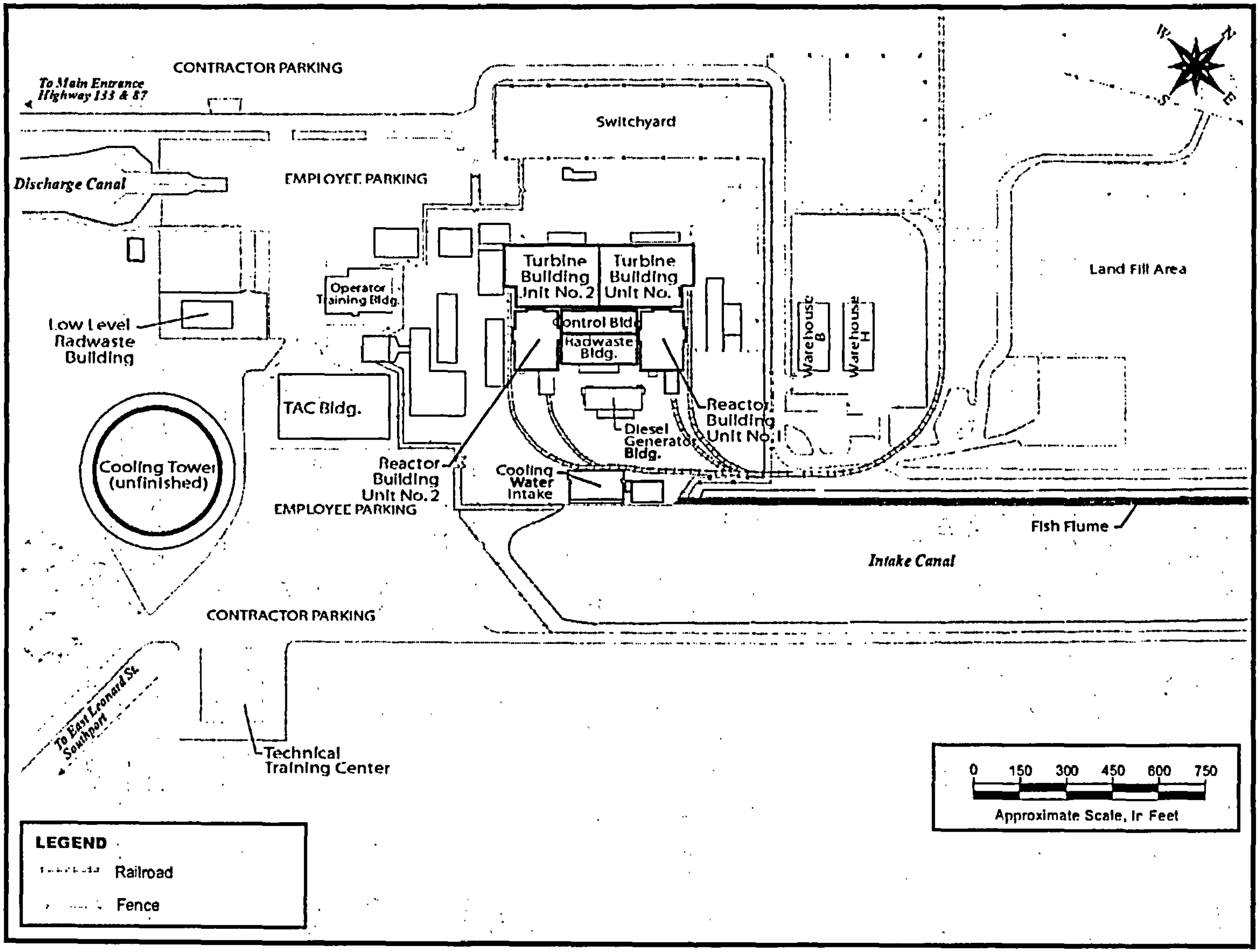


Figure 2-4. BSEP General Plant Layout

from the canal passes through the plant's condensers, and the heated water travels 6 mi through a discharge canal to Caswell Beach, before being pumped 2000 ft offshore through underwater pipes into the Atlantic Ocean (CP&L 2004a).

The plant is located in the eastern-most part of the Coastal Plain Physiographic Province near the southeastern border of North Carolina. It is in a region of low relief with elevations ranging from sea level to about 30 ft above mean sea level. Extensive areas of marshes and swamps occur in the region (AEC 1974). The area immediately surrounding the BSEP site is a mix of agricultural lands, woodlands, swamps, and marshes. Except for Southport and the few small local communities, the area is rural in nature with privately-owned forestland, forested wetland, and crop land (CP&L 2004a). The Cape Fear Estuary is an important waterway in the region, and the lower Cape Fear area is important for recreation in the area (AEC 1974).

2.1.2 Reactor Systems

BSEP is a two-unit plant, each with a BWR and a steam-driven turbine generator manufactured by General Electric. United Engineers and Constructors, Inc. was the architect/engineer for the project, and Brown and Root, Inc. was the construction contractor. As originally built and operated, each of the BSEP units had a design rating of 2436 megawatts-thermal [MW(t)], with a corresponding net electrical output of approximately 821 megawatts-electric [MW(e)]. In 1996, the U.S. Nuclear Regulatory Commission (NRC) approved an increase in the licensed maximum core thermal levels for the BSEP units to 2558 MW(t) per unit. In May 2002, the NRC approved a second uprate. Plant modifications needed to support the extended power uprate (EPU) were completed during the outage in the spring of 2005; each reactor has a licensed core thermal level of approximately 2923 MW(t). Unit 1 is capable of generating 958 MW(e), and Unit 2 is capable of generating 951 MW(e). Fuel enrichment at BSEP will increase to approximately 4.4 percent as a result of the EPU with burnup remaining at approximately 45,000 megawatt days per metric ton uranium.

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.

Spent fuel is currently stored onsite in a storage pool. Certain spent fuel elements meeting burnup and cooling criteria are shipped offsite for storage. CP&L is considering building a dry cask storage facility for BSEP (CP&L 2004a).

2.1.3 Cooling and Auxiliary Water Systems

Cooling water for BESP is obtained from the lower Cape Fear River Estuary and discharged to the Atlantic Ocean. Water passes from the lower Cape Fear Estuary through screens used to limit the entrainment of biota into the intake canal. The 3-mi-long intake canal flows via gravity from the screens at the Cape Fear River to the plant. At the plant, cooling water is drawn through a combination of eight bays (four for each unit). Each bay has a trash rack, traveling screens, and an intake pump. For each unit, two bays have fine mesh (1-mm) screens, and the other two bays have half fine mesh and half coarse (3/8-in.; 9.4-mm) mesh screens. Typically, each unit operates with two of the fine mesh bays and one of the half fine bays. Biota impinged on the traveling screens are flushed through a trough to a holding basin before being released to Walden Creek, which flows into the Cape Fear River.

After passing through the plant the discharge water is released to a 6-mi-long canal that flows by gravity to a stilling basin at Caswell Beach. From there, the effluent is pumped through a 2000-ft submerged pipe and discharged offshore into the Atlantic Ocean. Chlorine is injected into the circulating water intake system to prevent biofouling. Total residual chlorine is monitored under terms of the plant's National Pollutant Discharge Elimination System (NPDES) permit before the effluent is pumped into the ocean.

BSEP receives potable and process water from the Brunswick County Public Utilities. CP&L reports that from 1996 through 2001, BSEP's water imports averaged 0.23 million gallons per day (MGD). Most of the water treated by Brunswick County Public Utilities is surface water from the lower Cape Fear River. BSEP operates one groundwater well onsite to supply water to the biological laboratory. The well has a rated capacity of 30 gpm, but the actual use is far less than this rated capacity.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, and solid wastes. BSEP uses radioactive waste management systems to collect and process these wastes before they are released to the environment or shipped to offsite disposal facilities. The waste disposal systems meet the design objectives and release limits as set forth in Title 10 of the Code of Federal Regulations (CFR) Part 20 and 10 CFR Part 50, Appendix I ("Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As is Reasonably Achievable' for Radiological Material in Light-Water-Cooled Nuclear Power Reactor Effluents"), and controls the processing, disposal, and release of radioactive wastes. Unless otherwise noted, the descriptions of the radioactive waste management systems and effluent control systems for liquid, gaseous, and solid wastes presented here

(Sections 2.1.4.1, 2.1.4.2, and 2.1.4.3, respectively) are based on information provided in the *Brunswick Steam Electric Plant Updated Final Safety Analysis Report* (CP&L 2001).

The liquid and gaseous radioactive waste systems are designed to reduce the activity in the wastes so the concentrations in routine discharges are below the applicable regulatory limits. Liquid waste releases to the discharge canal occur in batches, which are monitored during discharge and diluted by the circulating water flow. Gaseous wastes are processed and routed to a common tall stack for release to the atmosphere, or filtered and released through the turbine and reactor building vents. The liquid and gaseous effluents are continuously monitored, and discharge is stopped if the effluent concentrations exceed predetermined levels.

Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but as a result of fuel cladding failure and corrosion, small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination. Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids, and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service as well as contaminated protective clothing, paper, rags, and other trash generated from plant operations, during design modification, and during routine maintenance activities. The solid waste disposal system is designed to package solid wastes for removal to disposal facilities. Some solid waste is temporarily stored onsite.

Fuel assemblies that have exhausted a certain percentage of their fuel and that are removed from the reactor core for disposal are called spent fuel. BSEP Units 1 and 2 currently operate on 24-month refueling cycles, with one unit refueled each year. Spent fuel is temporarily stored in spent fuel pools, with each unit having its own pool, or is shipped offsite for storage in spent fuel pools at CP&L's Shearon Harris Nuclear Power Plant. In April 2003, CP&L announced that it was considering construction of an independent spent fuel storage installation (ISFSI) for storage of spent fuel in dry storage casks at BSEP (CP&L 2004a).

The Offsite Dose Calculation Manual (ODCM) for BSEP describes the methods used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from BSEP (CP&L 2004b). The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with NRC regulations.

In the fall of 2001, CP&L submitted a request to NRC to amend the BSEP facility operating licenses to allow for a EPU of 15 percent, from 2558 MW(t) to 2923 MW(t) (CP&L 2004a). The NRC prepared an environmental assessment (EA) and finding of no significant impact (FONSI) for this action, concluding that the issuance of the amendment would not have a significant effect on the quality of the human environment (67 FR 36040). In the EA and FONSI, NRC concluded that the uprate could result in up to a 15 percent increase in the amount of radioactive material in gaseous effluents, no significant increase in the amount of radioactive material in liquid effluents, and up to a 15 percent increase in solid radioactive wastes (67 FR 36040). Concentrations in effluents and the resulting offsite doses would continue to be well within applicable regulatory limits (67 FR 36040). The EPU was completed in the spring of 2005 (CP&L 2004a).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The liquid radioactive waste system receives and processes all radioactive or potentially radioactive liquid wastes from multiple sources in both units. The wastes received are of different purities and chemical compositions. The liquid radioactive waste system is used to process these wastes to make them suitable for either reuse within the plant or for release to the discharge canal where dilution occurs with the circulating water.

The principal sources of liquid waste are equipment drains (high purity), floor drains (medium to low purity), chemical wastes (very low purity), detergents, and oily liquid drains. The larger volumes of liquid radioactive waste are contained within completely closed tanks that are vented to the radioactive waste building ventilation system. The salt water release tank is also connected to the liquid radioactive waste system. The salt water release tank, an open top tank in the turbine building pipe tunnel, is used to collect, monitor, and release salt water leakage and low-activity, low-purity liquids.

High-purity liquid waste is liquid effluent having a low conductivity, thus making it generally reclaimable for reuse within the nuclear facility. High purity wastes are recycled, except shortly after refueling operations, when a portion or all of the processed refueling water is discharged (after proper treatment and monitoring) to maintain plant operational liquid inventory balance. These wastes are collected in the waste collector tank from a variety of sources, including the equipment drain sumps in the drywell, reactor building, radioactive waste building, and turbine building. The high-purity wastes are processed by filtration and ion exchange and sampled. If the analysis of the sample reveals water of a conductivity greater than administrative controls allow, it is returned to the system for additional processing or temporarily stored in the waste surge tank. If the water is satisfactory for reuse, it is transferred to the condensate storage tank and used as makeup water.

Medium- to low-purity waste is normally processed for recycle or release, depending on the level of impurity. This waste typically comes from floor drain sumps in the drywell, reactor building, radioactive waste building, and turbine building. This waste normally has low concentrations of radioactive impurities and is processed by filtration.

Chemical or very low-purity waste is collected in the waste neutralizer tank or other suitable containers. This waste typically comes from a variety of sources, including the condensate demineralizer area, decontamination drains and solutions, and laboratory drains. This waste has variable radioactivities and high conductivity. The waste can be treated in the waste neutralizer tank and subsequently processed through the waste filter and demineralizer or can be discharged, evaporated, or processed by vendor skids.

Detergent waste, which typically comes from laundry drains, cask or area cleaning fluids, and personnel decontamination stations, are normally of low specific activity. Connections to an optional vendor processing skid have been provided to facilitate treatment of the detergent drain tank water. The detergent drains are released routinely after proper sampling and monitoring. Detergent wastes are filtered prior to release. The shop drains and the turbine building oily drains are taken to an oil separator skid where the water and oil are separated.

Liquid waste releases occur in a batch mode and are released with the circulating water to the discharge canal. All batches scheduled for release are sampled and analyzed and then monitored during the discharge process. Batch releases occur only when the plant water inventory demands it and the following conditions are met: (1) the liquids have purity levels and chemical compositions suitable for release, (2) laboratory analysis indicate that activity levels are sufficiently low, and (3) circulating water dilution flow exists to the extent necessary to meet predetermined release parameters so that compliance with 10 CFR Part 20 and Appendix I of 10 CFR Part 50 will always be maintained.

Protection against accidental discharge is provided by redundancy in design, instrumentation for detection and alarm of abnormal conditions, and administrative controls. The actual mechanics of a discharge require the opening of at least two separate valves, actuation of pumps, and opening of the valves on the pump discharge. These operations are required to occur in series, so failure of any one will prevent a discharge. Radioactivity is monitored during the discharge, which automatically terminates if the activity exceeds preset levels.

Annual liquid effluents reported in the *Brunswick Steam Electric Plant Annual Radioactive Effluent Release Reports* for the years 1999 through 2003 (PEC 2000a, 2001a, 2002a, 2003b, 2004a) were reviewed to evaluate yearly releases. Liquid effluent releases are reported for both BSEP units combined. Over this period, an annual average of 45 batch discharges of liquid effluents containing fission and activation products occurred. The annual average activity released in liquid effluents was 5.6×10^{-3} Ci/yr of fission and activation products and 83.1 Ci/yr of tritium (including releases from the storm water collection system, discussed below in Section 2.1.5). All liquid discharges were well within the NRC regulatory limits. The radioactivity contained in liquid discharges is not expected to increase as a result of the EPU completed in 2005 (67 FR 36040). CP&L does not anticipate any significant annual increases in liquid waste effluents during the license renewal term.

See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of liquid effluent releases.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

At BSEP, gaseous releases may occur from the 100-m plant stack, the turbine building vents, and the reactor building vents. Sources of releases to the stack are the main condensor steam jet air ejectors, the radioactive waste building and off-gas charcoal absorber building ventilation system exhausts, mechanical vacuum pump exhausts during startup, and gland seal off-gases. Releases from the turbine and reactor building vents result from steam leakage through valve stems, pump seals, and flanged connections. BSEP ventilation systems are designed to maintain gaseous effluents to levels as low as reasonably achievable. This is accomplished by a combination of holdups for decay of short-lived radioactive material, filtration, and monitoring.

The gaseous radioactive waste system processes and disposes of non-condensible gases from the main condenser air ejectors, the startup vacuum pumps, and the gland seal condensers. During normal operation, noncondensible gases are produced in the reactor coolant and must be continuously removed to maintain turbine efficiency. These gases include hydrogen and oxygen from radiolysis of water, mixed fission products, activation products, and air from condenser in-leakage. Off-gas is discharged from the condenser via steam-jet air ejectors and diluted with steam to keep hydrogen levels below explosive concentrations. The off-gas is then passed through a system where hydrogen and oxygen are catalytically recombined into water. After recombination, the off-gas is routed to a condenser to remove moisture, and then through a 30-minute delay pipe before entering the augmented off-gas (AOG) charcoal adsorber system. The AOG charcoal adsorber system provides a long delay period for radioisotope decay as the off-gas passes through. Off-gas exiting the AOG charcoal adsorber system is routed to the 100-m plant stack for release to the environment. A separate AOG charcoal adsorber system is provided for each unit.

Off-gases from the gland seal condenser, startup vacuum pumps, and the radioactive waste building ventilation exhausts bypass the AOG charcoal adsorber system, and are routed to the plant stack to minimize release points to the environment, provide for continuous monitoring of effluent, and take advantage of additional atmospheric dispersion. The exhaust from each turbine building is filtered using high-efficiency particulate air and charcoal adsorption filters. Continuous radiation monitoring is provided at various points in each system.

Gaseous effluents were reported in the *Annual Brunswick Steam Electric Plant Radioactive Effluent Release Reports* for the years 1999 through 2003 (PEC 2000a, b; 2001a, b; 2002a, b; 2003b, c; 2004a, b). Gaseous effluents are reported for both units combined. During this 5-yr period, the average annual releases of radioactive effluents were as follows:

- 674 Ci/yr of noble gases
- 1.99×10^{-2} Ci/yr of radioiodine
- 4.64×10^{-3} Ci/yr of beta and gamma emitters as particulates
- 118 Ci/yr of tritium.

All gaseous effluents were well within the NRC regulatory limits. As noted above, the EPU completed in 2005 could result in up to a 15 percent increase in the amount of radioactive material in gaseous effluents (67 FR 36040). However, such an increase would not result of gaseous effluents exceeding applicable regulatory limits. CP&L does not anticipate any significant annual increases in gaseous waste effluents during the license renewal term, beyond the increase from the EPU.

See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of gaseous releases.

2.1.4.3 Solid Waste Processing

The solid waste management system at BSEP is designed to collect, process, store, package, and prepare solid radioactive waste materials for offsite shipment. Some solid waste is temporarily stored onsite. Solid wastes consist of spent (dewatered) resin, filters, filter sludge, evaporator bottoms, concentrated wastes, dry compressible waste, air filters from radioactive ventilation systems, irradiated components (control rods, etc.), contaminated clothing and tools, paper and rags from contaminated areas, and used reactor equipment. The solid waste system is used to process dry and wet solid radioactive wastes, and is common to Units 1 and 2.

Dry solid waste is low activity level waste consisting of contaminated air filters, miscellaneous paper, rags, solid laboratory wastes, clothing, tools, and equipment parts. The dry solid waste is normally stored temporarily in various work areas and then moved to the process area. Most waste of this type has relatively low radioactive content and may be handled manually. This waste is compressed into authorized containers for offsite shipment or interim onsite storage.

Irradiated reactor components consist primarily of spent control blades, fuel channels, in-core ion chambers, and large pieces of equipment. Because of the high activation and contamination levels, these components are stored in the spent fuel storage pool before removal to onsite or offsite storage and final disposal in shielded containers.

Wet solid waste includes spent demineralizer resins, beaded charcoal, and filter and tank sludges. The spent resins and accumulated sludges are de-watered in a vendor-supplied dewatering system and placed in shipping containers constructed in accordance with U.S. Department of Transportation regulations. If warranted by the radioactive content, these containers can be shipped in a cask licensed by the NRC. The processing of wet solid waste is accomplished remotely under manual control of an operator behind shield walls. Suitable containers are brought into the processing area where they are transferred to the filling station where de-watered solid waste is added. Demineralizer resins, beaded charcoals, filter sludges, and evaporator concentrates are handled separately because of their differing de-watering requirements.

Transportation and disposal of solid radioactive wastes are performed in accordance with the applicable requirements of 10 CFR Parts 71 and 61, respectively. There are no releases to the environment from solid radioactive wastes created at BSEP. During the period 1999 through 2003, the annual average amount of solid radioactive waste shipped from BSEP was 382 m^3/yr containing 14,900 Ci/yr of activity from both units combined (PEC 2000a, 2001a, 2002a, 2003b, 2004a).

2.1.5 Nonradioactive Waste Systems

The principal nonradioactive wastes from BSEP include various solid waste, chemical waste, sanitary waste, as well as storm water runoff.

Uncontaminated waste is collected in designated containers located throughout the plant. Once filled, the containers are surveyed for the presence of loose surface contamination and then transported to the clean material processing facility. The chemical storage building is used as a central collection facility to process uncontaminated chemicals, paint, oil, fluorescent bulbs, and other items that have either been used or exceeded their useful shelf life. The materials are received in various forms and are processed to meet all regulatory requirements prior to final disposition. Most items are packaged and shipped to vendors for processing offsite. An open area of approximately 10 ac at BSEP was used as a landfill for office wastes (primarily paper), but was closed in 1997.

Two sewage treatment plants are operated at BSEP. Both are permitted under the NPDES permit, with effluent limits that prescribe discharges below State and Federal regulatory limits. Discharge of both treatment plants is to the discharge canal.

The storm drain collection system has been recognized as a potential effluent pathway because of contaminated liquids entering the storm drains. The drainage collection system consists of an underground network of storm sewer piping, noncontaminated building floor drains, and building roof drainage piping. Surface drainage, runoff after rains, cooling tower blowdown discharge, and the makeup water treatment system discharge feed into the storm water drainage basin.

The storm water drainage basin is a concrete structure with a total capacity of 102,000 gal. An oil skimmer removes surface oils that may be present in the drainage water. The water is directed through a weir into the storm drainage basin pump bay from which it is pumped into a stabilization pond. The stabilization pond covers approximately 64 ac; however, a standpipe located at 30 ft above mean sea level only allows water to collect in 39 ac. The stabilization pond is constructed from a spoils pond used during the dredging of the intake canal. When full, the mean depth of the pond is 3.5 ft. The underflow-overflow discharge structure that leads to the intake canal prevents discharge of oil, grease, and floating debris to the environment.

The stabilization pond discharge is a permitted release point and discharges to the intake canal. In addition, during periods of heavy rains, the storm water drain collector drainage basin can be discharged to the discharge canal. The collector basin is a permitted release point during periods of inclement weather to protect plant personnel and equipment. Releases from the stabilization pond and collector basin are monitored, and the estimated amounts of radioactivity (primarily tritium) released by these pathways are included in the BSEP radioactive liquid effluents summarized in Section 2.1.4.1.

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation. Maintenance activities conducted at BESP include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating, but others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of major components. CP&L refuels each BSEP reactor unit about every 24 months. Each outage is typically scheduled to last approximately 35 days and about one-third of the core is replaced at each refueling. Approximately 1000 additional workers are onsite during a typical reactor outage.

CP&L performed an aging management review and developed an integrated plant assessment (IPA) for managing the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. The aging management program is described in Appendix B of CP&L's application for renewal of the BSEP operating licenses (OLs) (CP&L 2004a). The IPA identified the programs and inspections that are managing the effects of aging at BSEP. CP&L expects to conduct activities related to the management of aging effects during plant operation or during normal refueling and other outages. CP&L has no plans to add additional full-time staff (non-outage workers) at the plant during the license renewal term.

2.1.7 Power Transmission System

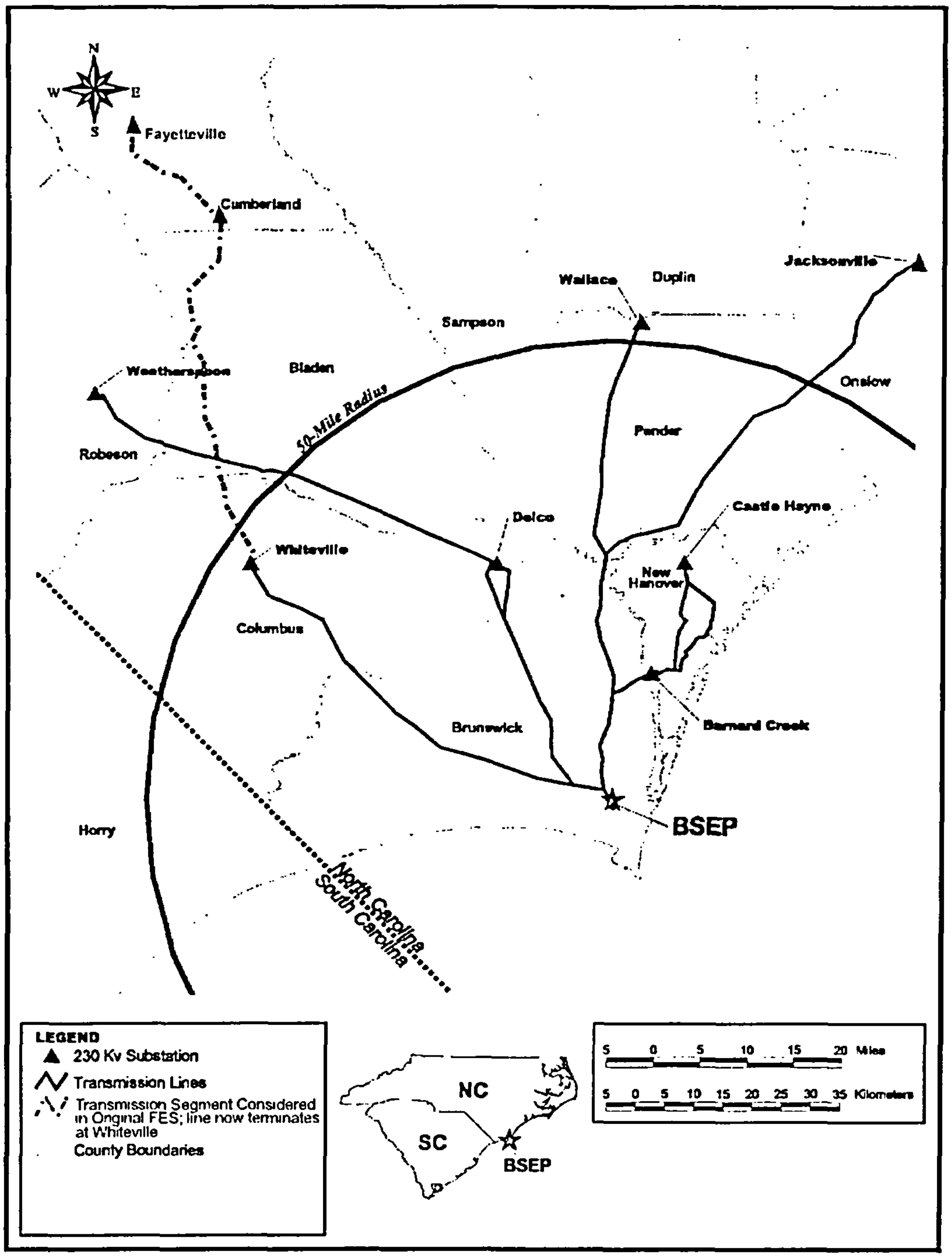
Eight 230-kV transmission lines constructed to connect the BSEP to the electrical power transmission system were described in the final environmental statement for operation of BSEP Units 1 and 2 (AEC 1974). These lines included two lines to the Delco and Barnard Creek substations and lines to the Fayetteville, Wallace, and Jacksonville substations. In addition, 31 mi of new transmission line were constructed to connect BSEP to the Weatherspoon substation. Potential effects of these lines associated with electromagnetic fields were not considered in the Final Environmental Statement for the Brunswick OLs (AEC 1974).

CP&L's Environmental Report (ER) (CP&L 2004a) describes changes to the way in which BSEP is connected to the transmission grid that have occurred since publication of the Final Environmental Statement. The two lines to Barnard Creek substation have been extended to the Castle Hayne substation and Wilmington Corning switching station, located about 12 mi to the north of the Barnard Creek substation. Both the Castle Hayne and the Wilmington Corning lines are considered in their entirety in this supplemental environmental impact statement (SEIS). The original Fayetteville line now connects to the grid at the Whiteville Substation. However, because the Fayetteville line, which was built to connect BSEP to the grid, remains in existence, the full extent of the original line is considered in this SEIS.

The transmission lines are shown in Figure 2-5. To the extent practical, the lines are grouped in common rights-of-way, with the first 1.3 mi of the right-of-way containing all eight lines. At that point the lines separate into two rights-of-way with four lines each. One right-of-way contains lines connecting BSEP to the transmission system to the northwest of the site, and the other contains lines connecting BSEP to the transmission system to the north. In general, the rights-of-way widths are determined by the number of lines. Typically, rights-of-way widths are 100 ft wide for the first line, and increase by 70 ft for each additional line.

In total, about 390 mi of transmission lines in about 260 mi of rights-of-way are considered in this SEIS. The rights-of-way cover approximately 4690 ac. The lengths of the lines and the areas covered by the associated rights-of-way are listed in Table 2-1. In estimating the rights-of-way area for each line, the total area in shared rights-of-way was distributed equally among the lines within the rights-of-way.

The rights-of-way 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 Highway 40 (CP&L 2004a).



1 **Figure 2-5.** BSEP Transmission Line Map

Table 2-1. BSEP Transmission Lines

Substation	Approximate Line Length miles	Estimated Right-of-Way Area acres
Fayetteville	103	900
Weatherspoon	31	460
Delco East	31	320
Delco West	31	300
Wallace	55	720
Jacksonville	75	940
Castle Hayne East	35	650
Wilmington Corning Switching Station	27	400
Total	388	4690

Ongoing right-of-way surveillance and maintenance activities along BSEP transmission lines include routine aerial and ground inspections as well as activities associated with vegetation management. Routine aerial inspections are conducted every 6 months to ensure the integrity of the system and to ensure that any abnormalities are promptly identified and corrective actions or preventive maintenance actions are planned and scheduled (BSEP 2002a). Biennial ground inspections include examinations of structural integrity, clearance of vegetation at questionable locations, and surveillance for dead or dying trees that might fall on the conductors or towers (CP&L 2004a). Maintenance activities may include re-clearing vegetation (mowing, hand cutting, and herbicide application), tree trimming, and danger-tree removal (BSEP 2002b). Mowing and hand cutting, for a specified right-of-way, is conducted on a 3-yr cycle, tree trimming is conducted on a 2-yr cycle, and danger-tree cutting is conducted every 5 to 9 yrs, depending on the transmission line (BSEP 2002c).

CP&L uses several different methods to control vegetation in its transmission line rights-of-way. CP&L employs an integrated vegetation management approach that includes both mechanical and chemical control methods. This approach allows the maintenance practices to be designed to fit the different kinds of terrain and soils that are crossed by the transmission lines. Mechanical methods include pruning, felling, mowing, and hand trimming. Chemical methods include the use of tree growth regulators to slow the growth of fast-growing trees, and U.S. Environmental Protection Agency (EPA)-approved herbicides to control undesirable woody vegetation that regrows after mowing. Over time, the combination of mowing and herbicides results in a community dominated by low-growing, non-woody plants, such as grasses and herbaceous plants that require less maintenance but still provide food and cover for wildlife (PEC 2005a).

CP&L and the North Carolina Department of Environment and Natural Resources (NCDENR) signed a Memorandum of Understanding in 1993 to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission line rights-of-way (CP&L and NCDENR 1993). The company protects rare plant species on its rights-of-way through several best management practices (PEC 2005a). CP&L and contractor personnel that are involved in transmission line maintenance activities must complete environmental training regarding endangered species (BSEP 2003). These personnel are responsible for familiarizing themselves with any identified rare plants in their work area. They must comply with rare plant signs posted within or along the right-of-way. CP&L personnel also install, maintain, and monitor stakes and signs that are posted at the known rare plant locations (BSEP 2005b). The use of herbicides, heavy equipment and mowing is prohibited at known rare plant locations during the active, "above-ground" period of the plants growing cycle. Therefore, maintenance activities are normally conducted in the fall and winter, after frost, in those segments of transmission line rights-of-way that contain rare plants (BSEP 2003).

2.2 Plant Interaction with the Environment

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

2.2.1 Land Use

BSEP is located in unincorporated Brunswick County in southeastern North Carolina. The plant is located in the southeastern portion of the county near the mouth of the Cape Fear River. The BSEP site is zoned Industrial by Brunswick County (Brunswick County 1997), and comprises approximately 1200 ac.

Section 307(c)(3)(A) of the Coastal Zone Management Act [16 USC 1456(c)(3)(A)] requires applicants for Federal licenses to conduct an activity in a coastal zone to provide to the licensing agency a certification that the proposed activity complies with the enforceable policies of the State's coastal zone program. A copy of the certification is also to be provided to the State. The State is to notify the Federal agency whether the state concurs with or objects to the applicant's certification. This notification is to occur within 6 months of the State's receipt of the certification. BSEP is within North Carolina's coastal zone for purposes of the Coastal Zone

Management Act. Progress Energy's certification that renewal of the BSEP OLs would be consistent with the North Carolina coastal management program is in Appendix E of its ER (CP&L 2004a). Correspondence among North Carolina agencies related to the certification is in Appendix E of this SEIS.

2.2.2 Water Use

With the exception of the small increase in evaporative water loss resulting from the increase in temperature of the water discharged from the once-through cooling system, the cooling system does not consumptively use water. Water withdrawn from the lower Cape Fear River Estuary for cooling is returned to the Atlantic Ocean. Except during extremely high flow conditions in the Cape Fear River, a significant portion of the water entering the BSEP intake is brackish water that originated in the Atlantic Ocean. During the months of January through April, the average monthly discharge of freshwater from the Cape Fear River exceeds 8000 cubic feet per second (cfs). During the months of June through November, the average monthly discharge of fresh water from the Cape Fear River is less than 4000 cfs. The daily maximum intake by BSEP is limited to 2210 cfs and 1844 cfs during April through November and December through March, respectively. BSEP discharges to the Atlantic Ocean 2000 ft offshore of Caswell Beach.

BSEP receives potable and process water from the Brunswick County Public Utilities. CP&L reports that from 1996 through 2001, BSEP's water imports averaged 0.23 MGD. The source of the majority of water imported from Brunswick County Public Utilities is surface water from the lower Cape Fear River.

2.2.3 Water Quality

Pursuant to the Federal Water Pollution Control Act (also known as the Clean Water Act), discharges from operation of BSEP are regulated by an NPDES permit. The EPA has delegated the administration of the NPDES permit process in North Carolina to the NCDENR's Division of Water Quality. NCDENR issued NPDES permit NC0007064 on June 30, 2003, for BSEP. The permit requires periodic renewal and the current permit will expire November 30, 2006.

The BSEP NPDES permit limits the discharge from the plant of chlorine, copper, biological oxygen demand, suspended solids, and oil and grease. Monitoring is required to ensure that the standards prescribed by the NPDES permit are not exceeded. Additionally, the NPDES permit regulates the flow and thermal impacts of the discharge.

Two mixing zones are prescribed for the offshore discharge to ensure that any thermal impacts are limited to a relatively insignificant area. A 120-ac mixing zone limits the extent of the water in excess of 7°F greater than the ambient water temperature. A 2000-ac mixing zone limits the extent of the water in excess of 3.96°F greater than the ambient water temperature during June through August and 1.44°F greater than the ambient water temperature during September through May. At no time should the temperature outside this mixing zone exceed 89.6°F. To ensure that these mixing zone criteria are met, semiannual monitoring is performed.

2.2.4 Air Quality

BSEP is located in the tidewater region of southeastern North Carolina, near the Atlantic Ocean. It is about 16 mi south of Wilmington and 2 mi west of the Cape Fear River. The maritime location of the site makes the climate unusually mild for its latitude.

Climatological records for Wilmington, North Carolina, should be generally representative of the BSEP site (NCDC 2004a). Normal daily maximum temperatures range from about 56.3°F in January to about 89.8°F in July; and normal daily minimum temperatures range from about 35.8°F in January to about 72.3°F in July. Precipitation averages about 57.0 in. per year, with an average of about 2 in. of snow per year.

The area has an average of about 48 thunderstorm days per year with more than half occurring in the months of June, July, and August. During late summer and fall, the area may be affected by passing tropical storms and hurricanes. In the 12 years from 1993 through 2004, Brunswick county has been hit by six hurricanes and three tropical storms, including the two events in 2004 (NCDC 2005). Based on tornado statistics for the period from 1950 through August 2003 compiled by the National Climatic Data Center (NCDC 2004b), the staff estimates the probability of a tornado striking the site to be approximately 2.5×10^{-4} per year.

The primary wind resource in North Carolina is found along the Atlantic Coast and in the mountains in the western part of the state. Wind power densities along the coast in the vicinity of BSEP are estimated to be in the 400 to 500 W/m^2 range at 50 m above ground. North of Cape Lookout along the barrier islands, wind power densities are estimated to be in the 500 to 600 W/m^2 range, and in the near Cape Lookout and Cape Hatteras, densities are estimated to be as high 600 to 800 W/m^2 (DOE 2004).

On an annual basis, the area receives about 63 percent of the total possible solar radiation, with monthly average percentages ranging from 56 percent in January to 70 percent in April. The National Renewable Energy Laboratory estimates that the annual average solar radiation on a horizontal flat plate collector is between 4 and 5 kWh/m^2 per day (RReDC 2005).

Estimates of monthly average daily solar radiation range from a low of 2 to 3 kWh/m^2 November through January to a high of 6 to 7 kWh/m^2 in May and June.

BSEP is in Brunswick County, which is part of the Southern Coastal Plain Intrastate Air Quality Control Region (AQCR) (40 CFR 81.152). Air quality for the counties in this AQCR near BSEP (Columbus, New Hanover, and Pender Counties) is designated as better than national standards, in attainment, or unclassifiable for all primary pollutants (40 CFR 81.334), as is the air quality in Horry County, South Carolina, which is in the Georgetown Intrastate AQCR (40 CFR 81.341).

The Air Quality Index (AQI) (40 CFR Part 58, Appendix G) is a national standard method for reporting air-pollution levels for the general public. The AQI is based on comparison of the concentrations of six pollutants with National Ambient Air Quality Standards. The six pollutants are ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter smaller than 10 micrometers (PM_{10}), and particulate matter smaller than 2.5 micrometers ($PM_{2.5}$). The air-pollution level for each day is placed in one of six categories based on the AQI. In order of decreasing air quality, the categories are Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous.

The Wilmington, North Carolina, metropolitan statistical area includes Brunswick County and the BSEP site. Air quality data (1993 through 2002) indicate that there has been a statistically significant decease in annual average sulfur dioxide and the second highest daily maximum ozone concentrations in Wilmington metropolitan statistical area (EPA 2004). For the five years from 2000 through 2004, almost 82.2 percent of the daily AQIs for were in the Good category, and about 17.5 percent of the days had AQIs of Moderate. The AQIs on the remaining 0.3 percent (6 days) were in the Unhealthy for Sensitive Groups category (EPA 2005a).

Emissions from diesel generators and auxiliary boilers at BSEP are covered by an air permit issued by NCDENR. The current permit was issued in December 2003 and expires in December 2008 (CP&L 2004a). Emissions from other sources are sufficiently small that they are below regulatory concern.

No national parks or wilderness areas designated in 40 CFR Part 81 as mandatory Class I Federal areas in which visibility is an important value are within 50 mi of BSEP. The closest mandatory Class I Federal areas are the Swanquarter Wilderness Area about 120 mi northeast of BSEP and the Cape Romain Wilderness Area about 100 mi southwest of BSEP.

2.2.5 Aquatic Resources

BSEP is surrounded by a diverse and complex aquatic ecosystem. Aquatic habitat types surrounding the plant include salt marshes, the river channel/estuary, and offshore regions (CP&L 1980). BSEP is situated approximately 5.7 mi upstream from the mouth of the Cape Fear River (CP&L 1985). The plant's cooling systems draw water predominantly from the surface layer of the Cape Fear River ship channel through a 3-mi long intake channel. Water is discharged to the Atlantic Ocean after flowing through a 6-mi discharge canal. The water is pumped approximately 2000 ft offshore through subaqueous pipes to the point of discharge (CP&L 1979).

The Cape Fear River, at the point where water is drawn into the intake canal, is part of the Cape Fear Estuary. Estuaries are partially enclosed coastal areas where freshwater and saltwater mix. These areas are under tidal influence, but are protected from the full force of the ocean, often by barrier islands, salt marshes, or other land forms. The species found in estuaries are specially adapted for life in this transitional area. Estuaries are considered to be among the most productive areas on earth (EPA 2005b).

The region surrounding the BSEP intake canal entrance, just downstream of Sunny Point, is in an area that experiences a large tidal exchange (CP&L 1985). A salinity gradient exists where runoff from the Cape Fear River mixes with water from the Atlantic Ocean. From Sunny Point upstream to Wilmington, the water is often two-layered, with the less dense freshwater moving downstream over the more dense seawater (CP&L 1980). Downstream from Sunny Point, the water is more uniformly mixed because of complex water circulation patterns, vigorous tidal action, and high exchange ratios with the ocean. This portion of the estuary is shallow and irregular in shape, with many islands and channels that enhance mixing (CP&L 1980, 1985). Salinity is influenced primarily by tidal conditions and the rate of freshwater inflow. Because the freshwater inflow from the Cape Fear River and its tributaries is highly variable, salinities at the intake may range from nearly 0 to 32 parts per thousand (ppt) (AEC 1974). During periods of average freshwater inflow, salinities near Sunny Point are generally in the range of 8 to 15 ppt (CP&L 1980). Minimum salinities are generally recorded in winter and maximum salinities in late summer (CP&L 1985). Water temperatures in the estuary are influenced largely by changes in season, with the warmest temperatures (as high as 103°F) observed during late summer (CP&L 1985).

The Cape Fear Estuary serves as a "nursery" area for larval and post-larval stages of fish and shellfish. Some species, such as anchovy (*Anchoa* spp.) and gobies (*Gobionellus* spp., *Gobiosoma* spp.) are spawned in the estuary, while others, such as Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), croaker (*Micropogonias undulatus*), and pinfish (*Lagodon rhomboides*) are spawned in the ocean (PEC 2003a). Salinity and temperature influence the spatial and seasonal distribution of these estuarine species (CP&L 1985). The ebb and flow of water in the estuary also contributes to the transport and/or retention of larvae and other organisms throughout the estuary (CP&L 1980).

Many species that inhabit waters in the vicinity of the BSEP have commercial or recreational value. Brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), and white shrimp (*Litopenaeus seiferus*) inhabit salt marshes, including Snows Marsh, which borders the intake canal (CP&L 1980). The shrimp spawn in offshore waters and the post-larvae are recruited into the estuary where they find food and protection. As the shrimp mature, they migrate to deeper waters where commercial fishermen harvest them (AEC 1974). Croaker, an important food fish and sport fish, is another inhabitant of the salt marsh, including Snow's Creek (AEC 1974). Croaker spawn in the ocean during fall and winter. The young spend their first year in the low-salinity regions of the estuary, and then move to the ocean. Examples of other species found in salt marshes near BSEP include blackcheek tonguefish (*Symphurus plagiusa*), striped anchovy (*Anchoa hepsetus*), Atlantic menhaden, and pinfish (AEC 1974).

In the river channel and estuary, developing larvae of brown, pink, and white shrimp, as well as blue crab (*Callinectes* spp.) can be found (AEC 1974). This portion of the estuary also supports the larvae of anchovy (*Anchoa* spp.), croaker, gobies, spot, blackcheek tonguefish, Atlantic menhaden, and striped mullet (*Mugil cephalus*) (AEC 1974). The estuary supports larval fish year-round, although the species composition varies by season. Important adult fish using the estuary include gray sea trout (*Cynoscion regalis*), spot, croaker, bay anchovy (*Anchoa mitchilli*), summer flounder (*Paralichthys dentatus*), windowpane (*Scophthalmus aquosus)*, American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), and blue backed herring (*Alosa aestivalis*) (AEC 1974).

The heated effluent is discharged into the offshore region at Oak Island. Important larval species that have been recorded in this region include shrimp, anchovies, gobies, spot, croaker, gray seatrout, pinfish, and menhaden (AEC 1974). Adults with some commercial value captured in this area include brown, pink, and white shrimp, blue crab, anchovy, spot, king fish (*Mentaicirrhus americanus*), croaker, thread herring (*Opistonema oglinum*), bluefish (*Pomatomus saltatrix*), drum (*Stellifer lanceolatus*), and sole (*Symphurus plagiusa*). Benthic organisms found in the mud and sand of this offshore area include the snail (*Retusa canaliculata*), brittle star (*Ophiophragumus* spp.), and polychaete worms (AEC 1974).

Aquatic species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) or the State of North Carolina and have potential to occur in the vicinity of the BSEP site are presented in Table 2-2.

Table 2-2. Federally Listed and State-Listed Aquatic Species Potentially Occurring in the Vicinity of BSEP

Scientific Name	Common Name	Federal Status	State Status	Counties
		REPTILES		
Caretta caretta	loggerhead turtle	Threatened	Threatened (NC) Threatened (SC)	Brunswick, New Hanover, Onslow, Pender, and Horry (South Carolina)
Chelonia mydas	green turtle	Threatened	Threatened	Brunswick, New Hanover, Onslow
Dermochelys coriacea	leatherback turtle	Endangered	Endangered	Brunswick
Eretmochelys imbricata	hawksbill turtle	Endangered	Endangered	(North Carolina)
Lepidochelys kempii	Kemp's [Atlantic] ridley turtle	Endangered	Endangered	Brunswick
		MAMMALS		
Balaenoptera borealis	sei whale	Endangered	---	(North Carolina)
Balaenoptera musculus	blue whale	Endangered	---	(North Carolina)
Balaenoptera physalus	fin whale	Endangered	---	(North Carolina)
Eubalaena glacialis	right whale	Endangered	---	(North Carolina)
Megaptera novaeangliae	humpback whale	Endangered	---	(North Carolina)
Physeter macrocephalus	sperm whale	Endangered	---	(North Carolina)
Trichechus manatus	West Indian manatee	Endangered	Endangered	Brunswick, New Hanover, Onslow, Pender
		FISH		
Acipenser brevirostrum	shortnose sturgeon	Endangered	Endangered	Bladen, Brunswick, Columbus, New Hanover, Pender

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status	State Status	Counties
Acipenser oxyrhynchus	Atlantic sturgeon	Federal Species of Concern	Special Concern	
Acipenser oxyrhynchus oxyrhynchus	Atlantic sturgeon	Federal Species of Concern	Special Concern	Bladen, Brunswick, New Hanover, Pender
Carcharhinus obscurus	dusky shark	Federal Species of Concern	---	(North Carolina)
Carcharhinus signatus	night shark	Federal Species of Concern	---	(North Carolina)
Elassoma boehlkei	Carolina pygmy sunfish	Federal Species of Concern	Threatened	Brunswick, Columbus
Eleotris pisonis	spinycheek sleeper	---	Significantly Rare	Brunswick
Epinephelus drummondhayi	speckled hind	Federal Species of Concern	---	(North Carolina)
Epinephelus nigritus	Warsaw grouper	Federal Species of Concern	---	(North Carolina)
Etheostoma perlongum	Waccamaw darter	Federal Species of Concern	Threatened	Columbus
Evorthodus lyricus	lyre goby	---	Significantly Rare	New Hanover
Fundulus luciae	spotfin killifish	---	Significantly Rare	Brunswick
Fundulus waccamensis	Waccamaw killifish	Federal Species of Concern	Special Concern	Columbus
Gobionellus stigmaticus	marked goby	---	Significantly Rare	Brunswick
Heterandria formosa	least killifish	---	Special Concern	Brunswick
Hypsoblennius ionthas	freckled blenny	---	Significantly Rare	Brunswick
Menidia extensa	Waccamaw silverside	Threatened	Threatened	Columbus
Microphis brachyurus	opossum pipefish	---	Significantly Rare	Brunswick
Noturus sp 1	broadtail madtom	---	Special Concern	Brunswick
Odontaspis taurus	sand tiger shark	Federal Species of Concern	---	(North Carolina)
Poecilia latipinna	sailfin molly	---	Significantly Rare	Brunswick
MOLLUSKS				
Anodonta couperiana	barrel floater	---	Endangered	Bladen, New Hanover
Elliptio folliculata	pod lance	---	Special Concern	Bladen, Brunswick, Columbus, Pender

Table 2-2. (contd)

Scientific Name	Common Name	Federal Status	State Status	Counties
Elliptio marsupiobesa	Cape Fear spike	---	Threatened	Bladen, Pender
Elliptio roanokensis	Roanoke slabshell	---	Threatened	Bladen
Elliptio sp. 5	Waccamaw lance pearlymussel	Federal Species of Concern	---	Columbus
Elliptio waccamewensis	Waccamaw spike	Federal Species of Concern	Threatened	Brunswick, Columbus
Fusconaia masoni	Atlantic pigtoe	Federal Species of Concern	Endangered	Bladen, Pender
Helisoma eucosmium= Taphius eucosmius eucosmius	Greenfield ramshorn	Federal Species of Concern	Endangered	Brunswick
Lampsilis cariosa	yellow lampmussel	Federal Species of Concern	Endangered	Bladen, Columbus, Pender
Lampsilis fullerkati	Waccamaw fatmucket	Federal Species of Concern	Threatened	Columbus
Ligumia nasuta	Eastern pondmussel	---	Threatened	Brunswick
Planorbella magnifica	magnificent ramshorn	Federal Species of Concern	Endangered	Brunswick, Columbus
Toxolasma pullus	Savannah lilliput	Federal Species of Concern	Endangered	Columbus
Triodopsis soelneri	Cape Fear threetooth	Federal Species of Concern	Threatened	Brunswick, Columbus, New Hanover
Villosa delumbis	Eastern creekshell	---	Significantly Rare	Bladen, Brunswick

In 1998, CP&L prepared a self-assessment report of compliance with regard to State and Federal threatened and endangered species as well as other species of concern that were identified by FWS, National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), the North Carolina Natural Heritage Program (NCNHP), and an NRC-sponsored document (Sackschewsky 1997). Three Federally listed aquatic species, the loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), and Kemp's ridley turtle (*Lepidochelys kempii*), were identified during the self-assessment as potentially being affected by BSEP operations, future facility expansion, or other activities.

BSEP holds an endangered species permit, issued on an annual basis by the North Carolina Wildlife Resources Commission, to tag sea turtles entrained in the intake canal, using methods in accordance with the FWS and NMFS sea turtle tagging protocols. BSEP also holds an incidental take statement issued by the NMFS that contains terms and conditions that authorize the capture and relocation of sea turtles. These permits allow certain BSEP staff to possess and transport entrained or stranded sea turtles for the purpose of rehabilitation and/or release and the possession of dead stranded sea turtles for the purposes of disposition (NCWRC 2004). The permit requires notification of each stranding event within 24 hours, and submittal of a written report within 48 hours of each stranding event.

All three sea turtle species have been collected, as recently as 2004, in the vicinity of the BSEP intake canal (BSEP 2005a). Seventy-five percent of these turtles were released unharmed to the ocean or transported to a sea turtle hospital for rehabilitation. "Turtle-blocker panels" have been installed at the diversion structure, located at the entrance to the intake canal, to minimize the potential for sea turtles to enter the canal. BSEP staff regularly patrol the canal to look for turtles and to ensure the blocker panels are well maintained.

The loggerhead turtle is listed by the FWS as threatened. The species occurs on beaches suitable for nesting from North Carolina to Florida (FWS 2005f). The loggerhead may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship canals, and the mouths of large rivers (FWS 2005f). Nesting season is generally between May and November. Loggerhead turtles were the most common species observed at BSEP in 2004. Sixty-nine percent of the sea turtles handled were loggerheads.

The green turtle is also listed by the FWS as threatened. In eastern North America, this species is found from Massachusetts to Mexico. Continental United States nesting is limited to between 300 and 1000 nests annually on Florida's east coast (FWS 2005d). Green turtles are generally found in shallow waters inside reefs, bays, and inlets and are attracted to lagoons and shoals with an abundance of marine grass and algae (FWS 2005d). Approximately 12 percent of the sea turtles handled at BSEP in 2004 were green turtles.

The Kemp's ridley turtle is listed by the FWS as endangered. Adults of this species are found primarily in the Gulf of Mexico, but immature turtles are found along the Atlantic coast as far north as Canada (FWS 2005e). The Kemp's ridley turtle is found in shallow coastal waters, often in association with red mangrove shorelines (FWS 2005e). Nearly 19 percent of the sea turtles handled at BSEP in 2004 were Kemp's ridley turtles.

Two more sea turtle species, the leatherback turtle (*Dermochelys coriacea)* and the hawksbill turtle (*Eretmochelys imbricata*) are listed as endangered by the FWS, NMFS, and the State of North Carolina. None has been observed at the BSEP site. Both species rarely enter the estuary. Only historical sightings of the leatherback turtle (last observed more than 20 years ago) have been documented in Brunswick County (NCNHP 2004a). The hawksbill turtle has been observed in the county within the past 20 years, but sightings north of Florida are rare. Also, it is generally found in deeper, offshore waters, rather than in salt marshes or estuaries (NCNHP 2004a).

Seven marine mammals that potentially occur in the vicinity of BSEP are Federally listed endangered species, the West Indian manatee (*Trichechus manatus*), sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*). The manatee may be found as far north as Virginia along the Atlantic Coast. At least two manatees have been observed in the Cape Fear Estuary, but none has been reported at the BSEP site (CP&L 1998; PEC 2005d). They may inhabit both salt and freshwater, generally between 1.5 and 6 m deep (FWS 2005o). The diversion structure with turtle-blocker panels installed at the entrance to the intake canal should minimize the potential for manatee entry into the canal. None of the six whale species is expected to enter the Cape Fear estuary or to be found near the BSEP discharge structure because the sei whale favors temperate, deep offshore waters. Local distribution is thought to be linked to their food source, which consists of copepods, fish, or krill. Current population estimates are around 54,000 individuals (American Cetacean Society 2005). Although blue whales have been seen in coastal waters, they are found predominantly offshore (NMFS 2005a). This species is most frequently sighted in more northern waters, off eastern Canada. It is considered an occasional visitor in the U.S. Atlantic. Although fin whales are found in all oceans of the world, they prefer the vastness of the open sea (American Cetacean Society 2005). Precise estimates of population abundance are unavailable, but present fin whale populations may number around 40,000 in the northern hemisphere. The majority of right whales in the western North Atlantic population utilize wintering and calving areas off the southeastern United States, then move to summer feeding and nursery grounds in New England waters and to the north (NMFS 2005a). Critical habitat for the species has been designated in coastal Florida and Georgia, but not in North Carolina. Humpback whales are seasonal migrants. They generally swim to polar waters in summer and to tropical waters in winter. In the western North Atlantic, humpback whales feed during spring, summer, and fall along the eastern coast of the United States (NMFS 2005a). An increased number of sightings in the U.S. mid-Atlantic and southern states, including North Carolina, has been reported. These areas may be increasingly important habitat for juvenile humpback whales (NMFS 2005a). Sperm whales are uncommon in waters shallower than 300 meters deep (NMFS 2005a). Because of their association with deep waters, it is unlikely that this species would be found near the BSEP.

One fish species from Brunswick County, the shortnose sturgeon (*Acipenser brevirostrum*) is Federally listed as endangered (FWS 2005h). Nine adult shortnose sturgeon were captured in the Cape Fear River between 1987 and 1998 (CP&L 1998). No sturgeon were collected at the BSEP site before 1998 (CP&L 1998).

The Waccamaw silverside (*Menidia extensa*), which is Federally listed as threatened, resides in freshwater and is, therefore, not expected to occur at the BSEP site.

The Carolina pygmy sunfish (*Elassoma boehlkei*), Waccamaw darter (*Etheostoma perlongum*), Waccamaw killifish (*Fundulus waccamensis*), Warsaw grouper (*Epinephelus nigritus*), speckled hind (*Epinephelus drummondhayi)*, night shark (*Carcharhinus signatus*), dusky shark (*Carcharhinus obscurus*), sand tiger shark (*Odontaspis taurus*), and Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhunchus*) are Federal species of concern. The sunfish is a freshwater species. It is not known to exist at the BSEP site (CP&L 1998, FWS 2005h). The Warsaw grouper, speckled hind, and night shark are all deep-water species, preferring much greater depths than those found in the vicinity of BSEP (NMFS 2005b). The dusky shark avoids low salinities and is not commonly found in estuaries (NMFS 2005b). The two species of concern most likely to be present in the vicinity of the BSEP are the sand tiger shark and Atlantic sturgeon. The sand tiger shark is a coastal species and may generally be found in the surf zone to depths of 75 ft (NMFS 2005b). Juvenile sand tiger sharks are found in estuaries of the eastern United States and therefore may be present in the vicinity of BSEP. The Atlantic sturgeon is relatively common in the lower Cape Fear River (Moser and Ross 1995). Juveniles were found to prefer waters greater than 10 m deep in the vicinity of the saltwater and freshwater interface.

Several other fish found in counties surrounding the BSEP site do not have Federal listing status, but are either State species of special concern or are considered significantly rare (NCNHP 2004a). Species that have been documented at the BSEP site are the marked goby (*Gobionellus stigmaticus*), lyre goby (*Evorthodus lyricus*), freckled blenny (*Hypsoblennius ionthas*), spinycheek sleeper (*Eleotris pisonis*), and opossum pipefish (*Microphis brachyurus*) (CP&L 1998). Many of these species are at the northern extent of their range and are uncommon in the area. The least killifish (*Heterandria formosa*) and sailfin molly (*Poecilia latipinna*) are documented as occurring within the past 20 years in Brunswick County (NCNHP 2004a). The spotfin killifish (*Fundulus luciae*), and broadtail madtom (*Noturus* sp 1) are State-listed species, but they have not been documented in Brunswick County for more than 20 years (NCNHP 2004a). The listing status of these fish species can be found in Table 2-2.

Three snails, the magnificent ramshorn (*Planorbella magnifica*), the Greenfield ramshorn (*Helisoma eucosmium=Taphius eucosmius eucosmius*), and the Cape Fear threetooth (*Triodopsis soelneri*) are listed by the FWS as Federal species of concern. None are known to exist on the BSEP site (CP&L 1998).

Five mussels are listed as Federal species of concern in counties surrounding the BSEP site (FWS 2005h; CP&L 2004a; NCNHP 2004a). They are the Waccamaw lance pearlymussel (*Elliptio* sp. 5), Waccamaw spike (*Elliptio waccamawensis*), Atlantic pigtoe (*Fusconaia masoni*), yellow lampmussel (*Lampsilis cariosa*), and Waccamaw fatmucket (*Lampsilis fullerkati*). Each of the mussels is a freshwater species and is, therefore, not known or expected to exist at the BSEP site or to be affected by continued plant operation (NCNHP 2004a; CP&L 1998).

Five mussels that have been documented in counties surrounding the BSEP site, but that do not have Federal status, are State-listed as endangered or threatened. These include the barrel floater (*Anodonta couperiana*), Cape Fear spike (*Elliptio marsupiobesa*), Roanoke slabshell (*Elliptio roanokensis*), Eastern pondmussel (*Ligumia nasuta*), and Savannah lilliput (*Toxolasma pullus*) (NCNHP 2004a; CP&L 2004a). Two additional mussel species, the pod lance (*Elliptio folliculata*) and Eastern creekshell (*Villosa delumbis*) are State-listed as of special concern and significantly rare, respectively (NCNHP 2004a; CP&L 2004a). All of these mussel species are found in freshwater and are, therefore, not known or expected to exist at the BSEP site or to be affected by continued plant operation (NCNHP 2004a; CP&L 1998).

The non-native invasive aquatic plant species, *Gracilaria tenuistipitata,* was first documented in the Cape Fear Estuary in 2001 (Sargeant 2005). The plant originated in southeast Asia where it is reported to be edible (as jelly) and is used for animal feed and fertilizer. As its population in the estuary increases, it may begin to outcompete native macroalgae species and may impact the shrimp fishery (Sargeant 2005). In addition, the plants have become a nuisance, occasionally causing blockage problems at the BSEP diversion structure. As a result the diversion screens are now cleaned seven days a week.

One exotic invasive aquatic organism tolerant of salt water may be found near the BSEP. The eel swimbladder nematode, *Anguillicola crassus,* was found in an eel from the Cape Fear River drainage in 1998 (Moser et al. 2001). This parasite has the potential to impact native eel populations in the Cape Fear River and adjacent drainages.

2.2.6 Terrestrial Resources

The BSEP site is located within the mid-Atlantic coastal plain ecoregion, which in pre-European settlement times was dominated by longleaf pine (*Pinus palustris*) with patches of oak (*Quercus* spp.), gum (*Nyssa* spp.), and cypress (*Taxodium* spp.) (Griffith et al. 2002). The BSEP site is within the Carolina flatwoods sub-region, which includes a wide variety of community types including pine flatwoods, pine savannas, fresh-water marshes, pond-pine woodlands, Carolina bays, some sandhill communities, and pocosins (Griffith et al. 2002). Pocosins, which are a relatively unique community type in the area, are wetland depressions vegetated with dense stands of various evergreen shrubs and small trees such as red bay (*Persea borbonia*) and sweet bay (*Magnolia virginiana*) (CP&L 2004a). The transmission line rights-of-way cross other sub-region types including mid-Atlantic floodplains and low terraces, and non-riverine swamps and peatlands. The region is a significant center of endemic biota (Hall et al. 1999). Although there is still a substantial amount of native habitat in the vicinity of the BSEP site, much of it has been converted to other uses, including loblolly pine (*Pinus. taeda*) plantations and croplands of corn, soybeans, and tobacco.

The terrestrial environment on the BSEP site includes waterways such as the Cape Fear River, Dutchman Creek, and Nancy Creek; saline and brackish marshes; coastal dunes; and uplands (AEC 1974). Most upland portions of the BSEP site have been replanted with loblolly pine. Terrestrial and wetland communities in the vicinity of BSEP include pine savannas, longleaf pine-wiregrass (*Aristida stricta*) communities, pine-hardwood forests, pocosins, dune-strand communities, and salt marshes (CP&L 2004a).

Loblolly Pine is the principal pine species in the pine-hardwood forests in the vicinity of BSEP. Important hardwoods include sweet gum (*Liquidamber styraciflua*), blackgum (*Nyssa sylvatica*), hickory (*Carya* spp.), and oaks. Along the ancient dunes, which tend to be well drained, the forests are dominated by longleaf pine, turkey oak (*Q. laevis*), and wiregrass, and a few remnants of pine savannas. Remnant pine savannas occur in periodically flooded areas; these areas are characterized by an open canopy of longleaf pine or pond pine (*P. serotina*) with a dense ground cover of herbs and shrubs.

Sparse stands dominated by sea oats (*Uniola paniculata*) characterize the seaward side of the dune-strand communities found at the interface between the sea and land. Because of the wind and salt spray, plants are primarily found on the landward side of the dunes. Relatively dense herbaceous shrub communities dominated by sabal palm (*Sabal palmetto*) and live oak (*Quercus virginiana*) develop in these more protected areas (CP&L 2004a).

Cordgrass (*Spartina alterniflora*) and needlerush (*Juncus romerianus*) are the dominant species in the salt marshes at the BSEP site. The marshes represent habitat for many important aquatic organisms that are prey for a variety of terrestrial wildlife species (CP&L 2004a).

Wildlife species in the vicinity of BSEP are typical of those found in the southeastern Coastal Plain. The upland communities support many species of birds including hawks, woodpeckers, warblers, and sparrows; mammals such as white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), squirrels (*Sciurus* spp.), skunk (*Mephitis mephitis*), and bobcat (*Lynx rufus*); and a variety of snakes, toads, frogs, and lizards. Wetlands such as the salt-marshes provide habitat for the American alligator (*Alligator mississippiensis*), raccoon, otter (*Lontra canadensis*), and many species of wading birds (CP&L 2004a).

Section 2.1.7 describes the eight transmission lines that were constructed to connect BSEP to the transmission system. The Whiteville line crosses several pocosins as well as the Green Swamp, which has been designated a National Natural Landmark (NPS 2005). The Whiteville line also passes about 1 mi west of Lake Waccamaw State Park and approximately 2 mi south of Lake Waccamaw. The Jacksonville line crosses the Holly Shelter Game Land in the Holly Shelter Swamp. The Wallace line crosses the B. W. Wells Savannah in northwest Pender County; this is a 117-ac remnant of wetland savannah that supports 170 native plant species, some of which are considered rare (NCCLT 2001). The transmission line rights-of-way do not cross any Federal or State parks. CP&L has partnered with the North Carolina Coastal Land Trust (NCCLT), the Conservation Trust for North Carolina, the Nature Conservancy, North Carolina Wild Flower Preservation Society, and the NCNHP to preserve unique and rare species within its transmission line rights-of-way.

Terrestrial species that are listed as threatened or endangered by FWS and have potential to occur in the vicinity of the BSEP site or along the transmission line rights-of-way are presented in Table 2-3. Species listed by the State of North Carolina in the vicinity of BSEP and along the transmission line rights-of-way are presented in Table 2-4.

In 1998, CP&L conducted an assessment of the State and Federal threatened and endangered species as well as other species of concern identified by FWS, NCNHP, and NRC (Sackschewsky 1997). CP&L evaluated more than 90 sensitive plant and animal species that could occur in the vicinity of BSEP and evaluated potential threats to these species from activities at BSEP (CP&L 1998). Three Federally listed terrestrial species, the red-cockaded woodpecker (*Picoides borealis*), Cooley's meadowrue (*Thalictrum cooleyi)*, and rough-leaf loosestrife (*Lysimachia asperulaefolia*), were identified during the assessment as potentially affected by BSEP operations, future facility expansion, or other activities. In 1996, one population of golden sedge (*Carex lutea*) was recorded in Onslow County along the Jacksonville transmission line right-of-way, but the species did not receive Federal protection until 2002. Therefore, the golden sedge was not identified in the 1998 CP&L assessment as being a potentially affected, Federally listed species. The CP&L assessment also identified the American alligator as being widespread in Walden Creek and the intake and discharge canals.

The golden sedge is listed by FWS as endangered and is only found in Pender and Onslow Counties, North Carolina. This species was first discovered in 1991, and was not formally described until 1994 (67 FR 3120); therefore, relatively little is known about its ecology. Golden sedge is a perennial found in a rare habitat type of coastal savanna underlain by calcareous (limestone) deposits (FWS 2002). At the time it was listed as endangered, there were only eight known populations of golden sedge, all within a 2-mi radius. Several additional populations have been found since the publication of the final listing determination (NCNHP 2005). In 1996, a single population of golden sedge was recorded along Jacksonville transmission right-of-way in Onslow County. Since that time, additional populations have been noted, and data provided by the NCNHP indicate the presence of three populations within the Jacksonville transmission line right-of-way and three others within one-half mile of that right-of-way in Onslow and Pender Counties. The populations in the Jacksonville transmission line right-of-way are protected and managed by CP&L under an agreement with the NCNHP.

Table 2-3. Federally Listed Terrestrial Species Reported from Counties Associated with BSEP and Its Transmission Line Rights-of-Way

Species	Common Name	Federal Status	State Status	Counties
		REPTILES		
Alligator mississippiensis	American alligator	T(S/A)	T	Bladen, Brunswick, Columbus, Cumberland, New Hanover, Pender, Robeson
		MAMMALS		
Puma concolor cougar	eastern cougar	E	E	Brunswick,[a] Onslow[b]
		BIRDS		
Charadrius melodus	piping plover	T	T	Brunswick, New Hanover, Onslow, Pender
Haliaeetus leucocephalus	bald eagle	T	T	Bladen,[b] Brunswick, Columbus, Onslow[b]
Mycteria americana	wood stork	E	E	Brunswick
Picoides borealis	red cockaded woodpecker	E	E	Bladen, Brunswick, Columbus, Cumberland, New Hanover, Onslow, Pender, Robeson
		INVERTEBRATES		
Neonympha mitchellii francisci	Saint Francis' satyr butterfly	E	SR	Cumberland
		PLANTS		
Amaranthus pumilus	seabeach amaranth	T	T	Brunswick, New Hanover, Onslow, Pender
Carex lutea	golden sedge	E	E	Onslow, Pender
Dichanthelium hirstii	Hirst's panic grass	C	E	Onslow
Isotria medeoloides	small whorled pogonia	T	E	Cumberland[c]
Lindera melissifolia	Pondberry or southern spicebush	E	E	Cumberland, Bladen[a]
Lysimachia asperulifolia	rough-leaf loosestrife	E	E	Bladen, Brunswick, Columbus,[a] Cumberland, New Hanover, Onslow, Pender
Rhus michauxii	Michaux's sumac	E	E	Cumberland, Robeson
Schwalbea americana	chaffseed	E	E	Bladen,[a] Cumberland, Pender[a]
Thalictrum cooleyi	Cooley's meadowrue	E	E	Brunswick, Columbus, New Hanover,[d] Onslow, Pender

E - endangered, T - threatened, T(S/A) - threatened because of similarity of appearance, SR - state rare

(a) Historic record at least 20, maybe more than 50, years old

(b) Recorded in State database but not USFWS listing

(c) Obscure record in State database but not in FWS listing

(d) Obscure record

Table 2-4. North Carolina State Listed Terrestrial Species Reported from Counties Associated with BSEP and Its Transmission Line Rights-of-Way

Species	Common Name	Federal Status	State Status	Counties
		MAMMALS		
Corynorhinus rafinesquii	Rafinesque's big-eared bat	SC	T	Bladen, Brunswick, Columbus,[a] Pender, Robeson
Neotoma floridana floridana	eastern woodrat	-	T	Brunswick,[a] New Hanover, Onslow, Pender
		BIRDS		
Falco peregrinus	peregrine falcon	-	E	Brunswick
Sterna nilotica	gull-billed tern	-	T	Brunswick, Onslow[a]
		REPTILES		
Crotalus adamanteus	eastern diamondback rattlesnake	-	E	Bladen, Brunswick,[b] Columbus,[b] Cumberland,[a] New Hanover,[a] Onslow, Pender,[a] Robeson[a]
Micrurus fluvius	eastern coral snake	-	E	Bladen, Brunswick,[a] Cumberland,[a] New Hanover, Onslow, Pender
		AMPHIBIANS		
Ambystoma tigrinum	eastern tiger salamander	-	T	Cumberland, Robeson
Rana capito	Carolina gopher frog	SC	T	Bladen,[a] Brunswick, New Hanover,[a] Onslow, Pender, Robeson
		PLANTS		
Adiantum capillus-veneris	Venus hair fern	-	E	Columbus
Amorpha georgiana var *confusa*	savanna indigo-bush	SC	T	Bladen,[a] Brunswick, Columbus, New Hanover,[a] Pender, Robeson[a]
Amorpha georgiana var *georgiana*	Georgia indigo-bush	SC	E	Cumberland
Asplenium heteroresiliens	Caolina spleenwort	SC	E	Bladen,[a] Onslow[a]
Astragalus michauxii	Sandhills milk-vetch	SC	T	Bladen,[a] Cumberland, New Hanover,[a] Pender, Robeson[a]
Calopogon multiflorus	many-flowered grass-pink	SC	E	Onslow
Carex exilis	coastal sedge		T	Cumberland
Carya myristiciformis	nutmeg hickory	-	E	Pender
Chrysoma pauciflosculosa	woody goldenrod	-	E	Columbus, Cumberland, Robeson
Cystopteris tennesseensis	Tennessee bladder-fern	-	E	Onslow[a]
Eupatorium resinosum	resinous boneset	-	T	Cumberland, Bladen[a]
Fimbristylis perpusilla	Harper's fimbry	SC	T	Brunswick, Columbus

Table 2-4. (contd)

Species	Common Name	Federal Status	State Status	Counties
Helenium brevifolium	littleleaf sneezeweed	-	E	Brunswick
Helenium vernale	spring sneezeweed	-	E	Brunswick, Columbus
Lilaeopsis carolinensis	Carolina grasswort	-	T	Brunswick, New Hanover
Lilium pyrophilum	Sandhills lily	-	E	Cumberland
Lindera subcoriacea	bog spicebush	SC	T	Cumberland, Robeson
Lobelia boykinii	Boykin's lobelia	SC	T	Bladen,[a] Cumberland, Onslow
Lophiola aurea	golden crest	-	E	Brunswick, Columbus, New Hanover, Onslow
Macbridea caroliniana	Carolina bogmint	SC	T	Bladen, Brunswick, Columbus, Pender, Robeson
Muhlenbergia torreyana	pinebarren smokegrass	-	E	Brunswick, Cumberland, Onslow, Pender, Robeson
Myriophyllum laxum	loose watermilfoil	SC	T	Brunswick, Cumberland, Onslow
Parnassia caroliniana	Carolina grass-of-parnassas	-	E	Bladen, Columbus, Cumberland, Onslow, Pender
Parnassia grandiflora	large-leaved grass-of-parnassus	SC	T	Brunswick, Columbus
Plantago sparsiflora	pineland plantain	SC	E	Bladen,[a] Brunswick, Columbus, Onslow, Pender
Platanthera integra	yellow fringeless orchid	-	T	Brunswick, Columbus, Onslow,[a] Pender, Robeson[b]
Platanthera nivea	snowy orchid	-	T	Bladen,[a] Brunswick, Columbus,[a] New Hanover,[a] Pender, Robeson[a]
Pteroglossaspis ecristata	spiked medusa	SC	E	Bladen,[b] Cumberland,[a] New Hanover[a]
Pyxidanthera barbulata var *brevifolia*	Sandhills pixie-moss	SC	E	Cumberland
Rhexia aristosa	awned meadow-beauty	SC	T	Bladen, Brunswick,[a] Cumberland,[a] Onslow, Robeson
Rhynchospora macra	southern white beaksedge	-	E	Cumberland
Rhynchospora thornei	Thorne's beaksedge	SC	E	Brunswick, Onslow, Pender
Sabatia kennedyana	Plymouth gentian	-	T	Brunswick, Columbus
Solidago pulchra	Carolina goldenrod	-	E	Brunswick, Cumberland, Onslow, Pender
Solidago villosicarpa	coastal goldenrod	-	E	Brunswick,[a] New Hanover,[a] Onslow, Pender
Sporobolus teretifolius	wireleaf dropseed	SC	T	Brunswick, Columbus

Table 2-4. (contd)

Species	Common Name	Federal Status	State Status	Counties
Stylisma pickeringii var *pickeringii*	Pickering's dawnflower	SC	E	Bladen, New Hanover
Trillium pusillum var *pusillum*	Carolina least trillium	SC	E	Pender
Utricularia olivacea	dwarf bladderwort	-	T	Brunswick,[a] Cumberland, New Hanover, Onslow, Pender

E - endangered, T- threatened, SC - Species of Concern.
(a) Historic record (more than 20 years old)
(b) Obscure record

The Cooley's meadowrue is listed by FWS as endangered; there are approximately 11 known populations in North Carolina, all in Brunswick, Columbus, Onslow, and Pender Counties, and one very small population in northern Florida (FWS 1994, 2005b). The populations in North Carolina are in two clusters; there are six sites within 4 mi of each other in Pender and Onslow Counties, and five sites within 8 mi of each other in Brunswick and Columbus Counties. The Cooley's meadowrue is a perennial herb that grows in circumneutral soils in wet pine savannas, grass-sedge bogs, often at the border of intermittent drainages or swamp forests. It is often associated with some type of disturbance such as clearings, edges of frequently burned savannas, and utility or highway rights-of-way that are maintained by fire or mowing (NatureServe 2005). The species typically occupies a narrow hydrological niche, where soil is moist to saturated, but water does not stand above the soil surface (NatureServe 2005). The Cooley's meadowrue is potentially affected by plant or transmission line operations and maintenance. Several populations have been found in or near the Jacksonville transmission right-of-way in Onslow County. The populations within the right-of-way are protected and managed by CP&L under an agreement with NCNHP. Several other populations have been observed near, but not within the Fayetteville transmission line right-of-way in western Brunswick County. It is likely that there are additional areas of suitable habitat along several of the transmission line rights-of-way.

The rough-leaf loosestrife is listed by FWS as endangered. It is a perennial herb that occurs in pocosins in the coastal plain and sandhills of North Carolina (FWS 2005k). Habitat is generally in the ecotone between longleaf pine or oak savannas and wetter, shrubby areas where moist sandy or peaty soils occur, and where low vegetation allows abundant sunlight to penetrate the herb layer (FWS 1995b). This grass-shrub ecotone would naturally be fire maintained; therefore, the species appears to benefit from some periodic disturbance. Eight populations of rough-leaf loosestrife are known from Brunswick County; one occurs in a transmission line right-of-way north of BSEP in the Boiling Spring Lakes area (i.e., the right-of-way that contains the Castle Hayne East, Wilmington Corning, Wallace, and Jacksonville transmission lines).

Several populations are associated with the Wallace and Jacksonville transmission line rights-of-way in Pender County (CP&L 2004a), and one population is found near the end of the Fayetteville transmission line. These populations are protected and managed by CP&L under an agreement with NCNHP. It is likely that there are additional areas with suitable habitat for this species near the BSEP site and several of the transmission line rights-of-way.

The red-cockaded woodpecker is listed by FWS as endangered. It occurs throughout the southeastern United States and has been observed near the BSEP site and in all of the counties crossed by the BSEP transmission line rights-of-way. In eastern North Carolina, it is found in mature pine forests (generally longleaf pine) with sparse understory vegetation. As of 2003, there were nine active red-cockaded woodpecker nesting groups on the Military Ocean Terminal Sunny Point, and it is thought that the facility could support as many as 17 nesting groups (FWS 2003). Suitable nesting habitat for this species is not found at BSEP (CP&L 2004a), however birds may forage in the vicinity of the plant and could nest or forage near many of the transmission lines.

In addition to the species CP&L noted as potentially being affected by BSEP operations, future expansion or other activities, 12 other Federally listed species (described below) have been identified that may occur in the vicinity of BSEP or the transmission line rights-of-way.

The American alligator is listed by FWS as threatened because of its similarity in appearance with other threatened species of crocodilians. This species is not biologically endangered or threatened and is not subject to Section 7 consultation pursuant to the Endangered Species Act of 1973 (ESA) (16 USC 1536). Alligators are found in freshwater wetland areas throughout southeastern North Carolina (NCNHP 2005). In the vicinity of BSEP, this species is widespread in Walden Creek, the intake and discharge canals, and has been seen along the Fayetteville and Wallace transmission line rights-of-way.

The bald eagle is listed as Federal and State threatened. It was proposed for delisting on July 6, 1999 (64 FR 36453), but a decision about delisting the bald eagle is still pending. Bald eagle nests are large, measuring up to 6 ft across (FWS 2005a). Nest trees are usually large diameter trees characterized by open branching and stout limbs. Because fish is the primary food source, the majority of nest sites are within a half mile of bodies of water such as coastal shorelines, bays, rivers, lakes, farm ponds, dammed up rivers (i.e., beaver dams, log jams, etc.) and have unobstructed views of the water. Winter foraging areas are usually located near open water on rivers, lakes, reservoirs, and bays where fish and waterfowl are abundant, or in areas with little or no water (i.e., rangelands, barren land, tundra, suburban areas, etc.) where other prey species are abundant (e.g., rabbit, rodents, deer, carrion). Bald eagles have been periodically observed near BSEP and along the transmission line rights-of-way, but there are no known nesting locations near BSEP. In the last 15 years, there have only been two confirmed nest sites within 20 mi of BSEP in Brunswick County.

The eastern cougar is listed by FWS as endangered under the ESA. This large cat formerly ranged throughout the eastern United States and Canada, but was driven to near extinction during the 1800s. This species may be extirpated from North Carolina (FWS 2005c), and may be extinct throughout its former range (NatureServe 2005). It has not been reported from Brunswick County or any of the surrounding counties for over 20 years, and is not likely to occur near BSEP or the transmission lines.

The piping plover is listed by FWS as threatened under the ESA. This small shorebird breeds along the Atlantic coast from Newfoundland to North Carolina, as well as along the great lakes and on river sandbars in the upper great plains (FWS 2005i). They winter along the Atlantic and Gulf coasts from North Carolina to Mexico. The FWS has designated portions of the Atlantic coastal beaches in Brunswick, Hanover, Pender, and Onslow Counties as critical habitat for the piping plover (66 FR 36038). Critical habitat does not occur at BSEP or adjacent to associated transmission lines (CP&L 2004a). Suitable nesting or foraging habitat is not known to occur at the BSEP site or along the transmission line rights-of-way.

The wood stork is listed as endangered under the ESA. It inhabits freshwater and brackish wetlands and normally nest in cypress or mangrove swamps. Because of its unique feeding technique (tacto-location) it typically requires higher prey concentrations than other birds, and tend to rely on depressions in marshes or swamps where prey can become concentrated during periods of falling water levels. Breeding colonies are located in Florida, Georgia, and South Carolina (FWS 1997). Every summer since the 1980s, between 15 and 100 wood storks have frequented the area around Sunset Beach, North Carolina, approximately 30 mi southwest of BSEP. This non-breeding colony represents the northernmost extent of this species, and is the only known colony of wood storks in North Carolina (FWS 2005p). This species has been periodically observed foraging in the bypass return pond on the BSEP site. It has not been observed along the transmission lines, which are at least 15 mi from the Sunset Beach colony.

The Saint Francis' satyr butterfly is listed as endangered under the ESA. It occurs in a single metapopulation in the sandhills of Cumberland and Hoke Counties, North Carolina (FWS 2005l). Its habitat consists primarily of wet meadows dominated by sedges (*Carex* spp.) and other wetland graminoids (FWS 1996a). It has been observed in a variety of other wetland areas, including areas with pitcher plants and the endangered rough-leaf loosestrife, but it is not known if the Saint Francis' satyr uses these habitats for any part of its life cycle other than as a travel corridor. Although suitable habitat for the Saint Francis' satyr potentially could occur within or near the Brunswick to Fayetteville transmission line right-of-way, the NCNHP does not have record of this species within at least 8 mi of the right-of-way.

Seabeach amaranth is listed as threatened under the ESA. It is an annual plant that inhabits open sand areas on Atlantic Ocean beaches, originally from Massachusetts to South Carolina, but is now restricted to approximately 55 populations in South Carolina, North Carolina, and

New York (FWS 1996). Between 60 and 70 percent of the surviving populations are in North Carolina, including some in Brunswick, New Hanover, Onslow, and Pender Counties (FWS 2005m and NCNHP 2005a). All populations are strictly coastal, and it often co-occurs in the same areas as the piping plover (FWS 1996b). There are no known populations near the BSEP site, and it is unlikely that there is any suitable habitat at the BSEP site or near any of the transmission line rights-of-way.

The pondberry or southern spicebush is a Federally listed endangered shrub. It occurs in wetland habitats such as bottomland and at the margins of sinks, ponds, and other depressions. It normally grows in shaded areas but may also be found in full sun (FWS 2005j). It occurs in widely scattered sites along an arc from southeastern North Carolina through Georgia and Mississippi to Arkansas and southern Missouri (FWS 1993). It is known from three sites in North Carolina, including one population in Bladen County. Suitable habitat could be found within several of the transmission line rights-of-way, but the NCNHP data do not include records of it occurring within at least 1 mi of the nearest BSEP transmission line right-of-way.

Hirsts' panic grass is currently a candidate for protection under the ESA. It is currently known from only three sites, one in Delaware and two in North Carolina, with two sites in New Jersey where it has not been seen in 10 to 20 years (FWS 2002). Hirsts' panic grass inhabits coastal plain intermittent ponds in wet savanna or pine barren habitats. The species relies on periods of standing water to help minimize competition from other species. The two known populations in North Carolina are both located on Camp LeJeune Marine Corps Base in Onslow County. The known populations of Hirsts' panic grass are at least 7 mi from the nearest BSEP transmission line rights-of-way, but suitable habitat may be found within or near the Jacksonville right-of-way.

The Michaux's sumac is a Federally listed endangered shrub. It inhabits a variety of soil types that may range from sandy, acidic soils to clayey, circumneutral soils (NatureServe 2005). It survives best in areas that are subjected to some form of disturbance that provides open space. At least 12 populations in North Carolina are on highway rights-of-way, road clearings, or on the edges of artificial clearings (FWS 2005g). There are an estimated 31 populations remaining in North Carolina, spread over eight counties, including one population in Robeson County, which contains the terminus of the Weatherspoon transmission line. There are also three populations in Virginia and two populations in Georgia. The known population in Robeson County is not within at least 2 mi of the Witherspoon transmission line right-of-way. However, there is a potential for suitable habitat to occur within or near the Weatherspoon right-of-way.

The American chaffseed is listed by FWS as endangered. Of the 72 known extant populations, 18 are located in North Carolina. However, 17 of those populations are on Fort Bragg in Cumberland and Hoke Counties. The other extant population in North Carolina is along a roadside in Moore County (FWS 1995a). Historically, the species has been reported in Bladen and Pender Counties, but has not been observed in these counties for at least 20 years (NCNHP 2005a). The American chaffseed is a hemi parasitic plant that occurs in sandy, acidic, seasonally moist to dry soils. It is generally found in habitats described as open, moist, pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems. It is dependent on factors such as fire, mowing, or fluctuating water tables to maintain the open-to partly-open conditions that it requires (FWS 1995a). No populations have been recorded near the BSEP site or along the transmission line rights-of-way, or anywhere in the counties containing these rights-of-way for at least 20 years. However, suitable habitat potentially exists in these areas.

The small whorled pogonia, a species listed as threatened under the ESA, is listed by NCNHP (NCNHP 2005) as occurring in Cumberland County based on an obscure record. The FWS does not include this species in its county listings (FWS 2005k). This species occurs in very small populations that are widely distributed from southern Maine and New Hampshire south through Virginia, to northern Georgia and Eastern Tennessee, with outlying populations occurring in a number of states west to Michigan and Illinois (FWS 1992). In the southern portion of its range, the small whorled pogonia is normally found in white pine (*P. strobus*)-mixed deciduous forests. It appears to be somewhat shade intolerant (FWS 1992). All of the known populations of the small whorled pogonia in North Carolina or South Carolina are located on the far western end of each state, and no known populations are located within 150 mi of the BSEP or its associated transmission lines.

In addition to the Federally listed species described above, there are six additional species that have been found within the BSEP transmission line rights-of-way, and approximately 14 other species occurring within 1 mi of the transmission line rights-of-way that are currently listed by the State of North Carolina as endangered or threatened. The species that are known from the BSEP site or transmission line rights-of-way are discussed below.

The Carolina gopher frog inhabits xeric upland habitats in long-leaf pine/turkey oak communities and other similar community types (NatureServe 2005) in the coastal plain and sandhills from southern Alabama and Florida through southeastern North Carolina. It breeds in temporary fish-free pools (NCNHP 2004a; NatureServe 2005) but spends most of its adult life foraging in upland areas. Gopher frogs use the burrows of rodents or gopher tortoises for shelter. The NCNHP database includes records of gopher frogs within the rights-of-way of the Jacksonville, Whiteville, and Wilmington-Corning transmission lines. Additional habitat likely occurs within several of the BSEP transmission line rights-of-way.

The savanna indigo-bush is a short shrub that inhabits wet savannas in the coastal plain (NCNHP 2004b). Apparently, the only high quality population remaining is within the Green Swamp preserve in Brunswick County (NatureServe 2005). The one record in the NCNHP database of this species occurring within a BSEP transmission line right-of-way is a very old record (1949) from approximately 2 mi east of what is now the Delco substation. However, suitable habitat may occur elsewhere within the BSEP transmission line rights-of-way.

The Sandhills lily was first described as a separate species in 2002 and is currently listed as endangered by NCNHP. It is narrowly endemic to the sandhills from southern Virginia to northern South Carolina (FONA 2003a). The species is fire dependent, and appears to survive best on military bases where fires are frequently initiated by exploding ordnance (FONA 2003a). The species' habitat is in streamhead pocosins, seeps, and drainages in maintained power lines (FONA 2003a), or peaty seepage bogs (NCNHP 2004b). One population of sandhills lily has been identified within the Fayetteville transmission right-of-way in Cumberland County, and suitable habitat may occur elsewhere in the western reaches of the BSEP transmission lines.

Carolina grass-of-parnassas inhabits wet savannas in the coastal plain and sandhills (NCNHP 2004b). Although many of the existing populations are on timber lands, the species is adversely affected by fire suppression because of encroachment by shrubs and trees (NatureServe 2005). One population of this species is known to occur in the Jacksonville transmission right-of-way in western Onslow County. However, suitable habitat likely exists in other BSEP transmission line rights-of-way.

The pineland plantain is a perennial forb that inhabits wet savannas (NCNHP 2004b) in the coastal plain from Florida to southeastern North Carolina (NatureServe 2005). Like many of the rare species in this area, this species requires fires to maintain viable populations. A fire frequency of 1 to 10 year return intervals is needed to maintain the open character of the savannas where species such as the pineland plantain are found (Nature Conservancy 2001). One population of pineland plantain is known to occur within the Jacksonville transmission line right-of-way in western Onslow County. However, additional suitable habitat may occur elsewhere within the BSEP transmission line rights-of-way.

Thorne's beaksedge is a small perennial sedge-like plant that grows on the shores of limestone ponds, seeps (FONA 2003b), and wet savannas (NCNHP 2004b) within the coastal plains in Florida, Georgia, Alabama, and North Carolina. Thorne's beaksedge occurs at several of the same sites as golden sedge and Cooley's meadowrue (67 FR 3120), as it does at one location along the Jacksonville transmission right-of-way in western Onslow County. Additional habitat is likely to occur elsewhere within the BSEP transmission line rights-of-way.

No other Federally or State-listed threatened or endangered terrestrial species is known to occur at BSEP or along its transmission line rights-of-way. CP&L has procedures in place to protect endangered or threatened species if they are encountered at the plant site or along transmission line rights-of-way and provides training for employees on these procedures (BSEP 2003, 2005b). In 1993, CP&L signed a Memorandum of Understanding with the

NCDENR to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission line rights-of-way (CP&L and NCDENR 1993). The company also maintains best management practices for management of rare plants on Progress Energy rights-of-way (BSEP 2005b).

2.2.7 Radiological Impacts

CP&L has conducted a radiological environmental monitoring program (REMP) around the BSEP site since 1973. Through this program, radiological impacts to workers, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are to measure accumulation of radioactivity in the environment, determine whether this radioactivity is the result of operations of BSEP, and assess the potential dose to the off-site population based on the cumulative measurements of radioactivity of plant origin (PEC 2004b).

Each year, results of measurements of radiological releases and environmental monitoring are summarized in two annual reports: the *BSEP Annual Radiological Environmental Operating Report* (PEC 2004b) and the *BSEP Radioactive Effluent Release Report* (PEC 2004a). The limits for all radiological releases are specified in the ODCM, and these limits are designed to meet Federal standards and requirements (CP&L 2004b).

The REMP includes monitoring of the waterborne environment (surface water and shoreline sediments), ingestion pathways (milk, fish, and vegetation), direct radiation (gamma dose on thermoluminescent dosimeter locations), and atmospheric environment (airborne radioiodine, particulates, gross beta, and gamma) (PEC 2004b) at a variety of locations surrounding the BSEP site. Sampling locations are chosen based on meteorological factors, preoperational planning, and results of land-use surveys. A number of locations in areas unlikely to be affected by plant operations are selected as controls. Monitoring results for the 5-year period 1999 through 2003 indicate that the radiation and radioactivity in the environmental media monitored around the plant are well within applicable regulatory limits and are not significantly higher than pre-operational levels (PEC 2000b, 2001b, 2002b, 2003c, 2004b)

In addition to monitoring radioactivity in environmental media, CP&L annually assesses doses to the maximally exposed individuals from gaseous and liquid effluents at several locations based on actual liquid and gaseous effluent release data. Calculations are performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM (CP&L 2004b). For 2003, a summary of the calculated maximum doses to individuals in the vicinity of BSEP from liquid and gaseous effluents is as follows:

- The total body dose from liquid effluents was 6×10^{-5} mrem, which is about 0.001 percent of the 6 mrem dose design objective specified in 10 CFR Part 50, Appendix I. The critical organ dose from liquid effluents was 3×10^{-4} mrem. This dose was about 0.001 percent of the 20 mrem dose design objective (PEC 2004a).

- The air dose from noble gases in gaseous effluents was 3.7×10^{-3} mrad from gamma radiation, which is 0.02 percent of the 20 mrad gamma dose design objective, and 1.6×10^{-3} mrad from beta radiation, which is 0.004 percent of the 40 mrad beta dose design objective (PEC 2004a).

- The critical organ dose from gaseous effluents because of iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days was 6.8×10^{-2} mrem, which is 0.2 percent of the 30 mrem dose design objective (PEC 2004a).

These results were consistent with those reported for the period 1999 through 2002 (PEC 2000a, 2001a, 2002a, 2003b). In all cases, doses were well below the limits as defined in the ODCM and confirm that BSEP is operating in compliance with 10 CFR Part 50 Appendix I, 10 CFR Part 20, and 40 CFR Part 190.

As described in Section 2.1.4, CP&L completed a EPU in 2005, and the NRC concluded that the uprate could result in up to a 15 percent increase in the amount of radioactive material in gaseous effluents (67 FR 36040). Such an increase could result in up to a 15 percent increase in the doses from gaseous effluents. However, because the estimated doses to individuals in the vicinity of BSEP from current operations are much less than regulatory limits (less than 1 percent of the applicable limit in all cases), a 15 percent increase in gaseous effluents would not result in significantly greater impacts than current does limits. In addition, CP&L (2004a) does not anticipate any significant changes to the radioactive effluent releases or exposures from BSEP operations during the license renewal term and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the ER (CP&L 2004a) and information obtained from several county, city, and local economic development staff during a site visit to southeastern North Carolina and northeastern South Carolina from January 22 through 28, 2005. The following sections describe the housing market, public services, offsite land use, visual aesthetics, noise, demography, and economy of the region surrounding the BSEP site.

2.2.8.1 Housing

As of January 2005, approximately 1143 employees work at BSEP (about 300 long-term contract employees and 743 permanent employees). Approximately 90 percent of CP&L's permanent employees live in Brunswick and New Hanover Counties, and the rest of the employees live in other locations (see Table 2-5). Table 2-5 also provides residence information for all contractors employed during 2004, but does not distinguish between long-term and temporary workers. The staff assumed that the residence distribution of the approximately 300 long-term contractor employees was equal to that of permanent employees.

Table 2-5. BSEP Permanent and Contractor Employment

Permanent Staff (Jan. 2005)			All Contractor Staff (2004 - Unit 1 Outage)		
County or State	**Employees**	**Percent**	**Region**	**Contractors**	**Percent**
Brunswick	407	54.8%	All Other Southern States	153	13.1%
New Hanover	273	36.7%	Brunswick County, NC	149	12.7%
Columbus	28	3.8%	Midwestern States	148	12.6%
Pender	19	2.6%	All Other North Carolina	109	9.3%
South Carolina	5	0.7%	South Carolina	104	8.9%
Bladen	3	0.4%	Northeastern States	91	7.8%
Sampson	3	0.4%	Texas	81	6.9%
			Columbus County, NC	73	6.2%
			Florida	62	5.3%
All other counties	5	0.7%	Western States	59	5.0%
			Virginia	52	4.4%
			Georgia	51	4.4%
			New Hanover County, NC	39	3.3%
Total Employees	743	100.0%	Total Contractors	1171	100.0%

Source: Progress Energy 2005a.

CP&L refuels BSEP on an 24-month cycle (CP&L 2004a). Each spring, one of the plant's reactors is shut down for approximately 35 days to replace some of the fuel and to perform a variety of maintenance activities. During refueling outages, the number of workers onsite increases substantially, as reflected in Table 2-5. Most outage workers come from all parts of the country, and during the length of the outage, are assumed to reside in the same general proportion to long-term employees. However, the bulk of the economic impact accrues to the economy of their home residence. Given the predominance of CP&L employees living in Brunswick and New Hanover Counties and the small possibility of significant socioeconomic effects in other locations, the focus of the analyses undertaken in this SEIS is on these two counties.

Table 2-6 provides the number of housing units and housing unit vacancies for Brunswick and New Hanover Counties for 1990 and 2000. Both the number and percentage of vacancies grew in both counties during that period. Both Brunswick County and New Hanover County have urban development boundaries within which development is to take place. Land-use planning for each county addresses several issues with respect to successful co-existence of mixed land uses. Extremely high vacancy rates in Brunswick County stem from the seasonal nature of beachfront rental housing or summer homes, which remain vacant outside of the summer beach season.

Table 2-6. Housing Units by County During 1990 and 2000

	1990	2000	Approximate Percentage Change 1990 to 2000
Brunswick County, NC			
Housing Units	37114	51431	38.6%
Occupied Units %	54.1%	59.2%	51.7%
Vacant Units %	45.9%	40.8%	23.2%
New Hanover County, NC			
Housing Units	57076	79616	39.5%
Occupied Units %	84.3%	85.6%	41.6%
Vacant Units %	15.7%	14.4%	27.9%
Source: USCB 1990a, b; 2000a, b			

2.2.8.2 Public Services

- Water Supply

Brunswick County receives most of its potable water from the Lower Cape Fear Water and Sewer Authority (LCFWSA), which has 15 deep wells that tap into the Castle Hayne aquifer. Table 2-7 shows water supplies in the Lower Cape Fear region used for water planning. Brunswick County receives the majority of its potable water 7.5 MGD from the LCFWSA (LCFWSA 2005). 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 (CP&L 2004a).

All the systems that currently obtain water from Wilmington or LCFWSA and the other local government water systems in New Hanover and Brunswick counties are considered a regional group for water planning purposes. The 27 systems included in this group have a combined projected 2050 average daily demand of 73.4 MGD. They have 115.5 MGD of available supply

Table 2-7. Water Supply and Demand in the Lower Cape Fear Planning Group

Lower Cape Fear Group Water Suppliers and Customers	Total Current Supply MGD	2010 Demand MGD	2010 Demand MGD
Apple Valley	0.166	0.156	0.241
Brickstone - Marsh Oaks	0.216	0.075	0.117
Brunswick Co	0.000	14.466	26.586
Carolina Beach	0.890	0.742	1.104
Caswell Beach	0.000	0.220	0.314
Figure Eight Island	0.564	0.399	0.642
Holden Beach	0.000	0.799	2.599
Kure Beach	0.824	0.414	0.766
Lower Cape Fear WSA	53.300	11.650	11.650
Monterey Heights	0.360	0.122	0.177
Murrayville	2.916	1.667	2.855
Navassa	0.000	0.053	0.084
New Hanover Co Airport	0.000	0.024	0.040
New Hanover Co Flemington	0.432	0.362	0.315
North Brunswick WSA	0.000	0.588	0.953
Oak Island	0.000	1.215	2.383
Ocean Isle Beach	0.000	0.589	1.157
Prince George	0.180	0.066	0.103
Runnymeade	0.144	0.066	0.103
Shallotte	0.000	0.228	0.303
Southport	0.000	0.800	1.446
Sunset Beach	0.000	0.628	1.185
Walnut Hills	0.148	0.092	0.143
Westbay	0.792	0.050	0.077
Wilmington	53.300	11.952	16.696
Wrightsville Beach	1.222	1.111	1.372
Group Total	115.454	48.534	73.412

Source: NCDENR 2002

when the supplies from existing wells are combined with the 106.6 MGD available at the intakes located on the Cape Fear River. Based on this analysis NCDENR concludes these systems have enough water available to meet future demands (NCDENR 2002).

BSEP receives water from Brunswick County Public Utilities. From 1996 through 2001, BSEP's water use ranged from approximately 0.22 MGD to approximately 0.25 MGD with an average consumption of 0.23 MGD (CP&L 2004a). 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.

- Transportation

Brunswick County is served by US Hwy. 17, which runs east-west and connects Myrtle Beach, South Carolina, with Wilmington, North Carolina. North Carolina Department of Transportation (NCDOT) currently is planning significant expansion of US 17 and is studying the significant feeder and collector routes in Brunswick County (NRC 2005). Traffic congestion during the summer beach season occurs along access routes to the island beach communities in Brunswick County and at points along US 17 and NC Hwy. 211. The largest capacity highway in the immediate vicinity of the BSEP site is NC Hwy. 87/133 to which the BSEP access road connects. This north-south route carries the merged volume of NC 87 and NC 133, connecting Southport and Wilmington.

Road access to BSEP is via River Road (NC 87/133), a two-lane paved highway (see Figure 2-2). River Road intersects NC 211 (Southport-Supply Road) via the Dosher Cut Off, a 0.6 mi link to the west of NC 87/133, about 0.3 mi north of the plant access road. About 0.9 mi south of the plant access road, River Road intersects Howe Street (NC 211) in Southport. Employees traveling from areas of Brunswick County west of BSEP most likely take the Southport-Supply Road (NC 211) to the Dosher Cut Off to connect with River Road. Employees traveling from the Wilmington area or northern Brunswick County most likely take River Road (NC 133 or the George Hwy. (NC 87) from their junctions with US 17 and travel south to BSEP. Traffic count data for routes in the immediate vicinity of BSEP is shown in Table 2-8 (NCDOT 2004).

The State of North Carolina does not make level of service determinations in rural, non-metropolitan areas unless it has deemed it necessary. None of the roads listed have had level-of-service determinations calculated by the North Carolina Department of Transportation (CP&L 2004a). Both Brunswick and New Hanover Counties are served by Class I railroads, and there is rail service to the BSEP site.

2.2.8.3 Offsite Land Use

BSEP is located in unincorporated Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. Brunswick County is the sixth largest county in North Carolina and encompasses approximately 855 mi^2. The county has a population of approximately 82,000 people. Bolivia is the county seat of Brunswick County.

Table 2-8. Traffic Counts for Roads in the Vicinity of BSEP

Route No.	Vicinity of	2003 Est. AADT[a]
NC 133/87 (River Road)	Bethel Road	16,000
NC 211 (Howe Street)	Between River Road and Dosher Cut Off	17,000
NC 211 (Howe Street)	Downtown Southport	9200
NC 211 (Southport-Supply Road)	NC 133 (Long Beach Road)	28,000
NC 133 (Long Beach Road)	NC 211 (Southport-Supply Road)	22,000
NC 133	Oak Island Drive	16,000
Dosher Cut Off	Between NC 87 and NC 211	10,000
NC 87 (River Road)	NC 211 (Howe Street)	8100
NC 87 (George Hwy)	Boiling Spring Lakes	9600

AADT = Annual Average Daily Traffic volumes – all for 2003.
NC = State highway
(a) North Carolina Department of Transportation 2004.

National land cover satellite imagery data (Vogelmann et al. 2001) were analyzed within ArcView 9 Geographic Information System for the region within 50 mi of the BSEP. Table 2-9 provides a summarization of land-use classifications.

Table 2-9. Land-Use Classification in the 50 mi Region of BESP[a]

Land Classification	Area (ac)	Percent of Total
Open Water	66,952	3.0
Developed Residential	34,781	1.6
Developed Nonresidential	24,845	1.1
Open Underdeveloped	45,939	2.1
Forested	1,025,143	46.0
Agricultural	303,191	13.6
Wetlands	728,126	32.7
Total Acreage	2,228,976	

(a) U.S. Geological Survey land-cover classes have been aggregated for presentation purposes based on Vogelmann et al. (2001). Rounding may affect totals.

Under Brunswick County's land classification system, the majority of land in Brunswick County is rural and is classified as rural, conservation, or transitional (Brunswick County 1997). The area immediately surrounding BSEP is a mix of agricultural lands, woodlands, swamps, and marshes.

The nearest incorporated community to BSEP is the town of Southport, located approximately 2.5 mi south of BSEP. The communities of Boiling Spring Lakes, Caswell Beach, Oak Island, and Bald Head Island are within 6 mi of BSEP.

The closest metropolitan area to BSEP is Wilmington, North Carolina. Wilmington is in New Hanover County.

2.2.8.4 Visual Aesthetics and Noise

BSEP typically is not visible to people in the vicinity because of dense vegetation. It is visible from the Cape Fear River and from points in southern New Hanover County, such as Fort Fisher State Park and Kure Beach. Noise from plant operations is not distinguishable from other industrial noise to people in the vicinity.

The discharge canal is a prominent feature of the surrounding populated area. Bridges on two major highway routes in the vicinity cross the discharge canal. Depending on conditions, steam rising from the discharge canal is visible from roadways. The discharge pumping station in Caswell Beach is a prominent building in the beach access area of that community. It is located just north of Caswell Beach Road, across the street from beachfront housing, and is well lighted during night-time hours. Noise occurs as a result of pumping operations and is audible to people in the area (NRC 2005). Residents of Caswell Beach report that a noticeable concavity in the shape of the beach has been developing for an unspecified amount of time, and hypothesize that perhaps the ocean outfall may be a contributing factor (NRC 2005). No study has been carried out to investigate potential causes of beach erosion at Caswell Beach.

The nearest municipalities to the BSEP site are Southport, located approximately 1.9 mi southeast of the plant; Oak Island, located approximately 5 mi southwest of the plant; and Boiling Spring Lakes, located about 6 mi northwest of the plant.

2.2.8.5 Demography

The staff estimated population from the BSEP site out to a distance of 50 mi. NRC guidance calls for the use of the most recent USCB decennial census data, which in the case of the BSEP site is data from the 2000 census (USCB 2001). The NRC staff used 2000 census data and GIS analysis in discussing both minority and low-income populations. Population projections based on census data have been made by the North Carolina Statistical Data Center (NCSDC).

Using USCB 2000 census information and the Azimuthal Equidistant projection in the ArcView 9 Geographic Information System, the staff estimated that 133,341 people lived within 20 mi of BSEP. Applying the GEIS sparseness measures, Brunswick has a population density of 226 persons/mi^2 within 20 mi and falls into the least sparse category, Category 4 (having 120 or more persons per square mi).

Using USCB 2000 census information, the staff estimated that 361,872 people live within 50 mi of the BSEP site. This equates to a population density of 111 persons/mi^2 within 50 mi. Applying the GEIS proximity measures, the BSEP site is classified as being "not in close proximity," Category 2 (having no city of more than 100,000 persons and less than 190 persons/mi^2 within 50 mi). Based on the GEIS sparseness and proximity matrix, the BSEP site meets sparseness Category 4 and proximity Category 2. This results in the conclusion that the site is located in a medium population area. All or parts of seven counties are located within 50 mi of the BSEP site. Over 92 percent of BSEP site employees live in New Hanover and Brunswick Counties. The remaining 8 percent are distributed across 11 counties, with numbers ranging from 1 to 28 people. The cities of Wilmington, Southport, and Oak Island have the highest numbers of employees in residence, with 34 percent, 17 percent, and 10 percent of the plant workforce, respectively (PEC 2005b).

Both Brunswick and New Hanover Counties are growing at faster rates than North Carolina as a whole. From 1990 to 2003, North Carolina's average annual population growth rate was 2 percent, while New Hanover County increased by 3.1 percent per year and Brunswick County increased by 4.7 percent per year (NCSDC 2001). In 2003, North Carolina reported a population estimate of 8.4 million people. By the year 2030, North Carolina is projected to have 12.9 million people (NCSDC 2004b), growing at an average annual rate of 2 percent. By the year 2030, Brunswick and New Hanover Counties are projected to grow at average annual rates of 2.3 and 1.3 percent, respectively (NCSDC 2004b). Both Brunswick and New Hanover counties are projected to outpace North Carolina's overall population growth rate through 2030.

Table 2-10 shows estimated populations and annual growth rates for the four counties that comprise the economic region (Farrell and Hall 2004) found to be affected by BSEP operations. The table is based on State of North Carolina projections through 2030.

Table 2-10. Regional Population Growth

Year	Brunswick County	Columbus County	New Hanover County	Pender County	4-County Region	Percent Change
1970[a]	24,223	46,937	82,996	18,149	172,305	
1980[a]	35,777	51,037	103,471	22,262	212,547	23.4%
1990[a]	50,985	49,587	120,284	28,855	249,711	17.5%
2000[b]	73,141	54,749	160,327	41,082	329,299	31.9%
2003[b]	81,810	54,557	169,050	43,699	349,116	6.0%
2010[c]	95,961	57,945	194,392	51,906	400,204	14.6%
2020[c]	115,412	62,442	229,603	63,898	471,355	17.8%
2030[c]	133,435	66,538	262,828	75,516	538,317	14.2%

(a) NCSDC 2001
(b) NCSDC 2004a
(c) NCSDC 2004b

- **Resident Population Within 50 miles**

Table 2-11 presents the population distribution within 50 mi of the BSEP site for the year 2000 based on the 2000 census.

Table 2-11. Year 2000 Population Distribution Within 50 mi of the BSEP Site

0 to 10 mi	10 to 20 mi	20 to 30 mi	30 to 40 mi	40 to 50 mi	Total
24,666	10,8675	9,6874	58,361	73,296	361,872

Source: USCB 2001

- **Migrant Labor**

Migrant farm workers are individuals whose employment requires travel to tend or harvest agricultural crops. Some migrant workers may follow seasonal crop cycles through North Carolina and South Carolina, while others may be permanent residents of the Brunswick area who travel from farm to farm performing seasonal work.

Migrant workers can be members of minority or low-income groups. Because migrant workers travel and can spend significant time in an area without being residents, they may be unavailable for counting by census takers. If this occurs, they would be "under-represented" in census minority and low-income population counts.

There are 270 farms in Brunswick County and 77 in New Hanover County. The other two counties in the BSEP economic region are substantially more rural and have more farms (Columbus County with 828 and Pender County with 296) (USDA 2004). According to the 2002 Census of Agriculture, approximately 4050 farm workers were present at some time during the year on 569 farms hiring farm labor in the four-county economic region (USDA 2004). Of the 569 farms reporting hired farm labor, 98 reported hiring migrant farm labor. No estimate of the actual number of migrant laborers hired is available. Migrant labor is also employed in Brunswick County during the golf season (February to October) for golf course maintenance and the beach season (June to August) for retail and service jobs, although no estimates of migrant employment for these jobs are available (NRC 2005). Especially in Brunswick County, previous migrant laborers are increasingly settling in the county as a result of stable employment in the tourism industry. Continued strong, off-season housing construction provides a constant demand for unskilled labor. Farming and farm labor play a secondary role to tourism in the use of migrant labor.

2.2.8.6 Economy and Taxes

A recent study by the University of North Carolina - Wilmington (Farrell and Hall 2004) determined that the region affected by the Brunswick plant should include the entire Wilmington Metropolitan Statistical Area (MSA) formed by New Hanover, Brunswick, and Pender Counties; and should include Columbus County. This region of North Carolina has been growing significantly in economic activity over the last decade. Brunswick and New Hanover Counties border the Atlantic Ocean and have ready access to domestic and international markets, with a transportation network consisting of interstate highway access to major north-south and east-west routes, trucking and rail terminals, an international airport, and two international ports.

Brunswick County is a regional tourism and retirement living center. The increasing popularity of destination golfing has spilled over from the Myrtle Beach region of South Carolina in to the county and has lead to the development of 42 golf courses in Brunswick County. The golf season begins in February and extends through October into November. The beach communities along the southern coastal islands of Brunswick County have been extremely popular summer destination for vacationer from the northeast and from interior sections of North Carolina, specifically. At current rates of construction, these islands will exhaust the remaining available land for construction in the next 10-15 years (NRC 2005). The real estate and home construction market has been booming in Brunswick County for several years as the retirement market has boomed. Retirees relocate to Brunswick County principally from the Northeast, other parts of North Carolina, and from Florida to take advantage of the climate, amenities, lower taxes, and relatively lower home prices (NRC 2005).

The four-county economic region suggested by Farrell and Hall (2004) has developed into an economy strongly weighted toward health care, leisure services, retail and land development/

construction. There is a strong wood products extraction and conversion industry as well, however the service sector of the economy dominates employment (NCESC 2005). This is consistent with the observations that the area has become a retirement destination. The trade, health care, construction/real estate, and leisure services sectors make up over 60 percent of region employment.

BSEP is the second largest employer in Brunswick County, behind the public school system. BSEP pays annual property taxes to Brunswick County and is its most significant property taxpayer. Property tax revenues fund Brunswick County operations, school systems, the county general fund, fire districts, libraries, the emergency management system, and various environmental services (NCDST 2005). From 1997 to 2004, property taxes paid by Progress Energy for BSEP have remained relatively constant, while the tax base of the county has greatly expanded with in-migration of new residents. The Progress Energy share of property tax revenue in Brunswick County has been steadily decreasing since the mid 1990's, from 13.5 percent of tax revenue in 1997, to as low as 6.5 percent in 2003 (PEC 2005c; NCDST 2005). Although the county's reliance on Progress Energy for tax revenue has been decreasing, if the operating license for BSEP were not renewed and the plant were decommissioned, impacts to the tax basis of Brunswick County and its economic structure still would be significant, as discussed in Section 8.4.7 of the GEIS (NRC 1996). Table 2-12 compares BSEP's tax payments to Brunswick County tax revenues.

In the BSEP ER, Progress Energy assumed that BSEP's annual property taxes will remain relatively constant through the license renewal term. The North Carolina legislature has

Table 2-12. Local Government Revenues and Property Tax Payments for BSEP

County Fiscal Year	County[a] Property Taxes ($Million)	County[a] Total Revenue ($Million)	Progress Energy[b] Tax Payments ($Million)	Progress Energy Proportion of Property Taxes	Progress Energy Proportion of County Revenue
1999	45.3	103.6	4.2	9.3%	4.1%
2000	52.8	120.0	4.2	8.0%	3.5%
2001	55.7	163.2	4.6	8.3%	2.8%
2002	61.0	115.7	4.6	7.5%	4.0%
2003	62.8	146.1	4.1	6.5%	2.8%
2004	68.5	193.6	4.8	7.0%	2.5%

(a) NCDST (2005)
(b) PEC (2005c)

studied the issue of electric power industry deregulation, and has decided to defer any consideration of deregulation for the foreseeable future (CP&L 2004a). Any changes to BSEP tax rates due to deregulation would, however, be independent of license renewal.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at BSEP and in the surrounding area. The North Carolina State Historic Preservation Office, Department of Cultural Resources Office of Archives and History, North Carolina Office of State Archaeology, and the North Carolina Archive and State Library are the primary sources of information used in this assessment. Additional information is derived from a cultural resource management report completed in the vicinity of BSEP by New South Associates and other secondary sources relevant to Brunswick county history (Abbot et al. 2003; Perdue 1985).

2.2.9.1 Cultural Background

The prehistoric-historic cultural chronology for the North Carolina Coastal Plain is broadly divided into four periods: Paleo-Indian (12,000 to 8000 B.C.), Archaic (8000 to 1000 B.C.), Woodland (1000 B.C. to A.D. 1650), and Historic (A.D. 1650 to 1715).

Paleo-Indian Period (12,000 to 8000 B.C.)

The Paleo-Indian period is the first cultural tradition present in the North Coastal Plain (Perdue 1985). The subsistence strategy characterized by this time period focused on big-game hunting of large animals such as mammoth and bison supplemented by smaller animals and fishing (Abbott et al. 2003). Population densities were also low. Cultural materials associated with this region consist largely of projectile points diagnostically associated with Clovis and Hardaway-Dalton culture (Abbott et al. 2003). However, there is very little evidence of Paleo-Indian presence within the vicinity of Brunswick County. Most likely any cultural resources that were present have been erased by rising sea levels along the coast of North Carolina.

Archaic Period (8000 to 1000 B.C.)

The Archaic period is divided into Early, Middle, and Late periods. Major climate changes (warming trends) forced a shift from big-game subsistence to a reliance on small animals, fish, and plants at 8000 B.C. (Perdue 1985). The Early and Middle periods are characterized by increased population densities and less migration (Abbott et al. 2003). Cultural materials associated with this period include the atlatl, atlatl weights, soapstone bowls, and lithic tools. These sites have been located in both the upland areas and along river banks in North Carolina.

During the Late Archaic period, the economy began to transition from the hunter-gathering subsistence to a horticultural focus, leading to permanent settlements. The end of the Late Archaic period coincides with the advent of pottery production. Archaeological sites associated with this period have been located in the southern North Carolina Coastal Plain.

Woodland Period (1000 B.C. to A.D. 1650)

The Woodland Period is also divided into Early, Middle, and Late periods. Relying on horticultural practices, Woodland peoples planted squash, corn, and pumpkin, and constructed permanent housing structures (Perdue 1985). The Early Woodland period is recognized by the presence of fiber-tempered pottery (Abbott et al. 2003). This pottery is represented by the New River ceramics style in the southern North Carolina Coastal Plain. The pottery from this region and era is characterized by cordmarked and fabrics and designs (Abbott et al. 2003). There are two site types associated with the Woodland Period that are represented in the vicinity of BSEP. One site type is a large highly populated camp "situated along estuaries resources," while the second type can be described as less populated "foray camp"(Abbott et al. 2003).

Shell midden sites, "low sand burial mounds," and the bow and arrow became prevalent during the Middle Woodland Period in the Coastal Plain (Abbott et al. 2003). McFayden Mound is the closest Middle to Late Woodland mound to have been excavated near BSEP. White-Oak pottery tempered with shell is a hallmark of the Late Woodland period along the southern North Carolina Coastal Plain (Abbott et al. 2003). Late Woodland sites typically consist of large shell middens located on estuaries, which is indicative of an estuarine adaptation. An additional unique characteristic of the Late Woodland period is the use of ossuaries to bury the dead.

Early Historic and Historic Period (Post A.D. 1650)

The South Coastal Plain was occupied historically by three Siouan speaking tribes: the Cape Fear, Waccamaw, and Woccon Indians (Abbott et al. 2003). These groups encountered European colonists in the 1660s. By 1730, European settlement and disease forced the Cape Fear Indians to move out of the area that now encompasses Brunswick County. Descendants of these groups who still have an interest in this area today include two State-recognized tribes, the Lumbee and the Waccamaw-Siouan.

Although the first known European exploration of North Carolina occurred around 1523 by Giovanni da Verrazano, a Florentine navigator sent by France, there is little evidence of colonization in the area until the early 1700s. According to historic maps, the area in the vicinity of BSEP had no evidence of permanent European settlement until 1725 when Waldren's Plantation appears in the records (Hyrne 1749). Plantations provided indigo, rice, and naval stores in the Southport area (Abbott et al. 2003).

The first defense facility established by colonialists in the area was Fort Johnson, burned by the patriots during the American Revolution in 1775. The area survived the American Revolution, and the town of Southport, formerly called Smithville, was established in 1792 along the Cape Fear River. The Southport National Register-eligible historic district is located within 1 mi of BSEP (Lounsbury 1980). Fort Fisher, an earthwork fortification constructed by the Confederacy in the 1860s to defend the mouth of the Cape Fear River, played an important role in protecting the security of the Southport and Wilmington river ports during the Civil War (Abbott et al. 2003). Smithville fell to Federal forces in 1865. In the 1880s, a natural deep harbor was created at Southport, and for a short time, the town drew business to the area (Abbott et al. 2003). Wilmington, North Carolina, dominated the region, and Southport was never a busy deep river port (Abbott et al. 2003). Throughout the twentieth century, the area grew slowly with an emphasis on agriculture, commercial fishing, and timber products. CP&L constructed BSEP in 1974.

2.2.9.2 Historic and Archaeological Resources at the BSEP Site

An archaeological records and literature search was conducted at the North Carolina State Office of Archaeological Research to identify historic properties that may be located in the area of potential effect (APE) to determine if significant archaeological and historic resources may exist at the BSEP site. The APE was defined by NRC as being contained to the power plant site and its immediate environs.

The BSEP Final Environmental Statement identified seven National Register-eligible properties near the construction area (AEC 1974). None however, were identified within the boundaries of the plant construction area. A concern was raised regarding the possible impact of the plant's construction of the Brunswick-Barnard's Creek transmission line on the archaeological site known as Old Town/Charlestown (AEC 1974). The area in question was inspected by Department of Archives and History staff who found no evidence of archaeological remains. It was also discovered, that the location of the "suspected archaeological...site of Old Town" is actually south of the transmission line right-of-way (AEC 1974).

Much of the APE has been disturbed by construction of BSEP and the intake and discharge canals. None of the APE has been systematically surveyed for cultural resources either before construction or since construction of BSEP. A cultural resource marine remote sensing survey was completed for the relocation of a submerged power cable crossing the Cape Fear River to Bald Head Island (Hall 2001). The survey did not locate any submerged cultural resources.

The only recorded resources located within the APE are two historic cemeteries recorded in 1979. Cemetery site number 31BW532 is described as a county Potters field, and cemetery site number 31BW529 is described as the Swain Cemetery. The Swain Cemetery consisted of three graves dating from 1875. The graves were relocated in the late 1980s with the consent of the Swain family (NRC 2005). Site 31BW532 is described as an abandoned cemetery dating to the early 1900s with no markers present. It was recorded as a burial ground for the poor or for unclaimed bodies.

Archaeological field personnel visited the locations of the two cemeteries on January 27, 2005. Having been relocated, there was no evidence of site 31BW529. Field personnel were also unable to locate site 31BW532. The area appears to be disturbed by the presence of communication and water towers. According to land acquisition records maintained by CP&L, most of the lands contained dairy farms owned by the Swain, Magnolia, and Cochran families. Archaeological personnel identified remains of the Magnolia Dairy were identified in the vicinity of site 31BW532. Surface and archaeological remains of these properties likely remain in the undisturbed portions of the area of potential effects.

The Georgiana McCaw Shipwreck (site number 02OIB) is located 100 yards off the beach near the BSEP cooling system discharge canal on Caswell Beach. It has not been evaluated for National Register eligibility.

There is a high potential for prehistoric archaeological resources to be located along the several creeks that traverse the area of potential effect.

2.2.10 Related Federal Project Activities and Consulations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OLs for BSEP. Any such activities could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency for preparation of the SEIS [10 CFR 51.10(b)(2)].

The only Federal land in close proximity to BSEP is the Military Ocean Terminal Sunny Point. This terminal is operated by the U.S. Army. The terminal comprises approximately 16,000 ac and is located immediately north of and adjacent to the BSEP. The terminal is the largest ammunition port in the nation, and the Army's primary east coast deep-water port. The terminal provides worldwide trans-shipment of ammunition, explosives, and other cargo for the U.S. Department of Defense.

After reviewing the Federal activities in the vicinity of BSEP, the staff determined that there were no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparation of this SEIS.

NRC is required under Section 102(C) of the National Environmental Policy Act to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the SEIS. During the preparation of this SEIS, NRC consulted with FWS and NMFS. Consultation correspondence is included in Appendix E.

2.3 References

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

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

10 CFR Part 61. Code of Federal Regulations, Title 10, *Energy*, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR Part 58. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 58, "Ambient Air Quality Surveillance."

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3.0 Environmental Impacts of Refurbishment

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

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

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

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

Table 3-1. Category 1 Issues for Refurbishment Evaluation

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

Category 1 and Category 2 issues related to refurbishment that are not applicable to Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) because they are related to plant design features or site characteristics not found at BSEP are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Carolina Power & Light Company (CP&L), operating as Progress Energy, Carolinas, Inc. indicated that it has performed an evaluation of systems, structures, and components pursuant to Title 10 of the Code of Federal Regulations (CFR) Part 54.21 to identify activities that are necessary to continue operation of BSEP during the requested 20-year period of extended operation. CP&L conducted an integrated plant assessment as part of this evaluation. In its Environmental Report for BSEP, CP&L stated that it "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" (CP&L 2004). Therefore, refurbishment is not considered in this supplemental environmental impact statement.

Table 3-2. Category 2 Issues for Refurbishment Evaluation

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

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

3.1 References

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

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

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report – Operating License Renewal Stage, Brunswick Steam Electric Plant, Units No. 1 and 2.* Docket Nos. 50-324 and 50-325, Southport, North Carolina.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report.* "Section 6.3 – Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

4.0 Environmental Impacts of Operation

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.

(2) A single significance level (i.e., SMALL, MODERATE, OR LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, and are applicable to the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). Section 4.1 addresses issues applicable to the BSEP cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was identified during the scoping period. Cumulative impacts of continued operation during the renewal term are examined in Section 4.8. The results of the evaluation of

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

environmental issues related to operation during the renewal term are summarized in Section 4.9, and finally, the references cited are listed in Section 4.10. Category 1 and Category 2 issues that are not applicable to BSEP because they are related to plant design features or site characteristics not found at BSEP are listed in Appendix F.

4.1 Cooling Systems

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to the BSEP cooling system operation during the renewal term are listed in Table 4-1. Carolina Power & Light Company (CP&L) stated in the Environmental Report (ER) that there is no new and significant information associated with renewal of the BSEP operating licenses (OLs) that would warrant additional plant-specific analysis of the remaining applicable Category 1 issues (CP&L 2004). The staff has not identified any new and significant information during its independent review of the ER (CP&L 2004), the staff's site visit, the North Carolina Department of Environment and Natural Resources (NCDENR), the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all Category 1 issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-1. Category 1 Issues Applicable to the Operation of the BSEP Cooling System During the License Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1; 4.3.2.2; 4.4.2
Altered salinity gradients	4.2.1.2.2; 4.4.2.2
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.2.2
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.2.2
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2
Discharge of other metals in wastewater	4.2.1.2.4; 4.3.2.2; 4.4.2.2
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.3; 4.4.2.2
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3

Table 4-1. (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
HUMAN HEALTH	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

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

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

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

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

- Altered salinity gradients. Based on the information in the GEIS, the Commission found that

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

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

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

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

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

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of scouring caused by discharged cooling water during the license renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, NCDENR, the scoping process, or its evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for BSEP (NCDENR 2003). Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information, including the NPDES permit for BSEP. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information, including the NPDES permit for BSEP. Therefore, the staff concludes that there are no impacts of discharges of other metals in wastewater during the license renewal term beyond those discussed in the GEIS.

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

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

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

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the license renewal term beyond those discussed in the GEIS.

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

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

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

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

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

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

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

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

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

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on distribution of aquatic organisms during the license renewal term beyond those discussed in the GEIS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that

  > Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.

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

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

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

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

The Category 2 issues related to cooling system operation during the renewal term that are applicable to BSEP are listed in Table 4-2 and are discussed in the following sections.

Table 4-2. Category 2 Issues Applicable to the Operation of the BSEP Cooling System During the License Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2; 4.3.3	B	4.1.1
Impingement of fish and shellfish	4.2.2.1.3; 4.3.3	B	4.1.2
Heat shock	4.2.2.1.4; 4.3.3	B	4.1.3

4.1.1 Entrainment of Fish and Shellfish in Early Life Stages

For plants with once-through cooling systems such as BSEP, entrainment of fish and shellfish in early life stages into nuclear power plants cooling water systems is considered a Category 2 issue, thus requiring a site-specific assessment before license renewal. The staff independently reviewed the CP&L ER, visited the site, and reviewed the applicant's existing NPDES permit and existing literature related to fish and shellfish populations of the Cape Fear Estuary, with particular regard to entrainment studies conducted at the BSEP.

Entrainment occurs when organisms are drawn through the cooling water intake structure into the cooling system. Entrained organisms are normally relatively small benthic, planktonic, and nektonic organisms, including early life stages of fish and shellfish, and often serve as food for larger organisms (66 FR 65255). Organisms that are too small to be caught on traveling screens at the intake pump bays enter the cooling water system where they are subject to mechanical, thermal, and/or toxic stress. The number of organisms entrained may be very large. However, the NPDES permit serves to limit entrainment to ensure the protection and propagation of a balanced, indigenous population of fish, shellfish, and other aquatic organisms.

Under new EPA regulations for existing cooling water intake facilities (40 CFR Parts 9 and 122-125, 69 FR 41575), the BSEP intake structure will be required to meet performance standards that protect aquatic organisms based on the facility's source water. The applicant is already in consultation with the North Carolina Department of Environment and National Resources (NCDENR) to determine if additional sampling or other actions will be required (NRC 2005c). Any additional requirements will be implemented through the NPDES permitting process.

The current NPDES permit was issued by the NCDENR, Division of Water Quality as a result of a Memorandum of Agreement between the State of North Carolina and the U.S. Environmental Protection Agency (EPA). The permit became effective August 1, 2003, and expires on November 30, 2006 (NCDENR 2003). The permit established a flow minimization schedule that limits the amount of water BSEP may draw from the Cape Fear River and discharge to the Atlantic Ocean. The limits are designed, in part, to minimize the number of organisms entrained by the cooling water system, while maintaining plant safety and efficiency. Daily maximum discharge limits (and hence, intake limits) are greater in the warmer months (April to November) than in the cooler months (December to March).

The diversion structure at BSEP was completed in 1982 (CP&L 1985). A set of removable 3/8-in. (9.4-mm) mesh screens, made of a copper-nickel alloy, extends through the water column along the entire diversion structure. Each of the two generating units at BSEP has four pump bays where water is drawn into the cooling water system. Water flowing into the intake pumps first passes through trash racks and traveling screens. There is one traveling screen for every pump bay, or four per unit. Two of the four traveling screens per unit are fully equipped with fine mesh (1-mm) screens to reduce the number and size of fish and larvae entrained in the condensers, in accordance with NPDES permit requirements (CP&L 2002; NCDENR 2003). The remaining two screens are half-covered with fine mesh screen and half-covered with larger mesh 3/8-in. screens. During normal full power operation, three intake pumps operate per unit. When three pumps are operating, two pumps must be completely covered with the fine mesh screen. Four-pump operation is allowed only between July and September, and only in one unit at a time (CP&L 2002). There are exceptions to these requirements that provide for plant safety and preventive screen maintenance, but a record of fine mesh screen outages must be reported on a monthly basis (NCDENR 2003).

Before the 1981 NPDES permit was issued, flow minimization schedules and fine mesh screens were not required (CP&L 1985; Cooke 2001). However, a monitoring program in the Cape Fear Estuary since 1973 has collected larval and postlarval fish, shrimp, and crab, allowing researchers to determine if any annual variation in populations of these organisms could be attributed to operation of the BSEP cooling system (CP&L 1985). Methods of sampling larvae and postlarvae were standardized in 1976. Between 1977 and 1984, the seasonality of larval species in the estuary remained unchanged (CP&L 1985). The total numbers of larval organisms collected in the estuary showed a significant increase during that time period as well, with no decreases in density for any of the species studied (CP&L 1985).

Larval and postlarval densities also increased in the immediate vicinity of BSEP (i.e., Walden Creek) and were not statistically different from larval and postlarval densities found in Dutchman's Creek, a site chosen to represent a similar habitat that was not affected by plant operation (CP&L 1985). In the river, larval fish monitoring programs found that eight taxa comprised over 90 percent of the total catch and that the relative abundance of these taxa was similar over a 10-year period between 1974 and 1984 (CP&L 1985).

In addition to the estuary-wide sampling described above, specific studies documenting entrainment of larval and postlarval fish and shellfish at BSEP have been conducted. North Carolina State University completed studies between 1974 and 1978 (prior to the use of fine mesh screens and flow minimization), while CP&L conducted entrainment studies from 1978 through 1985. By comparing entrainment rates (number/day) between historical flows and flow minimization periods, the reduction in numbers of organisms entrained per day ranged from 26.5 percent to 47.4 percent, depending on the amount of flow reduction.

Another short study designed to determine the effectiveness of the fine mesh screens in reducing entrainment was conducted by CP&L from November 1984 to January 1985. Small organisms were trapped over three 24-hour sampling periods. A sampling period with 3/8-in. screens in place was followed by (or in one case, done simultaneously with) a 24-hour period with 1-mm screens in place. The results from the short study showed an 82 percent reduction in the mean density of fish entrained when fine mesh screens were used (CP&L 1985). While entrainment densities were reduced with installation of the fine-mesh screens, the percent composition of entrainment density by species was not altered (CP&L 1985). Thus, the plant entrained fewer organisms, while the opportunity for entrainment remained the same (CP&L 1985).

Since issuance of the 1984 NPDES permit, the biological monitoring program at the BSEP concentrates, in part, on the entrainment of organisms. Annual studies of entrainment of larval fish and shellfish have been conducted since 1984. On a monthly basis, 24-hour sampling is conducted by placing plankton nets with 505-μm mesh in the discharge canal. Flow meters incorporated into the plankton net indicate the volume of water sampled. The results are compared to previous data sets and to the results of larval impingement sampling conducted monthly by sampling organisms from the fish return trough (see Section 4.1.2). The *Brunswick Steam Electric Plant 2003 Biological Monitoring Report* (PEC 2003b), the most recent available, states that the seasonalities of organisms collected in 2003 entrainment studies were similar to those of previous years. Shrimp and crab larvae, both commercially valuable species, show the greatest reduction in entrainment rates (PEC 2003b). Goby (*Gobiosoma* spp.), anchovy (*Anchoa* spp.), and silverside (Atherinidae) larvae are more susceptible to entrainment because of their small size and slender morphology (CP&L 1993). Overall, the combination of the diversion structure and fine-mesh screens help ensure the most valuable commercial species are returned alive to the estuary (PEC 2003a).

In summary, the NPDES permit issued by the NCDENR governs the operational impacts to the aquatic environment. Operation under the NPDES permit should result in the maintenance of a balanced, indigenous population of fish, shellfish, and other aquatic organisms, both in the Cape Fear Estuary and Atlantic Ocean in the vicinity of the discharge structure. Based on a review of the available information relative to potential impacts of the cooling water intake system on the entrainment of fish and shellfish in early life stages and on the success of the mitigative measures already in place at BSEP, the staff concludes that the potential impacts are SMALL, and no additional mitigation is warranted.

4.1.2 Impingement of Fish and Shellfish

For plants with once-through cooling systems, such as BSEP, impingement of fish and shellfish on screens associated with nuclear power plant cooling water systems is considered a Category 2 issue, thus requiring a site-specific assessment before license renewal. The staff independently reviewed the BSEP ER, visited the site, and reviewed the applicant's existing NPDES permit and existing literature related to fish and shellfish populations of the Cape Fear Estuary, with particular regard to impingement studies conducted at BSEP.

Impingement takes place when organisms are trapped against intake screens by the force of the water passing through the cooling water intake structure (66 FR 65255). Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill movement or organisms may be removed from the water for prolonged periods of time), and descaling (66 FR 65255). The number of organisms impinged may be large. However, the NPDES permit serves to limit impingement to ensure the protection and propagation of a balanced, indigenous population of fish, shellfish, and other aquatic organisms. Under new EPA regulations for existing cooling water intake facilities (6 FR 41575, 40 CFR Parts 9, 122-125), the BSEP intake structure will be required to meet performance standards that protect aquatic organisms based on the facility's source water. The applicant is already in consultation with the NCDENR to determine if additional sampling or other actions will be required (Sargeant 2005). Any additional requirements will be implemented through the NPDES permitting process.

The current NPDES permit was issued by the NCDENR Division of Water Quality as a result of a Memorandum of Agreement between the State of North Carolina and the EPA. The permit became effective August 1, 2003, and expires on November 30, 2006. The permit established a flow minimization schedule that limits the amount of water BSEP may draw from the Cape Fear River and discharge to the Atlantic Ocean. The limits are designed, in part, to minimize the number of organisms impinged on the intake screens, while maintaining plant safety and efficiency (NCDENR 2003).

The NPDES permit requires the continuous operation and maintenance of a diversion structure at the mouth of the intake canal to minimize impingement (NCDENR 2003). Annual assessments of the effectiveness of the diversion structure to curtail organism impingement are published. The diversion structure was completed in 1982 (CP&L 1985). A set of removable 3/8-in. mesh screens, made of a copper-nickel alloy, extends through the water column along the entire diversion structure. Between 1979 and 1982, fish sampled inside the intake canal equaled or exceeded those sampled outside the intake canal (CP&L 1985). In a 1984 study, catches of spot (*Leiostomus xanthurus*), croaker (*Micropogonias undulatus*), and Atlantic menhaden (*Brevootia tyrannus*) were significantly lower inside the canal than outside the diversion structure (CP&L 1985). The size of organisms captured inside the canal was also less than the size of organisms captured outside the diversion structure (CP&L 1985). Spot and croaker greater than 45 mm in length were not found inside the intake canal after construction of the diversion structure. Finally, a comparison of the amount of impinged fish entrained (by water volume) before and after installation of the diversion structure showed a 67 percent reduction in impingement following the diversion screen installation (CP&L 1985).

The NPDES permit also requires fine mesh (1-mm) screens to be installed on traveling screens at the intake pump bays. Two of the four traveling screens per unit are fully equipped with fine mesh screens to reduce the number and size of fish and larvae entrained in the condensers, in accordance with NPDES permit requirements (CP&L 2002; NCDENR 2003). The remaining two screens are half-covered with fine mesh screen and half-covered with larger mesh 3/8-in. screen. Reducing the screen mesh size decreases the number of organisms entrained in the cooling system, but increases the number of organisms impinged on the screens. However, while essentially all larvae entrained in the cooling system perish, many of the larval, juvenile, and adult fish and shellfish that are impinged on the screens survive.

At BSEP, in addition to the fine mesh screens discussed above and in Section 4.1.1, each of the eight traveling screens is equipped with a screen wash system to remove impinged debris and larval, juvenile, and adult fish and shellfish from the screens. Organisms are washed from the screens into a tray that deposits them to a collection trough that then flows to the fish return system. This gravity-fed sluiceway carries the organisms that were impinged on the screens to a holding pond. The pond is open to Walden Creek, which in turn flows to the Cape Fear River (CP&L 2002, 2004).

The ability of organisms to survive impingement varies by species and size. Survival studies were initiated at BSEP in 1984 to determine the percentage of impinged organisms returned to the estuary alive (CP&L 1985). Larval, juvenile, and adult organisms returned to the sluiceway through normal operation of the screen wash system were collected, sorted to species level, and held for 96 hours at a laboratory facility plumbed with continuous flowing water from the intake canal. Control organisms were collected from the intake canal and held under the same conditions. Dead organisms were removed, counted, measured, and recorded. After 96 hours, the number of live organisms was recorded. The results indicated that shrimp and crab, both commercially important species, had high survival rates ranging from 69 to 90 percent. Other commercially and recreationally important species, such as flounder, striped mullet (*Mugil cephalus*), blackcheek tonguefish (*Symphurus plagiusa*), and searobin (*Prionotus* spp.) had survival rates greater than 67 percent. For some species such as croaker and spot, the survival rate for smaller individuals was fair, but the survival rate increased as the size of the fish increased. Other species, such as the bay anchovy, weakfish, and menhaden showed little or no survival after being impinged.

Since the NPDES permit was issued in 1984, the biological monitoring program at BSEP has concentrated, in part, on the impingement of organisms. Annual studies of impingement rates of larval, juvenile, and adult fish and shellfish have been conducted since 1984. The most recent report available is the *Brunswick Steam Electric Plant 2003 Biological Monitoring Report* (PEC 2003b). This report states that the seasonalities of organisms collected in 2003 entrainment studies were similar to those of previous years. Spot was the most common species impinged in larval impingement studies in 2003; shrimp and crab were the most common species in 2002 (PEC 2003a, b). Bay anchovy and shrimp dominated the juvenile and adult impingement studies in both 2002 and 2003 (PEC 2003a, b). For all but one species studied between 1977 and 2003, significant reductions in impingement of juvenile and adults has occurred. White shrimp (*Litopenaeus seiferus*) is the only species that has shown a significant increase in impingement over the study period. The increase is attributed to a natural increase the number of white shrimp populating Walden Creek. Previous studies have shown that significant increases of these shrimp in Walden Creek coincide with increases in impingement of this species at BSEP (PEC 2003a). Greater than 80 percent survival following impingement has been documented for this species (PEC 2003a, b).

In summary, the NPDES permit issued by the NCDENR governs the operational impacts to the aquatic environment. Operation under the NPDES permit should result in the maintenance of a balanced, indigenous population of fish, shellfish, and other aquatic organisms, both in the Cape Fear Estuary and Atlantic Ocean in the vicinity of the BSEP discharge structure. Based on a review of the available information relative to potential impacts of the cooling water intake system on the impingement of fish and shellfish, and on the success of mitigative measures already in place at BSEP that reduce impingement and mortality caused by impingement, the staff concludes that the potential impacts are SMALL, and no additional mitigation is warranted.

4.1.3 Heat Shock

For plants with once-through cooling, such as BSEP, the effects of heat shock are listed as a Category 2 issue that requires plant-specific evaluation before license renewal. The staff independently reviewed the CP&L ER, visited the site, reviewed the CP&L's existing NPDES permit, and also reviewed existing literature related to fish and shellfish populations of the Cape Fear Estuary, with particular regard to the Clean Water Act Section 316(a) (33 USC 1326) Demonstration (CP&L 1979).

Aquatic organisms have optimal thermal limits within which they thrive. When an organism experiences a sudden increase in temperature, it may be stressed. If the temperature is above the tolerance range for the species, the organism may die. Plants that discharge heated effluent to the environment have the potential to cause heat shock in aquatic organisms if the temperature of the water discharged from the plant is much higher than the ambient water temperature. Heat shock is most likely to occur when an offline unit returns to operation.

Thermal effluent from BSEP is discharged through two 13-ft diameter, 2000-ft long submerged pipes that extend into the Atlantic Ocean (AEC 1974). Water depth at the point of discharge is approximately 10 ft. The ocean floor in the vicinity of the discharge pipes is sandy, with no natural hard bottom outcroppings that attract fish (CP&L 1979). The bottom is devoid of attached vegetation and there is a strong westerly tidal and longshore flow in this region.

The current NPDES permit was issued by the NCDENR Division of Water Quality as a result of a Memorandum of Agreement between the State of North Carolina and the EPA. The permit became effective August 1, 2003, and expires on November 30, 2006. The permit established thermal limits and monitoring requirements for water discharged from BSEP into the Atlantic Ocean (NCDENR 2003). It incorporates the plans for an extended power uprate at BSEP that would gradually increase generating capacity by 10 to 15 percent, resulting in an estimated increase in the discharge temperature of approximately 2.3°C (4°F).

CP&L has an approved 316(a) Demonstration, but has not sought a 316(a) variance under 40 CFR Part 125 that would allow the facility to discharge water warmer than normally allowed by State standards. Instead, the temperature limits in the current NPDES permit are based on North Carolina regulations governing "Tidal Salt Water Quality Standards for Class SB Waters" (Cooke 2001). If these thermal limits are met, then heat shock should not occur as a result of a sudden disruption in heated discharge from one or both units of BSEP. CP&L expects these conditions will be met, even with the extended power up rate (NCDENR 2003; CP&L 2004).

The permit states that ocean waters shall not exceed 0.8°C (1.44°F) above ambient during the months June through August or 2.2°C (3.96°F) above ambient during the months of September through May. Inside the approximately 2000-ac mixing zone, only a small area surrounding the discharge pipe (120 ac at the water surface and 1000 ft^2 at the bottom) is allowed to increase up to 3.9°C (7°F) over ambient (NCDENR 2003). Except within the defined mixing zone, at no time should the temperature exceed 32°C (89.6°F) as a result of the discharge of heated liquid as measured 3 ft below the water surface (NCDENR 2003).

Temperature monitoring is required on a semi-annual basis, with one sampling between April and November, and the second between December and March. Reactor power levels are required to be at least 85 percent for each unit during sampling (NCDENR 2003). To date, BSEP has been able to maintain the thermal standards while operating at or near full power in the once-through cooling mode (CP&L 2004).

The original thermal studies measured water temperatures at 27 stations over a 941-ha (2326-ac) grid surrounding the discharge once monthly between 1975 and 1979. The study determined that only under near full power operating conditions for both units was there any observable thermal plume at the surface anywhere within the grid (CP&L 1979). Wind, waves, and tides all work together to rapidly mix and dissipate the heat discharged by the plant.

While a number of aquatic species may use the nearshore area surrounding the discharge, the slightly increased temperature above ambient ocean temperature is not enough to cause heat shock in an organism upon the start-up of one or both BSEP units. Most aquatic organisms, including fish and shellfish, are highly mobile and can avoid the discharge area.

Thus, the staff concludes that the potential for heat shock impacts resulting from operation of the plant's cooling water discharge system to the aquatic environment on or in the vicinity of the site is SMALL, and no additional mitigation is warranted.

4.2 Transmission Lines

Eight 230-kV transmission lines constructed to connect BSEP to the transmission and distribution system were described in the final environmental statement (FES) for operation of BSEP (AEC 1974). These lines included two lines to the Delco and Barnard Creek substations and lines to the Fayetteville, Wallace, and Jacksonville substations. In addition, 31 miles of new transmission line were constructed to connect BSEP to the Weatherspoon substation. Potential electromagnetic effects of these lines were not considered in the FES.

CP&L's ER describes changes to the way in which BSEP is connected to the transmission grid that have occurred since publication of the FES. The two lines to Barnard Creek substation have been extended to the Castle Hayne substation and Wilmington Corning switching station, located about 12 mi to the north of the Barnard Creek substation. Both the Castle Hayne and the Wilmington Corning lines are considered in this supplemental environmental impact statement (SEIS) in their entirety. The original Fayetteville line now connects to the grid at the Whiteville substation. However, because the Fayetteville line, that was built to connect BSEP to the grid remains in existence, the full extent of the original line is considered in this SEIS.

Ongoing right-of-way surveillance and maintenance of BSEP transmission facilities ensure continued conformance to transmission line design standards. CP&L uses a variety of methods to control vegetation in transmission line rights-of-way. Maintenance activities are generally on a 3-year rotating schedule (BSEP 2002a). CP&L employs an integrated vegetation management approach that includes both mechanical and chemical control methods. This approach allows CP&L to design the maintenance practices to fit the different kinds of terrain and soils that are crossed by the transmission lines. Mechanical methods include pruning, felling, mowing, and hand trimming (BSEP 2002b). Chemical control methods include the use of tree growth regulators to slow the growth of fast-growing trees under lines, and EPA-approved herbicides to control undesirable woody vegetation that regrows after mowing. When herbicides are used, the program consists of low-volume foliar application from May through October, dormant-stem application from October through April, and cut-stump/vine application throughout the year (PEC 2005a). The transmission line right-of-way maintenance practices employed by CP&L are likely to have little or no detrimental impact on the species potentially present in or near the transmission line rights-of-way, and in some cases, the maintenance practices may be beneficial.

CP&L and NCDENR signed a Memorandum of Understanding in 1993 to preserve and protect rare, threatened, and endangered species and sensitive.natural areas occurring on transmission line rights-of-way (CP&L and NCDENR 1993). The company maintains best management practices for the management of rare plants on its rights-of-way and has procedures in place to protect these and other endangered or threatened species, if they are encountered (BSEP 2003, 2005a). CP&L also has procedures in place to address migratory bird strikes that may occur on the transmission lines (BSEP 2005b).

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to transmission lines from BSEP are listed in Table 4-3. CP&L stated in its ER that it is not aware of any new and significant information associated with the renewal of the BSEP operating licenses (OLs). The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, consultation with the U.S. Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Services (NMFS), and NCDENR or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-3. Category 1 Issues Applicable to the BSEP Transmission Lines During the License Renewal Term

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

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

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, consultation with the FWS and NCDENR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, consultation with the FWS and the NCDENR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the license renewal term beyond those discussed in the GEIS.

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

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

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

- Floodplains and wetlands on power line right of way. Based on information in the GEIS, the Commission found that

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, consultation with the FWS and the NCDENR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the license renewal term beyond those discussed in the GEIS.

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

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

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

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

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

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

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

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

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

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

Table 4-4. Category 2 and Uncategorized Issues Applicable to the BSEP Transmission Lines During the License Renewal Term

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

4.2.1 Electromagnetic Fields – Acute Effects

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

All BSEP transmission lines were constructed to the NESC specifications and industry guidance in effect at the time the lines were constructed. BSEP transmission facilities are maintained to ensure continued compliance with the standards and guidance in effect when they were constructed. However, since the lines were constructed, a new criterion has been added to the NESC for power lines with voltages exceeding 98 kV. This criterion states that the minimum clearance for a line must limit induced currents due to static effects to 5 mA.

CP&L (2004) reviewed its power lines for compliance with this criterion. The span on each line where the potential for induced current would be the greatest was identified. The electric field strengths and potential induced currents for these spans were calculated using the ACDCLINE computer code (EPRI 1991). Input to the code included line sag at 200°F conductor temperature, maximum operating voltage during normal load conditions, and a large tractor-trailer parked under the line in a position to maximize the induced current. NESC assumes a conductor temperature of 120°F. The calculated induced currents for all eight BSEP 230-kV lines were well below the NESC 5-mA criterion. The conductor temperature assumed would result in more line sag and higher induced currents than would the temperature specified in the NESC. Therefore, the induced currents listed in the CP&L ER are conservative.

The staff has reviewed the applicant's evaluation and computational results. Based on this review, the staff concludes that the impact of the potential for electric shock is SMALL, and no additional mitigation is warranted.

4.2.2 Electromagnetic Fields – Chronic Effects

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

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

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

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

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to BSEP in regard to radiological impacts are listed in Table 4-5. CP&L stated in its ER (CP&L 2004) that it is not aware of any new and significant information associated with the renewal of the BSEP OLs. The staff has not identified any new and significant information during its independent review of the CP&L ER the staff's site visit, the scoping process, or it's evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-5. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the License Renewal Term

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

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

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

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

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

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

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

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

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

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Term

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to socioeconomic impacts during the license renewal term are listed in Table 4-6. CP&L stated in its ER (CP&L 2004) that it is not aware of any new and significant information associated with the renewal of the BSEP OLs.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or the staff's evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-6. Category 1 Issues Applicable to Socioeconomics During the License Renewal Term

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

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

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

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

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

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

  > Only impacts of small significance are expected.

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

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

    No significant impacts are expected during the license renewal term.

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

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

    No significant impacts are expected during the license renewal term.

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

Table 4-7 lists the Category 2 socioeconomic issues, which require plant-specific analysis and environmental justice, which was not addressed in the GEIS.

4.4.1 Housing Impacts During Operations

In the GEIS, the staff defines the significance levels of housing impacts as SMALL when a small or not easily discernible change in housing availability occurs. Impacts are considered MODERATE when there is a discernible but short-lived reduction in available housing units because of project-induced migration. Impacts are considered LARGE when project-related housing demands result in very limited housing availability and would increase rental rates and housing values far above normal inflation (NRC 1996).

To determine housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996, 1999). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS Table C.1), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

Table 4-7. Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the License Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	SOCIOECONOMICS		
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3

Table 4-7. (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	SOCIOECONOMICS		
Public Services, transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental Justice	Not addressed[a]	Not addressed[a]	4.4.6

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in the licensee's environmental report and the staff's environmental impact statement.

For the year 2000, the staff estimated that population living within 20 mi of BSEP was approximately 133,341. This translates to around 226 persons/mi^2 living on the land area within a 20-mi radius of BSEP. This concentration falls into the GEIS sparseness Category 4 (i.e., having 120 or more persons per square mi).

The staff estimated a population of 361,872 within 50 mi of the site using the 2000 census, or 111 persons/mi^2, within the GEIS proximity Category 2. According to the GEIS, these sparseness and proximity scores identify BSEP as being located in a medium-population area.

In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts on housing availability are expected to be of small significance at plants located in a medium-population area where growth-control measures are not in effect. No additional population is expected as a result of license renewal at BSEP.

The staff reviewed the available information relative to housing impacts and CP&L's conclusions. Based on this review, the staff concludes that the impact on housing during the license renewal term would be SMALL, and no additional mitigation is warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

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

Analysis of impacts on the public water supply system considered both plant demand and plant-related population growth. Section 2.2.8 describes the use of water at BSEP. CP&L plans no refurbishment in conjunction with this license renewal, so plant demand would not change beyond current demands (CP&L 2004).

CP&L assumed no increase of employees during license renewal, which would create no impacts from plant-related population increases and no additional demand for potable water (CP&L 2004). The current potable water demand is within the residual capacity of the existing water system that services Brunswick and New Hanover Counties. As shown in Section 2.2.8.2, given projected demand for public water supplies to 2050 and current supplies, excess capacity will exist through the term of the license renewal. CP&L notes that no increase in plant work force or demand on water systems from the plant is expected, so the incremental impact of license renewal on either the public water system or the regional groundwater situation is minimal. As a result, the staff concludes that the impact on water use is SMALL, and no additional mitigation is warranted.

4.4.3 Offsite Land Use During Operations

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

Sections 3.7.5 and 4.7.4 of the GEIS define the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

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

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

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

CP&L determined that no additional plant workers would be required during the license renewal term (CP&L 2004). Section 3.7.5 of the GEIS states that if plant-related population growth is less than 5 percent of the study area's total population, offsite 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/mi^2, and at least one urban area with a population of 100,000 or more within 50 miles. In this case, although the Wilmington Metropolitan Statistical Area population is projected to grow significantly during the term of the proposed license renewal, there is no expected population growth as a result of license renewal. Consequently, the staff concludes that population changes resulting from license renewal are likely to result in SMALL offsite land-use impacts.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax driven land-use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdictions revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large (10 to 20 percent) relative to the community's total revenue, new tax driven land-use changes would be MODERATE. This is most likely to be true where the community has no pre-established patterns of development (i.e., land-use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past.

Over the period from 1999 to 2004, property tax payments made by CP&L to Brunswick County for BSEP constituted a proportion of the county's total tax revenue ranging between 6.5 percent and 9.3 percent of county tax revenue, equating to between 2.5 percent and 4.1 percent of gross revenue (PEC 2005b; NCDST 2005). Consequently, the staff concludes that tax driven land-use impacts resulting from renewal of the BSEP OLs are likely to be SMALL, and no mitigation is warranted.

4.4.4 Public Services: Transportation Impacts During Operations

On October 4, 1999, 10 CFR 51.53(c)(3)(ii)(J) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1, were revised to clearly state that "Public Services: Transportation Impacts During Operations" is a Category 2 issue (NRC 1999). The issue is treated as such in this SEIS.

Significant growth is expected in both Brunswick and New Hanover Counties during the license renewal term. However, expected growth will not result directly from increases in employment at BSEP. The permanent employment associated with BSEP is currently about 1140 employees, including both CP&L and long-term contractor employees (PEC 2005c). During refueling outages, which occur each year, as many as 950 to 1050 additional workers are hired on a temporary basis. The North Carolina Department of Transportation does not maintain level-of-service designations for roadways in the state; however, the local officials indicate that tourism-related traffic increases are the focus of current transportation planning efforts (NRC 2005). Because no additional employment increment is expected as a result of license renewal, CP&L concluded that the impacts on transportation during the license renewal term would be small (CP&L 2004).

The staff reviewed CP&L's assumptions and resulting conclusions. The staff concludes that any impact of licence renewal on transportation service degradation is likely to be SMALL, and no mitigation is warranted.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) of 1966, Section 106 process requires that Federal agencies to take into account the impacts of their undertakings on historic properties as outlined in 36 CFR Part 800. In accordance with 36 CFR Part 800.8, NRC informed the Advisory Council on Historic Preservation, the North Carolina State Historic Preservation Office, the Lumbee Tribe and the Wacammaw Siouan that the Section 106 process is being integrated with the NEPA process and "the SEIS will include analyses of potential impacts to historic and cultural resources" (Appendix E). As part of this integration, the area of potential effect (APE) was defined by NRC staff as:

> the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or

projected refurbishment activities, specifically related to license renewal, may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest (Appendix E).

With the exception of the site identified as 31BW532 (see Section 2.2.9), there are no historic and archaeological resources known to be located in the APE. It is unlikely there are intact significant historic and archaeological resources located in previously disturbed portions of the BSEP site. Land use records indicate that there is a potential for cultural resources to be located in areas undisturbed by plant construction. However, CP&L has procedures in place regarding the preservation of historic and archaeological resources. The guidance states that cultural resource assessments will be conducted prior to ground-disturbing activities and provides guidance on inadvertent discoveries of graves or archaeological sites.

CP&L does not plan to undertake major refurbishment activities in the APE. CP&L has a cultural resource policy in place to ensure that potential historic and archaeological resources that have not yet been identified or discovered are protected. Because of the extensive disturbance present in the APE and the lack of substantial land altering aspects of this license renewal, the staff concludes that the potential impacts to historic and archaeological resources would be SMALL, and no additional mitigation is warranted.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy that requires Federal agencies to identify and address, as appropriate, disproportionately high and adverse impacts on minority[(a)] or low-income populations. The memorandum accompanying Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under NEPA. The Council on Environmental Quality has provided guidance for addressing environmental justice (CEQ 1997a). Although the Executive Order is not mandatory for independent agencies, the NRC has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (NRC 2004a).

The staff examined CP&L's (2004) analysis of the geographic distribution of minority and low-income populations recorded during the 2000 Census within 50 mi of BSEP, encompassing all of Brunswick and New Hanover Counties in North Carolina; parts of Columbus, Pender, Onslow, Bladen, Sampson Counties in North Carolina; and part of Horry County in

(a) The NRC guidance for performing environmental justice reviews defines "minority" as American Indian or Alaskan Native; Asian; or other Pacific Islander, or Black not of Hispanic Origin, or Hispanic. (NRC 2004).

South Carolina. The analysis was also supplemented by field inquiries to the planning department and social service agencies in Brunswick County.[a]

For the purpose of the staff's review, a minority population is defined to exist if the percentage of minorities within the census block groups[b] in each state within the 50-mi radius potentially affected by the license renewal of BSEP exceeds the corresponding percentage of minorities in the state of which it is a part by 20 percent, or if the corresponding percentage of minorities within the census block group is at least 50 percent. A low-income population is defined to exist if the percentage of low-income population within a census block group exceeds the corresponding percentage of low-income population in the state of which it is a part by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent. For census block groups within Brunswick and New Hanover Counties, for example, the percentage of minority and low-income populations is compared to the percentage of minority and low-income populations in North Carolina. The staff used the 2000 census block groups for identifying minority and low-income populations.

The scope of the review as defined in NRC guidance (NRC 2004a) should include an analysis of impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on populations that are particularly sensitive, and any additional information pertaining to mitigation. The descriptions to be provided by this review should state whether these impacts are likely to be disproportionately high and adverse, and to evaluate the significance of such impacts.

The NRC staff used the census block groups in the 2000 census, which resulted in a universe of 257 block groups, and followed its latest guidance (NRC 2004a) for designating minority categories, including "other" races and multiple-race individuals. Figures 4-1 and 4-2 show the distribution of census block groups for the minority and low-income populations, respectively.

(a) Brunswick and New Hanover Counties were the focus of this inquiry because they lie completely within the 50-mi radius and contain the minority and low-income populations that are nearest the BSEP site. The staff concluded that any findings of environmental justice issues in these counties would warrant further field inquiries in more distant counties. For reasons stated later in this section, further investigation was not warranted.

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

Based on the NRC criteria, CP&L determined that Black minority populations exist in 44 census block groups: 41 in North Carolina and 3 in South Carolina. Two Columbus County block groups contain Native American minority populations. Staff analysis using the 2000 census confirmed the relative numbers and locations of minority populations in the CP&L analysis. Figure 4-1 shows the locations of minority populations.

Black minority populations were scattered throughout the 50-mi area, especially in Wilmington and the rural areas of southern Bladen County and northern Columbus County.

By the NRC criteria (50 percent of population, or at least 20 percent greater than state), three of the total 257 block groups from the 2000 census within 50 mi of the site contain low-income populations. All three census block groups containing low-income populations are located in central Wilmington. Figure 4-2 shows the locations of the low-income populations.

With the locations of minority and low-income populations identified, the staff proceeded to evaluate whether any of the environmental impacts of the proposed action could affect these populations in a disproportionate manner. Based on staff guidance (NRC 2004a), air, land, and water resources within about 50 mi of the BSEP site were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population.

The pathways through which the environmental impacts associated with BSEP license renewal can affect human populations are discussed in each associated section. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that offsite impacts to minority and low-income populations from BSEP license renewal would be SMALL, and no additional mitigation is warranted.

4.5 Groundwater Use and Quality

Only a minor fraction of the service water imported by BSEP is from coastal groundwater aquifers; therefore, the staff concludes that the combined onsite and offsite use of groundwater for the plant is less than 100 gpm for plant use. Therefore, the Category 1 issues, groundwater use and quality, in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, are applicable to BSEP. These issues are listed in Table 4-8. CP&L stated in the ER that it is not aware of any new and significant information associated with the renewal of the BSEP OLs (CP&L 2004). The staff

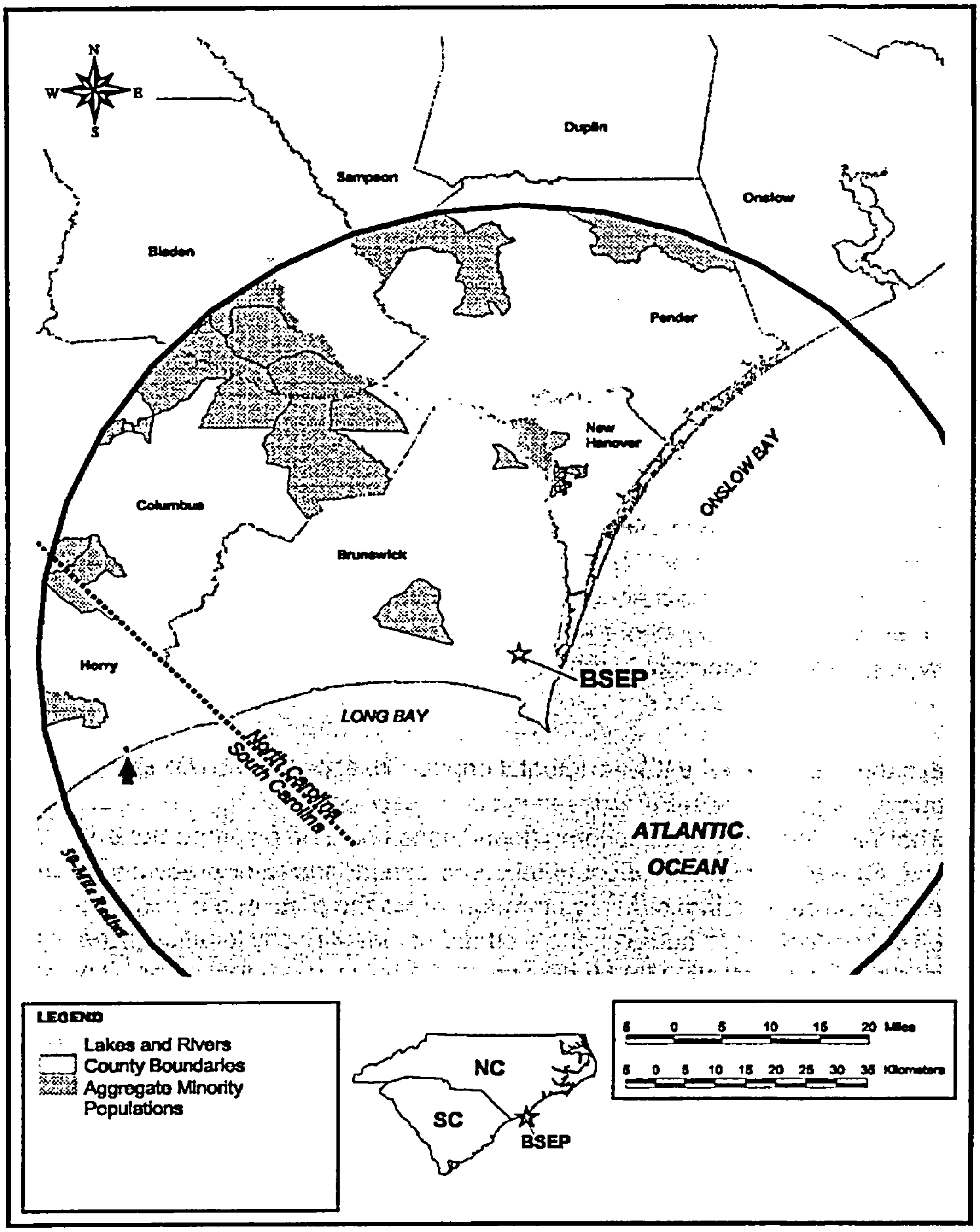

Figure 4-1. Geographic Distribution of Minority Populations (shown in shaded areas) Within 50 Miles of the BSEP Site Based on 2000 Census Block Group Data

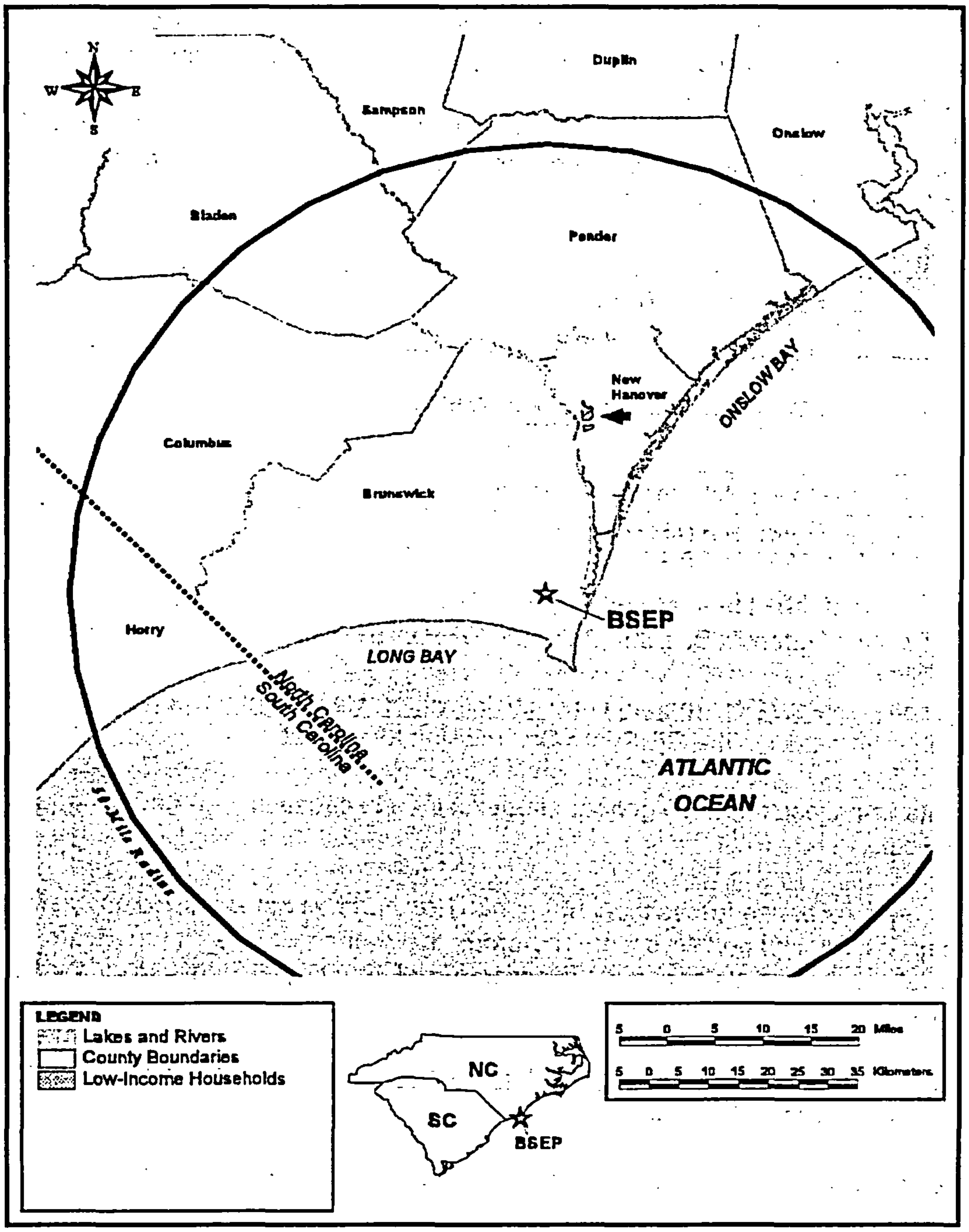

Figure 4-2. Geographic Distribution of Low-Income Populations (shown in shaded areas) Within 50 Miles of the BSEP Site Based on 2000 Census Block Group Data

has not identified any new and significant information on these issues during its independent review of the ER, the staff's site visit, the scoping process, discussions with other agencies, or its evaluation of other information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concludes that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-8. Category 1 Issue Applicable to Groundwater Use and Quality During the License Renewal Term

ISSUE – 10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
GROUNDWATER USE AND QUALITY	
Groundwater-use conflicts (potable and service water; plants that use <100 gpm).	4.8.1.1
Groundwater-quality degradation (saltwater intrusion)	4.8.1.2

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

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

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

  BSEP groundwater use is less than 100 gpm. The staff has not identified any new and significant information on this issue. Therefore, the staff concludes that there are no groundwater-use conflicts during the licenserenewal term beyond those discussed in the GEIS.

- Groundwater quality degradation (saltwater intrusion). Based on information in the GEIS, the Commission found that

  > Nuclear power plants do not contribute significantly to saltwater intrusion.

The staff has not identified any significant new information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no groundwater quality degradation impacts associated with saltwater intrusion during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to groundwater use and quality for BSEP.

4.6 Threatened or Endangered Species

The evaluation of threatened or endangered species is listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-9.

Table 4-9. Category 2 Issue Applicable to Threatened or Endangered Species in the Vicinity of BSEP During the License Renewal Term

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

This issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of the nuclear plant during the license renewal term. The presence of threatened or endangered species in the vicinity of the BSEP site is discussed in Sections 2.2.5 and 2.2.6. On December 29, 2004, the staff contacted the FWS and NMFS to request information on threatened and endangered species and the impacts of license renewal (NRC 2004 b, c). In response, on February 3, 2005, the FWS provided additional information regarding Federally listed species that have been observed or may occur in the vicinity of BSEP and its associated transmission lines, as well as the concerns that the FWS have regarding those species (FWS 2005a). NMFS responded on February 4, 2005, with a listing of marine species that were potentially affected by BSEP operations (NMFS 2005a). The staff has prepared biological assessments (BA) that document its review, and these have been transmitted to FWS and NMFS for their concurrence (NRC 2005a, b). These BAs are provided in Appendix E of this SEIS.

4.6.1 Aquatic Species

As described in Section 2.2.5, there are 14 Federally listed endangered or threatened aquatic species with some potential to occur in the vicinity of the BSEP. Five listed sea turtle species have been observed in Brunswick County. The loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*) turtles have each been found on the BSEP site. The hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) turtles have been observed on rare occasions in Brunswick County, but have not been documented at the BSEP site.

BSEP maintains a diversion structure at the mouth of the cooling water intake canal that supports 3/8-in. mesh screens and specially designed turtle-blocker plastic mesh panels, designed to prevent sea turtles from entering the intake canal. The screens on the diversion structure are cleaned daily, and the canal is patrolled during the primary turtle season to reduce the possibility of a sea turtle being harmed as a result of plant operation. BSEP has undergone Section 7 consultation with the NMFS and has been issued an incidental take statement by that agency. BSEP also maintains an endangered species permit, issued by the North Carolina Wildlife Resources Commission, that allows them to capture and transport live and dead sea turtles for the purpose of releasing them to the ocean, transporting them to a rehabilitation facility, or disposing of them. BSEP is required to report all incidental takes, turtle stranding events and handling activities to these agencies.

The West Indian manatee (*Trichechus manatus*) and short nose sturgeon (*Acipenser brevirostrum*) are Federal endangered species that have been documented in the Cape Fear Estuary on rare occasions but have never been documented at the BSEP site. The sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*) are also Federal endangered species, but they generally inhabit deeper offshore waters and are not expected to occur at the BSEP site (NMFS 2005e). The Federally threatened Waccamaw silverside (*Menidia extensa*) is known only from Lake Waccamaw in Columbus County and is therefore not expected to occur at the BSEP site (FWS 2005b).

CP&L monitors and records occurrences of Federally and State-sensitive aquatic species on the BSEP site and within transmission line rights-of-way. In addition, CP&L directs its contract personnel and consults with appropriate Federal and State agencies to develop and implement restrictions and safeguards to protect threatened and endangered species and their habitats (BSEP 2003; 2005a, b).

The staff concludes that continued operation of BSEP and associated transmission line rights-of-way maintenance during the license renewal term is not likely to adversely affect any Federally listed aquatic species. Thus, the staff concludes that the impact on threatened or endangered aquatic species from an additional 20 years of operation would be SMALL, and no additional mitigation is warranted. The staff's findings were documented in the BAs (Appendix E) that have been forwarded to NMFS and FWS for concurrence.

4.6.2 Terrestrial Species

A total of 16 Federally listed terrestrial species have been identified from counties traversed by transmission line rights-of-way. Federally listed terrestrial species reported to occur from Brunswick, Bladen, Columbus, New Hanover, Onslow, Pender, Cumberland, or Robeson

Counties include the bald eagle (*Haliaeetus leucocephalus*), red-cockaded woodpecker (*Picoides borealis*), piping plover (*Charadrius melodus*), wood stork (*Mycteria americana*), American chaffseed (*Schwalbea americana*), rough-leaf loosestrife (*Lysimachia asperulaefolia*), golden sedge (*Carex lutea*), pondberry (*Lindera melissifolia*), seabeach amaranth (*Amaranthus pumilus*), Hirsts' panic grass (*Panicum hirstii*), Michaux's sumac (*Rhus michauxii*), Cooley's meadowrue (*Thalictrum cooleyii*), small whorled pogonia (*Isotria medeoloides*), Saint Francis' satyr (*Neonympha mitchellii francisci*), and the American alligator (*Alligator mississippiensis*). There have been historical records of the eastern cougar (*puma concolor couguar*) in the vicinity.

Habitat for some of the Federal listed species could potentially be found within or traversed by BSEP transmission line rights-of-way. There are known populations of the roughleaf loosestrife, golden sedge, and Cooley's meadowrue as well as several state listed species within the BSEP transmission rights-of-way. These sites are managed in cooperation with NCDENR (CP&L and NCDENR 1993). Red-cockaded woodpeckers are known to inhabit the adjacent Military Ocean Port Sunny Point, and additional habitat is located in the vicinity of BSEP as well as along several of the transmission lines. 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 were harmed (CP&L 2004a). Wood storks and bald eagles are occasionally seen foraging at the bypass return pond on BSEP, but have not been recorded nesting in the vicinity of BSEP or the transmission rights-of-way. The American alligator is widespread in Walden Creek and has been seen near the transmission rights-of-way and near the intake and discharge canals. This species is not biologically endangered or threatened, but is listed because of its similarity in appearance to other threatened crocodilian species.

CP&L monitors and tracks populations of Federally and State-sensitive terrestrial species on the BSEP site and within transmission line rights-of-way. In addition, CP&L works with their contract personnel and appropriate Federal and State agencies to develop and implement restrictions and safeguards to protect threatened and endangered species and their habitats during maintenance of transmission line rights-of-way (BSEP 2003; 2005a, b).

The staff reviewed information provided by CP&L (2004) and obtained from the FWS and the North Carolina Natural Heritage Program. Based on the site audit, review of CP&L's ER, other reports, and information from FWS and the North Carolina Natural Heritage Program, the staff concludes that the impacts on terrestrial endangered, threatened, proposed, or candidate species of an additional 20 years of operation and maintenance of BSEP and associated transmission lines would be SMALL, and no additional mitigation is warranted. The staff's findings have been documented in the BA (NRC 2005a) (Appendix E).

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

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

4.8 Cumulative Impacts of Operations During the License Renewal Term

The staff considered the potential cumulative impacts during the evaluation of information applicable to each of the potential impacts of operations during the license renewal term identified within the GEIS. For purposes of this analysis, past actions were those related to the resources at the time of plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of the current license term, as well as the 20-year license renewal term. The geographical area over which past, present, and future actions could contribute to cumulative impacts is dependent on the type of action considered, and is described below for each impact area.

The impacts of the proposed action are combined with other past, present, and reasonably foreseeable future actions at BSEP, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor, but collectively significant, actions taking place over time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

4.8.1 Cumulative Impacts Resulting from Operation of the Plant Cooling System

The diversion of water from the Cape Fear River through the BSEP cooling system and then into the Atlantic Ocean does not appreciably impact the surface water supply in the vicinity. CP&L has not proposed any changes to the operation of the intake and discharge systems during the renewal period. Therefore, the staff has determined that operation of the BSEP cooling system does not appreciably contribute to the cumulative impacts on the surface water supply.

In Sections 4.1.1 and 4.1.2 the staff determined that the potential impacts resulting from continued operation of the BSEP cooling water intake system on the impingement and entrainment of fish and shellfish are SMALL. To consider cumulative impacts to aquatic resources, the staff reviewed projections for water withdrawal from the Cape Fear River in the vicinity of BSEP. Facilities in North Carolina with run-of-the-river intake systems are designed to withdraw only a portion of the expected low flow, which the NCDENR calculates as the lowest consecutive 7-day average flow expected to occur once in 10 years, or the 7Q10 flow. For general planning purposes, if a withdrawal does not take more than 20 percent of the 7Q10 flow, there is a general presumption that it will have minimum effect on local habitat and additional studies are not required. Using a limit of 20 percent of the 7Q10 flow as a maximum withdrawal rate for systems projected to withdraw water (cumulatively) from the Cape Fear River in New Hanover and Brunswick Counties through 2050, the systems are likely to have enough water available to meet future demands without significantly impacting aquatic resources (NCDENR 2002). Additionally, all facilities with water intake systems, including BSEP, are regulated by NCDENR so their operations do not impact the maintenance of a balanced, indigenous population of fish, shellfish, and other aquatic organisms. Because CP&L has proposed no changes in the operation of the cooling water system during the license renewal term and the projected cumulative water withdrawals from the lower Cape Fear River during the license renewal term are not likely to significantly impact aquatic resources, the staff has determined that continued operation of the BSEP cooling water intake system is not likely to contribute significantly to cumulative impacts for aquatic resources and no additional mitigation is warranted.

In Section 4.1.3 the staff also determined that the potential for heat shock impacts resulting from operation of the plant's cooling water discharge system to the aquatic environment on or in the vicinity of the site is SMALL. To consider cumulative impacts, the staff determined what other facilities currently discharge to the Atlantic Ocean in the vicinity of BSEP. In Brunswick and New Hanover Counties, there are currently 41 NPDES-permitted facilities. Besides BSEP, only one facility discharges to Atlantic Ocean. This facility, the Southport Cogeneration Plant, began commercial operation in 1987 and is located approximately one-half mile south of the developed portion of the BSEP site (CP&L 2004; Cogentrix 2005). The cogeneration plant burns coal to provide 120 megawatts of electricity to CP&L and process steam to the adjacent Archer Daniels Midland facility. The facility has no discharge limits, and its outfall discharges to the BSEP discharge canal, just outside the nuclear exclusion zone (CP&L 2004; NCDENR 2005). Thus, the two plants already operate simultaneously without impacting aquatic resources. Because the applicant has proposed no changes in the operation of the cooling water discharge during the renewal period, the staff has determined that continued discharge from the BSEP cooling system is not likely to contribute significantly to cumulative impacts for aquatic resources, and no additional mitigation is warranted.

Operation of the BSEP cooling system is not likely to contribute appreciatively to cumulative impacts on the surface water supply or to aquatic resources through water withdrawal or discharge. Therefore, the staff concludes that cumulative impacts resulting from 20 years of continued operation of the plant cooling system are SMALL, and no additional mitigation is warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

The continued operation of the BSEP electrical transmission facilities was evaluated to determine if there is a potential for interactions with other past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources such as wildlife populations, the size and distribution of habitat areas, aquatic resources such as wetlands and floodplains, and both the acute and chronic effects of electromagnetic fields. For purposes of this analysis, the area that could contribute to adverse cumulative effects is associated with the BSEP transmission lines (Figure 2-5). This geographic area encompasses the past, present, and foreseeable future actions associated with the transmission lines.

CP&L follows right-of-way management procedures that were found to be protective of sensitive ecological resources, including wildlife habitat, wetlands, and floodplains. CP&L maintains maps of known sensitive resources, such as wetlands, and maintains the transmission line rights-of-way to minimize impacts, with the result that no net loss of resources occurs. The maintenance procedures minimize disturbance to wildlife and, in many ways, provide greater protection relative to many of the surrounding areas with other land uses.

The staff determined that the electrical current induced by the electromagnetic fields from the BSEP transmission lines is well below the NESC recommendations for preventing electrical shock from induced currents. Therefore, continued operation of the BSEP transmission lines will not detectably change the overall potential for electrical shock in the future within the analysis area. With respect to chronic effects of electromagnetic fields, although the staff considers the GEIS conclusion of "not applicable" to be appropriate in regard to BSEP, the BSEP transmission lines are not likely to detectably contribute to the regional exposure to extremely low frequency electromagnetic fields (ELF-EMF). This conclusion is based on the fact that BSEP transmission lines primarily pass through sparsely populated rural areas, with few residences or businesses close enough to have detectable ELF-EMF.

Therefore, because the impacts from maintaining and operating the transmission system are so minor that they will neither destabilize or noticeably alter the existing aquatic or terrestrial environment, the staff determined that the cumulative impacts of continued operation of BSEP transmission lines will be SMALL, and no additional mitigation is warranted.

4.8.3 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers have been developed by EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 40 CFR Part 190, 10 CFR Part 20, and 10 CFR Part 50, Appendix I. For the purpose of this analysis, the area within a 50-mi radius of the BSEP site was included. As stated in Section 2.2.7, CP&L has conducted a radiological environmental monitoring program (REMP) around the BSEP site since 1973, with the results presented annually in the *BSEP Annual Radiological Environmental Operating Report*. The REMP measures radiation and radioactive materials from all sources, including BSEP, and Global Nuclear Fuels–Americas LLC, a manufacturer of nuclear fuel assemblies located approximately 20 mi north of the BSEP site. Monitoring results for the 5-yr period 1999 through 2003 were reviewed as part of the cumulative impacts assessment (PEC 2000, 2001, 2002, 2003c, 2004), and it was concluded that the radiation and radioactivity in the environmental media monitored around the plant are not significantly higher than pre-operational levels.

Additionally, in Sections 2.2.7 and 4.3, the staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of BSEP during the renewal term are SMALL. Therefore, the monitoring program and staff's conclusion considered cumulative impacts. The NRC and the State of North Carolina would regulate any reasonably foreseeable future actions in the vicinity of the BSEP site that could contribute to cumulative radiological impacts.

Therefore, the staff concludes that cumulative radiological impacts of continued operation of BSEP would be SMALL, and no additional mitigation is warranted.

4.8.4 Cumulative Socioeconomic Impacts

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

The continued operation of BSEP is not likely to add to any cumulative socioeconomic impacts beyond those already evaluated in Section 4.4. In other words, the impacts of issues, such as transportation or offsite land use, are likely to be undetectable beyond the regions previously evaluated and will quickly decrease with increasing distance from the site. The staff determined that the impacts on housing, public utilities, public services, and environmental justice would all be SMALL. The staff determined that the impact on offsite land use would be SMALL because no refurbishment actions are planned at BSEP, and no new incremental sources of plant-related tax payments are expected that could influence land use by fostering considerable growth. There are no reasonably foreseeable scenarios that would alter these conclusions in regard to cumulative impacts. Therefore, the staff determined that the cumulative socioeconomic impacts of continued operation at BSEP would be SMALL, and no additional mitigation is warranted.

4.8.5 Cumulative Impacts on Groundwater Use and Quality

A portion of the groundwater supply used by BSEP for service and auxiliary water needs comes from local groundwater wells. The applicant is not proposing an increase in demand of groundwater well usage during the renewal period. As demand for water supplies increase in the vicinity of BSEP, additional withdrawals of groundwater may be involved to satisfy the water needs of other water users in the region. Additionally, while no evidence suggests this is currently a significant concern, given the proximity of the BSEP site to the coastline, continued and increased groundwater withdrawals could conceivably increase the likelihood of saltwater intrusion developing in the coastal aquifers. However, given the relative abundance of local surface water supplies (notably from the Cape Fear River), the staff has determined that, if groundwater aquifers are unable to support the future increase in water demand adequate sources of surface water are available. Therefore, the staff concludes that the contribution of BSEP operations to cumulative impacts on groundwater use and quality are SMALL, and no mitigation is warranted.

4.8.6 Cumulative Impacts on Threatened or Endangered Species

The geographic area considered in the analysis of potential cumulative impacts to threatened or endangered species includes those North Carolina counties that contain the BSEP site and its associated transmission line rights-of-way (Figure 2-5) and the waters of the Cape Fear River and estuary in the vicinity of the BSEP site. As discussed in Sections 2.2.5 and 2.2.6, a number of threatened or endangered species could occur within this area. The staff's findings, presented in the BA (see Appendix E) and in Section 4.6, are that continued operation of BSEP and its associated transmission line rights-of-way maintenance during the license renewal term would have no effect, or would not likely adversely affect any Federally listed species or any designated critical habitat. Therefore, the staff concludes that the contribution of BSEP operations to cumulative impacts to Federally protected species or designated critical habitat is SMALL, and no additional mitigation is warranted.

- Aquatic Species

Fourteen Federally listed threatened or endangered aquatic species may occur in the vicinity of the BSEP site. However, eleven of these species (hawksbill turtle, leatherback turtle, West Indian manatee, sei whale, right whale, blue whale, humpback whale, sperm whale, fin whale, shortnose sturgeon, and Waccamaw silverside) have never been documented at the BSEP site. Therefore, continued plant operations are unlikely to contribute to cumulative impacts to these species. The remaining three sea turtle species, the loggerhead, green, and Kemp's ridley turtles, have occasionally been found in the BSEP intake canal (CP&L 2004), and cumulative impacts to these species are considered further.

Present and predicted future impacts to sea turtles at BSEP from continued operation may be characterized by recent turtle encounters at the plant. In 2004, BSEP reported 16 sea turtle encounters to NMFS. Seven of these sea turtles were found dead or died, either from plant-related injuries or other causes while nine were tagged and released unharmed to the Atlantic Ocean off Oak Island, far from the BSEP seawater intake canal (BSEP 2005a; TTP 2005). However, a biological opinion issued by NMFS regarding shrimp trawling and sea turtle conservation in the southeastern United States places the BSEP turtle loss in perspective, indicating that even under recent turtle excluder device regulations, approximately 9300 turtles are estimated to die annually as a result of the shrimp trawl fishery in the southeastern United States (NMFS 2002). Comparing sea turtle loss from coastal seawater intakes to the losses from incidental take during shrimp trawling, the biological opinion states that while, "sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. ...sea turtle mortality associated with these activities is relatively low and does not significantly affect the environmental baseline" (NMFS 2002). The 2000 NMFS biological opinion addressing impacts to sea turtles specifically resulting from BSEP operations reached the same conclusion, stating that BSEP "is not likely to jeopardize the continued existence of the loggerhead, leatherback, green, hawksbill, or Kemp's ridley sea turtles" (CP&L 2004).

The baseline condition for Atlantic sea turtles considers how conditions have changed over time and are likely to change in the future (CEQ 1997b). The assessment of cumulative impacts then considers the realistic potential for the resource to sustain itself in the future and whether the proposed action would affect this potential.

Sea turtle populations in the southeast Atlantic have been in a state of decline for many years. The Kemp's ridley turtle was listed as endangered in 1970, and its status has remained unchanged (NMFS 2005b). The green turtle was originally listed in 1978. The recovery team for the green turtle has concluded that the species status has not improved appreciably since listing, although trends are particularly difficult to assess because of wide year-to-year fluctuations in numbers of nesting females, difficulties of conducting research on early life stages, and long generation time (NMFS 2005c). The loggerhead was listed as endangered in 1978, and its status has also remained unchanged. Numbers of nesting females in Florida appear to be stable, but the number of nesting females in South Carolina and Georgia may still be on the decline (NMFS 2005d). The decline of these species is primarily caused by human activities such as harvest of eggs, killing adults for meat and other products, coastal development, commercial fisheries, and pollution (NMFS 2005b, c, d). All three sea turtle species have been subject to high levels of incidental take by shrimp trawlers (NMFS 2002). Besides impingement or entrainment resulting from operation of the BSEP cooling water intake, specific activities that may occur in the vicinity of the BSEP site and contribute to cumulative impacts include, but are not limited to destruction and alteration of nesting and foraging habitats, incidental capture in commercial and recreational fisheries, entanglement in marine debris, entrainment in hopper dredges during maintenance of shipping channels, and vessel strikes.

The proposed action is unlikely to increase sea turtle impacts over present conditions because operating conditions at BSEP are not expected to change. However other human activities, such as fishing, boating, and polluting are likely to continue, and possibly increase, as human populations along the coast increase. Additionally, because these sea turtle species are highly migratory and long-lived, they may also be affected by activities that occur far outside the action area. Fortunately, many coastal communities are adopting turtle nesting protection measures and State and the Federal governments are implementing turtle protection measures that may slow or reverse the sea turtle population decline. Future population increases would likely be attributed to two primary factors: full protection of nesting females and their nests in Mexico, and the requirement to use turtle excluder devices in shrimp trawls both in the United States and Mexico (NMFS 2005b). Table 4-10 summarizes the past, present, proposed, and future actions that would determine cumulative impacts to sea turtles in the vicinity of BSEP.

The staff has reviewed the current status of the Kemp's ridley, green, and loggerhead sea turtles, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects. While the sea turtle populations are threatened and endangered, the operation of BSEP does not contribute significantly to the cumulative impact or to the continued existence of these species, and its continued operation is not likely change its existing level of impact to the species. CP&L currently works with the appropriate State and Federal agencies to develop and establish guidelines to protect threatened and endangered species and has adopted mitigation measures to protect sea turtle species. Therefore, the staff has determined

Table 4-10. Actions that Would Determine Cumulative Impacts to Sea Turtles in the Vicinity of BSEP

Resource	Past Actions	Present Actions	Proposed Action	Future Actions	Cumulative Effect
Sea turtles (Kemp's ridley, green, loggerhead)	Significant decline in numbers and Federal listing as endangered and threatened species	Occasional documented take from BSEP operations; human impacts to nesting activities and to turtles in the marine environment; improved legislative protection for sea turtles in the United States and Mexico	Same level as present action regarding occasional documented take from BSEP operations	Continued loss of sea turtles from human activities; better sea turtle protection standards and improvement of population status estimates through refinements in science and technology	Significant decline in numbers; slow recovery of species possible through legislative action and enforcement of species and habitat protection measures

that the contributions to cumulative impacts to threatened and endangered aquatic species from continued operation of BSEP and its associated transmission line rights-of-way would be SMALL and no further mitigation is warranted.

- Terrestrial Species

Sixteen Federally listed threatened or endangered species may occur in the vicinity of the BSEP site and associated transmission line rights-of-way. Operation of BSEP is not likely to have a detectable effect on terrestrial species located in the vicinity of the BSEP site. Therefore, operations at the plant site would not have a detectable contribution to the cumulative, regional impacts on threatened or endangered species.

Federally listed species and habitats for these species have been found within the BSEP transmission line rights-of-way of. CP&L works with appropriate Federal and State agencies to develop and establish guidelines to protect threatened and endangered species on the BSEP site and transmission line rights-of-way. CP&L and NCDENR signed a Memorandum of Understanding in 1993 to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission line rights-of-way (CP&L and NCDENR 1993). CP&L maintains best management practices for rare plants on its rights-of-way and has procedures in place to protect these and other endangered or threatened species, if they are encountered (BSEP 2003, 2005a). In some cases, the rights-of-way and the maintenance practices may provide for habitat that is not found in surrounding areas.

Therefore, the staff determined that the contributions to cumulative impacts to threatened or endangered terrestrial species resulting from continued operation of BSEP and its associated transmission line rights-of-way would be SMALL, and no additional mitigation is warranted.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither CP&L nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with BSEP operation during the license renewal term. Consequently, the staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 10 Category 2 issues applicable to BSEP operation during the license renewal term and for environmental justice and chronic effects of electromagnetic fields. For all 10 issues and environmental justice, the staff concluded that the potential environmental impact of license renewal term operations of BSEP would be of SMALL significance in the context of the standards set forth in the GEIS and that additional mitigation would not be warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the staff did not conduct an evaluation of this issue.

4.10 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy,* Part 50, "Domestic Licensing of Production and Utilization Facilities."

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

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks Forests, and Public Property,* Part 800, "Protection of Historic Properties."

40 CFR Part 9. Code of Federal Regulations, Title 40, *Protection of the Environment,* Part 9, "OMB Approvals Under the Paperwork Reduction Act."

40 CFR Part 122. Code of Federal Regulations, Title 40, *Protection of the Environment,* Part 122, "EPA administered permit programs: The national pollutant discharge elimination system."

40 CFR Part 123. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 123, "State Program Requirements."

40 CFR Part 124. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 124, "Procedures for Decisionmaking."

40 CFR Part 125. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

59 FR 7629. February 16, 1994. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." *Federal Register.*

66 FR 65255. December 18, 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities: Final Rule." *Federal Register*, US Environmental Protection Agency. Accessed at: http://www.epa.gov/fedrgstr/EPA_WATER/2001/December/Day_18/w28968.pdf on May 5, 2004.

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5.0 Environmental Impacts of Postulated Accidents

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.

(2) Single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

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

5.1 Postulated Plant Accidents

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

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

5.1.1 Design-Basis Accidents

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

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients and a broad spectrum of postulated accidents without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in Title10 of the Code of Federal Regulations (CFR) Parts 50 and 100.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license (OL). The results of these evaluations are found in license documentation such as the staff's safety evaluation report, the final environmental statement, the licensee's updated final safety analysis report, and Section 5.1 of this supplemental environmental impact statement (SEIS). The licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant, including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal term. Accordingly, the design of the plant relative to DBAs during the extended term is considered to remain acceptable, and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs make them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, which is applicable to the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP), is listed in Table 5-1.

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

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

Based on information in the GEIS, the Commission found that

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

Carolina Power & Light Company (CP&L) stated in its Environmental Report (ER) (CP&L 2004) that it is not aware of any new and significant information associated with the renewal of BSEP. The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS.

5.1.2 Severe Accidents

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

Based on information in the GEIS, the Commission found that

> The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to 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.

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

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

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

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

5.2 Severe Accident Mitigation Alternatives

Section 51.53(c)(3)(ii)(L) of 10 CFR 51 *requires that license renewal applicants consider* alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for BSEP; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for BSEP conducted by CP&L and described in the ER, and the NRC's review of CP&L's evaluation. The details of the review are described in the NRC staff evaluation which was prepared with contract assistance from Information Systems Laboratories, Inc. The entire evaluation of SAMAs for BSEP is presented in Appendix G.

The SAMA evaluation for BSEP was conducted using a four-step approach. In the first step, CP&L quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic safety assessment (PSA) and other risk models.

In the second step, CP&L examined the major risk contributors and identified possible changes to components, systems, procedures, and training (i.e., SAMAs) that would reduce risk. CP&L initially identified 43 potential SAMAs for BSEP. CP&L screened out seven SAMAs from further consideration because they are not applicable to the BSEP design, they would require extensive changes that would involve implementation costs known to exceed any possible benefit, or they would exceed the dollar value associated with completely eliminating all internal and external event severe accident risk at both BSEP units. The remaining 36 SAMAs were subjected to further evaluation during which nine additional SAMAs were screened out on the basis of risk insights and other factors. When this screening was completed, 27 SAMAs remained for further consideration.

In the third step, CP&L estimated the benefits and the costs associated with each of the remaining 27 SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997). The cost of implementing each proposed SAMA was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining 27 SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). CP&L found seven SAMAs to be potentially cost-beneficial in the baseline analysis (SAMAs 1, 15, 17, 19, 25, 29, and 36), and several additional SAMAs to be potentially cost-beneficial when alternative discount rates and analysis uncertainties are considered (SAMAs 6, 13, 16, 18, 30, 31, 32, and 34) (CP&L 2004).

None of these SAMAs relate to adequately managing the effects of aging during the term of extended operation; therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. CP&L indicates that they plan to further evaluate the potentially cost-beneficial SAMAs for possible implementation. CP&L 's SAMA analyses and NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

CP&L submitted an assessment of SAMAs for BSEP in its ER (CP&L 2004). This assessment was based on the most recent BSEP PSA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2

(MACCS2) computer program, and insights from the BSEP Individual Plant Examination (CP&L 1992) and Individual Plant Examination of External Events (IPEEE) (CP&L 1995).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 4.19 x 10^{-5} per year. This CDF is based on the risk assessment for internally initiated events. CP&L did not include the contribution to risk from external events within the BSEP risk estimate; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of two. The breakdown of CDF by initiating event for Units 1 and 2 is provided in Table 5-3. As shown in the table, events initiated by loss of offsite power (dual unit) and turbine trips are the dominant contributors to CDF. Internal floods contribute about 2 percent of the CDF.

In its ER, CP&L estimated the dose to the population within 50 mi of the BSEP site to be approximately 29.35 person-rem per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Containment failures within the intermediate time frame (6 to 24 hours following event initiation) and early time frame (less than 6 hours following event initiation) dominate the population dose risk at BSEP.

The NRC staff has reviewed CP&L's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDFs and offsite doses reported by CP&L.

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, CP&L searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, CP&L considered insights from the plant-specific PSA, SAMA analyses performed for other operating plants that have submitted license renewal applications, and SAMAs that could further reduce the risk of the dominant fire compartments. CP&L identified 43 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures, and training.

Seven SAMAs were removed from further consideration because they are not applicable to the BSEP design, they would require extensive changes that would involve implementation costs known to exceed any possible benefit, or they would exceed the dollar value associated with completely eliminating all internal and external event severe accident risk at both BSEP units. The remaining 36 SAMAs were subjected to further evaluation. During the second phase of the evaluation, CP&L screened out nine additional SAMAs on the basis of risk insights and other factors. A detailed cost-benefit analysis was performed for each of the 27 remaining SAMAs.

Table 5-3. BSEP Core Damage Frequency for Internal Events

Initiating Event	CDF (per year)	Percent Contribution to CDF
Loss of offsite power (LOOP) – dual unit	1.47×10^{-5}	35.1
Turbine trip	1.14×10^{-5}	27.3
Main steam isolation valve (MSIV) closure/loss of condenser vacuum	4.78×10^{-6}	11.4
Loss of direct current (DC) panel	3.18×10^{-6}	7.6
Loss of alternating current (AC) emergency bus	2.39×10^{-6}	5.7
Loss of control rod drive (CRD)	1.72×10^{-6}	4.1
LOOP – single unit	1.01×10^{-6}	2.4
Other	1.01×10^{-6}	2.4
Internal floods	8.80×10^{-7}	2.1
Loss of reactor building closed cooling water (RBCCW)	4.60×10^{-7}	1.1
Interfacing systems loss of coolant accident (ISLOCA)/excessive LOCA	3.40×10^{-7}	0.8
Total CDF (internal events)	**4.19×10^{-5}**	**100**

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

Containment Release Mode	Population Dose (person-rem per year)	Percent Contribution
Early Containment Failure	8.38	28
Intermediate Containment Failure	20.92	71
Late Containment Failure	0.05	<1
Intact Containment	Negligible	Negligible
Total Population Dose	**29.35**	**100**

The staff concludes that CP&L used a systematic and comprehensive process for identifying potential plant improvements for BSEP, and that the set of potential plant improvements identified by CP&L is reasonably comprehensive and, therefore, is acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

CP&L evaluated the risk-reduction potential of the remaining 27 SAMAs. Most of the SAMA evaluations were performed using realistic assumptions with some conservatism. For several of the SAMAs, the risk reduction was based on bounding assumptions.

CP&L estimated the costs of implementing the 27 SAMAs through the application of engineering judgment, the use of estimates from other licensees' estimates for similar improvements, and the development of site-specific cost estimates. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles.

The staff reviewed CP&L's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and somewhat conservative (i.e., the estimated risk reduction is similar to or somewhat higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on CP&L 's risk-reduction estimates.

The staff reviewed the bases for CP&L's cost estimates. For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The staff found the cost estimates to be reasonable and generally consistent with estimates provided in support of other plants' analyses.

The staff concludes that the risk reduction and the cost estimates provided by CP&L are sufficient and adequate for use in the BSEP SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by CP&L was based primarily on guidance provided in the *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184 (NRC 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 states that two sets of estimates should be developed – one at 3 percent and one at 7 percent (NRC 2004). CP&L provided both sets of estimates and stated that it would consider for further evaluation any SAMA that was cost-beneficial using a 3 percent discount rate (CP&L 2004).

CP&L identified seven potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a 7 percent discount rate):

- SAMA 1 – Portable generator for direct current (DC) power: This SAMA involves the use of a portable generator to supply DC power during a station blackout.

- SAMA 15 – Diverse emergency diesel generator (EDG) heating, ventilation, and air-conditioning logic: This SAMA involves the installation of a diverse set of fan actuation logic that would reduce the reliance on operators to perform a fan start on loss of the automatic actuation logic.

- SAMA 17 – Provide alternative feeds to panels supplied only by DC bus 2A-1: This SAMA involves the installation of alternate DC feeds that may reduce plant risk through diversification of the power supplies.

- SAMA 19 – Provide an alternate means of supplying the instrument air header: This SAMA involves procurement of an additional portable compressor to be aligned to the supply header to reduce the risk associated with loss of instrument air.

- SAMA 25 – Proceduralize battery charger high-voltage shutdown circuit inhibit: This SAMA involves disabling the charger high-voltage trip circuit when the batteries are disconnected from the DC circuit, preventing the trip and allowing the chargers to remain online.

- SAMA 29 – Portable EDG fuel oil transfer pump: This SAMA provides additional means of supplying the EDG day tank in the event that a common cause failure prevents operation of the existing pumps.

- SAMA 36 – Use fire-fighting water as a backup for containment spray: This SAMA would provide redundant containment spray function without the cost of installing a new system.

When benefits are evaluated using a 3-percent discount rate, two additional SAMAs were determined to be potentially cost-beneficial in the staff's assessment:

- SAMA 13 – Install an inter-unit CRD cross-tie as a potential means of recovering from a loss of CRD at a given unit

- SAMA 34 – Use of DC generators to provide power to operate the power control breakers while a 480-V alternating current generator could supply the air compressors for breaker support

CP&L and the staff considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. If benefits are doubled to account for uncertainties, the following six additional SAMAs (beyond the nine SAMAs identified above) could be cost-beneficial: SAMAs are SAMAs 6, 16, 18, 30, 31, and 32.

Several of the SAMAs are not independent; that is, implementation of one SAMA could achieve a portion of the benefit of the others. CP&L noted that the high positive impact of implementing SAMA 1 could affect the cost-effectiveness of the remaining cost-beneficial SAMAs (Progress Energy 2005a). Accordingly, CP&L performed a probabilistic evaluation to investigate the impact on the remaining cost-beneficial SAMAs if SAMA 1 were to be implemented. Based on the information provided by CP&L, implementation of SAMA 1 would alter the cost-effectiveness of the remaining SAMAs such that several SAMAs would no longer be cost-beneficial. However, several of the SAMAs that were cost-beneficial in the baseline analysis (SAMAs 15, 25, and 29) would remain potentially cost-beneficial after implementation of SAMA 1, and several additional SAMAs that either became cost-beneficial at using a 3 percent discount rate or when uncertainties were considered might also remain potentially cost-beneficial (SAMAs 6, 16, 18, 30, 31, 32, 34).

CP&L has indicated that a further evaluation of the potentially cost-beneficial SAMA will be performed (Progress Energy 2005b). This assessment will focus on SAMA 1, and those baseline case SAMAs that would remain cost-beneficial if SAMA 1 were implemented (i.e., SAMAs 15, 25, and 29). In response to the staff's recognition that SAMAs other than those in the baseline case may become cost-beneficial when a 3-percent discount rate is used or when uncertainties are considered, CP&L stated that it will include these SAMAs (SAMAs 6, 16, 18, 30, 31, 32, and 34) in the assessment that will make recommendations for the further evaluations of SAMAs (Progress Energy 2005b). Completion of the evaluations is being tracked in the BSEP action tracking system.

The staff notes that all of the potentially cost-beneficial SAMAs identified in either the baseline case or the 3-percent discount rate case (see bolded entries in Table G-4) are included within the set of SAMAs that CP&L plans to further evaluate, with the exception of Phase II SAMAs 13, 19, and 36. The staff concludes that these three SAMAs are also potentially cost-beneficial and may remain so even if SAMA 1 is implemented.

The staff concludes that, with the exception of the potentially cost-beneficial SAMAs described above, the costs of the SAMAs would be higher than the associated benefits.

5.2.6 Conclusions

The staff reviewed CP&L's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by CP&L are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PSA, the likelihood of there being cost-beneficial enhancements in this area was minimized by (1) including several candidate SAMAs related to dominant fire events, (2) implementing plant improvements as a result of the IPEEE process, and (3) increasing the estimated SAMA benefits for internal events by a factor of two to account for potential benefits in external events.

The cost-benefit analyses showed that seven of the SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 1, 15, 17, 19, 25, 29, and 36). CP&L performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, eight additional SAMAs were identified as potentially cost-beneficial (SAMAs 6, 13, 16, 18, 30, 31, 32, and 34). CP&L has committed to further evaluate SAMA 1 and SAMAs that may remain potentially cost-beneficial if SAMA 1 is implemented (SAMAs 6, 15, 16, 17, 18, 25, 29, 30, 31, 32, and 34). The staff concluded all of these SAMAs are potentially cost-beneficial. In addition, the staff concluded that SAMAs 13, 19, and 36 are potentially cost-beneficial and may remain so even if SAMA 1 is implemented.

Based on its review of the SAMA analysis, the staff concurs with CP&L's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the staff agrees that further evaluation of these SAMAs by CP&L is warranted. However, none of the potentially cost-beneficial SAMAs identified relate to adequately managing the effects of aging during the term of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.3 References

10 CFR 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

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

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

10 CFR 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

Carolina Power & Light Company (CP&L). 1992. Letter from R. B. Starkey, Jr., CP&L, to U.S. NRC Document Control Desk. Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2, Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62, Response to Generic Letter 88-20 Supplement 1 – Submittal of Individual Plant Examination (IPE) for Brunswick Units 1 & 2, August 31, 1992.

Carolina Power & Light Company (CP&L). 1995. Letter from Roy A. Anderson, CP&L, to U.S. NRC Document Control Desk. Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2, Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62, Response to Generic Letter 88-20 Supplement 4 – Submittal of Individual Plant Examination for External Events (IPEEE), June 30, 1995.

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report–Operating License Renewal Stage, Brunswick Steam Electric Plant Units No. 1 and 2.* Docket Nos. 50-325 and 50-324, Southport, North Carolina.

Progress Energy Carolinas, Inc. (Progress Energy). 2005a. Letter from Cornelius J. Gannon, Progress Energy, to USNRC Document Control Desk. Subject: Brunswick Steam Electric Plant Units 1 and 2, Docket Nos. 50-325 and 50-324, License Nos. DPR-71 and DPR-62, Response to Request for Additional Information – License Renewal, April 21, 2005.

Progress Energy Carolinas, Inc. (Progress Energy). 2005b. Letter from Cornelius J. Gannon, Progress Energy, to USNRC Document Control Desk. Subject: Brunswick Steam Electric Plant Units 1 and 2, Docket Nos. 50-325 and 50-324, License Nos. DPR-71 and DPR-62, Further Response to License Renewal Severe Accident Mitigation Alternatives Request for Additional Information SAMA1-8 (NRC TAC Nos. MC4641 and MC4642), June 1, 2005.

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

U.S. Nuclear Regulatory Commission (NRC). 1997. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR-0184, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission.* NUREG/BR-0058, Rev. 4, Washington, D.C.

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

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

This chapter addresses the issues that are related to the uranium fuel cycle and solid-waste management during the license renewal term that are listed in Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, Table B-1, and are applicable to Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S–3, "Table of Uranium Fuel Cycle Environmental

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

Data," and in 10 CFR 51.52(c), Table S–4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

6.1 The Uranium Fuel Cycle

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

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

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

Carolina Power & Light Company (CP&L) stated in its Environmental Report (ER) that it is not aware of any new and significant information associated with the renewal of the BSEP operating licenses (OLs) (CP&L 2004). The staff has not identified any new and significant information during its independent review of the ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the license renewal term beyond those discussed in the GEIS.

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

  > The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no

> cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits and even smaller fractions of natural background exposure to the same populations.
>
> Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA [National Environmental Policy Act] implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- <u>Offsite radiological impacts (spent fuel and high-level waste disposal)</u>. Based on information in the GEIS, the Commission found that

> For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses,

but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 3×10^{-3}.

Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980 [DOE 1980]. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths world-wide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that

> these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

On February 15, 2002, based on a recommendation by the Secretary of the Department of Energy, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and HLW. The U.S. Congress approved this recommendation on July 9, 2002, in Joint Resolution 87, which designated Yucca Mountain as the repository for spent nuclear waste. On July 23, 2002, the President signed Joint Resolution 87 into law; Public Law 107-200, 116 Stat. 735 (2002) designates Yucca Mountain as the repository for spent nuclear waste. This development does not represent new and significant information with respect to the offsite radiological impacts from license renewal related to disposal of spent nuclear fuel and HLW.

The U.S. Environmental Protection Agency (EPA) developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000 year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63.

Therefore, for the HLW and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, we assumed that limits would be developed along the lines of the 1995 National Academy of Sciences report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository that would comply with such limits could and likely would be developed at some site. Peak doses to virtually all individuals will be 100 mrem per year or less.

Despite the current uncertainty with respect to these rules, some judgment as to the National Environmental Policy Act of 1969 (NEPA) implications of offsite radiological impacts of spent fuel and high-level waste disposal should be made. The staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and HLW disposal during the license renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the license renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low-level waste storage and disposal associated with the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of mixed waste storage and disposal associated with the license renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

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

> No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.

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

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

> The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada, are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S–4–Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.

BSEP meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS. There are no Category 2 issues for the uranium fuel cycle and solid-waste management.

6.2 References

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

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

10 CFR Part 63. Code of Federal Regulations, Title 10, *Energy*, Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards.* Washington, D.C.

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

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report – Operating License Renewal Stage, Brunswick Steam Electric Plant Units 1 and 2.* Docket Nos. 50-325 and 50-324, Southport, North Carolina.

U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS-0046F, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors,* NUREG-0586 (NRC 2002). The staff's evaluation of the environmental impacts of decommissioning presented in Supplement 1 resulted in a range of impacts for each environmental issue. These results may be used by licensees as a starting point for a plant-specific evaluation of the decommissioning impacts at their facilities.

The incremental environmental impacts associated with decommissioning activities resulting from continued plant operation during the license renewal term are evaluated in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a] The evaluation in NUREG-1437 includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

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

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

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

7.1 Decommissioning

Category 1 issues in Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, Table B-1, that are applicable to Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) decommissioning following the renewal term are listed in Table 7-1. Carolina Power & Light Company (CP&L) stated in its Environmental Report (ER) that it is aware of no new and significant information regarding the environmental impacts of BSEP Units 1 and 2 license renewal (CP&L 2004). The staff has not identified any new and significant new information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of BSEP Units 1 and 2 Following the License Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
DECOMMISSIONING	
Radiation doses	7.3.1; 7.4
Waste management	7.3.2; 7.4
Air quality	7.3.3; 7.4
Water quality	7.3.4; 7.4
Ecological resources	7.3.5; 7.4
Socioeconomic impacts	7.3.7; 7.4

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

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

    Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 person-rem caused by buildup of long-lived radionuclides during the license renewal term.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

    Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

    Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS

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

> Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

> Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

The staff has not identified any new and significant information during its independent review of the CP&L ER, the scoping process, the staff's site visit, or its evaluation of other available information. Therefore, the staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

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

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report – Operating License Renewal Stage, Brunswick Steam Electric Plant Units 1 and 2.* Docket Nos. 50-325 and 50-324, Southport, North Carolina.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report,* "Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Volumes 1 and 2, Washington, D.C.

8.0 Environmental Impacts of Alternatives to Operating License Renewal

This chapter examines the potential environmental impacts associated with not renewing the operating licenses (OLs) for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) (i.e., the no-action alternative); the potential environmental impacts from electric generating sources other than BSEP; the possibility of purchasing electric power from other sources to replace power generated by BSEP and the associated environmental impacts; the potential environmental impacts from a combination of generating and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by BSEP. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRCs) three-level standard of significance – SMALL, MODERATE, or LARGE – developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[(a)] with the additional impact categories of environmental justice and transportation.

8.1 No-Action Alternative

The NRC's regulations [10 CFR Part 51, Subpart A, Appendix A(4)] implementing the National Environmental Policy Act of 1969 (NEPA) specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the OLs for BSEP, and Carolina Power & Light Company (CP&L) would then decommission BSEP when plant operations cease. CP&L will be required to comply with NRC decommissioning requirements whether or not the OLs are

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

renewed. CP&L will be required to shut down BSEP and to comply with NRC decommissioning requirements whether or not the OLs are renewed. If the BSEP OLs are renewed CP&L continues to operate BSEP during the renewal period, shutdown of the units and decommissioning activities will not be avoided, but will be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning under both license renewal and the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the GEIS, Chapter 7 of this supplemental environmental impact statement (SEIS), and Supplement 1 to the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

The environmental impacts of the no-action alternative are summarized in Table 8-1 and are discussed in the following paragraphs. Implementation of the no-action alternative would also have certain positive impacts in that adverse environmental impacts associated with current operation of BSEP (e.g., solid waste impacts and adverse impacts on aquatic life) would be eliminated.

The no-action alternative is a conceptual alternative resulting in a net reduction in power production, but with no environmental impacts assumed for replacement power. In actual practice, the power lost by not renewing the BSEP OLs would likely be replaced by (1) CP&L generating alternatives other than BSEP, (2) power purchased from other electricity providers, (3) demand-side management (DSM) and energy conservation, or (4) some combination of these options. This replacement power would produce additional environmental impacts as discussed in Section 8.2.

8.1.1 Land Use

Temporary changes in onsite land use could occur during decommissioning. Temporary changes may include addition or expansion of staging and laydown areas or construction of temporary buildings and parking areas. No offsite land-use changes are expected as a result of decommissioning. Following decommissioning, the land occupied by BSEP would likely be retained by CP&L for other corporate purposes. Eventual sale or transfer of the land occupied by BSEP, however, could result in changes to land use. Notwithstanding this possibility, the staff concludes that the impacts of the no-action alternative on land use would be SMALL.

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comments
Land Use	SMALL	Onsite impacts expected to be temporary. No offsite impacts expected.
Ecology	SMALL	Impacts to ecology are expected to be temporary and largely mitigtable using best management practices.
Water Use and Quality	SMALL	Water use will decrease. Water quality unlikely to be adversely affected.
Air Quality	SMALL	Greatest impact is likely to be from fugitive dust. Impact can be mitigated by application of best management practices.
Waste	SMALL	Generation of low-level and mix waste will decrease and high level waste generation will eventually stop.
Human Health	SMALL	Radiological doses to workers and members of the public are expected to be within regulatory limits and comparable to, or lower than, doses from operating plants. Occupational injuries are possible, but injury rates at nuclear power plants are below the U.S. average industrial rate.
Socioeconomics	SMALL to MODERATE	There could be a decrease in employment in Brunswick County and surrounding counties and tax revenues in Brunswick County.
Aesthetics	SMALL	Positive impact from eventual removal of buildings and structures. Some noise impact during decommissioning operations.
Historic and Archaeological Resources	SMALL	Minimal impact on land utilized during plant operations. Land occupied by BSEP would likely be retained by CP&L for other corporate purposes.
Environmental Justice	SMALL to MODERATE	Some loss of employment opportunities and social programs is expected.

8.1.2 Ecology

At the BSEP site, impacts on aquatic ecology could result from removal of in-water pipes and structures or the filling of the intake and discharge canals. Any impacts to aquatic ecology would likely be short-term and could be mitigated. The aquatic environment is expected to recover naturally. Impacts on terrestrial ecology could occur as a result of land disturbance for additional laydown yards, stockpiles, and support facilities. Land disturbance is expected to be minimal and to result in relatively short-term impacts that can be mitigated using best management practices. The land is expected to recover naturally. Overall, the staff concludes that the ecological impacts associated with the no-action alternative would be SMALL.

8.1.3 Water Use and Quality

Decommissioning would be expected to result in a significant reduction in water use because reactor cooling would no longer be required. As plant staff size decreases, the demand for potable water is expected to also decrease. BSEP currently uses groundwater wells primarily for the biology laboratory. Plant shutdown would be expected to further reduce use of all groundwater resources. Overall, water use and quality impacts decommissioning are considered SMALL.

8.1.4 Air Quality

Decommissioning activities that can adversely affect air quality include dismantlement of systems and equipment, demolition of buildings and structures, and the operation of internal combustion engines. The most likely adverse impact would be the generation of fugitive dust. Best management practices, such as seeding and wetting, can be used to minimize the generation of fugitive dust. Overall, air quality impacts associated with from decommissioning are considered SMALL.

8.1.5 Waste

The impacts of waste generated by plant operation are discussed in Chapter 6. The impacts of low-level and mixed waste from plant operation are characterized as SMALL. When the plant stops operating, the plant will eventually stop generating high-level waste, and generation of low-level and mixed waste associated with plant operation and maintenance will be reduced. Disposal of nonradioactive waste would be at onsite and offsite licensed disposal facilities. Therefore, the staff concludes the impact of waste generated after shutdown of the plant would be SMALL.

8.1.6 Human Health

Radiological doses to occupational workers during decommissioning activities are estimated to average approximately 5 percent of the dose limits in 10 CFR Part 20, and to be similar to, or lower than, the doses experienced by workers in operating nuclear power plants. Collective doses to members of the public and to the maximally exposed individual as a result of decommissioning activities are estimated to be well below the limits in 10 CFR Part 20, and to be similar to, or lower than, the doses received from operating nuclear power plants. Occupational injuries to workers engaged in decommissioning activities are possible. However, historical injury and fatality rates at nuclear power plants have been lower than the average U.S. industrial rates. Overall, the staff concludes that the human health impacts associated with the no-action alternative would be SMALL.

8.1.7 Socioeconomics

If the two BSEP units cease operation at the end of their current OLs, there would be a decrease in employment and tax revenues associated with the plant closure. Employment (primary and secondary) impacts and impacts on population would occur principally in Brunswick and New Hanover Counties, where most BSEP employees reside (CP&L 2004). The no-action alternative would result in the loss of plant payrolls 20 years earlier than if the OLs were renewed.

Tax-related impacts would occur in Brunswick County. Property tax payments made by CP&L to Brunswick County for BSEP constituted approximately 7.5 percent of the county's total tax revenue in 2002 (CP&L 2004). The no-action alternative would result in the loss of the taxes attributable to BSEP. There could also be an adverse impact on housing values and the local nearby economy if BSEP were to cease operations.

Both Chapter 7 of the GEIS and Supplement 1 to NUREG-0586 (NRC 2002) note that socioeconomic impacts would be expected as a result of the decision to close a nuclear power plant, and that the direction and extent of the overall impacts would depend on the state of the economy, the net change in workforce at the plant, and the changes in local government tax receipts. The socioeconomic impacts of decommissioning activities are expected to be small. Appendix J of Supplement 1 to NUREG-0586 (NRC 2002) shows that the overall socioeconomic impact of plant closure plus decommissioning could be greater than small.

CP&L employees working at BSEP contribute time and money toward community involvement, including school, churches, charities, and other civic activities. It is likely that, with a reduced presence in the community following decommissioning, community involvement efforts by CP&L and its employees in the region would decrease.

Overall, the staff concludes that the socioeconomic impacts resulting from implementation of the no-action alternative would be SMALL to MODERATE.

8.1.8 Aesthetics

Decommissioning would result in the eventual dismantlement of buildings and structures at the BSEP site , and can normally be mitigated, resulting in a positive aesthetic impact. Operational noise would be reduced or eliminated. Noise that may be detectable offsite would be generated during decommissioning operations; however, the impact is unlikely to be of large significance and can normally be mitigated. Overall, the staff concludes that the aesthetic impacts associated with the no-action alternative would be SMALL.

8.1.9 Historic and Archaeological Resources

The amount of undisturbed land needed to support the decommissioning process will be relatively small. Activities conducted within operational areas are not expected to have a detectable effect on important cultural resources because these areas have been impacted during the operating life of the plant. Minimal disturbance of land outside the operational area for decommissioning activities is expected. Historic and archaeological resources on undisturbed portions of the site are not expected to be adversely affected. It is likely that the BSEP site would be retained by CP&L following decommissioning. Notwithstanding this possibility, the staff concludes that the impacts of the no-action alternative on historic and archaeological resources would be SMALL.

8.1.10 Environmental Justice

As discussed in Chapter 4, current operations at BSEP have no disproportionate impacts on the minority and low-income populations of Brunswick County and the surrounding counties, and no environmental pathways have been identified that would cause disproportionate impacts. Closure of BSEP could result in decreased employment opportunities and tax revenues in Brunswick County and the surrounding counties, with possible negative and disproportionate impacts on minority or low-income populations. Therefore, overall, the staff concludes that the environmental justice impacts under the no-action alternative would be SMALL to MODERATE.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by BSEP assuming that the OLs are not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- coal-fired generation at the BSEP site and at an alternate site (Section 8.2.1)
- natural gas-fired generation at the BSEP site and at an alternate site (Section 8.2.2)
- nuclear generation at the BSEP site and at an alternate site (Section 8.2.3).

The existing BSEP nuclear generating units use a once-through cooling system as described in Section 2.1.3 of this SEIS. For the coal (Section 8.2.1), natural gas combined-cycle (Section 8.2.2), and new nuclear (Section 8.2.3) alternatives, a closed-cycle cooling system using natural draft or mechanical draft cooling towers is assumed as the principal plant cooling option. Once-through cooling is considered as a secondary cooling option in Sections 8.2.1.2, 8.2.2.2, and 8.2.3.2.

The alternative of purchasing power from other sources to replace power generated at BSEP is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for BSEP are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an Annual Energy Outlook. In its *Annual Energy Outlook 2005 with Projections to 2025,* EIA projects that combined-cycle or combustion turbine technology fueled by natural gas is likely to account for more than 60 percent of new electric generating capacity through the year 2025 (DOE/EIA 2005a). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet baseload[a] requirements. Coal-fired plants are projected by EIA to account for approximately 33 percent of new capacity during this period. Coal-fired plants are generally used to meet baseload requirements. Renewable energy sources, primarily wind, geothermal, and biomass units, are projected by EIA to account for approximately 5 percent of capacity additions. The remaining capacity additions are projected by EIA to come from distributed generation, mostly natural gas-fired turbines. The EIA projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. Advanced natural gas combined-cycle plants are projected by EIA to have the lowest generation cost in 2015 and advanced coal-fired plants are projected to have the lowest generation cost in 2025 (DOE/EIA 2005a).

EIA projects that oil-fired plants will account for very little new generation capacity in the United States through the year 2025 because of higher fuel costs and lower efficiencies (DOE/EIA 2005a).

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States through the year 2020 because natural gas and coal-fired plants

(a) A baseload plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for baseload generation (i.e., these units generally run near full load).

are projected to be more economical (DOE/EIA 2005a). In spite of this projection, a new nuclear plant alternative for replacing power generated by BSEP is considered for reasons stated in Section 8.2.3.

If an alternative generating technology were selected to replace power generated by BSEP, the two BSEP units would be decommissioned. Environmental impacts associated with decommissioning are discussed in Section 8.1 and are not otherwise addressed in Section 8.2.

8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for both the BSEP site and an alternate site. The staff assumed construction of two 913 net megawatt electric (MW(e)) units, which is consistent with the Environmental Report (ER) CP&L prepared for license renewal of BSEP (CP&L 2004).[a] This assumption slightly understates the impacts of replacing the 1909 net MW(e) capacity of BSEP.

The staff reviewed the information in the CP&L ER and compared it to information in the GEIS for license renewal. Although the renewal period for the OLs is 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

The staff assumed that coal and lime or limestone for a coal-fired plant sited at the BSEP site would be delivered by railroad. The BSEP site is served by an existing rail line. Lime or limestone is used in the scrubbing process for control of sulfur dioxide (SO_2) emissions.[b] Rail delivery would be the most likely option for delivering coal and lime/limestone to an alternate site for the coal-fired plant. Barge delivery of coal and lime/limestone would also be possible, although there is no existing barge slip at BSEP. A coal slurry pipeline is also a technically feasible delivery option; however, the associated cost and environmental impacts make a slurry pipeline an unlikely transportation alternative. Construction at an alternate site could necessitate the construction of a new transmission line to connect to existing lines and a rail spur to the plant site.

The coal-fired plant is assumed to use tangentially fired, dry-bottom boilers and to consume bituminous, pulverized coal with an ash content of approximately 10.4 percent by

(a) Each unit would have a rating of 967 gross MW(e) and 913 net MW(e). The difference between "gross" and "net" is electricity consumed on the plant site.

(b) In a typical wet scrubber, lime (calcium hydroxide) or limestone (calcium carbonate) is injected as a slurry into the hot effluent combustion gases to remove entrained sulfur dioxide. The lime-based scrubbing solution reacts with sulfur dioxide to form calcium sulfite, which precipitates and is removed in sludge form.

weight (CP&L 2004). Annual coal consumption would be approximately 5.92 million tons (CP&L 2004). In its ER, CP&L assumed a heat rate[(a)] of 10,200 Btu/kWh and a capacity factor[(b)] of 0.85.

8.2.1.1 Closed-Cycle Cooling System

The staff assumed that a new coal-fired plant located at the BSEP site would use a closed-cycle cooling system with natural draft or mechanical draft cooling towers instead of the existing once-through cooling system used for BSEP. Closed-cycle cooling is also assumed for an alternate site. The overall impacts are discussed in the following sections and summarized in Table 8-2. The extent of impacts at an alternate site would depend on the location of the particular site. For comparison, Section 8.2.1.2 discusses impacts if a once-through cooling system were utilized.

- **Land Use**

  The staff assumed that the existing facilities and infrastructure at the BSEP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the coal-fired replacement plant alternative would use the existing switchyard, offices, and transmission line rights-of-way.

  Construction of the powerblock and coal storage area would impact approximately 520 ac (CP&L 2004). Cooling towers and associated infrastructure would impact approximately 30 ac. Disposal of ash and scrubber waste would impact an additional approximately 487 ac assuming a 40-year operating life for the plant (CP&L 2004). Additional land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 34 mi^2 would be affected for mining the coal and disposing of the waste to support a 1000 MW(e) coal plant during its operational life (NRC 1996). A replacement coal-fired plant to replace the 1909 net MW(e) capacity of BSEP would affect proportionately more land. Partially offsetting this offsite land use would be the elimination of the need for uranium mining and processing to supply fuel for BSEP. In the GEIS, the staff estimated that approximately 1000 ac would be affected for mining and processing the uranium during the operating life of a 1000 MW(e) nuclear power plant (NRC 1996).

(a) Heat rate is a measure of generating station thermal efficiency. In English units, it is generally expressed in British thermal units (Btu) per net kilowatt-hour (kWh). It is computed by dividing the total Btu content of fuel burned for electric generation by the resulting net kWh generation. A corresponding metric unit for energy is the joule (J).

(b) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation Using Closed-Cycle Cooling at the BSEP Site and an Alternate Site

	BSEP Site		Alternate Site	
Category Impact	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	Uses essentially all of the unused BSEP land for plant, infrastructure, and waste disposal. Additional offsite land impacts for coal and limestone mining.	MODERATE to LARGE	Uses up to 3200 ac for plant, infrastructure, and waste disposal; additional land impacts for coal and limestone mining; possible impacts for transmission line and rail spur.
Ecology	MODERATE	Uses undeveloped areas at BSEP. Potential habitat loss and fragmentation and reduced productivity and biological diversity.	MODERATE to LARGE	Impacts depend on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality (Surface)	SMALL	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal from the Cape Fear River.	SMALL to MODERATE	Impacts will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality (Groundwater)	SMALL	Existing well would likely continue to be used.	SMALL to MODERATE	Impacts will depend on the volume of water withdrawn and discharged and the characteristics of the aquifers.
Air Quality	MODERATE	Sulfur Oxides 4778 tons/yr Nitrogen Oxides 1479 tons/yr Particulate Matter 308 tons/yr of total suspended particulates which would include 71 tons/yr of PM_{10} Carbon Monoxide 1479 tons/yr Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials – mainly uranium and thorium	MODERATE	Potentially same impacts as the BSEP site, although emission control standards may vary.

Table 8-2. (contd)

	BSEP Site		Alternate Site	
Category Impact	**Impact**	**Comment**	**Impact**	**Comment**
Waste	MODERATE	Total waste volume would be approximately 876,000 tons/yr of ash and scrubber sludge requiring approximately 487 ac for disposal during the 40-year life of the plant.	MODERATE	Same impacts as BSEP site; waste disposal constraints may vary.
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.	SMALL	Same impacts as BSEP site.
Socioeconomics	MODERATE	The peak construction work force would be in the range of 1200 to 2500. Most workers likely to commute from the Wilmington area. After construction, the current BSEP work force of 1060 would be reduced to 150 for the completed coal plant. Tax base preserved. Rail transportation of coal and lime/limestone would have some impacts.	MODERATE to LARGE	Construction impacts depend on location, but could be significant if plant is located in a rural area. Brunswick County would experience loss of BSEP tax base and employment. Impacts during operation would be small. Transportation impacts associated with construction workers could be significant. For rail transportation of coal and lime/limestone, impacts are considered moderate. For barge transportation, the impacts are considered small.
Aesthetics	MODERATE	Exhaust stacks would be highly visible from offsite locations. Cooling towers and plumes would also be visible. Noise associated with rail transportation of coal and lime/limestone would have aesthetic impacts. Noise from plant operations would be noticeable.	MODERATE to LARGE	Impacts would depend on the site selected and the surrounding land features. If needed, a new transmission line or rail spur could have a significant aesthetic impact. Exhaust stacks, cooling towers, and cooling tower plumes would be visible from offsite locations. Noise associated with rail transportation of coal and lime/limestone would have an aesthetic impact. Barge transportation of coal and lime/limestone would have a smaller aesthetic impact. Noise from plant operations would be noticeable.

Table 8-2. (contd)

	BSEP Site		Alternate Site	
Category Impact	**Impact**	**Comment**	**Impact**	**Comment**
Historic and Archaeological Resources	SMALL	Some construction would affect previously undeveloped parts of BSEP site; cultural resource inventory would be needed to minimize any impacts on undeveloped lands.	SMALL	Alternate location would necessitate cultural resource studies. Impacts can likely be mitigated.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of operating jobs at BSEP could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at an alternate site would vary depending on population distribution and makeup at site. Brunswick County would lose tax revenue, which could impact minority and low-income populations.

PM = Particulate matter

Overall, the staff concludes that the land use impacts of new coal-fired generating units located at the BSEP site would be MODERATE. The impacts would expected to be greater than the alternative of renewing the BSEP OLs.

In the GEIS, the staff estimated that a 1000 MW(e) coal-fired plant and associated facilities would be expected to require approximately 1700 ac (NRC 1996). A 1909 MW(e) coal-fired generation plant at an alternate site would require proportionately more land. Additional land could be needed for a transmission line and for a rail spur to an alternative plant site. Depending particularly on transmission line and rail line routing requirements, the staff concludes that siting at an alternative location would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a coal-fired plant at the BSEP site would alter ecological resources because of the need to convert land that is currently unused to industrial use for the plant, coal storage, and waste disposal. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. However, some of the BSEP land would have been previously disturbed. Some impacts to terrestrial ecology from cooling tower drift could occur. Overall, the staff concludes that siting a coal-fired plant at the BSEP site would have a MODERATE ecological impact that would be greater than renewal of the BSEP OLs.

At an alternate site, the coal-fired generation alternative would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Some impacts to terrestrial ecology from cooling tower drift could occur. Use of cooling makeup water from a nearby surface water body could have adverse aquatic resource impacts. If needed, construction and maintenance of a transmission line and a rail spur would have ecological impacts. Overall, the staff concludes that the ecological impacts at an alternate site would be MODERATE to LARGE.

- **Water Use and Quality**

Surface Water. At the BSEP site, closed-cycle cooling with cooling water withdrawn from the existing intake canal connecting to the Cape Fear River is assumed. Blowdown would be discharged to the existing discharge canal that connects to the Atlantic ocean. Discharges would be regulated by the North Carolina Department of Environment and Natural Resources (NCDENR). The staff assumed that an alternative coal-fired plant located at the BSEP site would follow the current practice of obtaining potable, process, and fire-protection water from the Brunswick County Public Utilities Department (CP&L 2004). Some erosion and sedimentation would likely occur during construction (NRC 1996). Overall, the staff concludes that surface water use and quality impacts would be SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

For a coal-fired plant located at an alternate site, the staff assumes a surface water body will be used to withdraw cooling water. The impacts on surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. The staff concludes that the impacts on surface water use and quality would be SMALL to MODERATE.

Groundwater. An alternative coal-fired plant located at the BSEP site would likely continue to use the groundwater well that currently supplies water to the biology laboratory. The staff concludes that groundwater impacts would be SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

Groundwater withdrawal at an alternate site could require a permit; in addition, groundwater use would likely be equivalent or similar to current groundwater use at BSEP. The impacts of groundwater withdrawal would be site specific and would depend on the site aquifer characteristics and the amount of groundwater needed. Overall, the staff concludes that groundwater use and quality impacts would be SMALL to MODERATE.

- **Air Quality**

The air-quality impacts of coal-fired generation vary considerably from those of nuclear generation due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulate matter, carbon monoxide (CO), hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

Brunswick County, which is in the Southern Coastal Plain Intrastate Air Quality Control Region (40 CFR 81.152), is in compliance with the national ambient air quality standards for criteria pollutants (40 CFR 81.334).[a]

A new coal-fired generating plant located at the BSEP site would likely need a prevention of significant deterioration (PSD) permit issued under Title I Part C of the Clean Air Act and an operating permit issued under Title V of the Clean Air Act (42 USC 7401). The plant would be required to comply with the new source performance standards for such plants set forth in 28 40 CFR Part 60, Subpart Da. These regulations establish limits for particulate matter and opacity (40 CFR 60.42a), SO_2 (40 CFR 60.43a), and NO_x (40 CFR 60.44a).

EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. Brunswick County is classified as in attainment or unclassified for criteria pollutants.

Section 169A of the Clean Air Act establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment is caused by air pollution resulting from human activities. In addition, EPA issued a new regional haze rule in 1999 (64 FR 35714). The rule specifies that for each mandatory Class I Federal area located within a state, the state must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in

(a) Existing criteria pollutants under the Clean Air Act are ozone, CO, particulates, sulfur dioxide, lead, and NO_x. Ambient air standards for criteria pollutants are set out at 40 CFR Part 50.

visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a new coal-fired power station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. The mandatory Class I Federal area closest to the BSEP site is the Cape Romain Wilderness located approximately 100 mi southwest (40 CFR 81.426).

In 1998, EPA issued a rule requiring 22 eastern states, including North Carolina, to revise their state implementation plans to reduce NO_x emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone (40 CFR 50.9). The total amount of NO_x that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 through September 30) is set out at 40 CFR 51.121(e). Any new coal-fired plant sited in North Carolina would be subject to this limitation. For North Carolina, the amount is 165,306 tons.

EPA issued the Clean Air Interstate Rule (CAIR) in May 2005 (70 FR 25162). CAIR provides a Federal framework requiring certain states to reduce emissions of SO_2 and NO_x. EPA anticipates that states will achieve this reduction primarily by limiting emissions from the power generation sector. CAIR covers 28 eastern states. Any new fossil-fired power plant sited in North Carolina would be subject to the CAIR limitations.

Impacts for specific pollutants are as follows:

Sulfur oxides. CP&L states in its ER that an alternative coal-fired plant located at the BSEP site would use wet scrubber technology using lime for flue gas desulfurization (CP&L 2004).

A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes control on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchase or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally. Regardless, SO_2 emissions would be expected to be greater for the coal alternative than the alternative of renewing the BSEP OLs since a nuclear power plant releases almost no SO_2 during normal operations.

CP&L (2004) estimates that by using the best technology to minimize SO_2 emissions, the total annual stack emissions would be approximately 4778 tons of sulfur oxides.

Nitrogen oxides. Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 1.6 lb/MWh of gross energy output, based on a 30-day rolling average.

CP&L estimates that by using low NO_x burners, overfire air, and selective catalytic reduction with steam/water injection, the total annual NO_x emissions for a new coal-fired power plant would be approximately 1479 tons (CP&L 2004). Regardless of control technology, the level of NO_x emissions would be greater than the alternative of renewing the BSEP OLs because a nuclear power plant releases almost no NO_x during normal operations.

Particulate Matter. CP&L estimates that the total annual stack emissions would include 308 tons of filterable total suspended particulates (particulates that range in size from less than 0.1 μm up to approximately 45 μm) including 71 tons of PM_{10} (particulate matter having an aerodynamic diameter less than or equal to 10 μm). Fabric filters would be used for control (CP&L 2004). In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the alternative of renewing the BSEP OLs because a nuclear power plant releases few particulates during normal operations.

During the construction of a coal-fired plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process.

Carbon monoxide. CP&L estimates that the total CO emissions would be approximately 1479 tons per year (CP&L 2004). This level of emissions is greater than the alternative of renewing the BSEP OLs.

Hazardous air pollutants including mercury. In May 2005, EPA issued a final rule limiting mercury emissions from coal-fired power plants (70 FR 28606). Emissions are capped at specified, nationwide levels. A first phase cap of 38 tons per year (tpy) becomes effective in 2010 and a second phase cap of 15 tpy becomes effective in 2018. Plant owners must demonstrate compliance with the standard by holding one "allowance" for each ounce of mercury emitted in any given year. Allowances are transferable among regulated plants. A new coal-fired power plant would be subject to this rule.

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant had an annual release of approximately 5.2 tons of uranium and 12.8 tons of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Carbon dioxide. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

Summary. The GEIS analysis did not quantify emissions from coal-fired power plants but implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts (NRC 1996). Adverse human health effects from coal combustion such as cancer and emphysema have been associated with the products of coal combustion. Overall, the staff concludes that the air impacts from coal-fired generation at the BSEP site would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Siting a coal-fired generation plant at a location other than the BSEP site would not significantly change air-quality impacts, although it could result in the installation of more or less stringent pollution-control equipment to meet applicable local requirements. The plant would need to meet applicable new source performance standards. Siting in an area that is in compliance with national ambient air quality standards would likely require a prevention of significant deterioration (PSD) permit. Siting in an area not in attainment with national ambient air quality standards would likely require a nonattainment permit under Title I Part D of the Clean Air Act. An air operating permit would likely be needed at either type of location. Overall, the staff concludes that the air quality impacts would also be MODERATE.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. An alternative coal-fired plant would generate approximately 876,000 tons of this waste annually (CP&L 2004). The ash and scrubber sludge could potentially be disposed of onsite, accounting for approximately 485 ac of land area over the 40-year plant life. Alternatively, waste could be disposed of at a more inland location away from estuaries. Spent SCR catalyst would be regenerated or disposed of offsite. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality but, with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses.

In May 2000, EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (65 FR 32214). EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 to 70 percent of landfills and surface impoundments without reasonable control in place, particularly in the area of groundwater monitoring; and (4) EPA identified gaps in state oversight of coal combustion wastes. Accordingly, EPA announced its intention to issue regulations for disposal of coal combustion waste under subtitle D of the Resource Conservation and Recovery Act.

Construction-related debris would be generated during construction activities.

For all of the preceding reasons, the staff concludes that the waste impacts from a coal-fired plant sited a the BSEP site would be MODERATE; the impacts would be clearly noticeable but would not destabilize any important resource.

Siting the coal-fired plant at a location other than the BSEP site would not alter waste generation, although other sites might have more constraints on disposal locations. Therefore, the staff concludes that the impacts would also be MODERATE.

- **Human Health**

Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risks from coal and lime/limestone transportation, worker and public risks from disposal of coal combustion wastes, and public risks from inhalation of stack emissions. Emission impacts can be widespread, and health risks can be difficult to quantify. The coal alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

The staff stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates from a coal-fired plant, but did not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, the staff concludes that human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal at a newly constructed coal-fired plant would be SMALL.

- **Socioeconomics**

Construction of a coal-fired alternative would be expected to take approximately 4 years (Duke 2001). The staff assumed that construction would take place while BSEP continues operation and would be completed by the time BSEP Unit 1 permanently ceases operations. The staff estimates that the peak construction work force would be in the range of 1200 to 2500 workers (NRC 1996). These workers would be in addition to the approximately 1060 workers currently employed at BSEP. During construction of the new coal-fired plant, communities near the BSEP site would experience demands on housing and public services that would be noticeable. These impacts would be expected to be mitigable, however, because workers could commute to the site from Wilmington and other nearby communities. After construction, the nearby communities would be impacted by the loss of the construction jobs. CP&L estimates that the completed coal plant would employ approximately 150 workers (CP&L 2004).

If a coal-fired replacement plant were constructed at the BSEP site and the two nuclear units decommissioned, there would be a loss of approximately 910 permanent, high-paying jobs (1060 for BSEP down to 150 for the coal-fired plant), with a commensurate reduction in demand on socioeconomic resources and contributions to the regional economy. The coal-fired plant would provide a new tax base to offset the loss of tax base associated with decommissioning of the nuclear unit.

During the construction period for a replacement coal-fired plant, the construction workers would place significant traffic loads on existing highways near the BSEP site. Impacts would be less for the estimated 150 permanent workers operating the plant.

The BSEP site is served by an existing rail spur that would be used to deliver coal and lime/limestone for a replacement coal-fired plant. There would be some socioeconomic impacts associated with rail transportation, such as delays at rail crossings. Barge delivery of coal and lime/limestone would also be possible, although there is no existing barge slip at BSEP.

Construction of a replacement coal-fired power plant at an alternate site would relocate some socioeconomic impacts but not eliminate them. The communities around the BSEP site would experience the impact of BSEP operational job loss, and Brunswick County would lose some of its tax base. Communities around the alternate site would have to absorb the impacts of a substantial, temporary work force. The staff stated in the GEIS that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the peak construction work force would need to move to the area to work (NRC 1996). Alternate sites would need to be analyzed on a case-by-case basis.

Coal and lime/limestone would likely be delivered by rail, although barge delivery is feasible for an alternate site located on a navigable body of water.

For siting at the BSEP site or at an alternate site, socioeconomic impacts would also occur at the site of coal mining.

Overall, the staff concludes that socioeconomic impacts would be MODERATE at the BSEP site and MODERATE to LARGE at an alternate site.

- **Aesthetics**

If sited at BSEP, the coal-fired power block could be as much as 200 ft tall and would be visible from offsite during daylight hours. The exhaust stacks, which could be as much as 600 ft high, would likely be visible in daylight hours for distances greater than 10 mi. Natural draft cooling towers could be up to 520 ft high. Mechanical draft cooling towers could be up to 100 ft high and also have associated noise impacts from operation of the motors and fans. The plant and associated stacks and towers would also be visible at night because of outside lighting and aircraft warning lights. The U.S. Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 200 ft above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). Plumes from the cooling towers would also be visible offsite. The visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, provided the lighting meets FAA requirements, and appropriate use of shielding.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers, and the commuting of plant employees. There would likely also be noise impacts associated with rail transportation of coal and lime/limestone.

At an alternate site, there would be aesthetic impacts from the buildings, exhaust stacks, and cooling tower plumes. There would be aesthetic impacts that could be significant if construction of a new transmission line and/or rail spur is needed. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other power plants.

Overall, the staff concludes that the aesthetic impacts associated with a new coal plant would be MODERATE at the BSEP site and MODERATE to LARGE at an alternate site.

- **Historic and Archaeological Resources**

At the BSEP site or an alternate site, new construction could impact previously undeveloped land. Before construction at the BSEP site or at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. These studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line rights-of-way, rail lines, or other rights-of-way). The impact on historic and archaeological resources could be greater at an alternate site because more undeveloped land would likely be disturbed. However, construction activities at any site can generally be effectively managed under current laws and regulations to prevent significant adverse historic and archaeological resource impacts. Therefore, the staff concludes that historic and archaeological resource impacts would be SMALL at BSEP or at an alternate site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the BSEP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of BSEP would result in employment of approximately 910 fewer operating employees. Resulting economic conditions could reduce employment prospects for minority or low-income populations.

Impacts at other sites would depend upon the site chosen and the nearby population distribution. If a replacement coal-fired plant were constructed at an alternate site, Brunswick County would experience a loss of property tax revenue, which could affect its ability to provide services and programs. Property tax payments made by CP&L to Brunswick County for BSEP are discussed in Section 4.4.3 of this SEIS.

Overall, the staff concludes that environmental justice impacts would be SMALL to MODERATE at BSEP or at an alternate site.

8.2.1.2 Once-Through Cooling System

The environmental impacts of constructing a coal-fired generation plant at the BSEP site using a once-through cooling system are similar to the impacts for a coal-fired plant using a closed-cycle system. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

8.2.2 Natural Gas-Fired Generation

The environmental impacts of the natural gas-fired generation alternative are examined in this section for both the BSEP site and an alternate site. The staff assumed construction of five net

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation Using Once-Through Cooling at the BSEP Site

Impact Category	Impact	Change in Impacts from Closed-Cycle Cooling System
Land Use	MODERATE	Less land required because cooling towers and associated infrastructure would not be needed.
Ecology	MODERATE	Impacts would depend on ecology at the site. No impacts to terrestrial ecology from cooling tower drift. Increased water withdrawal with possible greater impacts to aquatic ecology.
Surface Water Use and Quality	SMALL	No discharge of cooling water blowdown. Increased water withdrawal and more thermal load on receiving body of water.
Groundwater Use and Quality	SMALL	No change
Air Quality	MODERATE	No change
Waste	MODERATE	No change
Human Health	SMALL	No change
Socioeconomics	MODERATE	No change
Aesthetics	SMALL to MODERATE	Less aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL	Less land impacted.
Environmental Justice	SMALL to MODERATE	No change

365 MW(e) units, which is consistent with CP&L's ER (CP&L 2004)[a]. This assumption slightly's understate the impacts of replacing the 1909 net MW(e) capacity of BSEP.

The staff reviewed the information in the CP&L ER and compared it to environmental impact information in the GEIS for license renewal. Although the renewal period for the OLs is 20 years, the impact of operating the natural gas-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a natural gas-fired plant).

CP&L states in its ER that for siting at the BSEP site, a new 114 mi gas pipeline would be needed to connect the site to the existing pipeline network (CP&L 2004). If a new natural gas-fired plant were built elsewhere to replace BSEP, a new transmission line could need to be constructed to connect to existing lines. In addition, construction or upgrade of a natural gas pipeline from the plant to a supply point where a firm supply of gas would be available could be needed.

The staff assumed that a replacement natural gas-fired plant would use combined-cycle combustion turbines (CP&L 2004). The following additional assumptions are made for the natural gas-fired plant (CP&L 2004):

- natural gas with an average heating value of 1032 Btu/ft^3 as the primary fuel
- heat rate of 6204 Btu/kWh electricity
- capacity factor of 0.85.

8.2.2.1 Closed-Cycle Cooling System

The staff assumed that a natural gas combined-cycle power plant located at the BSEP site would use a closed-cycle cooling system with natural draft or mechanical draft cooling towers instead of the existing once-through cooling system used for BSEP. Closed-cycle cooling is also assumed for an alternate site. The overall impacts are discussed in the following sections and summarized in Table 8-4. The extent of impacts at an alternate site would depend on the location of the particular site. For comparison, Section 8.2.2.2 discusses impacts if a once-through cooling system were used.

- **Land Use**

  For siting at the BSEP site, the staff assumed that the existing facilities and infrastructure would be used to the extent practicable, limiting the amount of new construction that would

(a) Each unit would have a rating of 380 gross MW(e) and 365 net MW(e).

Table 8-4. Summary of Environmental Impacts of Natural Gas Combined-Cycle Generation Using Closed-Cycle Cooling at the BSEP Site and at an Alternate Site

	BSEP Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	122 ac for powerblock, offices, roads, and parking areas. An additional 1382 ac impacted by construction of an underground gas pipeline.	MODERATE to LARGE	200 ac for powerblock, offices, roads, switchyard, and parking areas. Additional land possibly impacted for transmission line and/or natural gas pipeline.
Ecology	MODERATE	Uses undeveloped areas at the BSEP site plus land for a new gas pipeline.	MODERATE to LARGE	Impacts depend on location and ecology of the site, surface water body used for intake and discharge, and possible transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality (Surface)	SMALL	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal from the Cape Fear River.	SMALL to MODERATE	Impacts depend on volume of water withdrawal and discharge and characteristics of surface water body.
Water Use and Quality (Groundwater)	SMALL	Existing well would likely continue to be used.	SMALL to MODERATE	Impacts would be site dependent.
Air Quality	MODERATE	SO_x 149 tons/yr NO_x 478 tons/yr CO 99 tons/yr PM_{10} 83 tons/yr Some hazardous air pollutants	MODERATE	Same emissions as BSEP site.
Waste	SMALL	The only significant solid waste would be spent SCR catalyst used for control of NO_x emissions.	SMALL	The only significant solid waste would be spent SCR catalyst used for control of NO_x emissions.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.

Table 8-4. (contd)

	BSEP Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Socioeconomics	MODERATE	The peak construction work force would be up to 1200. Most workers likely to commute from the Wilmington area. After construction, the current BSEP work force of 1060 would be reduced to 55 for the completed plant. Tax base preserved.	MODERATE	Construction impacts depend on location, but could be significant if plant is located in a rural area. Brunswick County would experience loss of BSEP tax base and employment. Impacts during operation would be small. Transportation impacts associated with construction workers could be significant.
Aesthetics	MODERATE	Exhaust stacks, cooling towers, and cooling tower plumes would be visible from offsite locations. Noise would be detectable from offsite locations.	MODERATE to LARGE	Impacts would depend on the site selected and the surrounding land features. Exhaust stacks, cooling towers, and cooling tower plumes would be visible from offsite locations. If needed, a new transmission line could have significant aesthetic impacts. Noise would be detectable from offsite locations.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively mitigated.	SMALL	Any potential impacts can likely be effectively mitigated.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of operating jobs at BSEP could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at an alternate site would vary depending on population distribution and makeup at site. Brunswick County would lose tax revenue, which could impact minority and low-income populations.

be required. Specifically, the staff assumed that the natural gas combined-cycle replacement plant alternative would use the existing switchyard, offices, and transmission line rights-of-way. At the BSEP site, approximately 122 ac would be needed for the plant and associated infrastructure (CP&L 2004). There would be an additional land use impact on approximately 1382 ac for construction of a new natural gas pipeline to the BSEP site (CP&L 2004).

For construction at an alternate site, the staff assumed that approximately 200 ac would be needed for the plant and associated infrastructure (NRC 1996). Additional land could be impacted for construction of a transmission line and/or natural gas pipeline to serve the plant. For any new natural gas combined-cycle power plant, additional land would be required for natural gas wells and collection stations. In the GEIS, the staff estimated that approximately 3600 ac would be needed for a 1000 MW(e) plant (NRC 1996). Proportionately more land would be needed for a natural gas-fired plant replacing the 1909 MW(e) generated by BSEP. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining and processing to supply fuel for BSEP. The NRC staff states in the GEIS (NRC 1996) that approximately 1000 ac would be affected for mining the uranium and processing it during the operating life of a 1000 MW(e) nuclear power plant.

Overall, the staff concludes that land use impacts at the BSEP site would be MODERATE, and at an alternate site would be MODERATE to LARGE.

- **Ecology**

At the BSEP site, there would be ecological land-related impacts for siting of the natural gas-fired plant. There would also be ecological impacts associated with bringing a new underground gas pipeline to the site. Ecological impacts at an alternate site would depend on the nature of the land converted for the plant and the possible need for a new transmission line and/or gas pipeline. Construction of a transmission line and a gas pipeline to serve the plant would be expected to have temporary ecological impacts. Ecological impacts to the plant site and utility easements could include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. At an alternate site, the cooling makeup water intake and discharge could have impacts on aquatic resources. Some impacts to terrestrial ecology from cooling tower drift could occur at the BSEP or an alternate site. Overall, the staff concludes that ecological impacts would be MODERATE at the BSEP site and MODERATE to LARGE at an alternate site.

- **Water Use and Quality**

<u>Surface Water</u>. Closed-cycle cooling with cooling water withdrawn from the existing intake canal connecting to the Cape Fear River is assumed. Blowdown would be discharged to the existing discharge canal that connects to the Atlantic ocean. The staff assumed that an alternative natural gas-fired plant located at the BSEP site would follow the current practice of obtaining potable, process, and fire-protection water from the Brunswick County Public Utilities Department (CP&L 2004). Some erosion and sedimentation would likely occur

during construction (NRC 1996). Overall, the staff concludes that surface water use and quality impacts would be SMALL.

For a natural gas combined-cycle power plant located at an alternate site, , the staff assumes a surface water body will be used to withdraw cooling water. The impacts on surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. The staff concludes that impacts on surface water use and quality would be SMALL to MODERATE.

Groundwater. An alternative coal-fired plant located at the BSEP site would likely continue to use the groundwater well that currently supplies water to the biology laboratory. The staff concludes that groundwater impacts would be SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

Groundwater withdrawal at an alternate site could require a permit; in addition, groundwater use would likely be equivalent or similar to current groundwater use at BSEP. The impacts of groundwater withdrawal would be site specific and would depend on the characteristics of the site and the amount of groundwater used. Overall, the staff concludes that groundwater use and quality impacts would be SMALL to MODERATE.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative.

A new natural gas combined-cycle generating plant located at the BSEP site would likely need a PSD permit issued under Title I Part C of the Clean Air Act and an operating permit issued under Title V of the Clean Air Act. A new natural gas power plant would also be subject to the new source performance standards for such units at 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_x.

EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. Brunswick County is classified as attainment or unclassified for criteria pollutants.

Section 169A of the Clean Air Act establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment is from air pollution resulting from human activities. In addition, EPA issued a new regional haze rule in 1999 (64 FR 35714). The rule specifies that for each mandatory Class I Federal area located within a state, the state must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a new natural gas-fired power station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. The mandatory Class I Federal area closest to the BSEP site is the Cape Romain Wilderness located approximately 100 mi southwest (40 CFR 81.426).

In 1998, EPA issued a rule requiring 22 eastern states, including North Carolina, to revise their state implementation plans to reduce NO_x emissions. The NO_x emissions contribute to violations of the national ambient air quality standard for ozone (40 CFR 50.9). The total amount of NO_x that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 through September 30) is set out at 40 CFR 51.121(e). For North Carolina, the amount is 165,306 tons. Any new natural gas-fired plant sited in North Carolina would be subject to these limitations.

EPA issued the Clean Air Interstate Rule (CAIR) in May 2005 (70 FR 25162). CAIR provides a Federal framework requiring certain states to reduce emissions of SO_2 and NO_x. EPA anticipates that states will achieve this reduction primarily by limiting emissions from the power generation sector. CAIR covers 28 eastern states. Any new fossil-fired power plant sited in North Carolina would be subject to the CAIR limitations.

CP&L projects the following emissions for the natural gas-fired alternative (CP&L 2004):

- SO_x - 149 tons/yr
- NO_x - 478 tons/yr
- Co - 99 tons/yr
- PM_{10} particulates - 83 tons/yr.

A natural gas-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process.

Siting a natural gas combined-cycle generation plant at a site other than the BSEP site would not significantly change air quality impacts, although it could result in installing more or less stringent pollution control equipment to meet applicable local requirements. The plant would be required to meet applicable new source performance standards. Siting in an area that is in compliance with national ambient air quality standards would likely require a PSD permit. Siting in an area not in attainment with national ambient air quality standards would likely require a nonattainment permit under Title I Part D of the Clean Air Act. An air operating permit would likely be needed at either type of location.

Overall, the staff concludes that the air quality impacts of a natural gas combined-cycle power plant at the BSEP site or at an alternate site would be MODERATE.

- **Waste**

In the GEIS the staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant solid waste generated at a new natural gas combined-cycle power plant would be spent SCR catalyst. SCR catalyst is used for control of NO_x emissions. The spent catalyst would be regenerated or disposed of offsite.

Gas firing results in very few combustion byproducts because of the clean nature of the fuel. Other than spent SCR catalyst, waste generation at an operating natural gas combined-cycle power plant would be largely limited to typical office wastes; impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities.

In the winter, it may become necessary for a replacement baseload natural gas-fired plant to operate on fuel oil because of scarce gas supplies. Combustion of No. 2 fuel oil generates minimal waste products.

Overall, the staff concludes that the solid waste impacts associated with a natural gas combined-cycle power plant at the BSEP site or at an alternate site would be SMALL.

- **Human Health**

In the GEIS, the staff identified cancer and emphysema as potential health risks from natural gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. NO_x emissions from any plant would be regulated. For a plant sited in North Carolina, NO_x emissions would be regulated by the NCDENR. Human health effects are not expected to be detectable or sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the staff concludes that the impacts on human health of a new natural gas combined-cycle power plant sited at BSEP or at an alternate site would be SMALL.

- **Socioeconomics**

Construction of an alternative natural gas combined-cycle power plant would take approximately 30 months years (Duke 2001). Peak employment could be up to 1200 workers. The staff assumed that construction would take place while BSEP continues operation and would be completed by the time it permanently ceases operations. During construction, the communities immediately surrounding the BSEP site would experience demands on housing and public services. It is likely that most workers would commute from the Wilmington area. After construction, Wilmington and other nearby communities would be impacted by the loss of jobs. The current BSEP work force (1060 workers) would decline through a decommissioning period to a minimal maintenance size. The new natural gas combined-cycle plant would replace the BSEP tax base or provide a new tax base at an alternate site and provide approximately 55 permanent jobs.

In the GEIS, the staff concluded that socioeconomic impacts from constructing a natural gas-fired plant would not be noticeable and that the small operational work force would have the lowest socioeconomic impacts of any nonrenewable technology (NRC 1996). Compared to the coal-fired and new nuclear alternatives, the smaller size of the construction work force, the shorter construction time frame, and the smaller size of the operations work force would mitigate socioeconomic impacts.

Transportation impacts associated with construction personnel commuting to the plant site would depend on the population density and transportation infrastructure in the vicinity of the site. Impacts associated with operating personnel commuting to the plant site would be low.

Overall, the staff concludes that the socioeconomic impacts resulting from construction of a natural gas combined-cycle power plant at the BSEP site or at an alternate site would be MODERATE.

- **Aesthetics**

The turbine buildings, stacks (approximately 200 ft tall), cooling towers, and cooling tower plumes would be visible from offsite during daylight hours. The gas pipeline compressors also would be visible. Noise and light from the plant would be detectable offsite. At the BSEP site, the staff concludes that these impacts would result in MODERATE aesthetic impacts.

At an alternate site, the buildings, stacks, cooling towers, and cooling tower plumes would likely be visible offsite. If a new transmission line is needed, the aesthetic impacts could be significant. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the staff concludes that the aesthetic impacts associated with a replacement natural gas combined-cycle power plant at an alternate site would be MODERATE to LARGE, with site-specific factors determining the final categorization.

- **Historic and Archaeological Resources**

At the BSEP site or an alternate site, new construction could impact previously undeveloped land. Before construction at the BSEP site or at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. These studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line rights-of-way, rail lines, or other rights-of-way). The impact on historic and archaeological resources could be greater at an alternate site because more undeveloped land would likely be disturbed. However, construction activities at any site can generally be effectively managed under current laws and regulations to prevent significant adverse historic and archaeological resource impacts. Therefore, the staff concludes that historic and archaeological resource impacts would be SMALL at BSEP or at an alternate site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural gas-fired plant were built at the BSEP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of BSEP would result in a decrease in employment of approximately 1005 operating employees. Resulting economic conditions could reduce employment prospects for minority or low-income populations. Overall, the staff concludes that impacts would be SMALL to MODERATE.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution. If a replacement natural gas-fired plant were constructed at an alternate site, Brunswick County would experience a loss of property tax revenue, which could affect its ability to provide services and programs. Overall, the staff concludes that impacts to minority and low-income populations would also be SMALL to MODERATE.

8.2.2.2 Once-Through Cooling System

The environmental impacts of constructing a natural gas combined-cycle generation plant at the BSEP site using once-through cooling are similar to the impacts for a natural gas combined-cycle plant using closed-cycle cooling. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences.

Table 8-5. Summary of Environmental Impacts of Natural Gas Combined-Cycle Generation Using Once-Through Cooling at the BSEP Site

Impact Category	Impact	Change in Impacts from Closed-Cycle Cooling System
Land Use	SMALL to MODERATE	Less land required because cooling towers and associated infrastructure would not be needed.
Ecology	MODERATE	Impacts would depend on ecology at the site. No impacts to terrestrial ecology from cooling tower drift. Increased water withdrawal with possible greater impacts to aquatic ecology.
Surface Water Use and Quality	SMALL	No discharge of cooling water blowdown. Increased water withdrawal and increased thermal load on receiving body of water.
Groundwater Use and Quality	SMALL	No change
Air Quality	MODERATE	No change
Waste	SMALL	No change
Human Health	SMALL	No change
Socioeconomics	MODERATE	No change
Aesthetics	SMALL to MODERATE	Less aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL	Less land impacted.
Environmental Justice	SMALL to MODERATE	No change

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the System 80+ Design (10 CFR Part 52, Appendix B), and the AP600 Design (10 CFR Part 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to the NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. In addition, NRC is processing three applications for an early site permit under the procedures in 10 CFR Part 52 (NRC 2005b).

CP&L did not consider new nuclear generation as a alternative to replacement of baseline power, but for the preceding reasons, construction of a new nuclear power plant at the BSEP site and at an alternate site is considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime.

The NRC has summarized environmental data associated with the uranium fuel cycle in Table S–3 of 10 CFR 51.51. The impacts shown in Table S–3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs at the BSEP site or at an alternate site. The impacts shown in Table S–3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect impacts of 1909 MW(e) of new nuclear power (CP&L 2004). The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S–4 of 10 CFR Part 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51 Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant.

8.2.3.1 Closed-Cycle Cooling System

The staff assumed that a new nuclear plant located at the BSEP site would use a closed-cycle cooling system with natural draft or mechanical draft cooling towers instead of the existing once-through cooling system used for BSEP. Closed-cycle cooling is also assumed for an alternate site. The overall impacts are discussed in the following sections and summarized in Table 8-6. The extent of impacts at an alternate site would depend on the location of the particular site. For comparison, Section 8.2.3.2 discusses impacts if a once-through cooling system were used.

- **Land Use**

  The staff assumed that the existing facilities and infrastructure at the BSEP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing switchyard, offices, and transmission line rights-of-way. Because this existing infrastructure could be used, a replacement nuclear power plant at the BSEP site would require approximately 250 ac, some of which may be previously undeveloped land.

Table 8-6. Summary of Environmental Impacts of New Nuclear Generation Using Closed-Cycle Cooling at the BSEP Site and an Alternate Site

	Brunswick Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	SMALL to MODERATE	Requires approximately 250 ac of undeveloped land at the BSEP site.	MODERATE to LARGE	Requires approximately 500 ac. Possible additional land if a new transmission line is needed.
Ecology	SMALL to MODERATE	Uses undeveloped areas at the BSEP site. Potential habitat loss and fragmentation and reduced productivity and biological diversity.	MODERATE to LARGE	Impacts depend on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality (Surface)	SMALL	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal from the Cape Fear River.	SMALL to MODERATE	Impacts will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality (Groundwater)	SMALL	Existing well would likely continue to be used.	SMALL to MODERATE	Impacts will depend on the volume of water withdrawn and discharged and the characteristics of the aquifer.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amounts of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as the BSEP site.
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out at 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as the BSEP site.

Table 8-6. (contd)

	Brunswick Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out at 10 CFR Part 51, Subpart A, Appendix B, Table B-1.	SMALL	Same impacts as the BSEP site.
Socioeconomics	MODERATE	The peak construction work force could be as many as 3000 workers. Construction period of 3 years. Most workers likely to commute from the Wilmington area. Operating work force assumed to be similar to BSEP. Brunswick County tax base preserved. Transportation impacts associated with commuting construction workers would be noticeable. Transportation impacts during operation would be small.	MODERATE to LARGE	Construction impacts depend on location, but could be significant if plant is located in a rural area. Brunswick County would experience loss of tax base and employment. Transportation impacts associated with commuting construction workers would be noticeable. Transportation impacts during operation would be small.
Aesthetics	MODERATE	Containment buildings, the off-gas stack, and cooling towers and associated plumes would be visible offsite. Daytime visual impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	MODERATE to LARGE	Similar to impacts at the BSEP site. Aesthetic impacts would be significant if a new transmission line is needed.
Historic and Archaeological Resources	SMALL	Some construction could affect previously undeveloped parts of BSEP site; cultural resource inventory would be needed to minimize any impacts on undeveloped lands.	SMALL	Alternate location would necessitate cultural resource studies. Impacts can likely be mitigated.

Table 8-6. (contd)

	Brunswick Site		Alternate Site	
Impact Category	Impact	Comment	Impact	Comment
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction. Loss of operating jobs at BSEP could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at alternate site would vary depending on population distribution and makeup at site. Brunswick County would lose tax revenue, which could have an impact on minority and low-income populations.

There would be no net change in land needed for uranium mining because land needed for the new nuclear plant would offset land needed to supply uranium for fuel for the existing BSEP.

Overall, the staff concludes that the land use impacts of a replacement nuclear generating plant at the BSEP site would be SMALL to MODERATE. The impacts would be greater than the alternative of renewing the BSEP OLs.

Land-use requirements at an alternate site would be approximately 500 ac plus the possible need for a new electric power transmission line (NRC 1996). In addition, it may be necessary to construct a rail spur to an alternate site to bring in equipment during construction. Depending particularly on transmission line routing, the staff concludes that siting a new nuclear plant at an alternate site could result in MODERATE to LARGE land use impacts.

- **Ecology**

Locating a replacement nuclear power plant at the BSEP site would alter ecological resources because of the need to convert land to an industrial use. Some of this land, however, would have been previously disturbed. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Some impacts to terrestrial ecology from cooling tower drift could occur. The staff concludes that siting at the BSEP site would have SMALL to MODERATE ecological impacts that would be greater than renewal of the BSEP OLs.

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts could alter the ecology. Use of cooling water from a nearby surface water body could have adverse aquatic resource impacts. Some impacts to terrestrial ecology from cooling tower drift may occur. If needed, construction and maintenance of the transmission line rights-of-way would have ecological impacts. Overall, the staff concludes that ecological impacts at an alternate site would be MODERATE to LARGE.

- **Water Use and Quality**

Surface Water. Closed cycle cooling with cooling water withdrawn from the existing intake canal connecting to the Cape Fear River is assumed. Blowdown would be discharged to the existing discharge canal that connects to the Atlantic Ocean. Discharges would be regulated by the NCDENR. The staff assumed that an alternative new nuclear plant located at the BSEP site would follow the current practice of obtaining potable, process, and fire-protection water from the Brunswick County Public Utilities Department (CP&L 2004). Some erosion and sedimentation would likely occur during construction (NRC 1996). Overall, the staff concludes that surface water use and quality impacts would be SMALL.

For a new nuclear plant located at an alternate, the staff assumes a surface water body will be used to withdraw cooling water. Impacts on surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. The staff concludes that impacts on surface water use and quality would be SMALL to MODERATE.

Groundwater. An alternative new nuclear plant located at the BSEP site would likely continue to use the groundwater well that currently supplies water to the biology laboratory. The staff concludes that groundwater impacts would be SMALL.

Groundwater withdrawal at an alternate site could require a permit; in addition, groundwater use would likely be equivalent or similar to current groundwater use at BSEP. The impacts of groundwater withdrawal would be site specific, and will depend on the volume of water withdrawn and discharged and the characteristics of the aquifer. Overall, the staff concludes that groundwater use and quality impacts would be SMALL to MODERATE.

- **Air Quality**

Construction of a new nuclear plant at the BSEP site or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with diesel generators, auxiliary heating boilers, portable self-powered devices such as pumps and generators, and some types of welding and heat treatment equipment. Overall, the staff concludes that emissions and associated impacts would be SMALL at the BSEP site or at an alternate site.

- **Waste**

The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. In addition to the impacts shown in Table B-1, construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, the staff concludes that waste impacts would be SMALL at the BSEP site or at an alternate site.

- **Human Health**

Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Overall, the staff concludes that human health impacts would be SMALL at the BSEP site or at an alternate site.

- **Socioeconomics**

Information on the socioeconomic impacts of two new Advanced Boiling Water Reactors at the Tennessee Valley Authority's Bellefonte nuclear plant site in Alabama is included in Section 8.2.4 of the Browns Ferry Nuclear Plant SEIS (NRC 2005a). This information is used to estimate socioeconomic impacts for two new nuclear units sited at the BSEP site and at an alternate site. The staff assumed a construction period of 2 years and a peak work force of up to 3000. The staff also assumed that construction would take place while BSEP continues operation and would be completed by the time Unit 1 permanently ceases operations (NRC 2005a).

During construction, the communities surrounding the BSEP site would experience demands on housing and public services that would have noticeable impacts. These impacts would be expected to be mitigated by construction workers commuting to the site from Wilmington and other communities. After construction, the communities would be impacted by the loss of the construction jobs.

The replacement nuclear plant is assumed to have an operating work force comparable to the 1060 workers currently working at BSEP. The replacement nuclear plant would provide a new tax base to offset the loss of tax base associated with decommissioning of BSEP.

During the construction period the addition of the construction workers to the existing BSEP workers could place significant traffic loads on existing highways, particularly those leading to the BSEP site.

Construction of a replacement nuclear power plant at an alternate site would be expected relocate some socioeconomic impacts, but would not eliminate them. The communities around the BSEP site would experience the impact of BSEP operational job loss and the loss of tax base. The communities around the new site would have to absorb the impacts of a large, temporary work force and a permanent work force of approximately 1060 workers. In the GEIS, the staff noted that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction work force would need to move to the area to work (NRC 1996). Alternate sites would need to be analyzed on a case-by-case basis.

Overall, the staff concludes that socioeconomic impacts would be MODERATE at the BSEP site and MODERATE to LARGE at an alternate site.

- **Aesthetics**

The containment buildings for a replacement nuclear power plant sited at the BSEP site and other associated buildings would likely be visible from offsite. Visual impacts could be mitigated by landscaping and selecting a color for buildings that is consistent with the environment. The off-gas stack would also likely visible from offsite.

Cooling towers and associated plumes would be visible from offsite. Natural draft cooling towers could be up to 520 ft high. Mechanical draft cooling towers could be up to 100 ft high and also have an associated noise impact from operation of the motors and fans.

The plant and associated stacks and towers would also be visible at night from offsite because of outside lighting and aircraft warning lights. The FAA generally requires that all structures exceeding an overall height of 200 ft above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000).

Noise from operation of a replacement nuclear power plant would potentially be audible offsite in calm wind conditions or when the wind is blowing in the direction of the listener. Mitigation measures, such as reduced or no use of outside loudspeakers, could be employed to reduce noise level.

At an alternate site, there would be aesthetic impacts from the buildings, off-gas stack, and cooling towers and associated plumes. There would also be a significant aesthetic impact if a new transmission line were needed. Noise and light from the plant would be detectable offsite. The impact of noise and light would be mitigated if the plant is located in an industrial area adjacent to other power plants.

Overall, the staff concludes that the aesthetic impacts associated with a new nuclear plant would be MODERATE at the BSEP site and MODERATE to LARGE at an alternate site.

- **Historic and Archaeological Resources**

At the BSEP site or an alternate site, new construction could impact previously undeveloped land. Before construction at the BSEP site or at an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. These studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission line rights-of-way, rail lines, or other rights-of-way). The impact on historic and archaeological resources could be greater at an alternate site because more undeveloped land would likely be disturbed. However, construction activities at any site can generally be effectively managed under current laws and regulations to prevent significant adverse historic and archaeological resource impacts. Therefore, the staff concludes that historic and archaeological resource impacts would be SMALL at BSEP or at an alternate site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at the BSEP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. After completion of construction, it is possible that the ability of the local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for minority and low-income populations.

Impacts at an alternate site would depend upon the site chosen and the nearby population distribution. If a replacement nuclear plant were constructed at an alternate site, Brunswick County would experience a loss of property tax revenue, which could affect its ability to provide services and programs.

Overall, environmental justice impacts are expected to be SMALL to MODERATE at the BSEP site or at an alternate site.

8.2.3.2 Once-Through Cooling System

The environmental impacts of constructing a new nuclear generating plant at the BSEP site using once-through cooling are essentially the same as the impacts for a plant using closed-cycle cooling with wet cooling towers. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Using Once-Through Cooling at the BSEP Site

Impact Category	Impact	Change in Impacts from Closed-Cycle Cooling System
Land Use	SMALL to MODERATE	Less land required because cooling towers and associated infrastructure would not be needed.
Ecology	MODERATE	Impacts would depend on ecology at the site. No impacts to terrestrial ecology from cooling tower drift. Increased water withdrawal with possible greater impacts to aquatic ecology.
Surface Water Use and Quality	SMALL	No discharge of cooling water blowdown. Increased water withdrawal and increased thermal load on receiving body of water.
Groundwater Use and Quality	SMALL	No change
Air Quality	SMALL	No change
Waste	SMALL	No change
Human Health	SMALL	No change
Socioeconomics	MODERATE	No change
Aesthetics	SMALL to MODERATE	Less aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL	Less land impacted.
Environmental Justice	SMALL to MODERATE	No change

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the BSEP OLs. CP&L currently purchases electric power from other generators (CP&L 2004).

If power to replace the BSEP generating capacity were to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one of those described in this SEIS and in the GEIS (probably coal, natural gas, or nuclear). The descriptions of the environmental impacts of other technologies in Chapter 8 of the GEIS and in Chapter 8 of this SEIS are representative of the environmental impacts associated with the purchased electrical power alternative to renewal of the BSEP OLs. Under the purchased power alternative, the environmental impacts of power generation would still occur, but they would be located elsewhere within the region, the United States, or another country.

8.2.5 Other Alternatives

Other generation alternatives are discussed in the following subsections.

8.2.5.1 Oil-Fired Generation

The EIA projects that because of higher fuel costs and lower efficiencies, oil-fired power plants will not provide new power generation capacity in the United States through the year 2025, except for limited industrial combined heat and power applications (DOE/EIA 2005a). Oil-fired generation is more expensive than either the nuclear or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has resulted in a decline in its use for electricity generation. In addition, Section 8.3.11 of the GEIS, the staff estimated that construction of a 1000 MW(e) oil-fired plant would require about 120 ac of land (NRC 1996). For the preceding reasons, the staff concludes that an oil-fired power plant at or in the vicinity of the BSEP site would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.2 Wind Power

The DOE states that North Carolina has excellent wind resources in portions of the state (DOE 2005a). DOE estimates that if the wind energy potential in North Carolina were developed with utility-scale wind turbines, the power produced each year would equal approximately 1.9 million megawatt-hours, or approximately 2 percent of the state's electricity consumption (DOE 2005a). By contrast, the two units at BSEP produced approximately 14.7 million megawatt-hours in 2003 (DOE/EIA 2005b). For the preceding reasons, the staff concludes that a wind energy facility at or in the vicinity of the BSEP site would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar power technologies (both photovoltaic and thermal) cannot currently compete with conventional nuclear and fossil-fueled technologies in grid-connected applications because of solar power's higher capital cost per kilowatt of capacity (Hamrin and Rader 1993). Energy storage requirements also limit the use of solar energy systems as baseload electricity supply. In the GEIS, the staff determined that the average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996).

DOE states that for flat-plate collectors, North Carolina has useful resources throughout the State (DOE 2005b). However, a photovoltaic array with a collector area equal to the size of a football field in one of the State's better locations would produce approximately 961 megawatt-hours per year (DOE 2005b). By contrast, the two units at BSEP produced approximately 14.7 million megawatt-hours in 2003 (DOE/EIA 2005b).

For solar concentrating collectors, DOE states that North Carolina could pursue some types of technologies, but thermal electricity systems would not be effective with this resource (DOE 2005b). DOE states that a solar concentrator system with a collector area of 200,000 m^2 in the State's best areas could produce about 34,215 megawatt-hours per year (DOE 2005b), much less than needed to replace the baseline loads produced by BSEP. The two units at BSEP produced approximately 14.7 million megawatt-hours in 2003 (DOE/EIA 2005b).

For the preceding reasons, the staff concludes that a solar energy facility at or in the vicinity of the BSEP site would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.4 Hydropower

North Carolina could produce approximately 8 million megawatt-hours per year from hydropower (DOE 2005c). This amount is less than needed to replace the two BSEP units, which produced approximately 14.7 million megawatt-hours in 2003 (DOE/EIA 2005b). As stated in Section 8.3.4 of the GEIS, the percentage of U.S. generating capacity supplied by hydropower is expected to decline because hydroelectric facilities have become difficult to site as a result of public concerns about flooding, destruction of natural habitat, and alteration of natural river courses. In the GEIS, the staff estimated that land requirements for hydroelectric power are approximately 1 million ac per 1000 MW(e) (NRC 1996). Because of the amount of undeveloped hydropower resource in North Carolina and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 1909 MW(e), the staff concludes that local hydropower is not a feasible alternative to renewal of the SEP OLs.

8.2.5.5 Geothermal Energy

Two types of geothermal resources are being tapped commercially: hydrothermal fluid resources and earth energy (DOE 2005d). Hydrothermal fluid resources (reservoirs of steam or very hot water) are well suited for electricity generation. Earth energy, the heat contained in soil and rocks at shallow depths, is excellent for direct use and geothermal heat pumps. Direct-use applications require moderate temperatures; geothermal heat pumps can operate with low-temperature resources. The DOE states that North Carolina has low- to-moderate-temperature resources that can be tapped for direct heat or for geothermal heat pumps; however, electricity generation is not possible with these resources. For this reason, the staff concludes that a geothermal energy facility at or in the vicinity of the BSEP site would not be a reasonable alternative to renewal of the BSEP OLs (DOE 2005d).

8.2.5.6 Wood Waste

In the GEIS, the staff determined that a wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload power plant, the ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and relatively low efficiency, the staff concludes that wood waste would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and use the resultant heat to produce steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2005). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. In the GEIS, the staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently, approximately 102 waste-to-energy plants are operating in the United States. These plants generate approximately 2500 MW(e), or an average of approximately 28 MW(e) per plant, much less than needed to replace 1909 MW (e) of BSEP (IWSA 2004). For this reason, the staff concludes that generating electricity from municipal solid waste would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the staff determined that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large baseload plant (NRC 1996). For these reasons, the staff concludes that such fuels do not offer a reasonable alternative to renewal of the BSEP OLs.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two by an electrolyte. The only byproducts are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow (DOE 2004). Currently, the most widely marketed fuel cells cost about $4500 per kWh of installed capacity. By contrast, a diesel generator costs $800 to $1500 per kWh of installed capacity, and a natural gas turbine can cost even less (DOE 2004).

DOE initiated a program – the Solid State Energy Conversion Alliance – to bring about dramatic reductions in fuel cell cost. DOE's goal is to cut costs to as low as $400 per kWh of installed capacity by the end of this decade, which would make fuel cells competitive for virtually every type of power application (DOE 2004).

The staff concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Future gains in cost competitiveness for fuels cells compared to other fuels are speculative.

For the preceding reasons, the staff concludes that a fuel cell energy facility located at or in the vicinity of the BSEP site would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.10 Delayed Retirement

It is possible that delayed retirement of other CP&L generating units could replace the power generated by BSEP. However, CP&L has no plans for retiring any of its generating plants (CP&L 2004). For this reason, the staff concludes that delayed retirement of existing CP&L generating plants would not be a reasonable alternative to renewal of the BSEP OLs.

8.2.5.11 Utility-Sponsored Conservation

Electric utilities can meet increases in customer's electricity demands using supply-side management or demand-side management. The principal supply-side management tool is construction of new power plants. Demand-side management (DSM) attempts to reduce the demand for electricity or to shift it to times away from the system peak so that the need for additional generation capacity is minimized (NCSEO 2005). DSM programs are voluntary in North Carolina (NCUC 2004). Typical DSM programs that have been offered in North Carolina have included (NCSEO 2005):

- thermal efficiency in new and existing homes
- residential high-efficiency heat pumps
- interruptible residential central air conditioners/water heaters
- commercial energy-efficient lighting, heating, and air conditioning in new and existing buildings
- commercial thermal energy storage

- high-efficiency off-street security lighting
- industrial energy audits with incentives for efficiency improvements
- industrial time-of-use rates
- large-load curtailment during peak load periods
- remote-controlled voltage reduction.

Using DSM programs, CP&L expected to achieve a summer peak load reduction of 372 MW in 2004 and expects to achieve a reduction of 384 MW in 2013 (NCUC 2004). However, there has been a decline in DSM programs offered by North Carolina utilities for the following reasons: (1) electric utility restructuring appeared imminent, so to increase their competitive edge, many utilities sought to lower costs; (2) the cost of peak power plants, such as gas turbines, has become so low that they are less expensive than reductions in peak demand from DSM programs; and (3) some DSM programs were not able to provide the peak demand savings projected (NCSEO 2005).

CP&L's energy savings attributable to DSM are part of its long-range plan for meeting projected demand and, thus, are not available offsets for the generating capacity of BSEP.

Although DSM programs are an important part of CP&L's energy portfolio, the staff concludes that additional DSM, by itself, would not be sufficient to replace the BSEP capacity and that it is not a reasonable alternative to renewal of the BSEP OLs.

8.2.6 Combination of Alternatives

Even though individual alternatives might not be sufficient on their own to replace the BSEP capacity due to the small size of the resource or lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost-effective.

BSEP has a total generating capacity of 1909 MW(e). There are many possible combinations of alternatives to replace this capacity. Table 8-8 contains a summary of the environmental impacts of an assumed combination of alternatives consisting of 1460 MW(e) (four net 365 MW(e) units) plants of natural gas combined-cycle generation using mechanical draft cooling towers, 300 MW(e) purchased from other generators, and 149 MW(e) gained from additional DSM measures. The impacts associated with the natural gas combined-cycle units are based on the discussion in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new natural gas combined-cycle plants would result in increased emissions and other environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-8. The staff concludes that it is unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of the BSEP OLs.

Table 8-8. Summary of Environmental Impacts of an 1460 MW(e) of Natural Gas-Fired Generation, 300 MW(e) from Purchased Power and 149 MW(e) from Demand-Side Management Measures

	BSEP Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	98 ac for powerblock, roads, and parking areas. Up to 1382 ac impacted by construction of an underground gas pipeline.	MODERATE to LARGE	160 ac for powerblock, offices, roads, switchyard, and parking areas. Additional land possibly impacted for transmission line and/or natural gas pipeline.
Ecology	MODERATE	Uses undeveloped areas at the BSEP site plus land for a new gas pipeline.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and possible transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality (Surface)	SMALL	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal from the Cape Fear River.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body.
Water Use and Quality (Groundwater)	SMALL	Existing well would likely continue to be used.	SMALL to MODERATE	Impacts will depend on the volume of water withdrawn and discharged and the characteristics of the aquifer.

Table 8-8. (contd)

	BSEP Site		Alternate Site	
Impact Category	Impact	Comment	Impact	Comment
Air Quality	MODERATE	SO_x 119 tons/yr NO_x 382 tons/yr CO 79 tons/yr PM_{10} 66 tons/yr Some hazardous air pollutants	MODERATE	Same emissions as BSEP site.
Waste	SMALL	The only significant solid waste would be spent SCR catalyst used for control of NO_x emissions.	SMALL	The only significant solid waste would be spent SCR catalyst used for control of NO_x emissions.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.
Socioeconomics	SMALL to MODERATE	The peak construction work force would be up to 1200. Most workers likely to commute from the Wilmington area. After construction, the current BSEP work force of 1060 would be reduced to approximately 50 for the completed plant. Tax base preserved.	MODERATE	Construction impacts depend on location, but could be significant if plant is located in a rural area. Brunswick County would experience loss of BSEP tax base and employment. Impacts during operation would be small. Transportation impacts associated with construction workers could be significant.
Aesthetics	MODERATE	Exhaust stacks, cooling towers, and cooling tower plumes would be visible from offsite locations.	MODERATE to LARGE	Impacts would depend on the site selected and the surrounding land features. Exhaust stacks, cooling towers, and cooling tower plumes would be visible from offsite locations. If needed, a new transmission line could have significant aesthetic impacts.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively mitigated.	SMALL	Same as BSEP site; any potential impacts can likely be effectively mitigated.

Table 8-8. (contd)

	BSEP Site		Alternate Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of operating jobs at BSEP could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at an alternate site would vary depending on population distribution and makeup at site. Brunswick County would lose tax revenue, which could impact minority and low-income populations.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, renewal of the BSEP OLs, are SMALL for all impact categories, except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal for which a single significance level was not assigned. The following alternative actions were considered: the no-action alternative (discussed in Section 8.1); new generation alternatives from pulverized coal, coal gasification, natural gas combined-cycle, and new nuclear (discussed in Sections 8.2.1 through 8.2.4, respectively); purchased electrical power (discussed in Section 8.2.5); alternative technologies (discussed in Section 8.2.6); and the combination of alternatives (discussed in Section 8.2.7).

The no-action alternative would require replacing electrical generating capacity by (1) DSM and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than BSEP, or (4) some combination of these options, and would result in decommissioning BSEP. For each of the new generation alternatives (pulverized coal, coal gasification, natural gas combined-cycle, and new nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of BSEP. The impacts of purchased electrical power would still occur, but would occur elsewhere. Alternative technologies are not considered feasible at this time, and it is unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the BFN.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

8.4 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

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

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

40 CFR Part 50. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

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9.0 Summary and Conclusions

On October 18, 2004, the Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) for an additional 20-year period. If the OLs are renewed, State regulatory agencies and CP&L will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the jurisdiction of the State or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration of the current OLs, which expire on September 8, 2016, for Unit 1, and on December 27, 2014, for Unit 2.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 United States Code 4321) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a]

Upon acceptance of the CP&L application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping meetings on January 12, 2005 (70 FR 2188). The staff visited the BSEP site in January 2005 and held public scoping meetings on January 27, 2005, in Southport, North Carolina (NRC 2005). The staff reviewed the CP&L Environmental Report (ER) (CP&L 2004) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff also considered the public comments received during the scoping process for preparation of this supplemental environmental impact statement (SEIS) for BSEP. The public comments received during the scoping process are provided in Appendix A, Part I, of this SEIS.

The staff will hold two public meetings in Southport, North Carolina, in October 2005 to describe the preliminary results of the NRC environmental review and to answer questions in order to

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

provide members of the public with information to assist them in formulating their comments on this SEIS. When the comment period ends, the staff will consider and address all of the comments received in Appendix A, Part II, of the final SEIS.

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

The NRC has adopted the following statement of purpose and need for license renewal from the GEIS:

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

The evaluation criterion for the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

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

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

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed

action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b).[a]

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

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

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

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

For 69 of the 92 issues considered in the GEIS, the staff analysis in the GEIS shows the following:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off site radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

(a) The title of 10 CFR 51.23 is "Temporary Storage of Spent Fuel after Cessation of Reactor Operations – Generic Determination of No Significant Environmental Impact."

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

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

This SEIS documents the staff's consideration of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for BSEP) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the BSEP site or some other unspecified greenfield location.

9.1 Environmental Impacts of the Proposed Action – License Renewal

CP&L and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither CP&L nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process, CP&L, nor the staff has identified any new issue applicable to BSEP that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to BSEP.

CP&L's license renewal application presents an analysis of the Category 2 issues that are applicable to BSEP, plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the CP&L analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at BSEP. Four Category 2 issues are not discussed in this SEIS because they are specifically related to refurbishment. CP&L (2004) has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of BSEP, for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement Related to Continued Construction and Proposed Issuance of an Operating License for the Brunswick Steam Electric Plant Units 1 and 2* (AEC 1974).

Eleven Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this SEIS in relation to operation during the renewal term. For all 11 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs and the individual plant examination of external events report for BSEP and the plant improvements already made, CP&L identified 12 potentially cost-beneficial SAMAs. CP&L has committed to further evaluate these 12 SAMAs. The staffs concludes that three additional SAMAs are potentially cost-beneficial. However, none of the potentially cost-beneficial SAMAs identified relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

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

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

The adverse impacts of continued operation identified are considered to be of SMALL significance, and none warrants implementation of additional mitigation measures. The adverse impacts of likely alternatives if BSEP ceases operation at or before the expiration of the current OLs will not be smaller than those associated with continued operation of this unit, and they may be greater for some impact categories in some locations.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of BSEP during the current license period was made when the plant was built. The resource commitments to be considered in this SEIS are associated with continued operation of the plant for an additional 20 years. These resources include materials and equipment required for plant maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent offsite storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent HLW storage space. BSEP replaces approximately one-third of the fuel assemblies in each of the two units during every refueling outage, which occurs on a 24-month cycle.

The likely power generation alternatives if BSEP ceases operation on or before the expiration of the current OLs will require a commitment of resources for construction of the replacement plants as well as for fuel to run the plants.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the BSEP site was set when the plant was approved and construction began. That balance is now well established. Renewal of the OLs for BSEP and continued operation of the plants will not alter the existing balance but may postpone the availability of the site for other uses. Denial of the application to renew the OLs will lead to shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the BSEP site into a park or an industrial facility are quite different.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the OLs for BSEP, Units 1 and 2. Chapter 2 describes the site, the power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at BSEP. Chapters 4 through 7 discuss environmental issues associated with renewal of the OLs. Environmental issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OLs for Unit 1 and 2), the no-action alternative (denial of the application), alternatives involving nuclear or coal- or gas-fired generation of power at the BSEP site and an unspecified alternate site, and a combination of alternatives are compared in Table 9-1. Impact levels assume closed-cycle cooling. Because once-through cooling may be possible for facilities located at the BSEP site, impacts using this method of heat dissipation were also evaluated. In those cases in which the impact levels using once-through cooling would differ from impacts using closed-cycle cooling, such differences are noted.

Table 9-1 shows that the significance of the environmental impacts of the proposed action are SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental impacts in at least some impact categories that reach MODERATE or LARGE significance.

9.3 Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996, 1999); (2) the CP&L ER (2004); (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments received during the scoping process, the recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for BSEP are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using Closed-Cycle Cooling Except as Otherwise Specified

	Proposed Action	No-Action Alternative	Coal-Fired Generation		Natural-Gas-Fired Generation		New Nuclear Generation		Combination of Alternatives	
Impact Category	**License Renewal**	**Denial of Renewal**	**Brunswick Site**	**Alternate Site**	**Brunswick Site**	**Alternate Site[a]**	**Brunswick Site**	**Alternate Site**	**Brunswick Site**	**Alternate Site**
Land Use	SMALL	SMALL	MODERATE	MODERATE to LARGE	MODERATE[b]	MODERATE to LARGE	SMALL to MODERATE	MODERATE to LARGE	MODERATE	MODERATE to LARGE
Ecology	SMALL	SMALL	MODERATE	MODERATE to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE[c]	MODERATE to LARGE	MODERATE	MODERATE to LARGE
Water Use and Quality-Surface Water	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Use and Quality-Groundwater	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	MODERATE	SMALL	SMALL	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socio-economics	SMALL	SMALL to MODERATE	MODERATE	MODERATE to LARGE	MODERATE	MODERATE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	MODERATE
Aesthetics	SMALL	SMALL	MODERATE[b]	MODERATE to LARGE	MODERATE[b]	MODERATE to LARGE	MODERATE[b]	MODERATE to LARGE	MODERATE	MODERATE to LARGE
Historic and Archaeological Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE

(a) Except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal, for which a significance level was not assigned. See Chapter 6 for details.
(b) Impacts would be SMALL to MODERATE with once-through cooling .
(c) Impacts would be MODERATE with once-through cooling .

9.4 References

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

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

70 FR 2188. January 12, 2005 "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, U.S. Nuclear Regulatory Commission.

Carolina Power & Light Company (CP&L). 2004. *Applicant's Environmental Report – Operating License Renewal Stage, Brunswick Steam Electric Plant, Units 1 and 2.* Docket No. 50-324 and 50-325, Southport, North Carolina.

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

U.S. Atomic Energy Commission (AEC). 1974. *Final Environmental Statement related to the operation of Brunswick Steam-Electric Plant, Units 1 and 2.* Docket No. 50-261, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, "Section 6.3 – Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2005. *Environmental Impact Statement Scoping Process: Summary Report - Brunswick Steam Electric Plant, Units 1 and 2, Southport, North Carolina.* Washington, D.C.

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

Part I – Comments Received During Scoping

On January 12, 2005, the U.S. Nuclear Regulatory Commission (NRC) published a notice of intent in the *Federal Register* (70 FR 2188) to notify the public of the staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, to support the renewal application for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) operating license and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), and Title 10 of the Code of Federal Regulations (CFR) Part 51. As outlined by Part 51, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, State, and local government agencies; Native American tribal organizations, local organizations; and individuals to participate in the scoping process by providing oral comments at scheduled public meetings and/or submitting written suggestions and comments no later than March 11, 2005.

The scoping process included two public scoping meetings, which were held at Southport City Hall in Southport, North Carolina, on January 27, 2005. Approximately 40 people attended the meetings. Each session began with NRC staff members providing brief overviews of the license renewal process and the NEPA process. After the NRC's prepared statements, the meetings were open for public comments. Seven attendees provided oral statements that were recorded and transcribed by a certified court reporter. The meeting transcripts are an attachment to the Scoping Meeting Summary (ML050730184) dated March 11, 2005. No additional comments were received by the NRC.

At the conclusion of the scoping period, the NRC staff and its contractors reviewed the transcripts to identify specific comments and issues. Each set of comments from a given commenter was given a unique identifier (Commenter ID) so the comments could be traced back to the original transcript containing the comment. Specific comments were numbered sequentially within each comment set.

Table A.1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID number associated with each set of comments. Individuals who spoke at the scoping meetings are listed in the order in which they spoke at the public meeting. To maintain consistency with the *Brunswick Scoping Summary Report* dated May 24, 2005, the unique identifier used in that report for each set of comments is retained in this report.

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID	Commenter	Affiliation (If Stated)	Comment Source
A	Norman Holden	Mayor, City of Southport	Afternoon Scoping Meeting
B	Paul Fisher	Alderman, City of Southport	Afternoon Scoping Meeting
C	Mike Reaves	President, Brunswick Community College	Afternoon Scoping Meeting
D	Connie Majure-Rhett	Greater Wilmington Chamber of Commerce	Afternoon Scoping Meeting
E	Karen Sphar	Southport-Oak Island Chamber of Commerce	Afternoon Scoping Meeting
F	May Moore	Brunswick County Commissioner	Evening Scoping Meeting
G	Cynthia Tart	Director of Communities and Schools in Brunswick County, Chairman of County Parks and Recreation Board	Evening Scoping Meeting

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by the commenters. The comments fall into one of the following general groups:

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 or Category 2 issues or issues that were not addressed in the GEIS. They also address alternatives and related Federal actions.

- General comments (1) in support of or opposed to nuclear power or license renewal or (2) on the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the BSEP license renewal application.

- Questions that do not provide new information.

- Specific comments that address issues that do not fall within or are specifically excluded from the purview of NRC environmental regulations. These comments typically address issues such as the need for power, emergency preparedness, current operational safety issues, and safety issues related to operation during the renewal period.

Each comment received during this scoping process is summarized in the Brunswick Scoping Summary Report. The ADAMS accession number for the summary report is ML051440479. This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) at http://www.nrc.gov/reading-rm.html.

The following pages summarize the comments and suggestions received as part of the scoping process and discuss the disposition of the comments and suggestions. The parenthetical alpha-numeric identifier after each comment refers to the comment set (Commenter ID) and the comment number.

Comments in this section are grouped in the following categories:

A.1.1. General Support of Nuclear Power
A.1.2. Questions about the License Renewal Process
A.1.3. General Support of License Renewal at Brunswick Steam Electric Plant, Units 1 and 2
A.1.4. Comments Concerning the Environment
A.1.5. Comments Concerning Socioeconomics
A.1.6. Comments Concerning Plant Operations and Safety
A.1.7. Comments Concerning Waste Management

A.1 Comments and Responses

A.1.1. General Support of Nuclear Power

Comment: I firmly believe that the future generation of electricity should be geared towards nuclear plants. (B-5)

Response: *This comment is supportive of nuclear power and is general in nature. The comment provides no new information; therefore, it will not be evaluated further.*

A.1.2. Questions about the License Renewal Process

Comment: I think the one question that we all would ask is assuming that the license is renewed in 14 and 16, 20 years down the road, what happens next? Do you renew again, or do you have to mothball this plant? And I think the area would be very concerned about where that would leave us. (F-4)

Response: *If the licensee desires, based on a variety of economic and structural factors. Current regulations do allow the opportunity to renew the operating license again for another 20 years. The decision to apply would be up to the licensee, and could be made up to 20 years before the end of the license, which in this situation would be around 2014 and 2016 if the current licenses are renewed. This comment requests information about the license renewal process and provide no new information; therefore, it will not be evaluated further.*

A.1.3. General Support of License Renewal at Brunswick Steam Electric Plant, Units 1 and 2

Comment: The plant means so much to the City of Southport, and we really need to see it relicensed. ...But ladies and gentlemen, you are the ones that make the decision. I'm up here, and I would get on my knees if I could get back up, to beg for you to please relicense the Brunswick nuclear plant. (A-1)

Comment: I strongly recommend that you renew the license for the Brunswick plant. By doing that, I think you'll go into a win-win situation. (B-4)

Comment: I'm here today to support the Brunswick nuclear plant and their application for license renewal. ...I strongly encourage you to support their [Brunswick] application. (C-1)

Comment: On behalf of the 1650 companies that are members of the Greater Wilmington Chamber of Commerce, I would like to voice my very strong support for the processes, products and people of Progress Energy's Brunswick Nuclear Plant. ...Without a doubt, this facility and this company is an impressive one. Relicensing should be an obvious outcome of your work. (D-1)

Comment: Thank you for the opportunity to speak favorably about the license renewal application for Progress Energy's Brunswick plant. ...We are grateful to have the plant and Progress Energy as part of our community. We encourage the NRC to look favorably on this license renewal. (E-1)

Response: *These comments are supportive of license renewal for BSEP and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

A.1.4. Comments Concerning the Environment

Comment: Environmentally, the plant has contributed to the ongoing study of marine life in our area, and they take great pride in the protection of that marine life. (E-3)

Comment: The nuclear power plant is environmentally clean. ...We have good fish. We have good birds. We have clean water. We have clean air. We'd like to keep it that way, and we feel that Progress Energy and the Nuclear Regulatory Commission have worked to make this happen for us, and it's been a big help for us. (F-4)

Response: *These comments are supportive of BSEP's impact on the environment and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

A.1.5. Comments Concerning Socioeconomics

Comment: [The plant means so much]...not only to Southport, southeastern North Carolina, but for the whole state of North Carolina because all of you are aware of the economy. ...But when the nuclear plant came to Southport, things really began to prosper. (A-2)

Comment: This plant has a huge impact on our local economy – $901 million in 2003, 14 percent of our region's economic output. Economies don't start and stop at county lines, but if you go a few miles up the river to New Hanover County where my office is, the impact is still huge. ...Then there are the contributions this company makes that are harder to quantify but equally valuable to this region. (D-3)

Comment: [T]he plant has an overwhelming economic impact on the economy of our area. ...Not only has the plant been good for the economy, the employees of the plant are active in our community. (E-2)

Comment: This plant provides stable and excellent paying jobs to that workforce. (E-4)

Comment: They have done an enormous thing for our tax base since the '70s when the power plant began being constructed. ...It's not as an enormous a part of our tax base as it was in 1970 or '75, obviously, but it's still quite a large part of the money that both the town of Southport and the County of Brunswick counts on, so that is an issue. (F-2)

Response: *These comments are supportive of BSEP's impact on the local economy and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

Comment: And we have a great relationship with Progress Energy and the Brunswick plant here for community relations. ...It's a definite asset to the community. We have an outstanding relationship, in my opinion, with the plant out there and Progress Energy. (B-2)

Comment: They have been and continue to be a good corporate partner with the college. ...We also in the past have had a wonderful relationship with them in providing education, both there on the site as well as having students from there coming on our campus. (C-2)

Comment: Without a doubt, Progress Energy is among the best corporate citizens I have ever had the pleasure of working with. But as important as that is, the human capital invested in our region by employees of Progress Energy. ...Our community is better because of these corporate and individual efforts. (D-4)

Comment: I'm delighted to be here on behalf of Progress Energy. They've been a wonderful corporate neighbor in Brunswick County. ...They've worked with us on fire and rescue and security, which is important. ...Progress Energy lets us use their media center. They work with us on school programs. They're a source of employment of many friends and neighbors of mine, so it's been an excellent neighbor and a great addition to the county. (F-1)

Comment: In a partnership with a lease agreement with Progress Energy, we now have a park here in the Southport/Oak Island area, and without the partnership with Progress Energy, that would not be possible. (G-2)

Response: *These comments are supportive of CP&L's relationship with the community and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

Comment: They [CP&L] have enabled vast improvement to our school system. (F-3)

Comment: I've been here for 35 years, and I've seen, as May has said, what an impact the company has had on the community, the jobs it's provided, the educational resources it's provided in the schools. (G-1)

Comment: And if I could mention something as a plea ...The plant sitting here has so many resources as far as education for our children, and they are our future. ...[I]f we had some of those resources in the schools working with our science teachers, you know, what could we be teaching our children, our future, about nuclear plants in their area, about their future, about jobs that are there? So I would encourage just the connection there, to -- to work on it and to strengthen it to better educate our children and just join forces with 'em. (G-3)

Response: *These comments refer to CP&L's supportive relationship with the local schools, encourages additional support, and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

A.1.6. Comments Concerning Plant Operations and Safety

Comment: I think if you look at the operations of the Brunswick plant, you'll find why we talk about operations. It's always something nice to talk about because it's always way up here. They are the world leaders and that's documented. (B-1)

Comment: In the City of Southport we're very comfortable with the nuclear plant out here, and we're proud of their operating record and safety record. (B-3)

Comment: I have personally visited the plant on several occasions and have confidence in the personnel that work there. ...I view the Brunswick nuclear plant as a clean and safe industry, one that is sensitive to the environment. They do an excellent job of keeping the public informed about drills and other safety issues. (C-3)

Comment: The plant is a safe, well-run, efficient facility. (D-2)

Response: *These comments address BSEP's operational safety record and are general in nature. The comments provide no new information; therefore, they will not be evaluated further.*

A.1.7. Comments Concerning Waste Management

Comment: I am completely comfortable with the safety of how we store spent fuel. However, I urge the federal government to get along with the YUCCA mountain project. (B-6)

Response: *This comment is in support of how spent fuel is handled at BSEP, and encourages completion of a permanent high-level waste storage facility. The comment provides no new information; therefore will not be evaluated further.*

Appendix B

Contributors to the Supplement

Appendix B

Contributors to the Supplement

The overall responsibility for the preparation of this supplement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations, Pacific Northwest National Laboratory, Argonne National Laboratory, and Information Systems Laboratories.

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(a) Pacific Northwest National Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute.
(b) Argonne National Laboratory is operated for the U.S. Department of Energy by the University of Chicago.

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Carolina Power & Light Company's Application for License Renewal of Brunswick Steam Electric Plant Units 1 and 2

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Carolina Power & Light Company's Application for License Renewal of Brunswick Steam Electric Plant Units 1 and 2

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Progress Energy Carolinas, Inc. (CP&L) and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 51, of CP&L application for renewal of the Brunswick Steam Electric Plant (BSEP) operating license. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room at One White Flint North, 11555 Rockville Pike (first floor), Rockville, MD, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Document Access and Management Systems (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records (PARS) component of ADAMS. The ADAMS accession numbers for each document are included below.

October 18, 2004	Brunswick Units 1 and 2, Applicant's Environmental Report – Operating License Renewal Stage (Accession No. ML043060413)
October 18, 2004	BSEP Units 1 and 2, License Renewal Application (Accession No. ML043060411)
October 21, 2004	Note-to-file regarding forthcoming public information session for the U.S. Nuclear Regulatory Commission (NRC) staff to describe its license renewal process (Accession No. ML042950307)
October 25, 2004	NRC press release No. 04-134, "NRC Announces Availability of License Renewal Application for Brunswick Steam Electric Plant, Units 1 and 2" (Accession No. ML042990359)
November 4, 2004	Letter from Mr. Stephen Rynas, North Carolina Department of Environment and Natural Resources (NCDENR), to NRC regarding Federal Consistency Certification for license renewal of BSEP (Accession No. ML043150301)

November 9, 2004	Letter from NRC to Ms. Ilene Brown, University of North Carolina at Wilmington, regarding maintenance of reference material at the William Madison Randall Library at the BSEP, Units 1 and 2 License Renewal Application (Accession No. ML043170648)
November 10, 2004	Letter from NRC to Mr. Cornelius J. Gannon, CP&L, regarding the receipt and availability of the license renewal application for BSEP (Accession No. ML043170248)
December 1, 2004	Federal Register Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding the Renewal of Facility Operating License Nos. DPR-71 and DPR-62 for an Additional 20-Year Period (69 FR 70471)
December 29, 2004	Letter from NRC to Mr. Sam D. Hamilton, Regional Director, U.S. Fish and Wildlife Service (FWS), requesting a list of protected species within the area under evaluation for the BSEP, Units 1 and 2, License Renewal (Accession No. ML043650001)
December 29, 2004	Letter from NRC to Ms. Patricia A. Kurkul, Regional Administrator, National Oceanic and Atmospheric Administration (NOAA) Fisheries, requesting a list of protected species within the area under evaluation for the BSEP, Units 1 and 2, License Renewal (Accession No. ML043650002)
December 30, 2004	Letter from NRC to The Honorable Leon Jacobs, Tribal Council of the Lumbee Tribe, Tribal Administrator, seeking input for its environmental review to renew the operating licenses for the BSEP, Units 1 and 2 (Accession No. ML050050565)
December 30, 2004	Letter from NRC to Mr. Archie Ray Jacobs, Travel Chairman, Development Association Executive Director, Waccamaw Siouan, seeking input for its environmental review to renew the operating licenses for the BSEP, Units 1 and 2 (Accession No. ML050050566)
December 30, 2004	Letter from NRC to Mr. Don Klima, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation, seeking input for its environmental review to renew the operating licenses for the BSEP, Units 1 and 2 (Accession No. ML050050567)

December 30, 2004	Letter from NRC to Dr. Jeffrey Crow, Deputy Secretary of Archives and History, State Historic Preservation Officer, seeking input for its environmental review to renew the operating licenses for the BSEP, Units 1 and 2 (Accession No. ML050050490)
January 4, 2005	Letter from NRC to Mr. Cornelius J. Gannon, Vice President, BSEP, CP&L, Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the BSEP, Units 1 and 2 (Accession No. ML050050568)
January 12, 2005	NRC meeting notice announcing public meeting in Southport, North Carolina on January 27, 2005 , to discuss the environmental scoping process for the application for the license renewal of BSEP (Accession No. ML050130438)
January 12, 2005	Federal Register Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process regarding the application for license renewal of Brunswick Steam Electric Plant (70 FR 2188)
February 2, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #13 (Accession No. ML051220559)
February 2, 2004	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up list (Accession No. ML051220533)
February 3, 2005	Letter from Mr. Pete Benjamin, Ecological Services Supervisor, U.S. Department of Interior, FWS, to Mr. Pao-Tsin Kuo, NRC, regarding a list of all Federally protected endangered and threatened species in the area under review for license renewal at BSEP (Accession No. ML050600244)
February 4, 2005	Letter from Ms. Teletha Griffin, Administrative Support Assistant, U.S. Department of Commerce, NOAA, to NRC, regarding a list of Federally protected species in the area under review for license renewal at BSEP (Accession No. ML050600259)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #19 (Accession No. ML051220465)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #11 (Accession No. ML051220423)

February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #10 (Accession No. ML051220417)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #5 (Accession No. ML051220404)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #4 (Accession No. ML051220391)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #13 (Accession No. ML051220559)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #14 (Accession No. ML051220522)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #3 (Accession No. ML051220478)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #6 (Accession No. ML051220449)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #18 (Accession No. ML051220438)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #15 (Accession No. ML051220474)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #20 (Accession No. ML051220466)
February 4, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #12 (Accession No. ML051230196)
February 7, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #2 (Accession No. ML051220562)
February 8, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #7 (Accession No. ML051220444)
February 8, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #8 (Accession No. ML051220424)

February 17, 2005	Note-to-file regarding docketing of Draft Request for Additional Information Regarding Severe Accident Mitigation Alternatives Analysis in Support of the Environmental Review of CP&L License Renewal Application for BSEP, Units 1 and 2 (Accession No. ML050490382)
February 17, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #16 (Accession No. ML051220408)
February 17, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #17 (Accession No. ML051220377)
February 18, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #1 (Accession No. ML051220368)
February 18, 2005	E-mail from Paul Snead, CP&L, regarding Site Audit follow-up #9 (Accession No. ML051220358)
February 24, 2005	Letter to Mr. Cornelius J. Gannon, CP&L, from NRC, regarding Request for Additional Information (RAI) regarding severe accident mitigation alternatives (SAMAs) for BSEP, Units 1 and 2 (Accession No. ML050550262)
March 11, 2005	Note-to-file regarding Summary of Public Scoping Meetings Conducted to Support the review of the BSEP, Units 1 and 2 License Renewal Application (Accession No. ML050730200)
March 11, 2005	E-mail from Richard Emch, NRC, regarding additional requests on RAIs (Accession No. ML051220351)
March 11, 2005	E-mail from Richard Emch, NRC, regarding FWS Letter (Accession No. ML051220343)
March 14, 2005	E-mail from Jan Kozyra, CP&L, regarding the BSEP Offsite Dose Calculation Manual (Accession No. ML051230090)
March 15, 2005	Note-to-file regarding Summary of Teleconference conducted on February 28, 2005, with CP&L, to discuss SAMA RAIs for BSEP, Units 1 and 2 (Accession No. ML050750572)
March 16, 2005	E-mail from Jan Kozyra, CP&L, regarding Site Audit right-of-way specifications (Accession No. ML051220567)

March 16, 2005	E-mail from Richard Emch, NRC, regarding shock analysis for Whiteville-to-Fayetteville transmission line (Accession No. ML051220336)
March 17, 2005	Letter to Mr. Sam D. Hamilton, from NRC regarding amended request for list of protected species within the area under evaluation for BSEP (Accession No. ML0508005181)
March 18, 2005	E-mail from Jan Kozyra, CP&L, regarding endangered species (Accession No. ML051220303)
March 20, 2005	Note-to-file regarding Summary of Site Audit to support review of license renewal application for BSEP, Units 1 and 2 (Accession No. ML050880508)
March 30, 2005	E-mail from Jan Kozyra, CP&L, to NRC regarding transmission lines (Accession No. ML051220256)
March 30, 2005	E-mail from Jan Kozyra, CP&L, to NRC regarding transmission lines Whiteville to Fayetteville (Accession No. ML051220140)
March 30, 2005	E-mail from Jan Kozyra, CP&L, to NRC regarding draft SAMA responses (Accession No. ML051220176)
March 30, 2005	E-mail from Jan Kozyra, CP&L, to NRC regarding transmission lines (Accession No. ML051220182)
April 6, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing SAMA draft responses (Accession No. ML051220515).
April 6, 2005	E-mail from Jan Kozyra, CP&L, regarding draft SAMA responses (Accession No. ML051230064)
April 14, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing SAMA draft RAI 8 responses (Accession No. ML051220137)
April18, 2005	E-mail from Robert Palla, NRC, regarding SAMA RAI 8 (Accession No. ML051220131)
April 21, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing responses to SAMA RAIs (Accession No. ML051220545)

April 29, 2005	Note-to-file regarding summary of teleconference conducted on March 31, 2005, with CP&L to discuss the SAMA RAIs for BSEP, Units 1 and 2 (Accession No. ML051190231)
May 4, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing a proposed addendum to the response to BSEP SAMA RAI 8 (Accession No. ML051680188)
May 4, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing a proposed addendum to the response to BSEP) SAMA RAI 8 (Accession No. ML051680176)
May 5, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing responses to SAMA RAIs (Accession No. 051680167)
May 13, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing responses to SAMA follow-up questions (Accession No. ML051680156)
May 16, 2005	Note-to-file regarding summary of teleconference conducted on April 7, 2005, with CP&L, to discuss SAMA RAIs for BSEP, Units 1 and 2 (Accession No. ML051370282)
May 16, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing supplemental information for SAMA RAI 8 (Accession No. ML051680147)
May 23, 2005	E-mail from Jan Kozyra, CP&L, to NRC providing information on cooling towers (Accession No. ML051680095)
May 24, 2005	Letter from NRC to Mr. Cornelius J. Gannon, CP&L, regarding Issuance of Environmental Scoping Summary Report Associated with the Staff's Review of the Applications by CP&L for Renewal of the Operating Licenses for BSEP, Units 1 and 2 (Accession No. ML051440479)
June 1, 2005	Letter from Mr. Cornelius J. Gannon, CP&L, to NRC providing SAMA RAIs 1-8 (Accession No. ML051640476)
June 17, 2005	E-mail from Tom Thompson, CP&L, to NRC providing requested information regarding BSEP, Units 1 and 2 (Accession No. ML052030260)
June 18, 2005	E-mail from Dave Anderson, PNNL to NRC, submitting BSEP Units 1 and 2 Site Audit trip report regarding socioeconomics and land use topics (Accession No. ML052030237)

June 22, 2005	E-mail from Jan Kozyra, CP&L to NRC, regarding cooling towers at BSEP, Units 1 and 2 (Accession No. ML051930208)
July 7, 2005	E-mail from Paul Snead, CP&L to NRC regarding Swain Gravesites at BSEP, Units 1 and 2 (Accession No. ML051930221)
July 8, 2005	E-mail from Paul Snead, CP&L to NRC providing further information regarding license renewal of threatened and endangered species (Accession No. ML051930223)
August 8, 2005	Letter from NRC to Mr. Sam D. Hamilton, Regional Director, U.S. Fish and Wildlife Service (FWS), providing Biological Assessment for evaluation and concurrence by FWS for the BSEP, Units 1 and 2, License Renewal (Accession No. ML052200600)
August 9, 2005	Letter from NRC to Mr. David Bernhart, Assistant Regional Administrator for Protected Resources, National Oceanic and Atmospheric Administration's (NOAA) National.Marine Fisheries Service (NMFS), providing Biological Assessment for evaluation and concurrence by NMFS for the BSEP, Units 1 and 2, License Renewal (Accession No. ML052200644)

Appendix D

Organizations Contacted

Appendix D

Organizations Contacted

During the course of the staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, and local agencies were contacted:

Advisory Council on Historic Preservation, Office of Federal Agency Programs

Brunswick Family Assistance Agency

Brunswick County Center of the North Carolina Cooperative Extension Service

Brunswick County Schools

Brunswick County Chamber of Commerce

Brunswick County Economic Development Commission

Brunswick County Planning Department

Cape Fear Council of Governments

City of Southport

City of Boiling Spring Lakes

Lumbee Tribal Nation

Margaret Rudd & Associates, Inc. Realtors

National Oceanic and Atmospheric Administration, National Marine Fisheries Service

North Carolina Department of Cultural Resources, Division of Historical Resources, Underwater Archaeology Fort Fisher, Office of State Archaeology

North Carolina Department of Environment and Natural Resources, Division of Water Quality

North Carolina Department of Transportation

North Carolina State Archives, Archives and Records Section of the Office of Archives and History and the Department of Cultural Resources

Southport Maritime Museum

State Historic Preservation Office, Department of Archives and History Survey and Planning Branch, Lewis-Smith House, Survey File Room in Archives and History Building

Town of Oak Island

Town of Caswell Beach & Brunswick Beaches Consortium

Waccamaw Siouan Tribal Nation

University of North Carolina at Wilmington

U.S. Department of the Interior, Fish and Wildlife Service

Appendix E

Carolina Power & Light Company's Compliance Status and Consultation Correspondence

Appendix E

Carolina Power & Light Company's Compliance Status and Consultation Correspondence

Correspondence between Federal and State Agencies and Carolina Power & Light Company (CP&L), currently operating as Progress Energy Carolina, Inc., and between the U.S. Nuclear Energy Commission (NRC) during the evaluation process of the application for renewal of the operating licenses (OLs) for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) is listed in Table E-1. Copies of the correspondence are included at the end of this appendix.

Federal permits, licenses, approvals, and other entitlements which must be obtained for renewal of the BSEP OLs are listed in Table E-2.

Table E-1. Consultation Correspondence Regarding License Renewal for BSEP Units 1 and 2

Source	Recipient	Date of Letter
North Carolina Department of Environment and Natural Resources (NCDENR), Division of Parks and Recreation (Harry E. LeGrand, Jr.)	CP&L (Edward T. O'Neil)	May 21, 2003
U.S. Fish and Wildlife Service (FWS) (Dr. Garland Pardue)	CP&L (Edward T. O'Neil)	July 15, 2003
NCDENR, Division of Coastal Management (Doug Huggett)	NRC (Richard Emch)	December 7, 2004
NRC (Pao-Tsin Kuo)	FWS (Sam D. Hamilton)	December 29, 2004
NRC (Pao-Tsin Kuo)	NOAA Fisheries (Patricia A. Kurkul)	December 29, 2004
NRC (Pao-Tsin Kuo)	State Historic Preservation Office (Dr. Jeffrey Crow)	December 30, 2004
NRC (Pao-Tsin Kuo)	Advisory Council on Historic Preservation (Don Klima)	December 30, 2004

Table E-1. (contd)

Source	Recipient	Date of Letter
NRC (Pao-Tsin Kuo)	Tribal Council of Lumbee Tribe (Leon Jacobs)	December 30, 2004
NRC (Pao-Tsin Kuo)	Waccamaw Siouan (Archie Ray Jacobs)	December 30, 2004
FWS (Pete Benjamin)	NRC (Pao-Tsin Kuo)	February 3, 2005
NRC (Pao-Tsin Kuo)	FWS (Sam D. Hamilton)	March 17, 2005
NRC (Pao-Tsin Kuo)	FWS (Sam D. Hamilton)	August 8, 2005
NRC (Pao-Tsin Kuo)	NOAA's National Marine Fisheries Service (David Bernhart)	August 9, 2005

Table E-2. Federal Permits, Licenses, and Other Entitlements Related to Renewal of the BSEP OLs

Agency	Authority	Requirement	Remarks
NRC	Atomic Energy Act (42 USC 2011 et seq.); 10 CFR Parts 2, 50, and 51	Requirements for submitting license renewal applications	The CP&L application is online at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html.
FWS; National Oceanic and Atmospheric Administration (NOAA) Fisheries	Section 7 of the Endangered Species Act; 16 USC 1536	Requires a Federal agency to ensure that its actions are not likely to jeopardize the continued existence of any endangered or threatened species of any critical habitat for such species.	Consultation correspondence with the FWS and NOAA Fisheries is included in this Appendix E.
NRC; NCDENR	Section 401 of the Clean Water Act; 33 USC 1341	Applicants for a Federal license to conduct an activity which may result in discharges to navigable waters are to provide the licensing agency a certification from the state that the discharge will comply with the Clean Water Act.	Section 4.2.1.1 of the Generic Environmental Impact Statement states that issuance of an National Pollutant Discharge Elimination System (NPDES) permit by a state water quality agency implies certification under section 401 of the Clean Water Act. CP&L holds an NPDES permit (permit number NC0007064) for BSEP issued by NCDENR.
NRC; NCDENR, North Carolina Division of Coastal Management	Section 307 of the Coastal Zone Management Act; 16 USC 1456	Applicants for a Federal license to conduct an activity in a coastal zone are to provide a certification to the licensing agency that the activity will be conducted consistently with the State's coastal zone program. The State is to notify the federal agency if it concurs with the certification.	Correspondence related to the CP&L certification is included in this Appendix E.
NRC; North Carolina Department of Cultural Resources	Section 106 of the National Historic Preservation Act; 16 USC 470f; 36 CFR 800	Prior to issuing a license, a Federal agency is to take into account effects on historic properties. The Federal agency is to consult with the state historic preservation officer.	Correspondence related to the consultation process is included in this Appendix E.

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Parks and Recreation

Michael F. Easley, Governor   William G. Ross, Jr., Secretary   Philip K. McKnelly, Director

May 21, 2003

Mr. Edward T. O'Neil
Progress Energy Carolinas, Inc.
P.O. Box 10429
Southport, NC 28461

Subject: License Renewal for the Brunswick Steam Electric Plant; Southport, Brunswick County

Dear Mr. O'Neil:

The Natural Heritage Program has only one record of rare species on the Brunswick Plant site at Southport. The Carolina diamondback terrapin (*Malaclemys terrapin centrata*), a Federal Species of Concern, has been reported from the canal near the plant. This species is typically found along estuarine shores, however.

Although our maps do not show records of other natural heritage elements in the electric plant project area, it does not necessarily mean that they are not present. It may simply mean that the area has not been surveyed. The use of Natural Heritage Program data should not be substituted for actual field surveys, particularly if the project area contains suitable habitat for rare species, significant natural communities, or priority natural areas.

On the other hand, our Program has many dozens of rare species locations, mostly plants, within the powerline corridors in the overall project area, which extends in a 50-mile radius from the electric plant. Getting that material to Progress Energy is beyond the capabilities of our Program. The State's Center for Geographic Information and Analysis is best suited for such a large-area information request, and CGIA <www.cgia.state.nc.us> has the Natural Heritage data layer on rare species locations. They also have a data layer on protected or other Natural Heritage sites.

Your letter mentions several natural areas along PEC powerline corridors in the study area. It is also worth mentioning that in summer 2002, a biologist for a consulting firm, perhaps hired by PEC, found several new populations of the Federally Endangered golden sedge (*Carex lutea*) and rough-leaf loosestrife (*Lysimachia asperulifolia*) and numerous new populations of the Federal Species of Concern Venus flytrap (*Dionaea muscipula*) in the powerline on lands owned by The Nature Conservancy, north and east of Holly Shelter Game Land. Some of these lands are being inspected for potential acquisition by the Division of Parks and Recreation for a future state park

1615 Mail Service Center, Raleigh, North Carolina 27699-1615
Phone: 919-733-4181 \ Fax: 919-715-3085 \ Internet: www.ncsparks.net

unit. Thus, it is important the PEC continue its level and type of powerline maintenance, such as mowing/bush-hogging during the non-growing season on a roughly 3-year cycle, and avoid usage of herbicides or other chemicals to kill or retard vegetation in such sensitive biological areas.

You may wish to check the Natural Heritage Program database website at <www.ncsparks.net/nhp/search.html> for a listing of rare plants and animals and significant natural communities in the county and on the topographic quad map. Please do not hesitate to contact me at 919-715-8687 if you have questions or need further information.

Sincerely,

Harry E. LeGrand, Jr.

Harry E. LeGrand, Jr., Zoologist
Natural Heritage Program

HEL/hel

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

July 15, 2003

Edward T. O'Neil
Carolina Power and Light
Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

Dear Mr. O'Neil:

Thank you for your May 12, 2003 letter requesting information from the U.S. Fish and Wildlife Service (Service) concerning the proposed license renewal for the Brunswick Steam Electric Plant (Unit Numbers 1 and 2). The Brunswick Steam Electric Plant is located near Southport in Brunswick County, North Carolina. Transmission lines radiate from the plant in Southport to various points in Columbus, Robeson, Pender, New Hanover and Onslow Counties. Our comments are provided pursuant to, and in accordance with, provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act).

The Service is aware of various populations of federally protected plant species that occur in transmission line rights-of-way in southeastern North Carolina. Specifically, populations of rough-leaved loosestrife (*Lysimachia asperulaefolia*), Cooley's meadowrue (*Thalictrum cooleyi*), and golden sedge (*Carex lutea*) are known to occur in various CP&L power line rights-of-way in the counties mentioned above and specifically in the Jacksonville transmission line. Currently, there is a Memorandum of Understanding (MOU) (dated March 19, 1993) between Carolina Power and Light and the North Carolina Natural Heritage Program that addresses the management of these sites in order to protect the rare species that occur in them. In this MOU, CP&L agreed to "preserve and protect the special elements of natural diversity and natural areas which best exemplify the state's natural heritage which occur on their power line rights-of-way" by mowing only during the non-growing season and avoiding impact to the soil and hydrologic components of the natural area. The MOU states that herbicides will only be used selectively to supplement mechanical maintenance when woody or invasive species threaten the rare species or natural communities. In addition, CP&L agreed to notify the Natural Heritage Program when an emergency or operation has occurred which impacts a site. CP&L also agreed to notify the Natural Heritage Program if the right-of-way is sold or transferred, if threats to the natural area are observed by CP&L staff, or if management changes are anticipated.

Based on the information provided in your letter and the existing MOU, the Service believes that as long as CP&L continues to be an active participant in this MOU, the renewal of the license for the Brunswick Steam Electric Plant (Unit Numbers 1 and 2) is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act. We believe that the requirements of section 7(a)(2) of the Act have been satisfied. We remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

Thank you for your cooperation with our agency in protecting federally listed species. If you have any questions about our comments on this project, please contact Mr. Dales Suiter at (919) 856-4520, extension 18, or via email at Dale_Suiter@fws.gov.

Sincerely,

Dr. Garland Pardue
Ecological Services Supervisor

enclosure: Memorandum of Understanding

cc: North Carolina Natural Heritage Program (Jame Amoroso)

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Coastal Management

Michael F. Easley, Governor **Charles S. Jones, Director** William G. Ross Jr., Secretary

December 7, 2004

Richard L. Emch
Senior Project Manager
United States Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: Consistency Concurrence for Nuclear Plant License Renewal with the U.S. Nuclear Regulatory Commission.

Dear Mr. Emch:

The Division of Coastal Management received (Oct. 20, 2004) from Progress Energy (Carolina Power & Light Company) a consistency certification that the proposed license renewal from the U.S. Nuclear Regulatory Commission to authorize continued operation of Units 1 and 2 of the Brunswick Steam Electric Plant is consistent with the enforceable polices of North Carolina's coastal management program. Additionally Progress Energy has certified that it will conduct its activities consistent with the enforceable policies of North Carolina's coastal management program. To support this certification, Progress Energy submitted an environmental report evaluating the impacts of the proposed license renewal on the environment and with the State's coastal program. According to the environmental assessment, the continued operation of Units 1 and 2 will not have any new or previously unevaluated environmental effects that would adversely affect consistency with the State's coastal program since the proposed action will be a license renewal to authorize continuation of the existing operation.

To solicit public comments, Division of Coastal Management (DCM) published a public notice in the "*Brunswick Beacon*" on October 28, 2004 and circulated a description of the proposed project to State agencies that would have a regulatory interest in the proposed development. No comments asserting that the proposed license renewal would be inconsistent with the State's coastal program were received. Comments received have been attached to this letter.

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Phone: 919-733-2293 \ FAX: 919-733-1495 \ Internet: www.nccoastalmanagement.net

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The Division of Coastal Management has reviewed the submitted information pursuant to Title 15A of Chapter 7 of North Carolina's Administrative Code and concurs with the applicant's consistency certification that the proposed license renewal is consistent and will be conducted in a manner consistent with the enforceable policies of North Carolina's coastal management program.

Should the project be modified, a revised consistency certification could be necessary. This might take the form of either a supplemental consistency certification pursuant to 15 CFR 930.66, or a new consistency certification pursuant to 15 CFR 930.57. Likewise, should additional project assessments disclose environmental impacts not previously considered, a supplemental consistency certification might be required. If you have any questions, please contact Stephen Rynas at 252-808-2808. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Doug Huggett
Manager, Major Permits and Consistency Unit

cc: Jim Gregson, Division of Coastal Management
C. J. Gannon, Progress Energy

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management
Michael F. Easley, Governor | **Charles S. Jones, Director** | William G. Ross Jr., Secretary

MEMORANDUM

November 15, 2004

RECEIVED
NOV 18 2004
Morehead City DCM

TO: Stephen Rynas
Federal Consistency Coordinator
DCM – Morehead City Office
151-B Hwy. 24
Hestron Plaza II
Morehead City, NC 28557

FROM: Melissa Carle, Wetlands Specialist

SUBJECT: Proposed NRC License Renewal of Units 1 and 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear Area, Brunswick County

Thank you for the opportunity to comment on this project. Based on the consistency determination, the proposed action does not appear to include direct impacts to coastal wetlands. I particularly appreciate Progress Energy's efforts to mange transmission corridors for wildlife habitat and to work with the NC Natural Heritage Program to relocate threatened and endangered species found in the transmission corridors. This benefits adjacent ecological communities, including wetlands, by minimizing the impact of the corridors on wildlife movement. Overall, this project appears to be consistent with the goals of CAMA with regards to coastal wetlands.

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Phone: 919-733-2293 \ FAX: 919-733-1495 \ Internet: www.nccoastalmanagement.net

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NCDENR

North Carolina Department of Environment and Natural Resources

Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
NOV 1 8 2004
Morehead City DCM

RECEIVED
OCT 2 8 2004
DIV. OF COASTAL MANAGEMENT
RALEIGH

TO: Melissa Carle
Coastal Wetlands
DCM - Raleigh Office
1638 Mail Service Center
Raleigh, NC 27699-1638

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

____ No Comment.

_✓_ This office supports the project as proposed.

____ Comments to this project are attached.

____ This office objects to the project as proposed.

Signed: Melissa M Carle   Date: 10/15/04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

OCT 28 2004

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM RECEIVED #ER03-1382

October 26, 2004

NOV 1 8 2004

A

TO: Renee Gledhill-Early
Archives and History Building
NC Division of Archives and History
4617 Mail Service Center
Raleigh, NC 27699-4617

Morehead City DCM S

NC JGH Due 11/16 11/15

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004.** This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

RECEIVED
NOV 1 7 2004
DIV. OF COASTAL MANAGEMENT
RALEIGH

REPLY

X No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: Renee Gledhill-Earley Date: 11-15-04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RECEIVED
NOV 0 3 2004

RETURN COMPLETED FORM
to
Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

NOV 0

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NCDENR

North Carolina Department of Environment and Natural Resources

Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

RECEIVED

OCT 28 2004

Morehead City DCM

MEMORANDUM

October 26, 2004

TO:

Town of Sunset Beach
220 Shoreline Drive West
Sunset Beach, NC 28459-4418

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

✓ No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: [signature] Date: 10-26-04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM
to
Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

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NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

OCT 29 2004

Morehead City DCM

TO:

Town of Southport
201 East Moore Street
Southport, NC 28461-3900

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina.

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

____ No Comment.

_✓_ This office supports the project as proposed.

____ Comments to this project are attached.

____ This office objects to the project as proposed.

Signed: Norman R. Holden Date: 10/25/04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
OCT 2 9 2004
Morehead City DCM

TO:
Village of Bald Head
P.O. Box 3009
Bald Head Island, NC 28461-7000

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

___ No Comment.

_X_ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: Jonath Millett Date: Oct. 28

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to
Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
OCT 2 9 2004
Morehead City DCM

TO:
County of Brunswick
P.O. Box 249
Bolivia, NC 28422-0249

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004.** This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

____ No Comment.

_✓_ This office supports the project as proposed.

____ Comments to this project are attached.

____ This office objects to the project as proposed.

Signed: [signature] County Manager Date: 10-27-04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources

RECEIVED
OCT 27 2004
BY:

Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
NOV 04 2004
Morehead City DCM

TO: Dan Sams
NCDENR - Divison of Land Resources
127 Cardinal Drive Extension
Wilmington, NC 28405-5406

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

_____ No Comment.

_____ This office supports the project as proposed.

__X__ Comments to this project are attached. ⇒

_____ This office objects to the project as proposed.

Land disturbance that exceeds one acre of grading will require an erosion & sediment control plan application and approval!

Signed: [signature] Date: 10/29/04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM
to
Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
NOV 1 0 2004
Morehead City DCM

TO: Town of Calabash
P.O. Box 4967
Calabash, NC 28467-9820

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

✓ No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: Donna H. Drue / JT   Date: 11-9-04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor | Charles S. Jones, Director | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
NOV 1 6 2004
Morehead City DCM

TO: Town of Ocean Isle Beach
3 West Third Street
Ocean Isle Beach, NC 28469-7506

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004.** This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

✓ No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: Daisy Ivey   Date: 11/12/04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

1

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Marine Fisheries

Michael F. Easley, Governor
William G. Ross Jr., Secretary

Preston P. Pate Jr., Director

MEMORANDUM

RECEIVED
NOV 2 3 2004
Morehead City DCM

TO: Stephan Rynas
Federal Consistency Coordinator

FROM: Mike Street

DATE: November 23, 2004

SUBJECT: NRC License Renewal of Units 1 and 2 of Brunswick Steam Electric Plant
Brunswick County

Attached is the Divisions' reply for the above referenced project. If you have any questions, please do not hesitate to contact me.

MS/sw

3441 Arendell Street, P.O. Box 769, Morehead City, North Carolina 28557
Phone: 252 726-7021 \ FAX: 252 727-5127 \ Internet: www.ncdmf.net

1

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Governor — Charles S. Jones, Director — William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED OCT 26 2004 DMF-HABITAT

TO: Mike Street
NCDENR - Division of Marine Fisheries
P.O. Box 769
Morehead City, NC 28557-0769

FROM: Stephen Rynas, AICP; Federal Consistency Coordinator

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004**. This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

RECEIVED NOV 19 2004 DMF-HABITAT

X No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: [signature] Date: 11/18/04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to
Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

NCDENR

North Carolina Department of Environment and Natural Resources

Division of Coastal Management

Michael F. Easley, Governor | **Charles S. Jones, Director** | William G. Ross Jr., Secretary

MEMORANDUM

October 26, 2004

RECEIVED
DEC 06 2004
Morehead City DCM

TO: Bennett Wynne
Division of Inland Fisheries, Habitat Conservation Program
NC Wildlife Resources Commission
901 Laroque
Kinston, NC 28501-3519

FROM: *Stephen Rynas, AICP; Federal Consistency Coordinator*

SUBJECT: Consistency Review for the Proposed NRC License Renewal of Units 1 & 2 of the Brunswick Steam Electric Plant, Progress Energy

LOCATION: Cape Fear area, Brunswick County, North Carolina

Please review and comment by **November 19, 2004.** This document is available online at: http://www.nrc.gov/reactors/operating/licensing/renewal/applications/brunswick.html. Your responses will assist us in determining whether the proposed project would be consistent with the State's Coastal Management Program. If the proposed project does not conform to your requirements, please identify the measures that would be necessary to bring the proposed project into conformance. If you have any additional questions regarding the proposed project you may contact me at 252-808-2808 or e-mail me at: "stephen.rynas@ncmail.net".

REPLY

✓ No Comment.

___ This office supports the project as proposed.

___ Comments to this project are attached.

___ This office objects to the project as proposed.

Signed: ____________ Date: 12-3-04

CORRECTIONS

Please identify any corrections, additions, or deletions that should be made in terms of contact information.

RETURN COMPLETED FORM

to

Stephen Rynas, Federal Consistency Coordinator
NC Division of Coastal Management
Hestron Plaza II, 151B Hwy. 24
Morehead City, NC 28557-2518

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 29, 2004

Mr. Sam D. Hamilton, Regional Director
Southeast Regional Office
U.S. Fish and Wildlife Service
1875 Century Boulevard Northeast, Suite 400
Atlanta, Georgia 30345

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2, LICENSE RENEWAL

Dear Mr. Hamilton:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing applications submitted by Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., for the renewal of the operating licenses for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. As part of the review of the license renewal applications, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended, which includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. BSEP is situated on approximately 1,200 acres of land; 130 acres are occupied by generating facilities, support facilities, warehouses, parking areas, construction laydown areas, equipment storage areas, and roads. The remaining acreage consists of woodlands, open fields, wetlands and marshlands. The area immediately surrounding the plant is a mix of agricultural lands, woodlands, swamps, and marshes.

The BSEP circulating water system is a once-through heat dissipation system. Cooling water is drawn from the Cape Fear River by way of a three-mile long intake canal. 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.

BSEP transmission corridors are approximately 220 miles long and occupy 4,000 acres. These transmission line corridors are being evaluated as part of the SEIS process. The corridors pass through low population areas that are primarily forest, farm, and swamp lands. The lines cross numerous U.S. and State 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. The transmission line corridors traverse Brunswick, Columbus, Bladen, Robeson, New Hanover, Pender, and Onslow

1

S. Hamilton -2-

counties in North Carolina. The transmission lines and site boundary are identified in Enclosures 1 and 2. To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of BSEP and its associated transmission lines. The NRC has requested the same information and list of species from NOAA Fisheries. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

On January 25-26, 2005, the NRC staff plans to conduct a site audit at the BSEP site. In addition, NRC staff plans to hold two public NEPA scoping meetings on January 27, 2005, at the Southport City Hall, 201 E. Moore Street, Southport, North Carolina 28461. Your staff is invited to attend both the site audit and the public meetings. The NRC staff will also forward to your office a copy of the draft SEIS along with a request for comments.

If you have any questions concerning BSEP, the license renewal application, or other aspects of this project, please contact Richard L. Emch, Jr., Senior Project Manager, at 301-415-1590 or by e-mail at rle@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

Enclosures: As stated

cc w/encls.: See next page

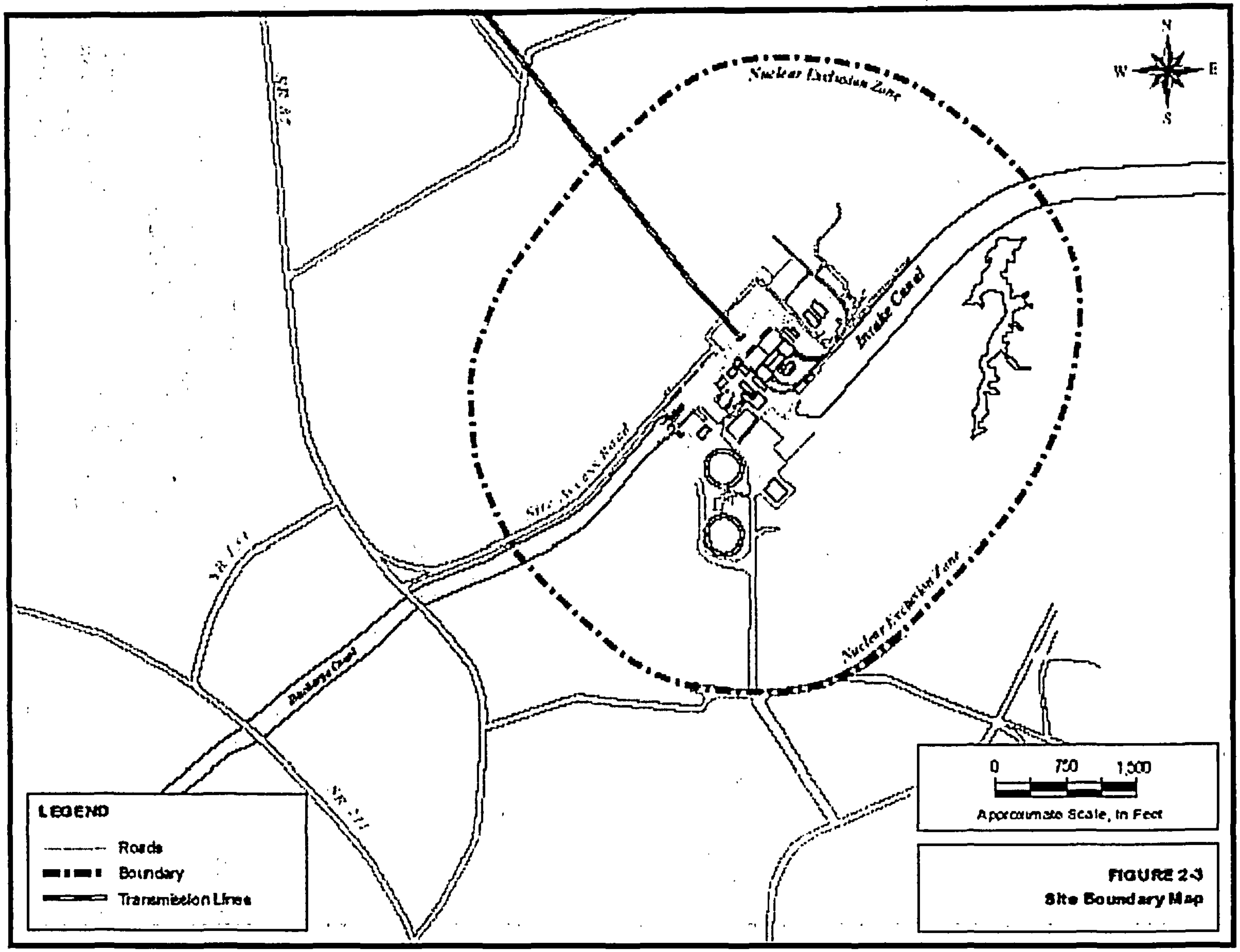
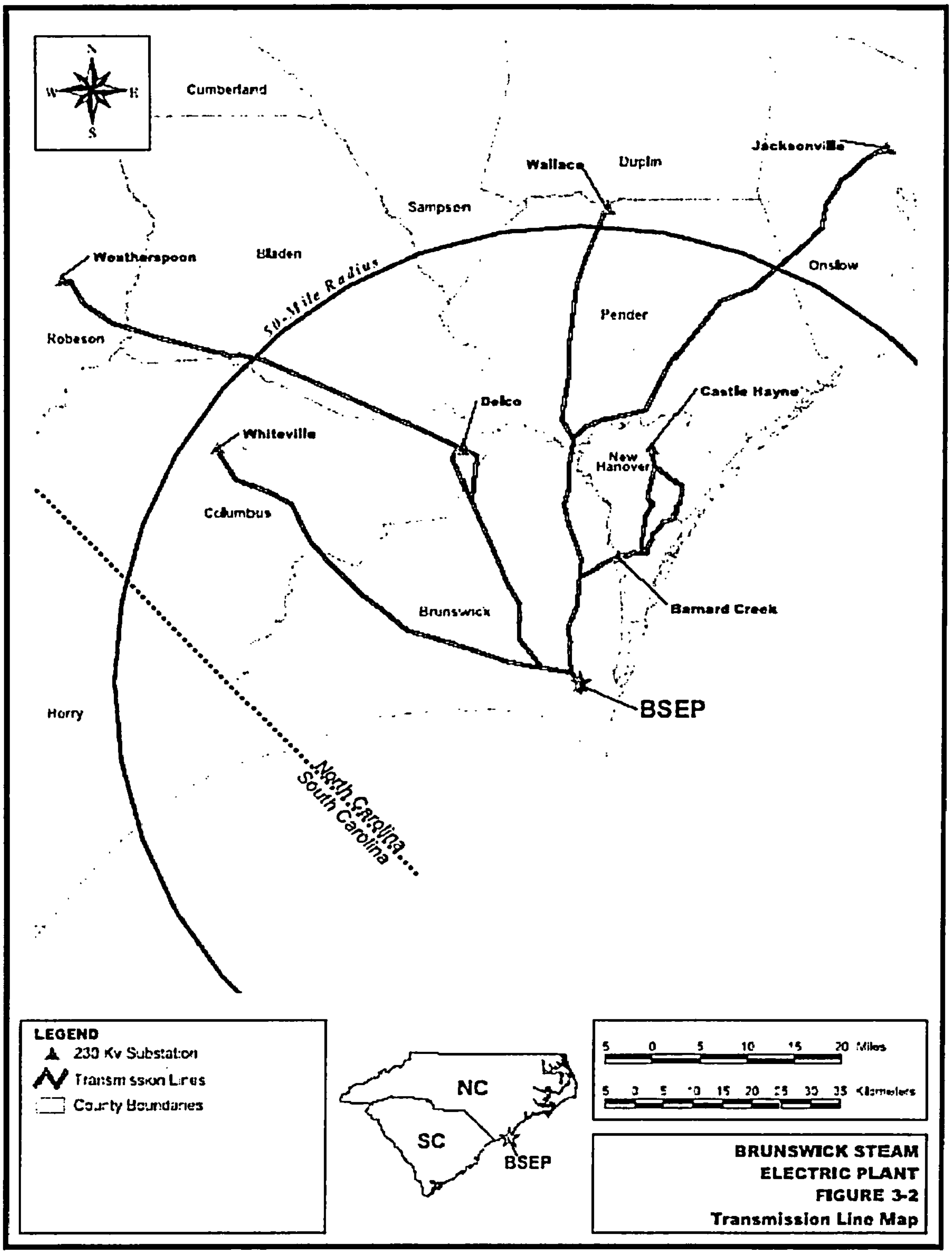


FIGURE 2-3
Site Boundary Map

1


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

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 29, 2004

Ms. Patricia A. Kurkul, Regional Administrator
NOAA Fisheries
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 09130-2298

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2, LICENSE RENEWAL

Dear Ms. Kurkul:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing applications submitted by Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., for the renewal of the operating licenses for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. As part of the review of the license renewal applications, the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended, which includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. BSEP is situated on approximately 1,200 acres of land; 130 acres are occupied by generating facilities, support facilities, warehouses, parking areas, construction laydown areas, equipment storage areas, and roads. The remaining acreage consists of woodlands, open fields, wetlands and marshlands. The area immediately surrounding the plant is a mix of agricultural lands, woodlands, swamps, and marshes.

The BSEP circulating water system is a once-through heat dissipation system. Cooling water is drawn from the Cape Fear River by way of a three-mile long intake canal. 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.

BSEP transmission corridors are approximately 220 miles long and occupy 4,000 acres. These transmission line corridors are being evaluated as part of the SEIS process. The corridors pass through low population areas that are primarily forest, farm, and swamp lands. The lines cross numerous U.S. and State 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. The transmission line corridors traverse Brunswick, Columbus, Bladen, Robeson, New Hanover, Pender, and Onslow

P. Kurkul -2-

counties in North Carolina. The transmission lines and site boundary are identified in Enclosures 1 and 2. To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of BSEP and its associated transmission lines. The NRC has requested the same information and list of species from the U.S. Fish and Wildlife Service.

On January 25-26, 2005, the NRC staff plans to conduct a site audit at the BSEP site. In addition, NRC staff plans to hold two public NEPA scoping meetings on January 27, 2005, at the Southport City Hall, 201 E. Moore Street, Southport, North Carolina 28461. Your staff is invited to attend both the site audit and the public meetings. The NRC staff will also forward to your office a copy of the draft SEIS along with a request for comments.

If you have any questions concerning BSEP, the license renewal application, or other aspects of this project, please contact Richard L. Emch, Jr., Senior Project Manager, at 301-415-1590 or by e-mail at RLE@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

Enclosures: As stated

cc w/encls.: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 30, 2004

Dr. Jeffrey Crow
Deputy Secretary of Archives and History
State Historic Preservation Officer
4610 Mail Service Center
Raleigh, NC 27699-4610

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 LICENSE RENEWAL REVIEW

Dear Mr. Crow:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing applications to renew the operating licenses for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP), which 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. BSEP is operated by Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc. The applications for renewal were submitted by CP&L on October 20, 2004, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and archaeological resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities, specifically related to license renewal, may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

While preparing its application, CP&L contacted your office by letter dated May 12, 2003. In that letter, CP&L stated there are no plans to significantly alter current operations over the license renewal period. CP&L further stated that no expansion of existing facilities is planned, and no major structural modifications have been identified for the purpose of supporting license renewal. In addition, no land-disturbing activities are anticipated beyond those required for routine maintenance and repairs.

J. Crow -2-

On January 27, 2005, the NRC will conduct two public NEPA scoping meetings at the Southport City Hall 201 E. Moore Street, Southport, North Carolina 28461. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is September 2005. If you have any questions or require additional information, please contact Mr. Richard L. Emch, Jr., Senior Project Manager at 301-415-1590 or RLE@nrc.gov.

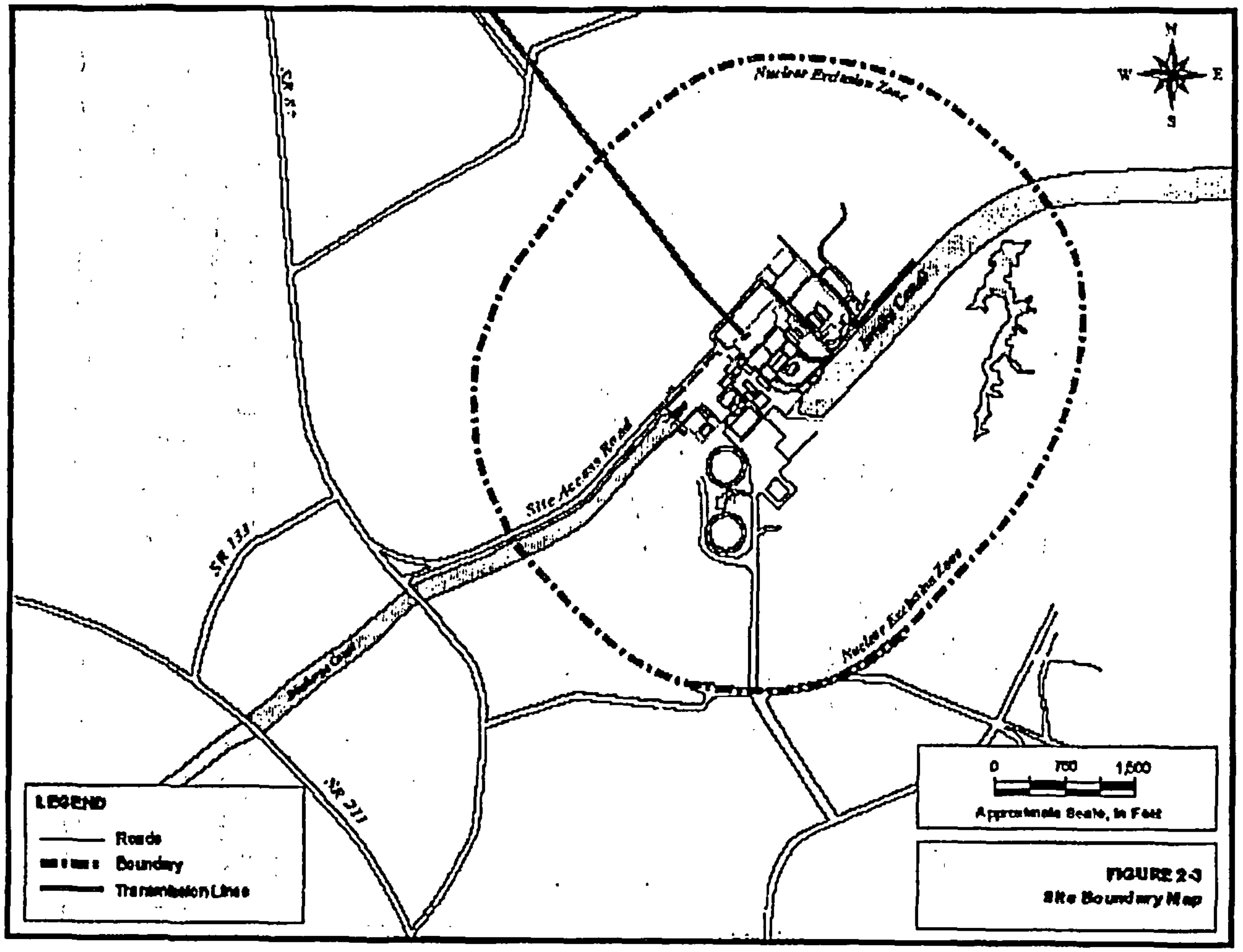
Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-325 and 50-324

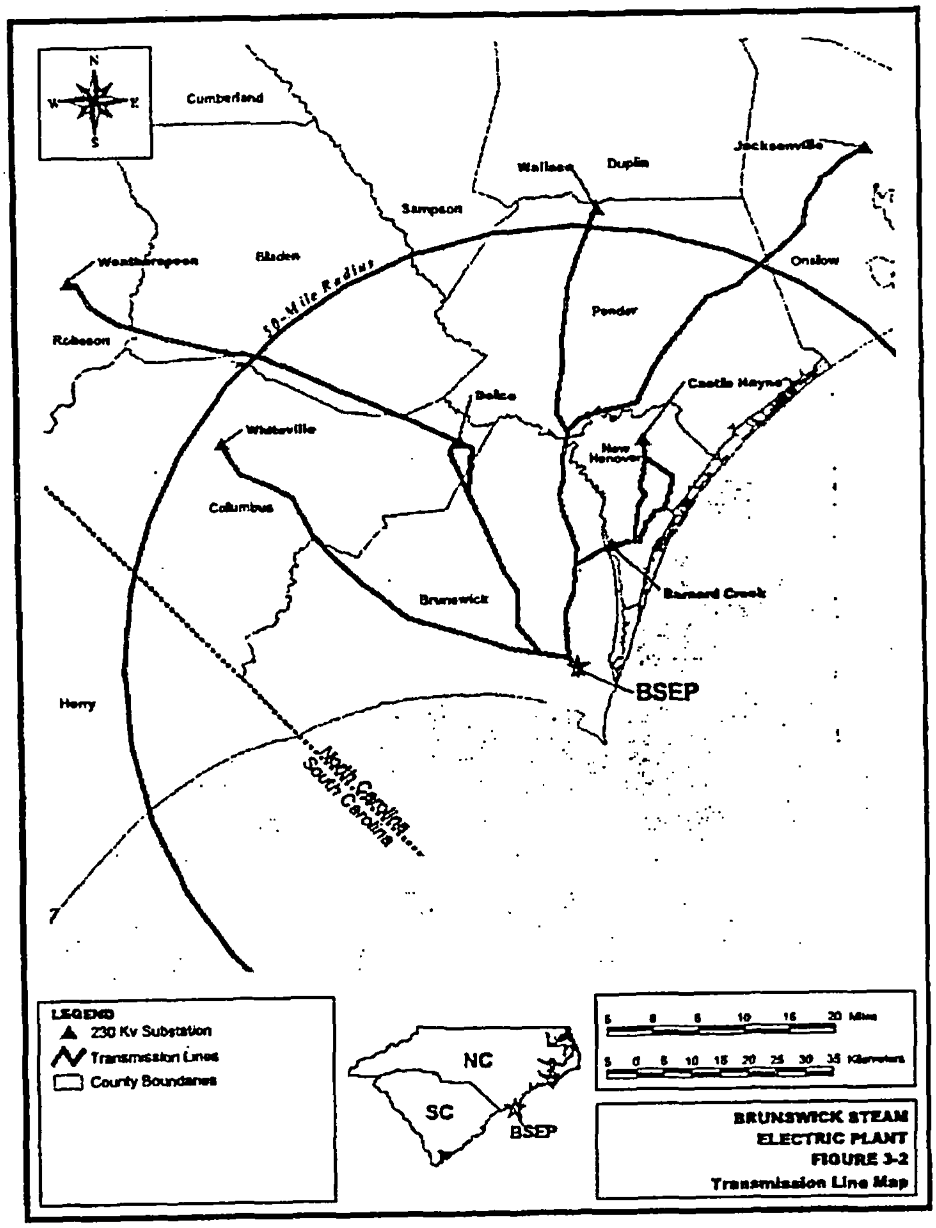
Enclosures: As stated

cc w/encl.: See next page



Nuclear Exclusion Zone
Site Access Road
SR 131
SR 211
LEGEND
Roads
Boundary
Transmission Lines
0 750 1,500
Approximate Scale, in Feet
FIGURE 2-3
Site Boundary Map

1


Cumberland
Sampson
Wallace
Duplin
Jacksonville
Onslow
Bladen
Robeson
50-Mile Radius
Pender
Castle Hayne
Delco
Whiteville
New Hanover
Columbus
Brunswick
Barnard Creek
BSEP
Horry
North Carolina
South Carolina
LEGEND
230 Kv Substation
Transmission Lines
County Boundaries
NC
SC
BSEP
BRUNSWICK STEAM
ELECTRIC PLANT
FIGURE 3-2
Transmission Line Map

1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 30, 2004

Mr. Don Klima, Director
Office of Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 809
Washington, DC 20004

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 LICENSE RENEWAL REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing applications to renew the operating licenses for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP), which 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. BSEP is operated by Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc. The applications for renewal were submitted by CP&L on October 20, 2004, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54). The NRC has established that, as part of the staff review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the SEIS will include analyses of potential impacts to historic and cultural resources. A draft SEIS is scheduled for publication in September of 2005, and will be provided to you for review and comment.

If you have any questions or require additional information, please contact Senior Project Manager, Mr. Richard L. Emch, Jr., at 301-415-1590 or RLE@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-325 and 50-324

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 30, 2004

Tribal Council of the Lumbee Tribe
The Honorable Leon Jacobs
Tribal Administrator
P.O. Box 2709
707 Union Chapel Rd
Pembroke, NC 28372

SUBJECT: U. S. NUCLEAR REGULATORY COMMISSION REVIEW OF BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 LICENSE RENEWAL APPLICATIONS

Dear Mr. Jacobs:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of applications from the Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., to renew the operating licenses for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. As described below, the NRC process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 Code of the *Federal Regulations* Part 51.28(b) (10 CFR 51.28(b)), the NRC invites the LumbeeTribal Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8, the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating licenses for BSEP Units 1 and 2 will expire in September 2016 and December 2014, respectively. CP&L submitted its application for renewal of the BSEP operating licenses on October 20, 2004.

The NRC is gathering information for a BSEP-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the BSEP site that are related to terrestrial ecology, aquatic ecology, hydrology, historic and archaeological resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action.

The NRC will hold two public scoping meetings for the BSEP license renewal supplement to the GEIS on January 27, 2005, at the Southport City Hall, 201 E. Moore Street, Southport, North Carolina 28461. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will

The Honorable Mr. Jacobs - 2 -

continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

The application is electronically available for inspection from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS) under Accession Number ML043060413. ADAMS is accessible at http://www.nrc.gov/reading-rm/adams.html which provides access through the NRC's Public Electronic Reading Room (PERR) link. *If you do not have access to ADAMS or if there are problems in accessing* the documents located in ADAMS, contact the NRC's Public Document Room (PDR) Reference staff at 1-800-397-4209, 1-301-415-4737, or by e-mail at pdr@nrc.gov. In addition, the application can be viewed on the Internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html.

A paper copy of the application can be viewed at the NRC's PDR, located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, 20852-2738 and the William Madison Randall Library, located at 601 S. College Road, Wilmington, N.C. 28403-5616. The GEIS, which assesses the scope and impact of environmental effects that would be associated with license renewal at any nuclear power plant site, can also be found on the NRC's website or at http://www.nrc.gov/reading-rm/pdr.html NRC's PDR.

Please submit any written comments that the LumbeeTribal Nation may have to offer on the scope of the environmental review by March 11, 2005. Comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington D.C. 20555-0001, or by e-mail to *BrunswickEIS@nrc.gov*. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached and will mail a copy to you.

The NRC will issue the draft supplemental environmental impact statement (SEIS) for public comment (anticipated publication date, September 2005), and will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for BSEP is planned

The Honorable Mr. Jacobs - 3 -

for April 2006. If you need additional information regarding the environmental review process, please contact Mr. Richard L. Emch, Jr., Senior Project Manager, at 301-415-1590 or by e-mail at RLE@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 30, 2004

Mr. Archie Ray Jacobs, Travel Chairman
Development Association Executive Director
Waccamaw Siouan
P.O. Box 69
Bolton, NC 28423

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION REVIEW OF BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 LICENSE RENEWAL APPLICATIONS

Dear Chairman Jacobs:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of applications from the Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., to renew the operating licenses for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. As described below, the NRC process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 Code of the *Federal Regulations* Part 51.28(b) (10 CFR 51.28(b)), the NRC invites the Waccamaw Siouan Tribal Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8, the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating licenses for BSEP Units 1 and 2 will expire in September 2016 and December 2014, respectively. CP&L submitted its application for renewal of the BSEP operating licenses on October 20, 2004.

The NRC is gathering information for a BSEP-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the BSEP site that are related to terrestrial ecology, aquatic ecology, hydrology, historic and archaeological resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action.

The NRC will hold two public scoping meetings for the BSEP license renewal supplement to the GEIS on January 27, 2005, at the Southport City Hall, 201 E. Moore Street, Southport, North Carolina 28461. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will

A. Jacobs -2-

continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

The application is electronically available for inspection from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS) under Accession Number ML043060413. ADAMS is accessible at http://www.nrc.gov/reading-rm/adams.html which provides access through the NRC's Public Electronic Reading Room (PERR) link. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's Public Document Room (PDR) Reference staff at 1-800-397-4209, 1-301-415-4737, or by e-mail at pdr@nrc.gov. In addition, the application can be viewed on the Internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html.

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Please submit any written comments that the Waccamaw Siouan Tribal Nation may have to offer on the scope of the environmental review by March 11, 2005. Comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington D.C. 20555-0001, or by e-mail to *BrunswickEIS@nrc.gov.* At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached and will mail a copy to you.

The NRC will issue the draft supplemental environmental impact statement (SEIS) for public comment (anticipated publication date, September 2005), and will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft SEIS will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for BSEP is planned

A. Jacobs -3-

for April 2006. If you need additional information regarding the environmental review process, please contact the NRC Senior Project Manager, Mr. Richard L. Emch, Jr., at 301-415-1590, or via email at rle@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

cc: See next page

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

February 3, 2005

Pao-Tsin Kuo
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Kuo:

Thank you for your December 29, 2004 letter regarding Progress Energy Carolinas, Inc. request for renewal of the operating licenses for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). The BSEP is located near Southport in Brunswick County, North Carolina. In addition to the 1,200 acre facility near Southport, the BSEP includes 220 miles of transmission corridors in Brunswick, Columbus, Bladen, Robeson, New Hanover, Pender and Onslow counties. This letter provides the U.S. Fish and Wildlife Service's (Service) response pursuant to section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531 *et seq.*) (Act).

A list of all federally-protected endangered and threatened species with known occurrences in North Carolina is available on the U.S. Fish and Wildlife Service's (Service) web page at <http://nc-es.fws.gov/es>. Our web page also contains habitat information for all of the endangered and threatened species known from North Carolina. Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. If the proposed project contains suitable habitat for any of the federally-listed species known to be present within the county where the project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If it is determined that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If it is

1 determined that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

On March 19, 1993, Carolina Power and Light Company (now Progress Energy Carolinas, Inc.) and the N.C. Department of Environment, Health and Natural Resources (now the N.C. Department of Environment and Natural Resources) entered into a Memorandum of Understanding (MOU) that is intended to "preserve and protect the special elements of natural diversity and natural areas which best exemplify the state's natural heritage which occur on ...powerline rights of way." As of January 1, 2001 the N.C. Natural Heritage Program listed 21 sites located within Carolina Power and Light rights of way that contain 22 state and federally listed rare plant species. Recent conversations with the N.C. Natural Heritage Program indicate that they are aware of additional sites on Progress Energy Carolinas, Inc. rights of way that are also in need of protection. The Service strongly recommends that Progress Energy Carolinas, Inc. discuss these sites with the N.C. Natural Heritage Program and incorporate as many of them as possible into their right of way management program. In addition, we also recommend that, as part of the license renewal process, Progress Energy Carolinas, Inc. revisit the original 21 sites listed in the January 1, 2001 memo and provide the Service and the N.C. Natural Heritage Program with updates on the size and/or number of stems and general health of those populations.

Thank you for the opportunity to review and provide comments on this project. If you have any questions or comments regarding our response, please contact Mr. Dale W. Suiter of this office at (919) 856-4520, Ext. 18 or Dale_Suiter@fws.gov.

Sincerely,

Pete Benjamin
Ecological Services Supervisor

cc: N.C. Natural Heritage Program (Linda Pearsall, Director)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, FL 33702
(727) 570-5312, FAX 570-5517
http://sero.nmfs.noaa.gov

FEB - 4 2005

Dear Colleague:

The National Marine Fisheries Service (NOAA Fisheries) Protected Resources Division has reviewed your letter pursuant to section 7(a)(2) of the Endangered Species Act (ESA) concerning Brunwick Steam Electric Plant, Units 1 and 2, License Renewal.

____ **There are no ESA-listed species or designated critical habitat** under our purview in the action area.

____ **We cannot determine** impacts to threatened or endangered species, or designated critical habitat, under NOAA Fisheries' purview because the letter lacks sufficient information to evaluate the project. **Enclosed are guidelines** to conduct a proper biological evaluation.

____ **Please provide a letter** from the lead federal action agency designating you to conduct ESA section 7 consultation with this office.

_X_ **Enclosed is a list** of federally-protected species under the jurisdiction of NOAA Fisheries for the state of **North Carolina.** Biological information on federally-protected species and candidate species can be found at the following website addresses: http://www.nmfs.noaa.gov/prot_res/prot_res.html; http://noflorida.fws.gov/SeaTurtles/seaturtle-info.htm); http://endangered.fws.gov/wildlife.html#Species: http://www.cmc-ocean.org/main.php3; http://floridaconservation.org/psm/turtles/turtle.htm; http://obis.env.duke.edu/data/sp_profiles.php; www.mote.org/~colins/Sawfish/SawfishHomePage.html; www.floridasawfish.com; www.flmnh.ufl.edu/fish/sharks/InNews/sawprop.htm; Gulf sturgeon critical habitat rule and maps (http://alabama.fws.gov/gs/); http://www.cccturtle.org;.

____ **It is NOAA Fisheries opinion that the project will have no effect** on listed species or critical habitat protected by the ESA under NOAA Fisheries' purview. No further consultation with NOAA Fisheries pursuant to section 7(a)(2) of the ESA is required unless the project description changes.

Consultation with NOAA Fisheries, Habitat Conservation Division (HCD), pursuant to the Magnuson-Stevens Fishery Conservation and Management Act's requirements for essential fish habitat consultation may be required. Please contact HCD at (727) 570-5317. If you have any ESA questions, please contact our ESA section 7 coordinator, Eric Hawk, at (727) 570-5312, or by e-mail at eric.hawk@noaa.gov.

____ **Other:** ____

Sincerely,

Teletha Griffin

Teletha Griffin
Administrative Support Assistant
Protected Resources Division

Enclosure
File: 1514-22.b

Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the National Marine Fisheries Service

North Carolina

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaeangliae*	Endangered	12/02/70
right whale	*Eubalaena glacialis*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78
Fish			
shortnose sturgeon	*Acipenser brevirostrum*	Endangered	03/11/67

Species Proposed for Listing
None

Designated Critical Habitat
None

Proposed Critical Habitat
None

Candidate Species[1]	Scientific Name
Fish	
dusky shark	*Carcharhinus obscurus*
sand tiger shark	*Odontaspis taurus*
night shark	*Carcharinus signatus*
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*

1. Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

o:\forms\nc_cand.sl (revised 10/24/02)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 17, 2005

Mr. Sam D. Hamilton, Regional Director
Southeast Regional Office
U.S. Fish and Wildlife Service
1875 Century Boulevard Northeast, Suite 400
Atlanta, Georgia 30345

SUBJECT: AMENDED REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2, LICENSE RENEWAL

Dear Mr. Hamilton:

The U.S. Nuclear Regulatory Commission (NRC) sent the U.S. Fish and Wildlife Service a letter, dated December 29, 2004, requesting a list of protected species within the area under evaluation for the Brunswick Steam Electric Plant, Units 1 and 2, license renewal. In that letter, the NRC staff requested a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of the Brunswick Steam Electric Plant (BSEP) and its associated transmission lines. This original request was based on information provided in the applicant's Environmental Report and included the transmission line corridors that transverse Brunswick, Columbus, Bladen, Robeson, New Hanover, Pender, and Onslow Counties in North Carolina. We have received a letter from your Raleigh Field Office, dated February 3, 2005, which responded to the original request.

On January 25-26, 2005, the NRC staff conducted a site audit at the BSEP site. During this audit, the NRC staff concluded that the original Fayetteville line, which now connects to the grid at the Whiteville substation, would need to be considered in this Supplemental Environmental Impact Statement (SEIS). The original Fayetteville line was built to connect BSEP to the grid and remains in existence. This change in the extent of the transmission lines adds Cumberland County in North Carolina to the list of counties that are being considered in this SEIS. The revised transmission line corridors considered in this SEIS are identified in Enclosure 1. To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a revised list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of BSEP and the associated transmission lines, including the line from the Whiteville substation to the Fayetteville substation.

S. Hamilton -2-

If you have any questions concerning BSEP, the license renewal application, or other aspects of this project, please contact Richard L. Emch, Jr., Senior Project Manager, at 301-415-1590 or by e-mail at rle@nrc.gov.

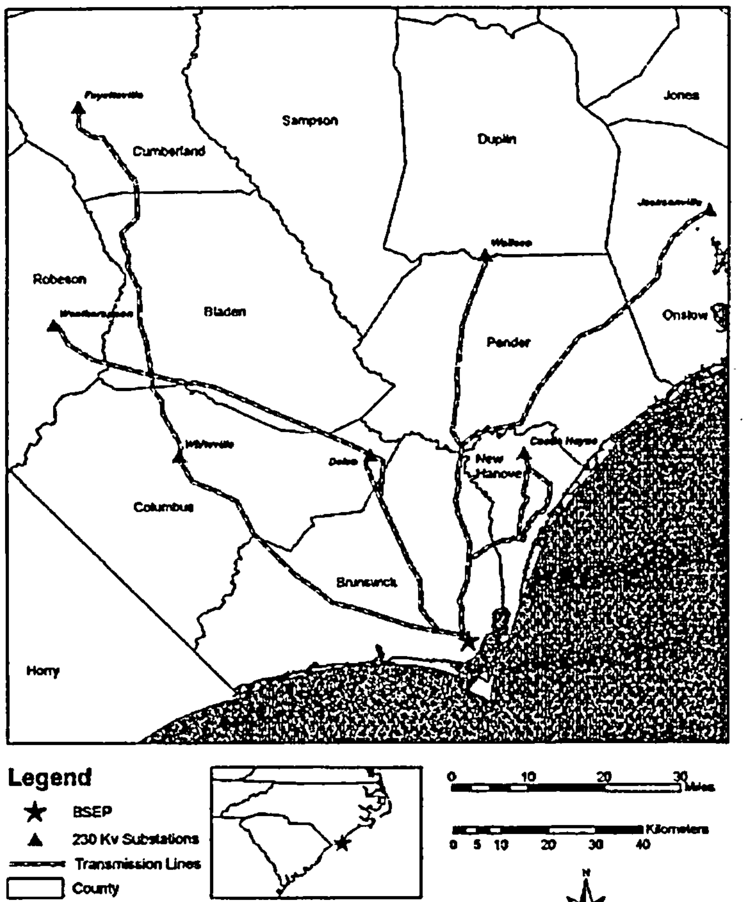
Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

Enclosure: As stated

cc w/encl.: See next page



BRUNSWICK STEAM ELECTRIC PLANT
Transmission Line Map

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 8, 2005

Mr. Sam D. Hamilton, Regional Director
Southeast Regional Office
U.S. Fish and Wildlife Service
1875 Century Boulevard Northeast, Suite 400
Atlanta, GA 30345

SUBJECT: BIOLOGICAL ASSESSMENT FOR LICENSE RENEWAL OF BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2, AND A REQUEST FOR INFORMAL CONSULTATION

Dear Mr. Hamilton:

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared the enclosed biological assessment (BA) (Enclosure 1) to evaluate whether the proposed renewal of the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) operating licenses for a period of an additional 20 years would have any adverse effect on listed species. The proposed action (license renewal) is not a major construction activity. BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River.

By letters dated December 29, 2004, and March 17, 2005, the NRC requested a list of Federally endangered or threatened species that may be in the vicinity of BSEP and its associated transmission lines. In a letter dated February 3, 2005, the U.S. Fish and Wildlife Service (FWS) directed the NRC to the following Website, http://nc.es.fws.gov/es, for a list of Federally listed endangered or threatened species to evaluate in a BA. The FWS Website listed 12 terrestrial and six aquatic Federally endangered, threatened, or candidate species as potentially occurring in counties containing the BSEP site, transmission line rights-of-way, and the Cape Fear River.

For documentation purposes, the NRC has included four terrestrial and one aquatic species that have been reported to occur in the counties containing BSEP or associated transmission line rights-of-way, but due to known habitat requirements, they are not likely to be found near BSEP or its associated transmission lines. This BA provides an evaluation of the potential impact of renewing the BSEP operating licenses for an additional 20 years of operation on the 22 endangered and threatened species and one candidate species.

In addition, the staff also contacted the National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NMFS) by letter dated December 29, 2004, requesting a list of Federally threatened or endangered aquatic species that may be in the vicinity of BSEP. In a letter dated February 4, 2005, NMFS identified 12 Federally threatened or endangered aquatic species of whales, sea turtles, and one fish species as having the potential to be present in North Carolina waters in the vicinity of BSEP and its associated transmission line rights-of-way. FWS has full jurisdiction for the terrestrial species, West Indian manatee, and Waccamaw silverside, while sharing the responsibilities for the sea turtles with NMFS.

S. Hamilton -2-

The NRC has determined that the proposed action would have no effect on the eastern cougar *(Puma concolor cougar)*, piping plover (Charadrius melodus), seabeach amaranth *(Amaranthus pumilus)* small whorled pogonia *(Isotria medeoloides)*, or the Waccamaw silverside *(Menidia extensa)*.

In addition, the NRC staff has determined the proposed action may affect, but is not likely to adversely affect, the American alligator *(Alligator mississippiensis)*, bald eagle *(Haliaeetus leucocephalus)*, wood stork *(Mycteria americana)*, red-cockaded woodpecker *(Picoides borealis)*, Saint Francis' satyr *(Neonympha mitchellii francisci)*, golden sedge *(Carex lutea)*, Hirst's panic grass *(Dichanthelium hirstii)*, Pondberry or southern spicebush *(Lindera melissifolia)*, rough-leaf loosestrife *(Lysimachia asperulifolia)*, Michaux's sumac *(Rhus michauxii)*, American chaffseed *(Schwalbea americana)*, Cooley's meadowrue *(Thalictrum cooleyi)*, West Indian manatee *(Trichechus manatus)*, loggerhead turtle *(Caretta caretta)*, green turtle *(Chelonia mydas)*, leatherback turtle *(Dermochelys coriacea)*, hawksbill turtle (*Eretmochelys imbricata*), and Kemp's ridley turtle *(Lepidochelys kempii)*.

We are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the licensee, on literature research and interviews with experts performed by NRC staff, and on information from the FWS (i.e., including current listings of species provided by FWS, Raleigh, Field Office).

If you have any questions regarding this BA or the staff's request, please contact Richard Emch, Senior Environmental Project Manager, at 301-415-1590 or by e-mail at rle@nrc.gov.

Sincerely,

/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

Enclosure: As stated

cc w/encl.: See next page

Biological Assessment
(for species under the jurisdiction of Fish and Wildlife Service)

Brunswick Steam Electric Plant, Units 1 and 2
License Renewal Review

August 2005

Docket Numbers
50-325
50-324

U.S. Nuclear Regulatory Commission
Rockville, Maryland

1

Biological Assessment of the Potential Effects on Endangered or Threatened Species from the Proposed License Renewal for the Brunswick Steam Electric Plant, Units 1 and 2 (for species under the jurisdiction of Fish and Wildlife Service)

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. The Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., operates Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) in southeastern North Carolina under Operating Licenses (OLs) DPR-62 and DPR-71, respectively. The OL for Unit 1 will expire September 8, 2016, and the Unit 2 license will expire December 27, 2014. CP&L has applied to renew the operating licenses for BSEP. If approved by the NRC, the renewed OLs would allow up to 20 additional years of plant operation beyond the current licensed operating term.

In letters dated December 29, 2004, the staff requested comments from the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on the license renewal application for BSEP (NRC 2004a, b). Specifically, the staff requested a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of BSEP and its associated transmission line rights-of-way. In a letter from the FWS dated February 3, 2005 (FWS 2005a), the staff was directed to an FWS website (http://nc-es.fws.gov/es) for a list of species to include in this biological assessment (BA). NMFS provided a list of Federally protected species under their jurisdiction in a letter dated February 4, 2005 (NMFS 2005a). A total of 16 terrestrial and 20 aquatic species, Federally listed as endangered, threatened, candidates for listing, or species of concern, occur or potentially occur in the counties within which the BSEP site and its transmission line rights-of-way are located or in the Cape Fear River. The Cape Fear River serves as the source of cooling water for BSEP. Of the 36 identified species, 23 are under full or partial FWS jurisdiction.

2.0 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for BSEP Units 1 and 2. BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. Wilmington, North Carolina is approximately 15 mi north of the BSEP site, and Myrtle Beach, South Carolina is approximately 50 mi to the southwest. By letter dated October 20, 2004, CP&L submitted an application to the NRC to renew these OLs for an additional 20 years of operation (i.e., until September 2036 for Unit 1 and December 2034 for Unit 2).

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No major refurbishment or replacement of important systems, structures, or components are expected during the 20-year BSEP license renewal term. In addition, no construction activities are expected to be associated with license renewal. If the NRC approves the license renewal application, the reactors and support facilities, including the cooling system, would be expected to continue to be operated and maintained until the renewed licenses expire in the mid-2030s. Continued maintenance activities on the transmission line rights-of-way that are used to connect BSEP to the electric power grid also would be required if the proposed action is approved. Ongoing right-of-way surveillance and maintenance activities along BSEP transmission lines include routine aerial and ground inspections as well as activities associated with vegetation management.

Pursuant to 10 CFR 54.23 and 51.53(c), CP&L submitted an Environmental Report (ER) (CP&L 2004) in which CP&L analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects. The NRC is using this ER, as well as its own analysis as the basis of a supplemental environmental impact statement, a plant-specific supplement to NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* This BA was prepared to evaluate the potential impacts to species protected under the Endangered Species Act of operating BSEP, Units 1 and 2 for an additional 20 years beyond the current license term for each unit.

3.0 The Plant and Associated Transmission Line System

3.1 Reactor Systems

BSEP uses boiling water reactors (BWRs) and steam-driven turbine generators manufactured by General Electric. As originally built and operated, each of the BSEP units had a design rating of 2436 megawatts-thermal (MW(t)). Since 1996, the NRC has approved two power uprates. Each unit is now licensed to operate at 2923 MW(t), 20 percent over the original licensed maximum power level.

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.

3.2 Cooling and Auxiliary Water Systems

Cooling water for BSEP is obtained from the lower Cape Fear River and discharged to the Atlantic Ocean. Water passes from the lower Cape Fear estuary through screens in a diversion structure used to limit the entrainment of biota into the intake canal. The 3-mi intake canal flows via gravity from the screens at the Cape Fear River to the plant. At the plant, cooling water is drawn through a combination of eight bays (four for each unit). Each bay has a trash rack, traveling screens, and an intake pump. For each unit, two bays have fine mesh (1mm)

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screens and the other two bays have half fine mesh and half coarse mesh (3/8 in.) screens. Typically, each unit operates utilizing two of the fine mesh bays and one of the half fine/half coarse bays. Organisms impinged on the traveling screens are washed into a trough that leads to a holding basin before being released to Walden Creek, which is part of the Cape Fear River watershed. The daily maximum intake by BSEP is limited to 2210 cubic feet per second (cfs) during April through November and to 1844 cfs during December through March.

Chlorine is injected into the circulating water intake system to prevent biofouling. Total residual chorine is monitored under terms of the plant's National Pollutant Discharge Elimination System (NPDES) permit before the effluent is pumped into the ocean. After passing through the plant, the discharge water is released into a 6-mi-long canal that flows by gravity out to Caswell Beach (Figure 1). At Caswell Beach the effluent is pumped 2000 ft offshore into the Atlantic Ocean.

BSEP receives potable and processed water from the Brunswick County Public Utilities. CP&L reports that from 1996 through 2001, BSEP's water imports averaged 0.23 million gallons per day (MGD). The source of the majority of water imported from Brunswick County Public Utilities is surface water from the lower Cape Fear River. BSEP operates one groundwater well onsite to supply water to the biological laboratory. The well has a rated capacity of 30 gallons per minute (gpm), but the actual use is far less than the rated capacity.

3.3 Electrical Transmission System

The eight 230-kV transmission lines constructed to connect the BSEP to the transmission system were described in the Final Environmental Statement (FES) for operation of BSEP Units 1 and 2 (AEC 1974). These lines included two lines to the Delco and Barnard Creek substations and lines to the Fayetteville, Wallace, and Jacksonville substations. In addition, 31 mi of new transmission line were constructed after initial licensing to connect BSEP to the Weatherspoon Substation.

The two lines to Barnard Creek Substation have been extended to the Castle Hayne Substation and Wilmington Corning Switching Station, located about 12 mi to the north of the Barnard Creek Substation. Both the Castle Hayne and the Wilmington Corning lines are considered in this BA in their entirety. The original Fayetteville line now connects to the grid at the Whiteville Substation. However, because the Fayetteville line, which was built to connect BSEP to the grid, remains in existence, the full extent of the original line is considered in this BA.

The transmission lines are shown in Figure 2. In total, about 390 mi of transmission lines in about 260 mi of rights-of-way are considered in this BA. The rights-of-way cover approximately 4690 ac. The length of each line and the area covered by the rights-of-way associated with the line are listed in Table 1. In estimating the rights-of-way for each line, the total area in shared rights-of-way was distributed equally among the lines within the right-of-way.

CP&L employs an integrated vegetation management approach that includes both mechanical and chemical control methods. This allows them to design the maintenance practices to fit the

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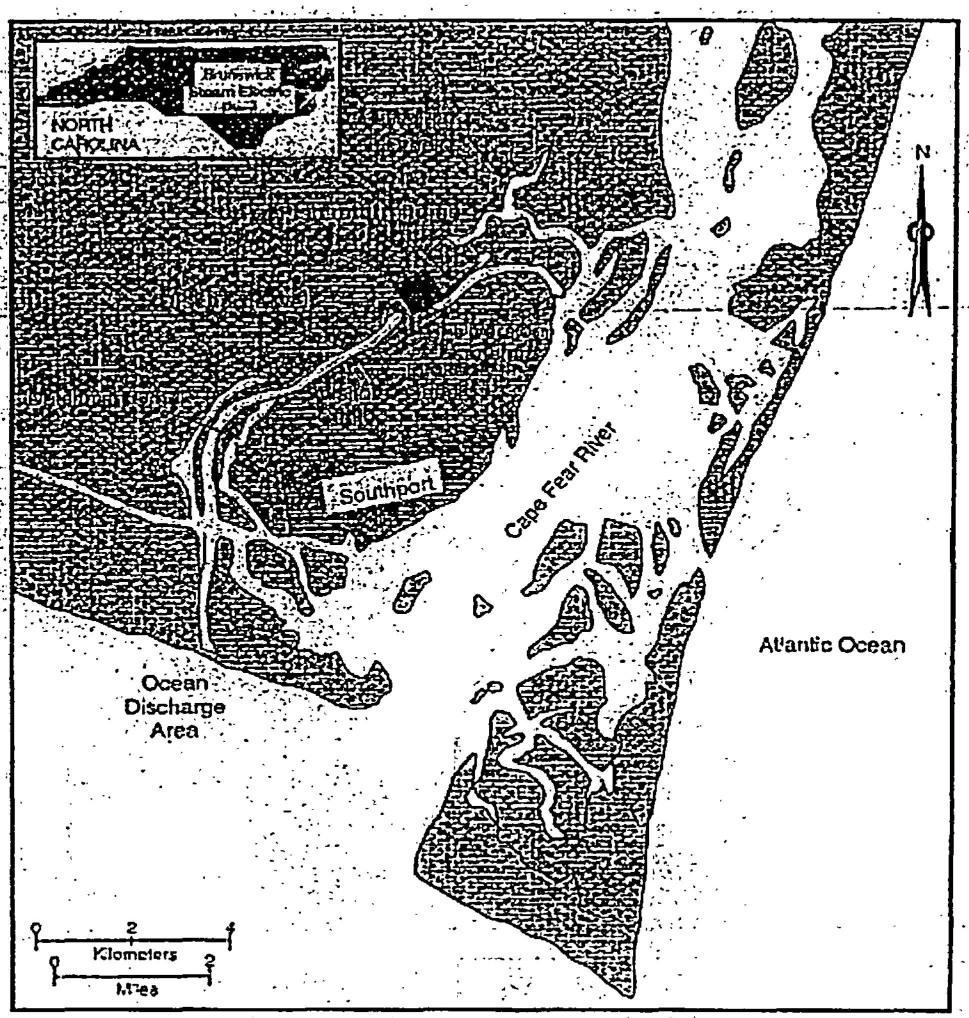

Figure 1. Location of Brunswick Steam Electric Plant, Units 1 and 2 (PEC 2003)

different kinds of terrain and soils that are crossed by the transmission lines. Mechanical methods include pruning, felling, mowing, and hand trimming. Chemical methods include the use of tree growth regulators to slow the growth of fast-growing trees, and U.S. Environmental Protection Agency (EPA)-approved herbicides to control undesirable woody vegetation that regrows after mowing. Over time, the combination of mowing and herbicides results in a

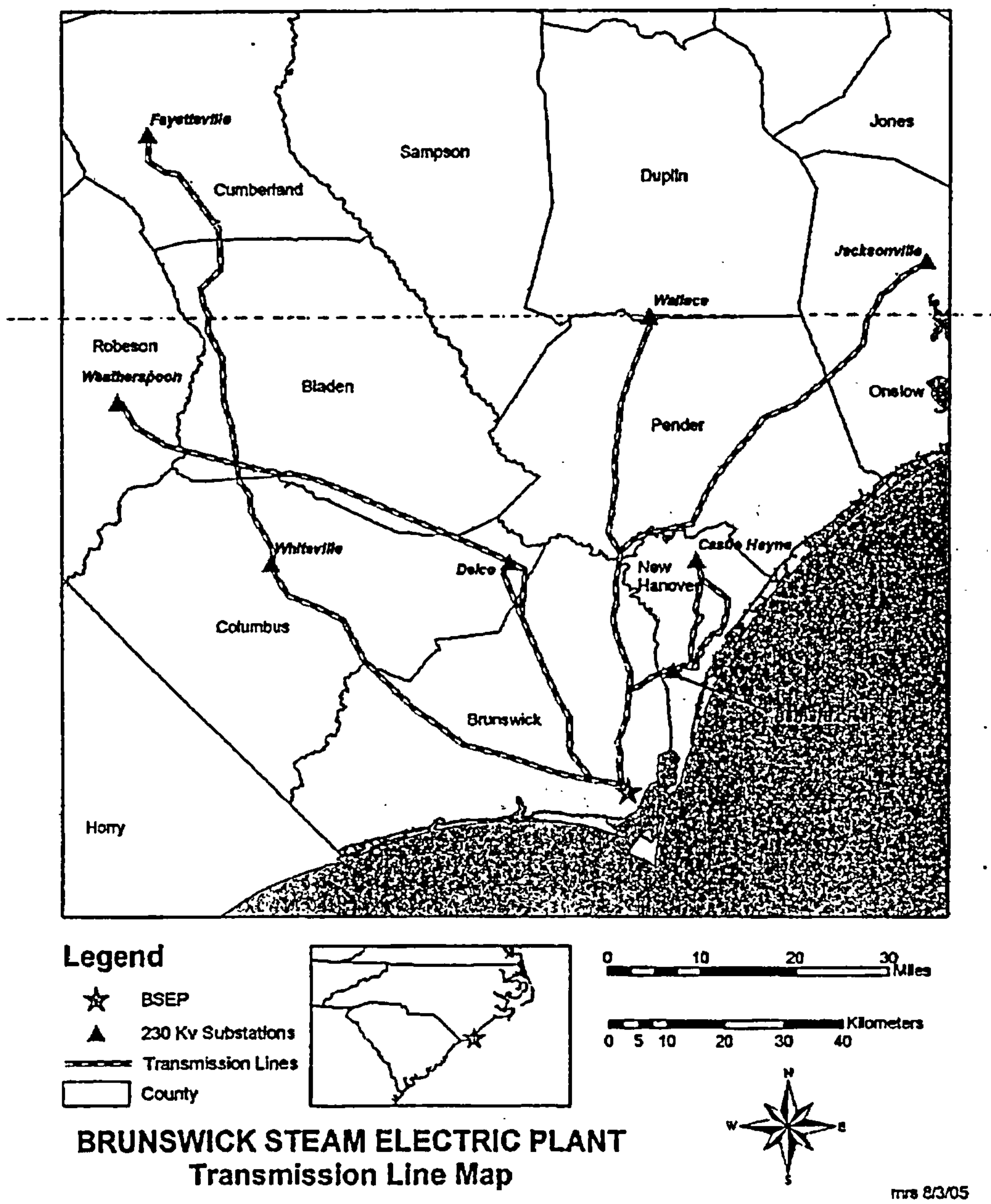

Figure 2. BSEP Transmission Line Map

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Table 1. Brunswick Nuclear Power Plant, Units 1 and 2 Transmission Lines

Substation	Approximate Line Length Miles	Estimated Right-of-Way Area Acres
Fayetteville	103	900
Weatherspoon	31	460
Delco East	31	320
Delco West	31	300
Wallace	55	720
Jacksonville	75	940
Castle Hayne East	35	650
Wilmington Corning Switching Station	27	400
Total	388	4690

community dominated by low-growing, non-woody plants, such as grasses and herbaceous plants that require less maintenance but still provide food and cover for wildlife (CP&L 2004).

4.0 Environmental Setting

BSEP is located in Brunswick County, in southeastern North Carolina, near the mouth of the Cape Fear River. The area within a 6-mi radius of the plant includes the town of Southport, the community of Boiling Spring Lakes, and the resort communities of Caswell Beach, Oak Island, and Bald Head Island. Wilmington, North Carolina, lies approximately 15 mi north of the BSEP site, and Myrtle Beach, South Carolina, lies approximately 50 mi to the southwest along the coast. The Military Ocean Terminal Sunny Point is situated immediately north of the BSEP site. Figure 3 shows the site location and features in the surrounding area.

Cooling water for BSEP is drawn from the Cape Fear River by way of a 3-mi-long intake canal that passes from the river to BSEP. After passing through the plant's condensers, the heated water travels through a 6-mi-long discharge canal to Caswell Beach where it is pumped 2000 ft offshore through large submerged pipes into the Atlantic Ocean.

4.1 Terrestrial Resources

The BSEP site is located within the mid-Atlantic coastal plain ecoregion (Griffith et al. 2002), which in pre-European settlement times was dominated by longleaf pine (*Pinus palustris*) with patches of oak (*Quercus* spp.), gum (*Nyssa* spp.), and cypress (*Taxodium* spp.) (Griffith et al. 2002). The BSEP site is within the Carolina flatwoods sub-region, which includes a wide variety of community types including pine flatwoods, pine savannas, freshwater marshes, pond pine

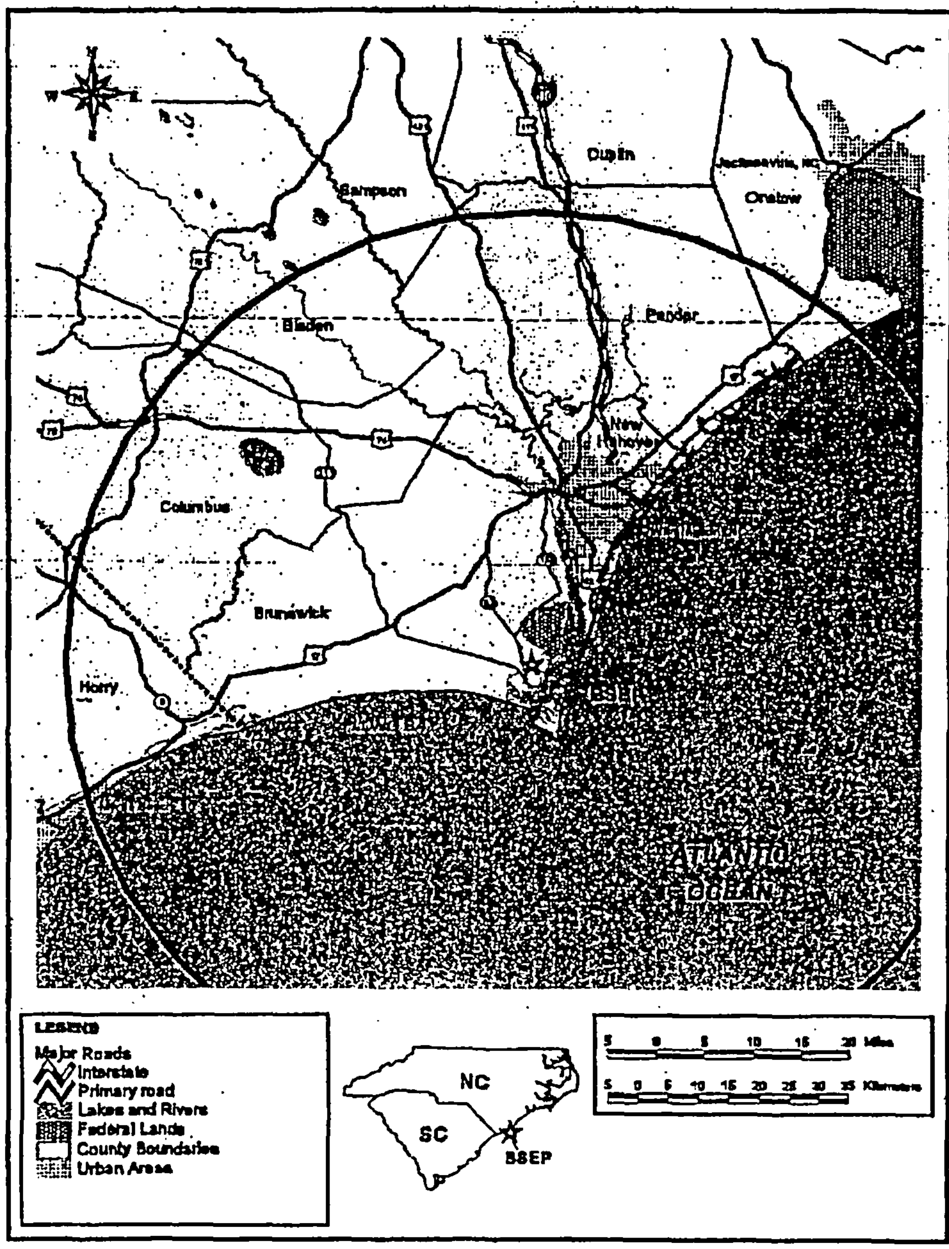

Figure 3. BSEP Location and Surrounding Area, 50-mi Radius

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woodlands, pocosins, Carolina bays, and some sandhill communities (Griffith et al. 2002). The transmission lines cross other sub-region types including mid-Atlantic floodplains and low terraces, and non-riverine swamps and peatlands. The region is a significant center of endemic biota (Hall et al. 1999). Although there is still a substantial amount of native habitat in the vicinity of the BSEP site, much of it has been converted to other uses, including loblolly pine (*Pinus taeda*) plantations and croplands of corn, soybeans, and tobacco.

The environment on the BSEP site includes waterways, such as the Cape Fear River, Dutchman Creek, and Nancy Creek; saline and brackish marshes; coastal dunes; and uplands (AEC 1974). Most upland portions of the BSEP site have been replanted with loblolly pine. Terrestrial and wetland communities in the vicinity of BSEP include pine savannas, longleaf pine/wiregrass (*Aristida stricta*) communities, pine-hardwood forests, pocosins, dune-strand communities, and salt marshes (CP&L 2004).

Loblolly pine is the principal pine species in the pine-hardwood forests in the vicinity of BSEP. Important hardwoods include sweet gum (*Liquidamba styraciflua*), blackgum (*Nyssa sylvatica*), hickory (*Carya* spp.), and oaks. Along the ancient dunes, which tend to be well drained, the forests are dominated by longleaf pine, turkey oak (*Quercus laevis*), and wiregrass. Remnant pine savannas occur in periodically flooded areas; these are characterized by an open canopy of longleaf pine or pond pine (*P. serotina*) with a dense ground cover of herbs and shrubs. A relatively unique community type in the area are pocosins. These are wetland depressions vegetated with dense stands of various evergreen shrubs and small trees such as red bay (*Persea borbonia*) and sweet bay (*Magnolia virginiana*) (CP&L 2004).

Sparse stands of grass dominated by sea oats (*Uniola paniculata*) characterize the seaward side of the dune-strand communities found at the interface between the sea and land. Because of the wind and salt spray, plants are primarily found on the landward side of the dunes. Relatively dense herbaceous shrub communities dominated by sabal palm (*Sabal palmetto*) and live oak (*Q. virginiana*) develop in these more protected areas (CP&L 2004).

Cordgrass (*Spartina alterniflora*) and needlerush (*Juncus romerianus*) are the dominant species in the salt marshes at the BSEP site. The marshes represent habitat for many important aquatic organisms that are preyed upon by a variety of terrestrial wildlife species (CP&L 2004).

Wildlife species in the vicinity of BSEP are typical of those found in the southeastern Coastal Plain. The upland communities support many species of birds, including hawks, woodpeckers, warblers, and sparrows; mammals such as white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), squirrels (*Sciurus* spp.), skunk (*Mephitis mephitis*), and bobcat (*Lynx rufus*); as well as a variety of snakes, toads, frogs and lizards. Wetlands such as the salt-marshes provide habitat for the American alligator (*Alligator mississippiensis*), raccoon (*Procyon lotor*), river otter (*Lontra canadensis*), and many species of wading birds (CP&L 2004).

There are eight transmission lines that were constructed to connect BSEP to the transmission system. The transmission line to the Barnard Creek substation crosses the Cape Fear River near the top of the estuary. The Whiteville transmission line crosses several pocosins and Green Swamp, which has been designated a National Natural Landmark (NPS 2005). The Whiteville transmission line also passes about 1 mi west of Lake Waccamaw State Park and approximately 2 mi south of Lake Waccamaw. The Holly Shelter Game Land in the Holly Shelter swamp is crossed by the Jacksonville transmission line. In northwest Pender County, the Wallace transmission line crosses the B. W. Wells Savannah, a 117-ac remnant of wetland savannah that supports 170 native plant species, some of which are considered rare (NCCLT 2001). The transmission line rights-of-ways do not cross any Federal or State parks. CP&L has partnered with the North Carolina Coastal Land Trust, the Conservation Trust for North Carolina, the Nature Conservancy, North Carolina Wild Flower Preservation Society, and the North Carolina Natural Heritage Program (NCNHP) to preserve unique and rare species within the transmission line rights-of way.

4.2 Aquatic Resources

BSEP is surrounded by a diverse and complex aquatic ecosystem. Aquatic habitat types surrounding the plant include salt marshes, the river channel/estuary, and offshore regions (CP&L 1980). The plant is situated approximately 5.7 mi upstream from the mouth of the Cape Fear River (CP&L 1985). BSEP's cooling system draws water predominantly from the surface layer of the Cape Fear River ship channel through a 3-mi-long intake channel. Water is discharged to the Atlantic Ocean after flowing through a 6-mi discharge canal. The water is pumped approximately 2000 ft offshore through submerged pipes to the point of discharge (CP&L 1979).

The Cape Fear River is estuarine at the point where water is drawn into the intake canal. Estuaries are partially enclosed coastal areas where freshwater and saltwater mix. These areas are under tidal influence, but they are protected from the full force of the ocean by barrier islands, salt marshes, or other land forms. The species found in estuaries are specially adapted for life in this transitional area. Estuaries are considered to be among the most productive areas on earth (EPA 2005).

The region surrounding the BSEP intake canal entrance, just downstream of Sunny Point, is in an area that experiences a large tidal exchange (CP&L 1985). Salinity is influenced primarily by tidal conditions and the rate of freshwater inflow. A salinity gradient exists where runoff from the Cape Fear River mixes with water from the Atlantic Ocean. From Sunny Point upstream to Wilmington, the water is often two-layered, with the less-dense freshwater moving downstream over the more-dense seawater (CP&L 1980). Downstream from Sunny Point, the water is more uniformly mixed because of complex water circulation patterns, vigorous tidal action, and high exchange rates with the ocean. This portion of the estuary is shallow and irregular in shape, with many islands and channels that enhance mixing (CP&L 1980, 1985). Because the freshwater inflow from the Cape Fear River and its tributaries is highly variable, salinities at the intake may range from nearly 0 to 32 parts per thousand (ppt) (AEC 1974). During periods of

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average freshwater inflow, salinities near Sunny Point are generally in the range of 8 to 15 ppt (CP&L 1980). Minimum salinities are generally recorded in winter, and maximum salinities are generally recorded in late summer (CP&L 1985). Water temperatures in the estuary are influenced largely by changes in season, with the warmest temperatures (as high as 103°F) observed during late summer (CP&L 1985).

The Cape Fear Estuary serves as a nursery area for fish and shellfish larvae and juveniles. Some species, such as anchovy (*Anchoa* spp.) and gobies (*Gobionellus* spp., *Gobiosoma* spp.) spawn in the estuary, while others, such as Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), croaker (*Micropogonias undulatus*), and pinfish (*Lagodon rhomboides*) spawn in the ocean (PEC 2003). Salinity and temperature influence the spatial and seasonal distribution of these estuarine species (CP&L 1985). The ebb and flow of water in the estuary also contribute to the transport and/or retention of larvae and other organisms throughout the estuary (CP&L 1980).

Many species that inhabit waters in the vicinity of the BSEP have commercial or recreational value. Brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), and white shrimp (*Litopenaeus seiferus*) inhabit salt marshes, including Snow's Marsh, which borders the intake canal (CP&L 1980). The shrimp spawn in offshore waters and the post-larvae are recruited into the estuary where they find food and protection. As the shrimp mature, they migrate to deeper waters where commercial fishermen harvest them (AEC 1974). Croaker, an important food fish and sport fish, is another inhabitant of the salt marsh, including Snow's Creek (AEC 1974). Croaker spawn in the ocean during fall and winter. The young spend their first year in the low-salinity regions of the estuary and then move to the ocean. Examples of other species found in salt marshes near BSEP include blackcheek tonguefish (*Symphurus plagiusa*), striped anchovy (*Anchoa hepsetus*), Atlantic menhaden, and pinfish (AEC 1974).

In the river channel and estuary, developing larvae of brown, pink, and white shrimp, as well as blue crab (*Callinectes* spp.) can be found (AEC 1974). This portion of the estuary also supports the larvae of anchovy, croaker, gobies, spot, blackcheek tonguefish, Atlantic menhaden, and striped mullet (*Mugil cephalus*) (AEC 1974). The estuary supports larval fish year-round, although the species composition varies by season. Important adult fish using the estuary include gray sea trout (*Cynoscion regalis*), spot, croaker, bay anchovy (*Anchoa mitchilli*), summer flounder (*Paralichthys dentatus*), windowpane (*Scophthalmus aquosus*), American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), and blue backed herring (*Alosa aestivalis*) (AEC 1974).

The heated effluent is discharged into the offshore region at Oak Island. Larvae of shrimp, anchovies, gobies, spot, croaker, gray seatrout, pinfish, and menhaden have been recorded in this region (AEC 1974). Adults with some commercial value captured in this area include brown, pink, and white shrimp, blue crab, anchovy, spot, king fish (*Mentaicirrhus americanus*), croaker, thread herring (*Opistonema oglinum*), bluefish (*Pomatomus saltatrix*), drum (*Stellifer*

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lanceolatus), and sole (*Symphurus plagiusa*). Benthic organisms found in the mud and sand of this offshore area include the snail (*Retusa canaliculata*), brittle star (*Ophiophragumus* spp.), and polychaete worms (AEC 1974).

5.0 Evaluation of Threatened and Endangered Species

5.1 Terrestrial Species

A total of 16 Federally listed terrestrial species have been identified from counties traversed by BSEP transmission line rights-of-way. Federally listed terrestrial species reported to occur from Brunswick, Bladen, Columbus, New Hanover, Onslow, Pender, Cumberland, or Robeson Counties include the bald eagle (*Haliaeetus leucocephalus*), red-cockaded woodpecker (*Picoides borealis*), piping plover (*Charadrius melodus*), wood stork (*Mycteria americana*), American chaffseed (*Schwalbea americana*), rough-leaf loosestrife (*Lysimachia asperulaefolia*), golden sedge (*Carex lutea*), pondberry (*Lindera melissifolia*), sea beach amaranth (*Amaranthus pumilus*), Hirst's panic grass (*Panicum hirstii*), Michaux's sumac (*Rhus michauxii*), Cooley's meadowrue (*Thalictrum cooleyii*), small whorled pogonia (*Isotria medeoloides*), Saint Francis' satyr (*Neonympha mitchellii francisci*), and the American alligator. Also, there have been historical records of the eastern cougar (*Puma concolor cougar*) in the vicinity of BSEP.

Habitat for some of the Federally listed species could potentially be found within or traversed by BSEP transmission line rights-of-way; however, there is no critical habitat for any of the Federally listed species on the BSEP site or on the associated transmission line rights-of-way. There are known populations of the rough-leaf loosestrife, golden sedge, and Cooley's meadowrue within the BSEP transmission line rights-of-way. These sites are managed in cooperation with the N.C. Department of Environment, Health and Natural Resources (NCDEHNR). Red-cockaded woodpeckers are known to inhabit the Military Ocean Port Sunny Point, which is adjacent to BSEP, and additional habitat is located in the vicinity of the BSEP as well as along several of the transmission line rights-of-way. Wood storks and bald eagles are occasionally seen foraging at the bypass return pond on BSEP but have not been recorded nesting in the vicinity of BSEP or its transmission line rights-of-way. The American alligator is widespread in Walden Creek and has been seen near the transmission line rights-of-way and the intake and discharge canals. This species is not biologically endangered or threatened, but is listed strictly because of similarly in appearance with other threatened crocodilian species.

CP&L monitors and records occurrences and populations of Federally listed and State-sensitive terrestrial species on the BSEP site and within transmission line rights-of-way. In addition, CP&L directs its contract personnel and consults with appropriate Federal and State agencies to develop and implement restrictions and safeguards to protect threatened and endangered species on the BSEPsite and the associated transmission line rights-of-way (BSEP 2003, 2005a).

CP&L and NCDEHNR signed a Memorandum of Understanding in 1993 to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on

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transmission line rights-of-way (CP&L and NCDEHNR 1993). The company manages rare plant species on its transmission line rights-of-way through several Best Management Practices (BSEP 2005a). CP&L and contractor personnel that are involved in transmission line maintenance activities must complete *Environmental Training: Endangered Species* (BSEP 2003). These personnel are responsible for familiarizing themselves with any identified rare plants in their work area. They must comply with rare plant signs posted within or along the right-of-way. CP&L personnel also install, maintain, and monitor stakes and signs that are posted at the known rare plant locations (BSEP 2005a). The use of herbicides, heavy equipment, and mowing is prohibited in areas with known populations of rare plants during the active, "above-ground" period of the plant's growing cycle. Therefore, maintenance activities are normally conducted in the fall and winter, after frost, in those segments of transmission lines that contain rare plants (BSEP 2003).

The NRC has reviewed life histories information for all the terrestrial threatened, endangered, and candidate species that have been identified in the vicinity of BSEP or the transmission line rights-of-way. The staff has also reviewed information provided by CP&L, FWS, and NCNHP regarding threatened and endangered species in the vicinity of the BSEP site and associated transmission line rights-of-way. The NRC has determined that the proposed action would either have *no effect* or *may affect, not likely to adversely affect* the terrestrial threatened, endangered, and candidate species. Terrestrial species that are listed as threatened or endangered by the FWS and have potential to occur in the vicinity of the BSEP site or along the transmission line rights-of-way are presented in Table 2. The basis for each determination is discussed in the following paragraphs.

Table 2 Federally Listed Terrestrial Species Reported From Counties Associated with BSEP and Its Transmission Line Rights-of Way

Species	Common Name	Federal Status[a]	Counties	Determination
REPTILES				
Alligator mississippiensis	American alligator	T(S/A)	Bladen, Brunswick, Columbus, Cumberland, New Hanover, Pender, Robeson	May affect, not likely to adversely affect
MAMMALS				
Puma concolor couguar	eastern cougar	E	Brunswick[b], Onslow[b]	No effect
BIRDS				
Charadrius melodus	piping plover	T	Brunswick, New Hanover, Onslow, Pender	No effect
Haliaeetus leucocephalus	bald eagle	T	Bladen[c] Brunswick, Columbus[c], Onslow	May affect, not likely to adversely affect

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Table 2. (contd)

Species	Common Name	Federal Status[a]	Counties	Determination
Mycteria americana	wood stork	E	Brunswick	May affect, not likely to adversely affect
Picoides borealis	red cockaded woodpecker	E	Bladen, Brunswick, Columbus, Cumberland, New Hanover, Onslow, Pender, Robeson	May affect, not likely to adversely affect
INVERTEBRATES				
Neonympha mitchellii francisci	Saint Francis' satyr	E	Cumberland	May affect, not likely to adversely affect
PLANTS				
Amaranthus pumilus	seabeach amaranth	T	Brunswick, New Hanover, Onslow, Pender	No effect
Carex lutea	golden sedge	E	Onslow, Pender	May affect, not likely to adversely affect
Dichanthelium hirstii	Hirst's panic grass	C	Onslow	May affect, not likely to adversely affect
Isotria medeoloides	small whorled pogonia	T	Cumberland[d]	No effect
Lindera melissifolia	pondberry or southern spicebush	E	Cumberland, Bladen[b]	May affect, not likely to adversely affect
Lysimachia asperulifolia	rough-leaf loosestrife	E	Bladen, Brunswick, Columbus[b], Cumberland, New Hanover, Onslow, Pender	May affect, not likely to adversely affect
Rhus michauxii	Michaux's sumac	E	Cumberland, Robeson	May affect, not likely to adversely affect
Schwalbea americana	American chaffseed	E	Bladen[b], Cumberland, Pender[b]	May affect, not likely to adversely affect
Thalictrum cooleyi	Cooley's meadowrue	E	Brunswick, Columbus, New Hanover[e], Onslow, Pender	May affect, not likely to adversely affect

(a) E - endangered, T - Threatened, T(S/A) -threatened due to similarity of appearance, C - candidate.
(b) Historic record at least 20, maybe >50, years old.
(c) Recorded in state database but not FWS listing.
(d) Obscure record in State database - not in FWS listing.
(e) Obscure record.
Based on: FWS 2005b; NCNHP 2004a

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American Alligator

The American alligator is listed by FWS as threatened because of its similarity of appearance with other threatened crocodilian species. This species is not biologically endangered or threatened and is not subject to Section 7 consultation. They are found in freshwater wetland areas throughout southeastern North Carolina (NCNHP 2005a). In the vicinity of BSEP, the American alligator is widespread in Walden Creek and the intake and discharge canals, and it has also been seen along the Fayetteville and Wallace transmission line rights-of-way. The proposed activities (continued maintenance of the transmission line right-of-way and the intake and discharge canals) would not result in detectable modifications of the freshwater systems and would not alter habitat quality in the surrounding areas. Therefore, the NRC concludes that the proposed license renewal of BSEP may affect, but is not likely to adversely affect the American alligator.

Eastern Cougar

The eastern cougar is listed by FWS as endangered. This large cat formerly ranged throughout the eastern United States and Canada but was driven to near extinction during the 1800s. It may be extirpated from North Carolina (FWS 2005c) and may be extinct throughout its former range (NatureServe 2005). It has not been reported from Brunswick or any of the surrounding counties for over 20 years, and is not likely to occur near BSEP or within its transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the eastern cougar.

Piping Plover

The piping plover is listed by FWS as threatened. This small shorebird breeds along the Atlantic coast from Newfoundland to North Carolina, as well as along the great lakes and on river sandbars in the upper great plains (FWS 2005d). It winters along the Atlantic and Gulf coasts from North Carolina to Mexico. FWS has designated portions of the Atlantic coastal beaches in Brunswick, Hanover, Pender, and Onslow counties as critical habitat for the piping plover (66 FR 36038). Critical habitat does not occur at BSEP or adjacent to associated transmission line rights-of-way (CP&L 2004). Suitable nesting or foraging habitat is not known to occur at the BSEP site or along the transmission line rights-of-way.

The staff visited the site and reviewed the life history and critical habitat information of the piping plover. Based on this information, along with information obtained from NCNHP on the known occurrences of piping plovers, the staff determined that suitable nesting and foraging habitat is not present at the BSEP site or along the transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the piping plover.

Bald Eagle

The bald eagle, found throughout the United States, is listed by FWS as threatened. It was proposed for delisting on July 6, 1999 (64 FR 36453), but a decision on whether to delist the bald eagle is still pending. Bald eagle nests are large often measuring 6 ft across (FWS 2005e). Nest trees are usually large diameter trees characterized by open branching and stout limbs. Because fish is the primary food source, the majority of nest sites are within 0.5 mi of a body of water, such as coastal shorelines, bays, rivers, lakes, farm ponds, or dammed rivers (i.e., beaver dams, log jams, etc.), and have an unobstructed view of the water. Winter foraging areas are usually located near open water on rivers, lakes, reservoirs, and bays where fish and waterfowl are abundant, or in areas with little or no water (i.e., rangelands, barren land, tundra, suburban areas, etc.) where other prey species (e.g., rabbit, rodents, deer, carrion) are abundant.

Bald eagles have been periodically observed near BSEP and along the transmission line rights-of-way, but there are no known nesting locations near BSEP. In the last fifteen years, there have only been two confirmed nest sites within 20 mi of BSEP in Brunswick County.

Field personnel are required to take training to become familiar with threatened and endangered species that are in the vicinity of BSEP and the transmission line rights-of-way. This training includes familiarizing personnel with the characteristics of the bald eagle and how to identify potential bald eagle nests (BSEP 2003). CP&L field personnel are required to report any potential nests and CP&L maintains a policy of "do not disturb nests, whether active or inactive" (BSEP 2003).

The staff visited the site and reviewed the life history information on the bald eagle. Based on this information, information obtained from NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, bald eagles.

Wood Stork

The wood stork is listed by FWS as endangered. It inhabits freshwater and brackish wetlands, and normally nests in cypress or mangrove swamps. Because of its unique feeding technique (tacto-location), it typically requires higher prey concentrations than other wading birds and tends to rely on depressions in marshes or swamps where prey can become concentrated during periods of falling water levels. Breeding colonies are located in Florida, Georgia, and South Carolina (FWS 1997). Every summer since the 1980s, between 15 and 100 individuals have frequented the area around Sunset Beach, North Carolina, which is approximately 30 mi southwest of BSEP. This non-breeding colony represents the northernmost extent of this species range and is the only known colony of wood storks in North Carolina (FWS 2005f).

This species has been periodically observed foraging in the bypass return pond on the BSEP site. It has not been observed along the transmission line rights-of-way which are at least 15 mi from the Sunset Beach colony.

The staff visited the site and reviewed the life history of the wood stork. Based on this information, information obtained from NCNHP, and the fact that the wood stork is known to occasionally forage near the BSEP site, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the wood stork.

Red-Cockaded Woodpecker

The red-cockaded woodpecker is listed by FWS as endangered. It occurs throughout the southeastern United States, and has been observed near the BSEP site and in all of the counties crossed by the BSEP transmission line rights-of-way. In eastern North Carolina, it is found in mature pine forests (generally longleaf pine) with sparse understory vegetation. It requires open stands of pines, with trees over 80 years old for nesting (FWS 1993a). As of 2003, there were nine active red-cockaded woodpecker nesting groups on the Military Ocean Terminal Sunny Point, and it is thought that the facility could support as many as 17 nesting groups (FWS 2003). Suitable nesting habitat for this species is not found at BSEP (CP&L 2004), but birds may forage in the vicinity of the plant and could nest or forage near many of the transmission line rights-of-way. 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 would be harmed (CP&L 2004).

Field personnel are required to take training to become familiar with threatened and endangered species that are in the vicinity of BSEP and the transmission line rights-of-way. This training includes familiarizing personnel with the characteristics of the red-cockaded woodpecker and how to identify potential red-cockaded woodpecker nests (BSEP 2003). CP&L field personnel are required to report any potential nests and CP&L maintains a policy of "do not disturb nests, whether active or inactive" (BSEP 2003).

The staff visited the site and reviewed the life history information about the red-cockaded woodpecker. Based on this information, information obtained from NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, red-cockaded woodpeckers.

Saint Francis' Satyr Butterfly

The Saint Francis' satyr butterfly is listed by FWS as endangered. It occurs in a single meta-population in the sandhills of Cumberland and Hoke Counties, North Carolina (FWS 2005g). Habitat consists primarily of wet meadows dominated by sedges (*Carex* spp.) and other wetland graminoids (FWS 1996a). The species has been observed in a variety of other wetland areas, including areas with pitcher plants and the endangered rough-leaf loosestrife, but it is not known if the Saint Francis' satyr uses these habitats for any part of its life cycle other than a travel corridor. Although suitable habitat for the Saint Francis' satyr potentially could occur within or near the Brunswick-to-Fayetteville transmission line right-of-way, the NCNHP does not have record of this species within at least 8 mi of the right-of-way.

The staff visited the site and reviewed the life history of the Saint Francis' satyr butterfly. Based on this information, information obtained from NCNHP, and the fact that wetland areas with pitcher plants and rough-leaf loosestrife are known to occur in the BSEP transmission line rights-of-way, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, Saint Francis' satyr butterfly.

Seabeach Amaranth

The seabeach amaranth is listed by FWS as threatened. It is an annual plant that inhabits open sand areas on Atlantic ocean beaches, originally from Massachusetts to South Carolina, but is now restricted to approximately 55 populations in South Carolina, North Carolina, and New York state (FWS 1996b). Between 60 and 70 percent of the surviving populations are in North Carolina, including some in Brunswick, New Hanover, Onslow, and Pender Counties (FWS 2005h; NCNHP 2005a). All populations are strictly coastal, and seabeach amaranth often co-occurs in the same areas as the piping plover (FWS 1996b). There are no known populations near the BSEP site, and it is unlikely that there is any suitable habitat at the BSEP site or near any of the transmission rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the seabeach amaranth.

Golden Sedge

The golden sedge is listed by FWS as endangered and is only found in Pender and Onslow Counties, North Carolina. This species was first discovered in 1991, but was not formally described until 1994 (67 FR 3120); therefore, relatively little is known about its ecology. Golden sedge is a perennial found in a rare habitat type of coastal savanna underlain by calcareous (limestone) deposits (FWS 2002a). At the time it was listed as endangered, there were only eight known populations of golden sedge, all within a 2-mi radius of each other. Several additional populations have been found since the publication of the final listing determination (NCNHP 2005b). In 1996, a single population of golden sedge was recorded along the Jacksonville transmission line right-of-way in Onslow County. Since that time, additional populations have been noted, and data provided by the NCNHP indicates the presence of three populations within the Jacksonville transmission line right-of-way and three others within 0.5 mi of that right-of-way in Onslow and Pender Counties. The populations in the Jacksonville right-of-way are protected by CP&L under an agreement with the NCNHP. In addition, field personnel are required to take *Environmental Training: Endangered Species* to become familiar with threatened and endangered species that are in the vicinity of BSEP and the transmission line rights-of-way and to become familiar with CP&Ls Best Management Practices

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related to protecting rare plants in CP&L rights-of-way. These Best Management Practices include scheduling activities outside the growing season for rare plants, avoiding the use of heavy equipment in areas with rare plants at all times, and not using herbicides in areas where rare plants have been identified (BSEP 2005a).

The staff visited the site and reviewed the life history information about the golden sedge. Based on this information, information obtained from NCNHP, and information obtained from BSEP on transmission line rights-of-way maintenance procedures and Best Management Practices, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, golden sedge.

Hirst's Panic Grass

The Hirst's panic grass is currently a candidate for protection . It is currently known from only three sites, one in Delaware and two in North Carolina; there are two sites in New Jersey where it has not been seen in 10 to 20 years (FWS 2002b). Hirst's panic grass inhabits coastal plain intermittent ponds in wet savanna or pine barren habitats. The species relies on periods of standing water to help minimize competition form other species. The two known populations in North Carolina are both located on Camp LeJeune Marine Corps Base in Onslow County. The known populations of Hirst's panic grass are at least 7 mi from the nearest BSEP transmission line rights-of-way, but suitable habitat may be found within or near the rights-of-way.

The staff visited the site and reviewed the life history of Hirst's panic grass. Based on this information, along with information obtained from NCNHP on the species distribution, the staff determined that suitable habitat could be found within the transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, Hirst's panic grass.

Small Whorled Pogonia

The small whorled pogonia is listed by FWS as threatened and by the NCNHP (NCNHP 2005a) as occurring in Cumberland County based on an obscure record. The FWS does not include this species in its county listings (FWS 2005l). This species occurs in very small populations that are widely distributed from southern Maine and New Hampshire south through Virginia, to northern Georgia and Eastern Tennessee, with outlying populations occurring in a number of states west to Michigan and Illinois (FWS 1992). In the southern portion of its range, the small whorled pogonia is normally found in white pine (*P. strobus*)/mixed deciduous forests, and it appears to be somewhat shade intolerant (FWS 1992). All of the known populations of the small whorled pogonia in North Carolina or South Carolina are located on the far western end of each state, and no known populations are located within 150 mi of BSEP or associated transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the small whorled pogonia.

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Pondberry (southern spicebush)

The pondberry or southern spicebush is listed by FWS as endangered. It is a shrub that occurs in wetland habitats such as bottomland, and the margins of sinks, ponds, and other depressions. It normally grows in shaded areas but may also be found in full sun (FWS 2005j). It occurs in widely scattered sites along an arc from southeastern North Carolina through Georgia and Mississippi to Arkansas and southern Missouri (FWS 1993b). It is known from three sites in North Carolina, including one population in Bladen County. Suitable habitat could be found within several of the rights-of-way, but the NCNHP data do not include records of it occurring within at least 1 mi of the nearest BSEP transmission line right-of-way.

The staff visited the site and reviewed the life history of the pondberry. Based on this information, along with information obtained from NCNHP on the species distribution, the staff determined that suitable habitat could be found within the transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, pondberry.

Rough-Leaf Loosestrife

The rough-leaf loosestrife is listed by FWS as endangered. It is a perennial herb that occurs in pocosins in the coastal plain and sandhills of North Carolina (FWS 2005k). Habitat is generally in the ecotone between longleaf pine or oak savannas and wetter, shrubby areas where moist sandy or peaty soils occur, and where low vegetation allows abundant sunlight to penetrate to the soil surface (FWS 1995a). This grass-shrub ecotone naturally would be fire maintained; therefore, the species appears to benefit from some periodic disturbance. Eight populations of rough-leaf loosestrife are known from Brunswick County; one occurs in a BSEP transmission line right-of-way north of BSEP in the Boiling Spring Lakes area (i.e., the right-of-way that contains the Castle Hayne East, Wilmington Corning, Wallace, and Jacksonville transmission lines). Several populations are associated with the Wallace and Jacksonville transmission line rights-of-way in Pender County (CP&L 2004) and one population is known near the end of the Fayetteville transmission line. These populations are protected and managed by CP&L under an agreement with the NCNHP. It is likely that there are additional areas with suitable habitat for this species near the BSEP site and several of the transmission line rights-of-way.

Field personnel are required to take training to become familiar with threatened and endangered species that are in the vicinity of BSEP and the transmission line rights-of-way and to become familar with CP&Ls Best Management Practices related to protecting rare plants in CP&L power line rights-of-way. These Best Management Practices include scheduling activities outside the growing season for rare plants, avoiding the use of heavy equipment in areas with rare plants at all times, and not using herbicides in areas with rare plants (BSEP 2003a, 2005a).

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The staff visited the site and reviewed the life history information about the rough-leaf loosestrife. Based on this information, information obtained from NCNHP, and information obtained from BSEP on transmission line rights-of-way maintenance procedures and Best Management Practices, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the rough-leaf loosestrife.

Michaux's Sumac

The Michaux's sumac is listed by FWS as endangered. It is a shrub that inhabits a variety of soil types that may range from sandy, acidic soils to clayey, circumneutral soils (NatureServe 2005). It survives best in areas that are subjected to some form of disturbance that provides open space. At least 12 populations in North Carolina are on highway rights-of-way, road clearings, or on the edges of artificial clearings (FWS 2005l). There are an estimated 31 populations remaining in North Carolina, spread over eight counties, including one population in Robeson County, which contains the terminus of the Weatherspoon transmission line. The known population in Robeson County is not within 2 mi of the Witherspoon transmission line right of way. However, there is a potential for suitable habitat to occur within or near the Weatherspoon transmission line right-of-way.

The staff visited the site and reviewed the life history of Michaux's sumac. Based on this information, along with information obtained from NCNHP on the species distribution, the staff determined that suitable habitat could be found within the transmission line rights-of-way. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the Michaux's sumac.

American Chaffseed

The American chaffseed is listed by FWS as endangered. Of the 72 known extant populations, 18 are located in North Carolina. However, 17 of those populations are on Fort Bragg in Cumberland and Hoke Counties. The other extant population in North Carolina is along a roadside in Moore County (FWS 1995b). Historically, the species has been reported in Bladen and Pender Counties, but has not been observed in these counties for at least 20 years (NCNHP 2005a). The American chaffseed is a hemiparasitic plant that occurs in sandy, acidic, seasonally moist, to dry soils. It is generally found in habitats described as open, moist, pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems. It is dependent on factors such as fire, mowing, or fluctuating water tables to maintain the open to partly-open conditions that it requires (FWS 1995b). No populations have been recorded near the BSEP site or along the transmission line rights-of-way, or anywhere in the counties containing these rights-of-way for at least 20 years. However, suitable habitat potentially exists in these areas.

The staff visited the site and reviewed the life history of American chaffseed. Based on this information, along with information obtained from NCNHP on the species distribution, the staff determined that suitable habitat could be found within the transmission line rights-of-way.

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Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the American chaffseed.

Cooley's Meadowrue

The Cooley's meadowrue is listed by FWS as endangered; there are approximately 11 known populations in North Carolina, all in Brunswick, Columbus, Onslow, and Pender Counties, and one very small population in northern Florida (FWS 1994, 2005m). The populations in North Carolina are in two clusters; there are six sites within 4 mi of each other in Pender and Onslow Counties, and five sites within 8 mi of each other in Brunswick and Columbus Counties. Cooley's meadowrue is a perennial herb that grows in circumneutral soils in wet pine savannas or grass-sedge bogs, often at the border of intermittent drainages or swamp forests. It is often associated with some type of disturbance such as clearings, edges of frequently burned savannas, and powerline or highway rights-of-way that are maintained by fire or mowing (NatureServe 2005). The species typically occupies a narrow hydrological niche, where soil is moist to saturated, but water does not stand above the soil surface (NatureServe 2005). Cooley's meadowrue is potentially affected by transmission line rights-of-way maintenance. Several populations have been found in or near the Jacksonville right-of-way in Onslow County. The populations within the right-of-way are protected by CP&L under an agreement with the NCNHP. Several other populations have been observed near, but not within the Fayetteville transmission right-of-way in western Brunswick County. It is likely that there are additional areas of suitable habitat along several of the transmission line rights-of-way.

Field personnel are required to take training to become familiar with threatened and endangered species that are in the vicinity of BSEP and the transmission line rights-of-way and to become familiar with CP&L's Best Management Practices related to protecting rare plants in CP&L transmission line rights-of-way. These Best Management Practices include scheduling activities outside the growing season for rare plants, avoiding the use of heavy equipment in areas with rare plants at all times, and not using herbicides in areas with rare plants (BSEP 2003a, 2005a).

The staff visited the site and reviewed the life history information about the Cooley's meadowrue. Based on this information, information obtained from NCNHP, and information obtained from BSEP on transmission line rights-of-way maintenance procedures and Best Management Practices, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the Cooley's meadowrue.

5.2 Aquatic Species

A total of seven Federally listed threatened or endangered aquatic species under either full or partial FWS jurisdiction were identified as having the potential to be present in North Carolina waters in the vicinity of BSEP and its associated transmission line rights-of-way (NMFS 2005a; FWS 2005a). There is no critical habitat for any of the Federally listed species at the BSEP site or near the associated transmission line rights-of-way. These include the West Indian manatee

(*Trichechus manatus*), five sea turtles (loggerhead turtle [*Caretta caretta*], green turtle [*Chelonia mydas*], leatherback turtle [*Dermochelys coriacea*], hawksbill turtle [*Eretmochelys imbricata*], and Kemp's ridley turtle [*Lepidochelys kempii*]), and a fish, the Waccamaw silverside (*Menidia extensa)* (Table 3). NMFS and the FWS share jurisdiction for the sea turtles, with NMFS having responsibility in the marine environment and FWS on nesting beaches.

The NRC has reviewed life histories information for all the aquatic threatened or endangered species that have been identified in the vicinity of BSEP or the transmission line rights-of-way. The staff has also reviewed information provided by CP&L, FWS, NMFS, and the NCNHP regarding threatened and endangered species in the vicinity of BSEP(CP&L 2004; NCNHP 2004b; NMFS 2005a, b, and c; FWS 2005b). The NRC has determined that the proposed action would either have *no effect* or *may affect, not likely to adversely affect* the endangered or threatened species. The basis for each determination is discussed in the following paragraphs.

Table 3 Federally Listed Aquatic Species Reported from Counties Associated with BSEP and Its Transmission Line Rights-of Way

Species	Common Name	Federal Status[(a)]	Counties	Determination
MAMMALS				
Trichechus manatus	West Indian manatee	E	Brunswick, New Hanover, Onslow, Pender	May affect, not likely to adversely affect
REPTILES				
Caretta caretta	loggerhead turtle	T[(b)]	Brunswick, New Hanover, Onslow, Pender	May affect, not likely to adversely affect
Chelonia mydas	green turtle	T[(b,c)]	Brunswick, New Hanover, Onslow	May affect, not likely to adversely affect
Dermochelys coriacea	leatherback turtle	E[2(b)]	Brunswick, Onslow	May affect, not likely to adversely affect
Eretmochelys imbricata	hawksbill turtle	E[(b)]	(NC)[(d)]	May affect, not likely to adversely affect
Lepidochelys kempii	Kemp's ridley turtle	E[(b)]	Brunswick	May affect, not likely to adversely affect
FISH				
Menidia extensa	Waccamaw silverside	T	Columbus	No effect

(a) E - endangered, T- threatened.
(b) Nesting areas are under FWS jurisdiction, otherwise the species is under NMFS jurisdiction.
(c) Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.
(d) (NC) - County-level listings are not available; the species has Federal listing status in North Carolina

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West Indian Manatee

The West Indian manatee is a Federally listed endangered species. These large mammals may be found as far north as Virginia along the Atlantic coast. At least two manatees have been observed in the Cape Fear Estuary, but none have been documented at the BSEP site (CP&L 1998; PEC 2005). They may inhabit both salt and fresh water, generally between 5 and 20 ft deep (FWS 2005n). The diversion structure with turtle-blocker panels installed at the entrance to the intake canal should minimize the potential for manatee entry into the canal.

The staff visited the site and reviewed the life history information on the West Indian manatee. Based on this information, information obtained from NCNHP and FWS, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the West Indian manatee.

Waccamaw Silverside

The Waccamaw silverside, which is Federally listed as a threatened species, is known only from Lake Waccamaw in Columbus County. Therefore, it is not expected to occur at the BSEP site (FWS 2005o). The Fayetteville transmission line passes approximately 2 mi south of Lake Waccamaw, but maintenance and operation of that transmission right-of-way has no impact on the lake.

The staff visited the site and reviewed the life history information on the Waccamaw silverside. Based on this information, information obtained from NCWRC, FWS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the Waccamaw silverside.

Sea Turtles

NMFS and the FWS share jurisdiction for the sea turtles, with NMFS having responsibility in the marine environment and FWS on nesting beaches. A Biological Opinion issued by the NMFS in 2000 addressed impacts to sea turtles specifically resulting from BSEP operation (NMFS 2002). There are no known suitable nesting beaches on the BSEP site or associated transmission line rights-of-way; therefore, Section 7 consultation with FWS has not been required.

Loggerhead Turtle

The loggerhead turtle is listed by the FWS as threatened. The loggerhead may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship canals, and the mouths of large rivers. Loggerhead turtles were the most common species observed at the BSEP in 2004; 69 percent of the sea turtles handled were loggerheads The species also nests on suitable beaches suitable for nesting from North Carolina to Florida, with primary nesting beaches found in Florida (FWS 2005p). Nesting season is generally between May and November.. Loggerhead turtle nesting in North Carolina occurs only on the Atlantic Coast beaches, and does not occur in the Cape Fear River estuary or anywhere near the BSEP site or associated transmission line rights-of-way.

The staff visited the site and reviewed the life history information on the loggerhead turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the loggerhead turtle.

Green Turtle

The green turtle is listed by the FWS as threatened. In eastern North America, this species is found from Massachusetts to Mexico. Green turtles are generally found in shallow waters inside reefs, bays, and inlets and are attracted to lagoons and shoals with an abundance of marine grass and algae. Approximately 12 percent of the sea turtles handled at the BSEP in 2004 were green turtles. Nesting in the continental United States is limited to between 300 and 1000 nests annually on Florida's east coast (FWS 2005q).

The staff visited the site and reviewed the life history information on the green turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, green turtles.

Leatherback Turtle

The leatherback turtle is listed as endangered by the FWS. The species rarely enters the estuary. Only historical sightings of the leatherback (last observed more than 20 years ago) have been documented in Brunswick County (NHP 2004b). Nesting in the United States occurs mainly in Florida, but has also occurred in Georgia, South Carolina, and North Carolina. No nests have been observed at the BSEP site.

The staff visited the site and reviewed the life history information on the leatherback turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the leatherback turtle.

Hawksbill Turtle

The hawksbill is listed as endangered by the FWS. In the continental United States, nesting is restricted to the southeast coast of Florida and the Florida Keys (NMFS 2005b). The hawksbill turtle has been reported from all the eastern seaboard, but sightings north of Florida are rare. This species has not been documented at the BSEP site.

The staff visited the site and reviewed the life history information on the hawksbill turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the hawksbill turtle.

Kemp's Ridley Turtle

The Kemp's ridley turtle is listed by the FWS as endangered. Nesting occurs in Tamaulipas Mexico, and sometimes in Texas. Adults of this species are found primarily in the Gulf of Mexico, but immature turtles are found along the Atlantic coast as far north as Canada (FWS 2005r). The Kemp's ridley turtle is found in shallow coastal waters, often in association with red mangrove shorelines (FWS 2005r). Nearly 19 percent of the sea turtles handled at BSEP in 2004 were Kemp's ridley turtles.

The staff visited the site and reviewed the life history information on the Kemp's ridley turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the Kemp's ridley turtle.

6.0 Conclusions

The staff has identified 12 terrestrial and 6 aquatic Federally listed endangered, threatened, and candidate species that are under full or partial FWS jurisdiction that have a reasonable potential to occur in the vicinity of BSEP or along the transmission line rights-of-way, and therefore may be affected by continued operations of BSEP and maintenance of the associated transmission line rights-of-way. Additionally, the staff identified four other Federally listed terrestrial species and one Federally listed aquatic species that have been reported to occur in the counties containing BSEP or associated transmission rights-of-way. However, because of known habitat requirements, these species are not likely to be found near BSEP or its associated transmission line rights-of-way and, therefore, would not be affected by continued operations at BSEP. CP&L has procedures in place to protect endangered or threatened species, if they are encountered at the plant site or along transmission line rights-of-way, and provides training for employees on these procedures (BSEP 2003, 2005a). In 1993, CP&L signed a Memorandum of Understanding with the NCDEHNR to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission line rights-of-way (CP&L and NCDEHNR 1993). CP&L also maintains Best Management Practices for Management of Rare Plants on its rights-of-way (BSEP 2005a).

The NRC staff has analyzed the species that are likely to be in the vicinity of BSEP or the associated transmission lines, the known distributions and records of those species, the ecological impacts of the operation of BSEP and the operation and maintenance of the associated transmission rights-of-way, the effects of these practices on the species potentially present, and the mitigation measures that CP&L has already implemented. Based on this analysis, the staff has determined that continued operation of BSEP and its associated transmission lines for an additional 20 years would not have an adverse impact on any threatened or endangered species.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 9, 2005

Mr. David Bemhart
Assistant Regional Administrator for Protected Resources
NOAA's National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue, South
St. Petersburg, FL 33701

SUBJECT: BIOLOGICAL ASSESSMENT FOR LICENSE RENEWAL OF BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2, AND A REQUEST FOR INFORMAL CONSULTATION

Dear Mr. Bemhart:

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared the enclosed biological assessment (BA) (Enclosure 1) to evaluate whether the proposed renewal of the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) operating licenses for a period of an additional 20 years would have any adverse effect on listed species. The proposed action (license renewal) is not a major construction activity. BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River.

By letter dated December 29, 2004, to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), the NRC requested a list of Federally threatened or endangered species that may be in the vicinity of BSEP and its associated transmission lines. In a letter dated February 4, 2005, NMFS identified 12 Federally listed endangered or threatened species and six species of concern as potentially occurring in the area containing the BSEP site, transmission line rights-of-way, and the Cape Fear River.

In addition, the staff also contacted the U. S. Fish and Wildlife Service (FWS) by letter dated December 29, 2004, requesting a list of Federally endangered or threatened species that may be in the vicinity of BSEP. In a letter dated February 3, 2005, FWS directed the staff to the following Website, http://nc.es.fws.gov/es, for a list of species. The staff identified a total of 16 terrestrial and 20 aquatic Federally listed endangered, threatened, or candidate species or species of concern having the potential to be present in the vicinity of BSEP and its associated transmission line rights-of-way. Regarding the marine species, NMFS has full jurisdiction for the whales and sturgeon, while sharing the responsibilities for the sea turtles with the FWS.

The NRC has determined that the proposed action would have no effect on the sei whale *(Balaenoptera borealis)*, blue whale *(Balaenoptera musculus)*, fin whale *(Balaenoptera physalus)*, North Atlantic right whale *(Eubalaena glacialis)*, humpback whale *(Megaptera Novaeangliae)*, sperm whale *(Physeter macrocephalus)*, dusky shark *(Carcharhinus obscurus)*, night shark *(Carcharhinus signatus)*, speckled hind *(Epinephelus drummondhayi)*, or warsaw grouper *(Epinephelus nigritus)*.

D. Bernhart -2-

Also, the NRC staff determined the proposed action may affect, but is not likely to adversely affect, the loggerhead turtle *(Caretta caretta)*, green turtle *(Chelonia mydas)*, leatherback turtle *(Dermochelys coriacea)*, hawksbill turtle *(Eretmochelys kempii)*, shortnose sturgeon *(Acipenser brevirostrum)*, Atlantic sturgeon *(Acipenser oxyrhynchus oxyrhynhus)*, or the sand tiger shark *(Odontaspis taurus)*. There is currently an Incidental Take Statement in place as a result of a previous formal Section 7 consultation and accompanying Biological Opinion issued by NMFS on January 20, 2000. Those take limits (six loggerhead, two Kemp's ridley, three green, one leatherback, and one hawksbill turtles) continue to apply to BSEP operation.

We are requesting your concurrence with our determination. In reaching our conclusion, the NRC staff relied on information provided by the licensee, on literature research and interviews with experts performed by NRC staff, and on information from the NMFS (Southeast Regional Office).

If you have any questions regarding this BA or the staff's request, please contact Richard Emch, Senior Environmental Project Manager, at 301-415-1590 or by e-mail at rle@nrc.gov.

Sincerely,

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-324 and 50-325

Enclosure: As stated

cc w/encl.: See next page

Biological Assessment

(for species under the jurisdiction of NOAA's National Marine Fisheries Service)

Brunswick Steam Electric Plant, Units 1 and 2

License Renewal Review

August 2005

Docket Numbers
50-325
50-324

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Biological Assessment of the Potential Effects on Endangered or Threatened Species from the Proposed License Renewal for the Brunswick Steam Electric Plant, Units 1 and 2 (for species under the jurisdiction of NOAA's National Marine Fisheries Service)

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. The Carolina Power & Light Company (CP&L), now doing business as *Progress Energy Carolinas, Inc.*, operates Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) in southeastern North Carolina under Operating Licenses (OLs) DPR-62 and DPR-71, respectively. The OL for Unit 1 will expire September 8, 2016, and the Unit 2 license will expire December 27, 2014. CP&L has applied to renew the operating licenses for BSEP. If approved by the NRC, the renewed OLs would allow up to 20 additional years of plant operation beyond the current licensed operating term.

In letters dated December 29, 2004, the staff requested comments from the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on the license renewal application for BSEP (NRC 2004a, b). Specifically, the staff requested a list of species and information on protected, proposed, and candidate species and critical habitat that may be in the vicinity of BSEP and its associated transmission line rights-of-way. In a letter from the FWS dated February 3, 2005 (FWS 2005a), the staff was directed to an FWS website (http://nc-es.fws.gov/es) for a list of species to include in this biological assessment (BA). NMFS provided a list of Federally protected species and species of concern under their jurisdiction in a letter dated February 4, 2005 (NMFS 2005a). A total of 16 terrestrial and 20 aquatic species, Federally listed as endangered, threatened, candidates for listing, or species of concern, occur or potentially occur in the counties within which the BSEP site and its transmission line rights-of-way are located or in the Cape Fear River. The Cape Fear River serves as the source of cooling water for BSEP. Of the 36 identified species, 18 are under full or partial jurisdiction of NMFS.

2.0 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for BSEP Units 1 and 2. BSEP is located in Brunswick County in southeastern North Carolina, near the mouth of the Cape Fear River. Wilmington, North Carolina is approximately 15 mi north of the BSEP site, and Myrtle Beach, South Carolina is approximately 50 mi to the southwest. By letter dated October 20, 2004, CP&L submitted an application to the NRC to renew these OLs for an additional 20 years of operation (i.e., until September 2036 for Unit 1 and December 2034 for Unit 2).

No major refurbishment or replacement of important systems, structures, or components are expected during the 20-year BSEP license renewal term. In addition, no construction activities are expected to be associated with license renewal. If the NRC approves the license renewal application, the reactors and support facilities, including the cooling system, would be expected to continue to be operated and maintained until the renewed licenses expire in the mid-2030s. Continued maintenance activities on the transmission line rights-of-way that are used to connect BSEP to the electric power grid also would be required if the proposed action is approved. Ongoing right-of-way surveillance and maintenance activities along BSEP transmission lines include routine aerial and ground inspections as well as activities associated with vegetation management.

Pursuant to 10 CFR 54.23 and 51.53(c), CP&L submitted an Environmental Report (ER) (CP&L 2004) in which CP&L analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects. The NRC is using this ER, as well as its own analysis as the basis of a supplemental environmental impact statement, a plant-specific supplement to NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* This BA was prepared to evaluate the potential impacts to species protected under the Endangered Species Act of operating BSEP, Units 1 and 2 for an additional 20 years beyond the current license term for each unit.

3.0 The Plant and Associated Transmission Line System

3.1 Reactor Systems

BSEP uses boiling water reactors (BWRs) and steam-driven turbine generators manufactured by General Electric. As originally built and operated, each of the BSEP units had a design rating of 2436 megawatts-thermal (MW(t)). Since 1996, the NRC has approved two power uprates. Each unit is now licensed to operate at 2923 MW(t), 20 percent over the original licensed maximum power level.

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.

3.2 Cooling and Auxiliary Water Systems

Cooling water for BSEP is obtained from the lower Cape Fear River and discharged to the Atlantic Ocean. Water passes from the lower Cape Fear estuary through screens in a diversion structure used to limit the entrainment of biota into the intake canal. The 3-mi intake canal flows via gravity from the screens at the Cape Fear River to the plant. At the plant, cooling water is drawn through a combination of eight bays (four for each unit). Each bay has a trash rack, traveling screens, and an intake pump. For each unit, two bays have fine mesh (1mm) screens and the other two bays have half fine mesh and half coarse mesh (3/8 in) screens. Typically, each unit operates utilizing two of the fine mesh bays and one of the half fine/half coarse bays. Organisms impinged on the traveling screens are washed into a trough that leads to a holding basin before being released to Walden Creek, which is part of the Cape Fear River watershed. The daily maximum intake by BSEP is limited to 2210 cubic feet per second (cfs) during April through November and to 1844 cfs during December through March.

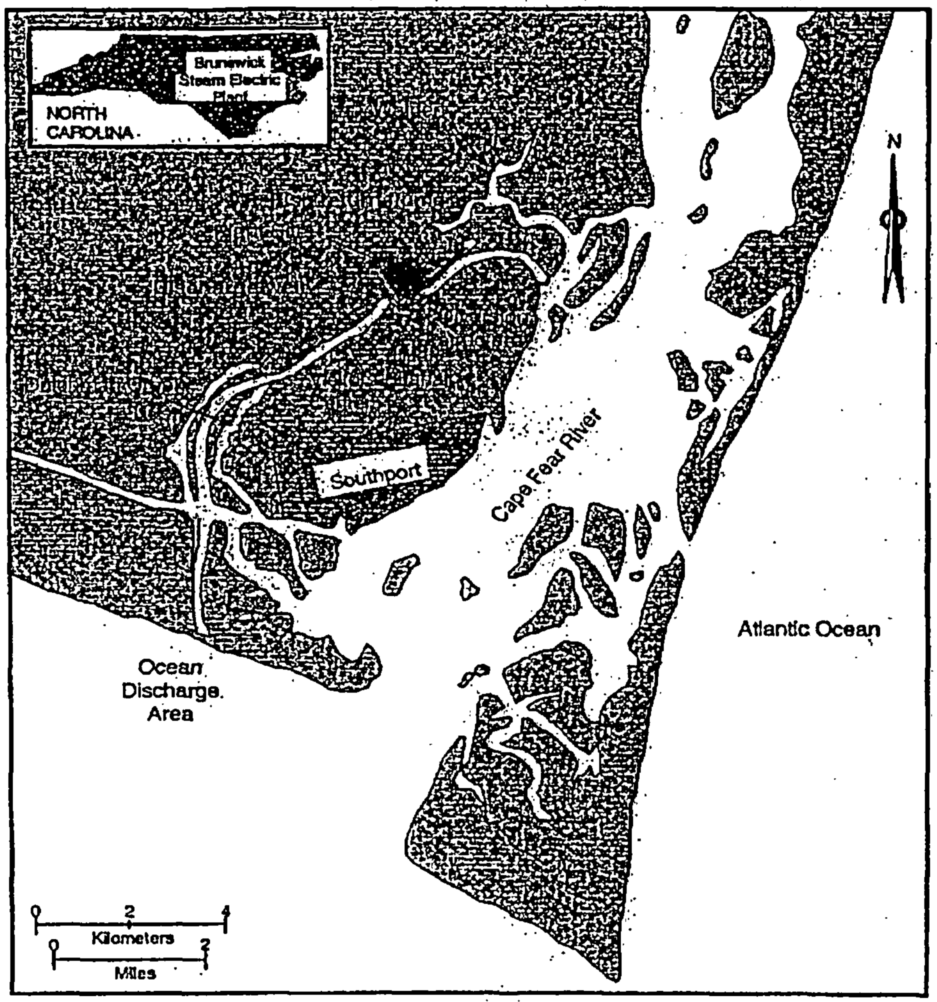

Figure 1. Location of Brunswick Steam Electric Plant, Units 1 and 2 (PEC 2003)

Chlorine is injected into the circulating water intake system to prevent biofouling. Total residual chorine is monitored under terms of the plant's National Pollutant Discharge Elimination System (NPDES) permit before the effluent is pumped into the ocean. After passing through the plant, the discharge water is released into a 6-mi-long canal that flows by gravity out to Caswell Beach (Figure 1). At Caswell Beach the effluent is pumped 2000 ft offshore into the Atlantic Ocean.

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BSEP receives potable and processed water from the Brunswick County Public Utilities. CP&L reports that from 1996 through 2001, BSEP's water imports averaged 0.23 million gallons per day (MGD). The source of the majority of water imported from Brunswick County Public Utilities is surface water from the lower Cape Fear River. BSEP operates one groundwater well onsite to supply water to the biological laboratory. The well has a rated capacity of 30 gallons per minute (gpm), but the actual use is far less than the rated capacity.

3.3 Electrical Transmission System

The eight 230-kV transmission lines constructed to connect the BSEP to the transmission system were described in the Final Environmental Statement (FES) for operation of BSEP Units 1 and 2 (AEC 1974). These lines included two lines to the Delco and Barnard Creek substations and lines to the Fayetteville, Wallace, and Jacksonville substations. In addition, 31 mi of new transmission line were constructed after initial licensing to connect BSEP to the Weatherspoon Substation.

The two lines to Barnard Creek Substation have been extended to the Castle Hayne Substation and Wilmington Corning Switching Station, located about 12 mi to the north of the Barnard Creek Substation. Both the Castle Hayne and the Wilmington Corning lines are considered in this BA in their entirety. The original Fayetteville line now connects to the grid at the Whiteville Substation. However, because the Fayetteville line, which was built to connect BSEP to the grid, remains in existence, the full extent of the original line is considered in this BA.

The transmission lines are shown in Figure 2. In total, about 390 mi of transmission lines in about 260 mi of rights-of-way are considered in this BA. The rights-of-way cover approximately 4690 ac. The length of each line and the area covered by the rights-of-way associated with the line are listed in Table 1. In estimating the rights-of-way for each line, the total area in shared rights-of-way was distributed equally among the lines within the right-of-way.

CP&L employs an integrated vegetation management approach that includes both mechanical and chemical control methods. This allows them to design the maintenance practices to fit the different kinds of terrain and soils that are crossed by the transmission lines. Mechanical methods include pruning, felling, mowing, and hand trimming. Chemical methods include the use of tree growth regulators to slow the growth of fast-growing trees, and U.S. Environmental Protection Agency (EPA)-approved herbicides to control undesirable woody vegetation that regrows after mowing. Over time, the combination of mowing and herbicides results in a community dominated by low-growing, non-woody plants, such as grasses and herbaceous plants that require less maintenance but still provide food and cover for wildlife (CP&L 2004).

4.0 Environmental Setting

BSEP is located in Brunswick County, in southeastern North Carolina, near the mouth of the Cape Fear River. The area within a 6-mi radius of the plant includes the town of Southport, the community of Boiling Spring Lakes, and the resort communities of Caswell Beach, Oak Island, and Bald Head Island. Wilmington, North Carolina, lies approximately 15 mi north of the BSEP site, and Myrtle Beach, South Carolina, lies approximately 50 mi to the southwest along the coast. The Military Ocean Terminal Sunny Point is situated immediately north of the BSEP site. Figure 3 shows the site location and features in the surrounding area.

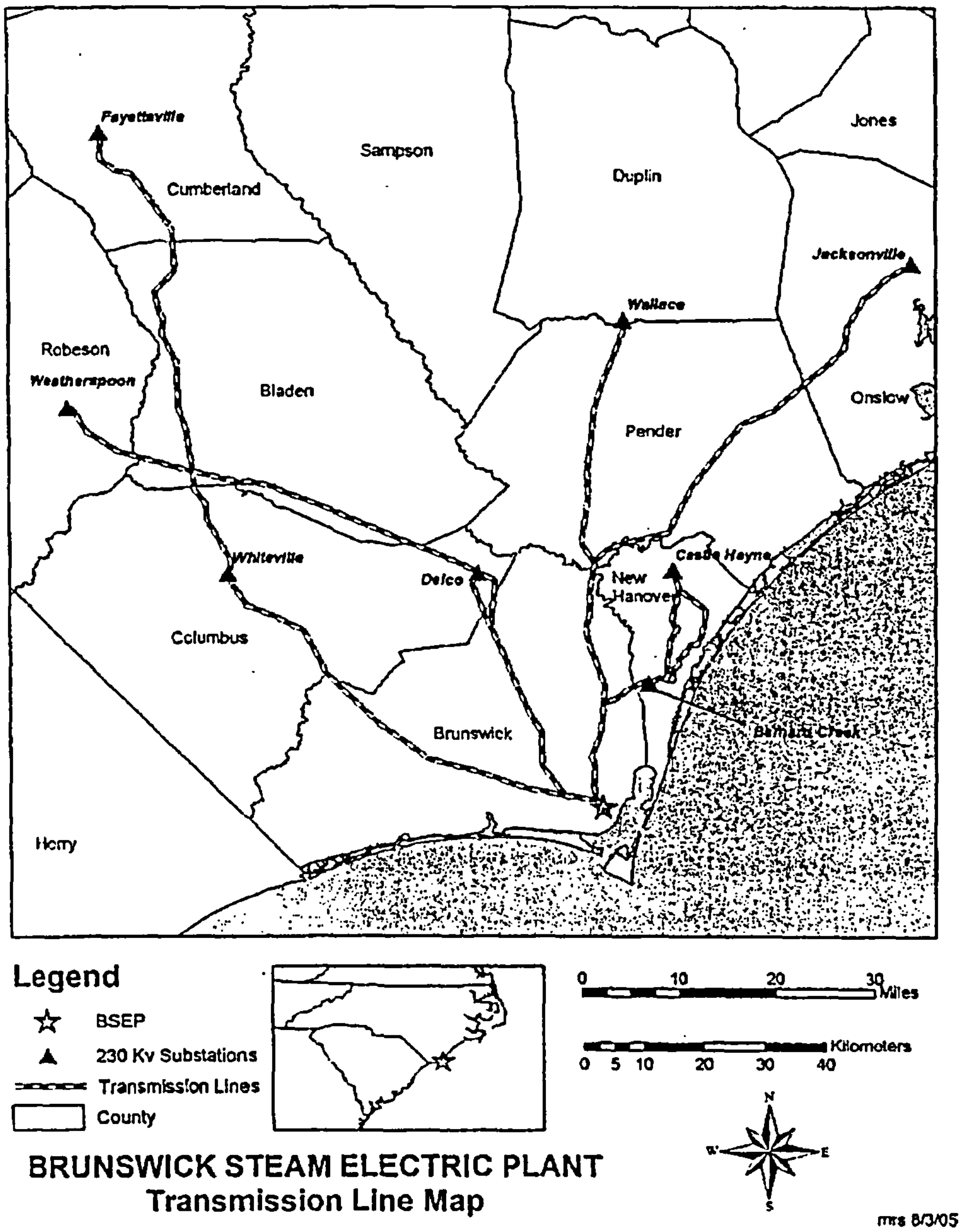

Figure 2. BSEP Transmission Line Map

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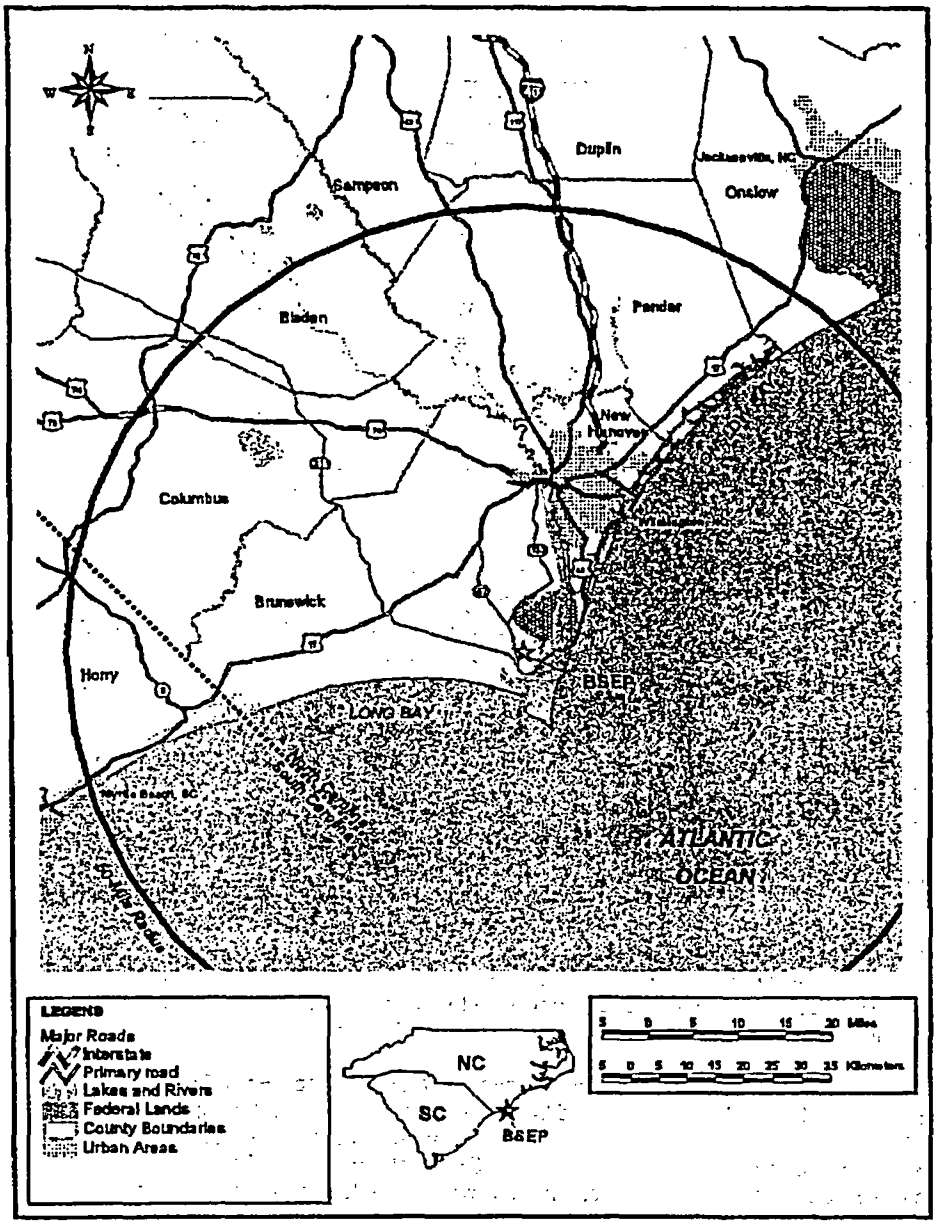

Figure 3. BSEP Location and Surrounding Area, 50-mi Radius

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Table 1. Brunswick Nuclear Power Plant, Units 1 and 2 Transmission Lines

Substation	Approximate Line Length Miles	Estimated Right-of-Way Area Acres
Fayetteville	103	900
Weatherspoon	31	460
Delco East	31	320
Delco West	31	300
Wallace	55	720
Jacksonville	75	940
Castle Hayne East	35	650
Wilmington Corning Switching Station	27	400
Total	388	4690

Cooling water for BSEP is drawn from the Cape Fear River by way of a 3-mi-long intake canal that passes from the river to BSEP. After passing through the plant's condensers, the heated water travels through a 6-mi-long discharge canal to Caswell Beach where it is pumped 2000 ft offshore through large submerged pipes into the Atlantic Ocean.

4.1 Terrestrial Resources

The BSEP site is located within the mid-Atlantic coastal plain ecoregion (Griffith et al. 2002), which in pre-European settlement times was dominated by longleaf pine (*Pinus palustris*) with patches of oak (*Quercus* spp.), gum (*Nyssa* spp.), and cypress (*Taxodium* spp.) (Griffith et al. 2002). The BSEP site is within the Carolina flatwoods sub-region, which includes a wide variety of community types including pine flatwoods, pine savannas, freshwater marshes, pond pine woodlands, pocosins, Carolina bays, and some sandhill communities (Griffith et al. 2002). The transmission lines cross other sub-region types including mid-Atlantic floodplains and low terraces, and non-riverine swamps and peatlands. The region is a significant center of endemic biota (Hall et al. 1999). Although there is still a substantial amount of native habitat in the vicinity of the BSEP site, much of it has been converted to other uses, including loblolly pine (*P. taeda*) plantations and croplands of corn, soybeans, and tobacco.

The environment on the BSEP site includes waterways, such as the Cape Fear River, Dutchman Creek, and Nancy Creek; saline and brackish marshes; coastal dunes; and uplands (AEC 1974). Most upland portions of the BSEP site have been replanted with loblolly pine. Terrestrial and wetland communities in the vicinity of BSEP include pine savannas, longleaf pine/wiregrass (*Aristida stricta*) communities, pine-hardwood forests, pocosins, dune-strand communities, and salt marshes (CP&L 2004).

Loblolly pine is the principal pine species in the pine-hardwood forests in the vicinity of BSEP. Important hardwoods include sweet gum (*Liquidamba styraciflua*), blackgum (*Nyssa sylvatica*), hickory (*Carya* spp.), and oaks. Along the ancient dunes, which tend to be well drained, the

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forests are dominated by longleaf pine, turkey oak (*Quercus laevis*), and wiregrass. Remnant pine savannas occur in periodically flooded areas; these are characterized by an open canopy of longleaf pine or pond pine (*Pinus serotina*) with a dense ground cover of herbs and shrubs. A relatively unique community type in the area are pocosins. These are wetland depressions vegetated with dense stands of various evergreen shrubs and small trees such as red bay (*Persea borbonia*) and sweet bay (*Magnolia virginiana*) (CP&L 2004).

Sparse stands of grass dominated by sea oats (*Uniola paniculata*) characterize the seaward side of the dune-strand communities found at the interface between the sea and land. Because of the wind and salt spray, plants are primarily found on the landward side of the dunes. Relatively dense herbaceous shrub communities dominated by sabal palm (*Sabal palmetto*) and live oak (*Q. virginiana*) develop in these more protected areas (CP&L 2004).

Cordgrass (*Spartina alterniflora*) and needlerush (*Juncus romerianus*) are the dominant species in the salt marshes at the BSEP site. The marshes represent habitat for many important aquatic organisms that are preyed upon by a variety of terrestrial wildlife species (CP&L 2004).

Wildlife species in the vicinity of BSEP are typical of those found in the southeastern Coastal Plain. The upland communities support many species of birds, including hawks, woodpeckers, warblers, and sparrows; mammals such as white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), squirrels (*Sciurus* spp.), skunk (*Mephitis mephitis*), and bobcat (*Lynx rufus*); as well as a variety of snakes, toads, frogs and lizards. Wetlands such as the salt-marshes provide habitat for the American alligator (*Alligator mississippiensis*), raccoon (*Procyon lotor*), river otter (*Lontra canadensis*), and many species of wading birds (CP&L 2004).

There are eight transmission lines that were constructed to connect BSEP to the transmission system. The transmission line to the Barnard Creek substation crosses the Cape Fear River near the top of the estuary. The Whiteville transmission line crosses several pocosins and Green Swamp, which has been designated a National Natural Landmark (NPS 2005). The Whiteville transmission line also passes about 1 mi west of Lake Waccamaw State Park and approximately 2 mi south of Lake Waccamaw. The Holly Shelter Game Land in the Holly Shelter swamp is crossed by the Jacksonville transmission line. In northwest Pender County, the Wallace transmission line crosses the B. W. Wells Savannah, a 117-ac remnant of wetland savannah that supports 170 native plant species, some of which are considered rare (NCCLT 2001). The transmission line rights-of-ways do not cross any Federal or State parks. CP&L has partnered with the North Carolina Coastal Land Trust, the Conservation Trust for North Carolina, the Nature Conservancy, North Carolina Wild Flower Preservation Society, and the North Carolina Natural Heritage Program (NCNHP) to preserve unique and rare species within the transmission line rights-of way.

4.2 Aquatic Resources

BSEP is surrounded by a diverse and complex aquatic ecosystem. Aquatic habitat types surrounding the plant include salt marshes, the river channel/estuary, and offshore regions (CP&L 1980). The plant is situated approximately 5.7 mi upstream from the mouth of the Cape Fear River (CP&L 1985). BSEP's cooling system draws water predominantly from the surface layer of the Cape Fear River ship channel through a 3-mi-long intake channel. Water is discharged to the Atlantic Ocean after flowing through a 6-mi discharge canal. The water is pumped approximately 2000 ft offshore through submerged pipes to the point of discharge (CP&L 1979).

The Cape Fear River is estuarine at the point where water is drawn into the intake canal. Estuaries are partially enclosed coastal areas where freshwater and saltwater mix. These areas are under tidal influence, but they are protected from the full force of the ocean by barrier islands, salt marshes, or other land forms. The species found in estuaries are specially adapted for life in this transitional area. Estuaries are considered to be among the most productive areas on earth (EPA 2005).

The region surrounding the BSEP intake canal entrance, just downstream of Sunny Point, is in an area that experiences a large tidal exchange (CP&L 1985). Salinity is influenced primarily by tidal conditions and the rate of freshwater inflow. A salinity gradient exists where runoff from the Cape Fear River mixes with water from the Atlantic Ocean. From Sunny Point upstream to Wilmington, the water is often two-layered, with the less-dense freshwater moving downstream over the more-dense seawater (CP&L 1980). Downstream from Sunny Point, the water is more uniformly mixed because of complex water circulation patterns, vigorous tidal action, and high exchange rates with the ocean. This portion of the estuary is shallow and irregular in shape, with many islands and channels that enhance mixing (CP&L 1980, 1985). Because the freshwater inflow from the Cape Fear River and its tributaries is highly variable, salinities at the intake may range from nearly 0 to 32 parts per thousand (ppt) (AEC 1974). During periods of average freshwater inflow, salinities near Sunny Point are generally in the range of 8 to 15 ppt (CP&L 1980). Minimum salinities are generally recorded in winter, and maximum salinities are generally recorded in late summer (CP&L 1985). Water temperatures in the estuary are influenced largely by changes in season, with the warmest temperatures (as high as 103°F) observed during late summer (CP&L 1985).

The Cape Fear Estuary serves as a nursery area for fish and shellfish larvae and juveniles. Some species, such as anchovy (*Anchoa* spp.) and gobies (*Gobionellus* spp., *Gobiosoma* spp.) spawn in the estuary, while others, such as Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), croaker (*Micropogonias undulatus*), and pinfish (*Lagodon rhomboides*) spawn in the ocean (PEC 2003). Salinity and temperature influence the spatial and seasonal distribution of these estuarine species (CP&L 1985). The ebb and flow of water in the estuary also contribute to the transport and/or retention of larvae and other organisms throughout the estuary (CP&L 1980).

Many species that inhabit waters in the vicinity of the BSEP have commercial or recreational value. Brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), and white shrimp (*Litopenaeus seiferus*) inhabit salt marshes, including Snow's Marsh, which borders the intake canal (CP&L 1980). The shrimp spawn in offshore waters and the post-larvae are recruited into the estuary where they find food and protection. As the shrimp mature, they migrate to deeper waters where commercial fishermen harvest them (AEC 1974). Croaker, an important food fish and sport fish, is another inhabitant of the salt marsh, including Snow's Creek (AEC 1974). Croaker spawn in the ocean during fall and winter. The young spend their first year in the low-salinity regions of the estuary and then move to the ocean. Examples of other species found in salt marshes near BSEP include blackcheek tonguefish (*Symphurus plagiusa*), striped anchovy (*Anchoa hepsetus*), Atlantic menhaden, and pinfish (AEC 1974).

In the river channel and estuary, developing larvae of brown, pink, and white shrimp, as well as blue crab (*Callinectes* spp.) can be found (AEC 1974). This portion of the estuary also supports the larvae of anchovy, croaker, gobies, spot, blackcheek tonguefish, Atlantic menhaden, and striped mullet (*Mugil cephalus*) (AEC 1974). The estuary supports larval fish year-round, although the species composition varies by season. Important adult fish using the estuary include gray sea trout (*Cynoscion regalis*), spot, croaker, bay anchovy (*Anchoa mitchilli*), summer flounder (*Paralichthys dentatus*), windowpane (*Scophthalmus aquosus*), American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), and blue backed herring (*Alosa aestivalis*) (AEC 1974).

The heated effluent is discharged into the offshore region at Oak Island. Larvae of shrimp, anchovies, gobies, spot, croaker, gray seatrout, pinfish, and menhaden have been recorded in this region (AEC 1974). Adults with some commercial value captured in this area include brown, pink, and white shrimp, blue crab, anchovy, spot, king fish (*Mentalcirrhus americanus*), croaker, thread herring (*Opistonema oglinum*), bluefish (*Pomatomus saltatrix*), drum (*Stellifer lanceolatus*), and sole (*Symphurus plagiusa*). Benthic organisms found in the mud and sand of this offshore area include snails, brittle star (*Ophiophragumus* spp.), and polychaete worms (AEC 1974).

5.0 Evaluation of Threatened and Endangered Species

A total of 12 Federally listed threatened or endangered aquatic species under full or partial NMFS jurisdiction were identified as having the potential to be present in North Carolina waters in the vicinity of BSEP and its associated transmission line rights-of-way (NMFS 2005a). These include six whales, (sei whale [*Balaenoptera borealis*], blue whale [*Balaenoptera musculus*], fin whale [*Balaenoptera physalus*], right whale [*Eubalaena glacialis*], humpback whale [*Megaptera novaeangliae*], and sperm whale [*Physeter macrocephalus*]), five sea turtles (loggerhead turtle [*Caretta caretta*], green turtle [*Chelonia mydas*], leatherback turtle [*Dermochelys coriacea*], hawksbill turtle [*Eretmochelys imbricata*], and Kemp's ridley turtle [*Lepidochelys kempii*]), and one fish species, the shortnose sturgeon (*Acipenser brevirostrum*) (Table 2). NMFS has full jurisdiction over the whales and sturgeon. NMFS and the FWS share jurisdiction for the sea turtles, with NMFS having responsibility in the marine environment and FWS on nesting beaches.

In their letter dated February 4, 2005, NMFS also identified six Federal fish species of concern under their jurisdiction in North Carolina (Atlantic sturgeon [*Acipenser oxyrhynchus oxyrhynchus*], dusky shark [*Carcharhinus obscurus*], night shark [*Carcharhinus signatus*], speckled hind [*Epinephelus drummondhayi*], Warsaw grouper [*Epinephelus nigritus*], and sand tiger shark [*Odontaspis taurus*]) (Table 2) (NMFS 2005a). These species are not protected under the Endangered Species Act, but concerns about their status indicate they may warrant listing in the future.

The NRC staff reviewed life history information for all the aquatic threatened, endangered, and species of concern that have been identified in the vicinity of BSEP or its transmission line rights-of-way. The staff has also reviewed information provided by CP&L, FWS, NMFS, and the North Carolina Natural Heritage Program (NCNHP), regarding threatened and endangered species in the vicinity of the BSEP site (CP&L 2004; NCNHP 2004; NMFS 2005a, b, c; FWS

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2005b). The NRC has determined that the proposed action would either have *no effect* or *may affect, not likely to adversely affect* these species. The basis for each determination is discussed in the following paragraphs.

Table 2. Federally Listed Marine Species Reported From Counties Associated with BSEP and Its Transmission Line Rights-of Way

Species	Common Name	Federal Status[a]	Counties	Determination
MAMMALS				
Balaenoptera borealis	sei whale	E	(NC)[b]	no effect
Balaenoptera musculus	blue whale	E	(NC)	no effect
Balaenoptera physalus	fin whale	E	(NC)	no effect
Eubalaena glacialis	North Atlantic right whale	E	(NC)	no effect
Megaptera novaeangliae	humpback whale	E	(NC)	no effect
Physeter macrocephalus	sperm whale	E	(NC)	no effect
REPTILES				
Caretta caretta	loggerhead turtle	T(c)	Brunswick, New Hanover, Onslow, Pender	may affect, not likely to adversely affect
Chelonia mydas	green turtle	T(c,d)	Brunswick, New Hanover, Onslow	may affect, not likely to adversely affect
Dermochelys coriacea	leatherback turtle	E(c)	Brunswick, Onslow	may affect, not likely to adversely affect
Eretmochelys imbricata	hawksbill turtle	E(c)	(NC)	may affect, not likely to adversely affect
Lepidochelys kempii	Kemp's ridley turtle	E(c)	Brunswick	may affect, not likely to adversely affect
FISH				
Acipenser brevirostrum	shortnose sturgeon	E	Bladen, Brunswick, New Hanover, Pender	may affect, not likely to adversely affect
Acipenser oxyrhynchus oxyrhynchus	Atlantic sturgeon	C	Bladen, Brunswick, New Hanover, Pender	may affect, not likely to adversely affect

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Table 2. (contd)

Species	Common Name	Federal Status(a)	Counties	Determination
FISH				
Carcharhinus obscurus	dusky shark	C	(NC)	no effect
Carcharhinus signatus	night shark	C	(NC)	no effect
Epinephelus drummondhayi	speckled hind	C	(NC)	no effect
Epinephelus nigritus	Warsaw grouper	C	(NC)	no effect
Odontaspis taurus	sand tiger shark	C	(NC)	may affect, not likely to adversely affect

(a) E - endangered, T- threatened, C- species of concern
(b) (NC) - County-level listings are not available; the species has Federal listing status in North Carolina
(c) Nesting areas are under FWS jurisdiction, otherwise the species is under NMFS jurisdiction.
(d) Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

Sei Whale

The sei whale favors temperate, deep, offshore waters. Local distribution is thought to be linked to the distribution of their food source, which includes copepods, fish, or krill. Current sei whale population estimates are around 54,000 individuals (American Cetacean Society 2005). This species is not expected to enter the Cape Fear estuary or to be found near the BSEP discharge structure. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the sei whale.

Blue Whale

Although blue whales have been seen in coastal waters, they are found predominantly offshore (NMFS 2005b). This species is most frequently sighted in more northern waters, off eastern Canada. It is considered an occasional visitor in the U.S. Atlantic. This species is not expected to enter the Cape Fear estuary or to be found near the BSEP discharge structure. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the blue whale.

Fin Whale

Although fin whales are found in all oceans of the world, they prefer the vastness of the open sea (American Cetacean Society 2005). Precise estimates of population abundance are unavailable, but present populations may number around 40,000 in the northern hemisphere. This species is not expected to enter the Cape Fear estuary or to be found near the BSEP discharge structure. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the fin whale.

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North Atlantic Right Whale

The majority of North Atlantic right whale females in the western North Atlantic population use wintering and calving areas off the southeastern United States, then move to summer feeding and breeding grounds in New England waters and to the north (NMFS 2005b). The majority of males do not migrate to the southern calving grounds, but males do frequent the northern waters in summer. Critical habitat for the species has been designated in coastal Florida and Georgia, but not in North Carolina. This species is not expected to enter the Cape Fear estuary or to be found near the BSEP discharge structure. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the North Atlantic right whale.

Humpback Whale

Humpback whales are seasonal migrants. They generally swim to polar waters in summer and tropical waters in winter. In the western North Atlantic, humpback whales feed during spring, summer, and fall along the eastern coast of the United States (NMFS 2005b). An increased number of sightings in the U.S. mid-Atlantic and southern states, including North Carolina, has been reported. These areas may be increasingly important habitat for juvenile humpback whales (NMFS 2005b). This species is not expected to enter the Cape Fear estuary or to linger along the coast near the BSEP discharge structure. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the humpback whale.

Sperm Whale

Sperm whales are uncommon in waters shallower than 300 m deep (NMFS 2005b). Because of their association with deep waters, it is unlikely that this species would be found near the BSEP. Therefore, the staff concludes that continued operation of BSEP over the 20-year license renewal term would have no effect on the sperm whale.

Sea Turtles

NMFS and the FWS share jurisdiction for the sea turtles, with NMFS having responsibility in the marine environment and FWS on nesting beaches. A Biological Opinion issued by the NMFS in 2000 addressed impacts to sea turtles specifically resulting from BSEP operation. The Biological Opinion concluded that the "BSEP is not likely to jeopardize the continued existence of the loggerhead, leatherback, green, hawksbill, or Kemp's ridley sea turtles" (CP&L 2004). More recently, a Biological Opinion comparing sea turtle loss from coastal seawater intakes to the losses from incidental take during shrimp trawling indicated that while "sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants sea turtle mortality associated with these activities is relatively low and does not significantly affect the environmental baseline" (NMFS 2002).

BSEP holds an endangered species permit, issued on an annual basis by the North Carolina Wildlife Resources Commission (NCWRC), to tag sea turtles entrained in the intake canal, using methods in accordance with the FWS and NMFS sea turtle tagging protocols. BSEP also holds an Incidental Take Statement issued by NMFS (NMFS 2000), which authorizes the capture and relocation of sea turtles. The Incidental Take Statement proscribes takes by plant-related injury or mortality to be limited to six loggerhead turtles, two Kemp's ridley turtles, three green turtles, one leatherback turtle, or one hawksbill turtle annually. These permits allow certain BSEP staff to possess and transport entrained or stranded sea turtles for the purpose of rehabilitation and/or release and the possession of dead stranded sea turtles for the purposes of disposition (NCWRC 2004). The permit requires notification of each stranding event within 24 hours, and submission of a written report within 48 hours of each stranding event.

Three sea turtle species have been collected, some as recently as July 2005, in the vicinity of the BSEP intake canal (BSEP 2005a). These were the loggerhead, green, and Kemp's ridley turtles. In 2004, the handling of 16 sea turtles by BSEP staff was reported to NMFS (BSEP 2005a). "Turtle-blocker panels" have been installed at the diversion structure, located at the entrance to the intake canal, to minimize the potential for sea turtles to enter the canal. BSEP staff regularly patrols the canal to look for turtles and to ensure the blocker panels are well maintained.

Loggerhead Turtle

The loggerhead turtle is listed as threatened. The species occurs on beaches suitable for nesting from North Carolina to Florida (FWS 2005c). The loggerhead may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship canals, and the mouths of large rivers (FWS 2005c). Nesting season is generally between May and November. Nesting occurs on suitable beaches from North Carolina to Florida, with primary nesting beaches found in Florida. Loggerhead turtle nesting in North Carolina occurs only on the Atlantic Coast beaches, and does not occur in the Cape Fear River estuary, or anywhere near the BSEP site or associated transmission line rights-of-way. However, loggerhead turtles were the most common species observed at the BSEP in 2004. Sixty-nine percent of the sea turtles handled were loggerheads.

The staff visited the site and reviewed the life history information on the loggerhead turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the loggerhead turtle.

Green Turtle

The green turtle is listed as threatened. In the western North Atlantic Ocean, this species is found from Massachusetts to Mexico. Nesting in the United States is limited to between 300 and 1000 nests annually on Florida's east coast (FWS 2005d). Green turtles are generally found in shallow waters inside reefs, bays, and inlets and are attracted to lagoons and shoals with an abundance of marine grass and algae (FWS 2005d). Approximately 12 percent of the sea turtles handled at the BSEP in 2004 were green turtles.

The staff visited the site and reviewed the life history information on the green sea turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the green turtle.

Leatherback Turtle

The leatherback turtle is listed as endangered. Nesting in the United States occurs mainly in Florida, but has also occurred in Georgia, South Carolina, and North Carolina. No nests have been observed at the BSEP site. The species rarely enters the estuary. Only historical sightings of the leatherback (last observed more than 20 years ago) have been documented in Brunswick County (NCNHP 2004).

The staff visited the site and reviewed the life history information on the leatherback turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the leatherback turtle.

Hawksbill Turtle

The hawksbill turtle is listed as endangered. In the United States, nesting is restricted to the southeast coast of Florida and the Florida Keys (NMFS 2005b). The hawksbill has been reported from all the eastern seaboard, but sightings north of Florida are rare. This species has not been documented at the BSEP site.

The staff visited the site and reviewed the life history information on the hawksbill turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the hawksbill turtle.

Kemp's Ridley Turtle

The Kemp's ridley turtle is listed as endangered. Nesting occurs in Tamaulipas, Mexico, and sometimes in Texas. Adults of this species are found primarily in the Gulf of Mexico, but immature turtles are found along the Atlantic coast as far north as Canada (FWS 2005e). The Kemp's ridley turtle is found in shallow coastal waters, often in association with red mangrove shorelines (FWS 2005e). Nearly 19 percent of the sea turtles handled at the BSEP in 2004 were Kemp's ridley turtles.

The staff visited the site and reviewed the life history information on the Kemp's ridley turtle. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the Kemp's ridley turtle.

Shortnose Sturgeon

The shortnose sturgeon is Federally listed as endangered. NMFS has jurisdiction for anadromous fish, including the shortnose sturgeon. A Biological Opinion issued by NMFS in 2000 addressed impacts to shortnose sturgeon specifically resulting from BSEP operation. The Biological Opinion stated that "NMFS believes the likelihood for shortnose sturgeon to be adversely affected by the proposed action is low enough to be considered discountable.

Therefore NMFS has determined it is unlikely that a shortnose sturgeon would be adversely affected by the proposed action" (NMFS 2000). No sturgeon individuals were collected at BSEP before 1998 (CP&L 1998). Nine adult shortnose sturgeon were captured in the Cape Fear River between 1987 and 1998 (CP&L 1998). A tagging and tracking study conducted between 1990 to 1993 managed to capture only eight adult shortnose sturgeon in the lower Cape Fear River (Moser and Ross 1995). Five tagged fish occupied river kilometers 16 through 96 from early January through May. This stretch of the river is upstream of the BSEP intake canal. NCNHP data indicate that shortnose sturgeon have been observed in the vicinity of the point where the Cape Fear River is crossed by the Jacksonville transmission line right-of-way.

The staff visited the site and reviewed the life history information on the shortnose sturgeon. Based on this information, information obtained from NCWRC, FWS, NMFS, and NCNHP, and information obtained from BSEP on endangered and threatened species procedures, the staff concludes that continued operation of BSEP over the 20-year license renewal term may affect, but is not likely to adversely affect, the shortnose sturgeon.

Species of Concern

Several of the species of concern are not expected to be present near the BSEP site. The dusky shark avoids low salinities and is not commonly found in estuaries (NMFS 2005c); the speckled hind, Warsaw grouper, and night shark are all deep-water species, preferring much greater depths than those found in the vicinity of BSEP (NMFS 2005c). Two other species of concern are more likely to be present in the vicinity of the BSEP. The sand tiger shark is a coastal species and may generally be found in the surf zone to depths of 75 ft (NMFS 2005c). Juvenile sand tiger sharks are found in estuaries of the eastern United States and, therefore, may be present in the vicinity of BSEP. The Atlantic sturgeon is relatively common in the lower Cape Fear River (Moser and Ross 1995). Juveniles were found to prefer waters greater than 10 m deep in the vicinity of the saltwater and freshwater interface.

6.0 Conclusions

The staff has identified eight Federally listed endangered, threatened, and species of concern under full or partial NMFS jurisdiction that have a reasonable potential to occur in the vicinity of BSEP or along the transmission line rights-of-way and, therefore, may be affected by continued operations of BSEP and maintenance of the associated transmission line rights-of-way. Additionally, the staff identified 10 additional species that have been reported to occur in the counties containing BSEP or associated transmission rights-of-way. However, because of known habitat requirements, these species are not likely to be near the BSEP or associated transmission line rights-of-way and, therefore, would not be affected by continued operations at BSEP. CP&L has procedures in place to protect endangered or threatened species if they are encountered at the plant site or along transmission line rights-of-way and provides training for employees on these procedures (BSEP 2003, 2005b). 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 (CP&L and NCDEHNR 1993).

The NRC staff has analyzed the species that are likely to be in the vicinity of BSEP or the associated transmission lines, the known distributions and records of those species, the ecological impacts of the operation of BSEP and the operation and maintenance of the

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associated transmission rights-of-way, the effects of these practices on the species potentially present, and the mitigation measures that CP&L has already implemented. Based on this analysis, the staff has determined that continued operation of BSEP and its associated transmission lines for an additional 20 years would not have an adverse impact on any threatened or endangered species or species of concern.

7.0 References

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U.S. Nuclear Regulatory Commission (NRC). 2004b. Letter from NRC to Ms. Patricia A. Kurkul, Regional Administrator, NOAA Fisheries Service, request for list of protected species within the area under evaluation for the BSEP License Renewal.

Appendix F

GEIS Environmental Issues Not Applicable to Brunswick Steam Electric Plant, Units 1 and 2

Appendix F

GEIS Environmental Issues Not Applicable to Brunswick Steam Electric Plant, Units 1 and 2

Table F-1 lists those environmental issues listed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996, 1999)[(a)] and Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B, Table B-1, that are not applicable to Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to BSEP

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Altered thermal stratification of lakes	1	4.2.1.2.2 4.4.2.2	BSEP does not discharge into a lake.
Eutrophication	1	4.2.1.2.3 4.4.2.2	BSEP does not discharge into a lake.
Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	4.3.2.1 4.4.2.1	BSEP does not discharge into a small river with low flow.
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER BASED HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	1	4.3.3	BSEP does not dissipate heat using cooling towers.
Impingement of fish and shellfish	1	4.3.3	BSEP does not dissipate heat using cooling towers.
Heat shock	1	4.3.3	BSEP does not dissipate heat using cooling towers.

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

Table F-1. (contd)

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
GROUNDWATER USE AND QUALITY			
Groundwater use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1 4.8.2.1	BSEP uses less than 100 gpm groundwater.
Groundwater use conflicts (plants using cooling towers withdrawing *make-up water from a small river)*	2	4.8.1.3 4.4.2.1	BSEP does not dissipate heat using cooling towers.
Groundwater use conflicts (Ranney wells)	2	4.8.1.4	BSEP does not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	BSEP does not have or use Ranney wells.
Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	BSEP does not have cooling ponds in salt marshes.
Groundwater quality degradation (cooling ponds at inland sites)	2	4.8.3	BSEP does not use cooling ponds.
TERRESTRIAL RESOURCES			
Cooling tower impacts on crops and ornamental vegetation	1	4.3.4	BSEP does not use cooling towers.
Cooling tower impacts on native plants	1	4.3.5.1	BSEP does not use cooling towers.
Bird collisions with cooling towers	1	4.3.5.2	BSEP does not use cooling towers.
Cooling pond impacts on terrestrial resources	1	4.4.4	BSEP does not use cooling ponds.
HUMAN HEALTH			
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	1	4.3.6	BSEP does not have cooling towers or cooling ponds and its cooling canal does not discharge to a small river.

F.1 References

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

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report*, "Section 6.3 – Transportation, Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives for Brunswick Steam Electric Plant, Units 1 and 2 in Support of the License Renewal Application Review

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives for Brunswick Steam Electric Plant, Units 1 and 2 in Support of the License Renewal Application Review

G.1 Introduction

Carolina Power and Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., submitted an assessment of severe accident mitigation alternatives (SAMAs) for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) as part of its Environmental Report (ER) (CP&L 2004). This assessment was based on the most recent BSEP Probabilistic Safety Assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the BSEP Individual Plant Examination (IPE) (CP&L 1992) and Individual Plant Examination of External Events (IPEEE) (CP&L 1995). In identifying and evaluating potential SAMAs, CP&L considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and population dose at BSEP, as well as SAMA candidates for other operating plants that have submitted license renewal applications. CP&L identified 43 potential SAMA candidates. This list was reduced to 36 unique SAMA candidates by eliminating SAMAs that are not applicable at BSEP because of design differences, that would require extensive changes that would involve implementation costs known to exceed any possible benefit, or that would exceed the dollar value associated with completely eliminating all internal and external event severe accident risk at both BSEP units. CP&L assessed the costs and benefits associated with each of the potential SAMAs and concluded that several of the candidate SAMAs evaluated may be cost-beneficial and warrant further review for potential implementation.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to CP&L by letter dated February 24, 2005 (NRC 2005). Key questions concerned changes to the Level 2 PSA model and source terms since the IPE, the approach for calculating replacement power costs, further information on several specific candidate SAMAs and low-cost alternatives, the potential impact of uncertainties on the assessment results, and licensee plans for future consideration of potentially cost-beneficial SAMAs. CP&L submitted additional information by letters dated April 21, 2005, and June 1, 2005 (Progress Energy 2005a, b). In the responses, CP&L provided a description of the changes to the Level 2 analysis and how the source terms were derived using the Modular Accident Analysis Program (MAAP) 4.0.4 computer program, an assessment of the impact of assuming replacement power cost based on loss of a single unit versus both units, a table that mapped the candidate SAMAs to important basic events and additional information regarding several specific SAMAs, a further assessment of uncertainties in the Level 1 model, and a description of future plans for evaluating potentially cost-beneficial SAMAs. CP&L's responses addressed the staff's concerns.

An assessment of SAMAs for BSEP is presented below.

G.2 Estimate of Risk for BSEP2

CP&L's estimates of offsite risk at the BSEP are summarized in Section G.2.1. The summary is followed by the staff's review of CP&L's risk estimates in Section G.2.2.

G.2.1 CP&L's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the BSEP Level 1 and 2 PSA model, which is an updated version of the IPE (CP&L 1992), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PSA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent BSEP Level 1 and 2 PSA model available at the time of the ER, referred to as the MOR03 Unit 2 model. CP&L considers the Unit 2 model to be appropriate for both Unit 1 and 2 as it incorporates the changes from the extended power uprate (EPU), which was approved in 2002 (the Unit 1 model does not yet include all EPU-related changes). The scope of the BSEP PSA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 4.2×10^{-5} per year. The CDF is based on the risk assessment for internally initiated events. CP&L did not include the contribution from external events within the BSEP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. This is discussed further in Section G.6.2.

The breakdown of CDF by initiating event is provided in Table G-1. As shown in this table, events initiated by loss of offsite power (dual unit) and turbine trips are the dominant contributors to CDF. In response to an RAI, CP&L stated that station blackout (SBO) sequences contribute 1.56×10^{-5} per year (about 37 percent of the total internal events CDF), while anticipated transients without scram (ATWS) sequences contribute 3.3×10^{-6} per year (about 8 percent of the CDF). Internal floods contribute 8.8×10^{-7} per year (about 2 percent of the CDF) (Progress Energy 2005a).

The current Level 2 BSEP PSA model has been developed for the EPU configuration and represents a significant update to the IPE. The Level 2 PSA involved the development of

Table G-1. BSEP Core Damage Frequency for Internal Events

Initiating Event	CDF (Per Year)	% Contribution to CDF
Loss of offsite power – dual unit (LOOP)	1.47×10^{-5}	35.1
Turbine trip	1.14×10^{-5}	27.2
Main steam isolation valve closure/loss of condenser vacuum	4.78×10^{-6}	11.4
Loss of direct current (DC) panel	3.18×10^{-6}	7.6
Loss of alternating current (AC) emergency bus	2.39×10^{-6}	5.7
Loss of control rod drive (CRD)	1.72×10^{-6}	4.1
LOOP – single unit	1.01×10^{-6}	2.4
Other	1.01×10^{-6}	2.4
Internal floods	8.80×10^{-7}	2.1
Loss of reactor building closed cooling water	4.60×10^{-7}	1.1
Interfacing systems loss of coolant accident/ excessive loss of coolant accident	3.40×10^{-7}	0.8
Total CDF (internal events)	**4.19×10^{-5}**	**100**

containment event trees, which are stated to incorporate a number of technical advances to make them consistent with current state of knowledge on severe accident issues and useful for risk-informed applications. A separate containment event tree is used for each of the Level 1 accident classes to describe the response of the containment. The containment event tree end states are grouped into release categories by magnitude and timing of the expected releases. The result of the Level 2 PSA is a set of release categories with their respective frequency and release characteristics. The results of this analysis for BSEP are provided in Table F-5 of the ER. The frequency of each release category was obtained from the quantification of the containment event tree for each Level 1 accident sequence. The release characteristics were obtained from the results of MAAP analyses of conservatively selected, representative sequences for each release category.

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 50-mi radius) for the year 2036, emergency response evacuation modeling, and economic data. The core radionuclide inventory is based on the generic boiling water reactor (BWR) inventory provided in the MACCS2 manual, adjusted to represent the BSEP uprated power level of 2923 megawatts-thermal (MW[t]). The magnitude of the onsite impacts (in terms of cleanup and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC 1997a).

In its ER, CP&L estimated the dose to the population within 50 mi of BSEP to be approximately 29.35 person-rem per year. The breakdown of the total population dose by containment release mode is summarized in Table G-2. Containment failures within the intermediate time frame (6 to 24 hours following event initiation) and early time frame (less than 6 hours following event initiation) dominate the population dose risk at BSEP.

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem Per Year)	% Contribution
Early Containment Failure	8.38	28
Intermediate Containment Failure	20.92	71
Late Containment Failure	0.05	<1
Intact Containment	Negligible	Negligible
Total Population Dose	**29.35**	**100**

G.2.2 Review of CP&L's Risk Estimates

CP&L's determination of offsite risk at BSEP is based on the following three major elements of analysis:

1. the Level 1 and 2 risk models that form the bases for the 1992 IPE submittal (CP&L 1992) and the 1995 IPEEE submittal (CP&L 1995)

2. the major modifications to the IPE model that have been incorporated in the BSEP PSA

3. the MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PSA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of CP&L's risk estimates for the SAMA analysis, as summarized below.

The original BSEP PSA was submitted to the NRC in May 1988 (CP&L 1988). This Level 1 PSA included internally and externally initiated events, and was reviewed by the Idaho National Engineering Laboratory (now known as Idaho National Laboratory) under contract for the NRC (NRC 1989). The overall conclusion of this review was that the PSA was a reasonable and competent investigation into the risks associated with operation of BSEP. The ER states that many of the insights provided by this review were factored into the IPE.

The BSEP IPE (CP&L 1992) was an update of the original PSA. The staff's review of the BSEP IPE is described in an NRC report dated January 21, 2000 (NRC 2000). Based on a review of the original IPE submittal, related supplements, and responses to RAIs, the staff concluded that the IPE submittal met the intent of Generic Letter 88-20; that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities.

There have been numerous revisions to the IPE model since its submittal. A comparison of internal events risk profiles between the IPE and the PSA used in the SAMA analysis indicates an increase of approximately 1.5×10^{-5} per year in the total internal events CDF (from 2.7×10^{-5} per year in the IPE to 4.19×10^{-5} per year in MOR03). The increase is mainly attributed to modeling changes that have been implemented since the IPE was submitted rather than plant hardware changes. A summary listing of those changes that resulted in the greatest impact on the internal events CDF was provided in the ER (CP&L 2004) and further discussed in response to an RAI (Progress Energy 2005a). The major changes are summarized in Table G-3.

The IPE CDF value for BSEP is close to the average of the CDF values reported in the IPEs for BWR 3/4 plants. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events CDF for BWR 3/4 plants ranges from 9×10^{-8} to 8×10^{-5} per year, with an average CDF for the group of 2×10^{-5} per year (NRC 1997b). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal events CDF results for BSEP are comparable to other plants of similar vintage and characteristics.

The PSA results used in the SAMA analysis were based on the Unit 2 PSA. In response to an RAI, CP&L described the differences between Unit 1 and Unit 2 that might affect the PSA results and concluded that the differences do not significantly affect the CDF (Progress Energy 2005a). The Unit 2 model incorporates the changes from the EPU; therefore, it is more up-to-date and consistent with the current plant configuration. The staff concludes use of the Unit 2 PSA results for the SAMA analysis for both units is acceptable.

Table G-3. BSEP PSA Historical Summary

PSA Version	Summary of Changes from Prior Version	CDF[a] (per year)
MOR92	• IPE Submittal	2.7×10^{-5}
93 IPE Update	• Increased LOOP initiating event frequency • Added credit for new SBO procedure • Improved human reliability analysis • Numerous system fault tree model changes	NA
94 IPE Update	• More detailed model of diesel generator failures and offsite power recovery options	1.1×10^{-5}
MOR96	• Consolidated selected event trees • Changed numerous system fault tree models • Updated failure data in conjunction with maintenance rule implementation	9.1×10^{-6}
MOR98	• Replaced prior Level 1 model with separate models for Units 1 and 2 • Modified Level 2 model to calculate only large early releases frequency results	2.54×10^{-5}
MOR98R1	• Revised modeling of credit for battery charger given battery failure • Modified Level 2 model to calculate releases for eight release categories	4.92×10^{-5}
MOR02	• Periodic update • Numerous miscellaneous changes and corrections, some in response to peer review	4.97×10^{-5}
MOR03	• Incorporated changes related to EPU implementation • Updated various common cause failure values • Updated LOOP frequency and recovery rules • Numerous additional changes and corrections to the Level 1 model • Modified the Level 2 model to calculate releases for 12 release categories	4.19×10^{-5}

(a) Values for MOR98 and later are based on a Unit 2-specific model.

The staff considered the peer reviews performed for the BSEP PSA and the potential impact of the review findings on the SAMA evaluation. In the ER and in response to an RAI, CP&L described the previous peer reviews, the most significant of which was the Nuclear Energy Institute/Boiling Water Reactor Owners Group (BWROG) Peer Review of the MOR98R1 PSA model conducted in 2001. In its ER, CP&L stated there were no "A" level facts and observations (i.e., facts and observations important and necessary to address before the next regular PSA update), and there were 66 "B" level facts and observations (i.e., facts and observations important and necessary to address, but disposition may be deferred until the next PSA update), six of which were resolved prior to the MOR03 model being used for the SAMA analysis. In response to an RAI, CP&L stated that resolution of the outstanding Level B peer review comments is still in progress, and described the six major issues associated with the outstanding comments (Progress Energy 2005a). These issues involve the need to address the following:

- safety relief valve re-closure in loss of decay heat removal (DHR) sequences during which the containment pressurizes

- net positive suction head issues in scenarios involving failure of suppression pool cooling and successful containment venting

- reactor building environmental conditions in scenarios in which the containment fails prior to core damage

- potential conservatisms in modeling including common cause failure modeling (double counting), heating, ventilation, and air-conditioning (HVAC) modeling for the diesel generator cells, failure of DC initiating events, modeling of CRD initiating events, and giving credit for alternate rod insertion for ATWS events

- potential non-conservatism in LOOP initiating event data

- refinement in human error probability estimates.

The impact of these issues on the results of the PSA was discussed by CP&L in general terms. CP&L concluded that only the first three issues could result in an increase in risk and potential retention of some additional SAMAs. These issues predominantly impact core damage sequences associated with loss of injection late in the event or with complete loss of DHR. CP&L identified four candidate SAMAs that would help mitigate these accident sequences. Phase II SAMA 36 (use fire-fighting water as a backup for containment spray) was already identified as potentially cost-beneficial in the baseline analysis in the ER; thus, the impact of the peer review comment resolution on this SAMA was not further evaluated. In its ER, CP&L identified three additional SAMAs that would have estimated benefits close to their implementation costs but that were not positively identified as cost-beneficial in the baseline SAMA analysis. Further evaluation of these three SAMAs considered conservative modeling assumptions that would tend to offset, to some extent, the potential impact of the resolution of the comments (Progress Energy 2005a). These three additional SAMAs are listed below, along with CP&L's assessment regarding the potential impact of peer review comment resolution.

- Phase II SAMA 6. Proceduralize all potential 4-kV AC bus cross-tie actions. The benefit of this SAMA is limited because the loss of DHR sequences are long evolutions and even without these procedures the onsite staff would likely perform the 4-kV cross-ties given that the hardware is in place to support it.

- Phase II SAMA 13. Install an inter-unit CRD cross-tie. Implementation of this SAMA could help mitigate the consequences associated with the Class II sequences by delaying the onset of core damage and containment failure. However, the cross-tie introduces the potential to fail the CRD system on the opposite unit. Additionally, in quantifying the benefit of this SAMA it was conservatively assumed that the initial failure of the CRD would not prevent the cross-tie from being performed. As a result, the actual benefit of this SAMA would be less than the estimated value, and the SAMA is not considered to be a candidate for further consideration.

- Phase II SAMA 34. Provide supplemental power supplies for offsite power recovery after battery depletion during SBO. This SAMA would remove the dependence on the switchyard station battery so that a means of aligning offsite power will be available when the station batteries are depleted. Recovery of AC power in loss of DHR sequences appears to be a viable means of reducing risk and one that may be cost-beneficial upon resolution of the BWROG peer review Level B facts and observations.

As a result of the evaluation, CP&L determined that Phase II SAMAs 6 and 13 should not be retained for further evaluation because the true benefits would be less than the benefit assessed, and the impact of the resolution of the facts and observations would probably not prove them to be cost-beneficial. However, the benefits associated with Phase II SAMAs 34 and 36 may increase if relevant facts and observations are resolved. Based on the information provided, the staff agrees with CP&L's general assessment of the potential impact of comment resolution on the results of the PSA. The SAMAs potentially impacted by resolution of the peer review comments are discussed further in Section G.6.

Given that the BSEP Level 1 PSA has been peer reviewed and the potential impact of the unresolved peer review findings has been assessed, that CP&L has satisfactorily addressed staff questions regarding the PSA, and that the CDF falls within the range of contemporary CDFs for BWR 3/4 plants with Mark I containment, the staff concludes that the Level 1 PSA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current BSEP PSA does not include external events. In the absence of such an analysis, CP&L used the BSEP IPEEE in the SAMA analysis to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

The 1988 BSEP PSA, which preceded the IPEEE, included external events with a seismic contribution to CDF of 6.6 x 10^{-5} per year (CP&L 1988). However, this was an early seismic risk assessment described by the licensee as "preliminary" and with results that were described as "screening values." The Idaho National Laboratory review of the external events analysis concluded that the analysis provided a reasonable and credible estimate of the external events risk, but that "it is fully expected that with more refined ongoing and planned analysis of seismic events, the core damage results will be significantly reduced" (NRC 1989). In response to an RAI, CP&L indicated that no further seismic analysis had been performed other than that associated with the IPEEE or Unresolved Safety Issue (USI) A-46 programs (Progress Energy 2005a).

The BSEP IPEEE was submitted in 1995, in response to Supplement 4 of Generic Letter 88-20 (CP&L 1995). BSEP did not identify any fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, or other external events. In a letter dated November 18, 1998, the staff concluded the submittal met the intent of Supplement 4 to Generic Letter 88-20, and the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 1998).

The IPEEE uses a focused-scope seismic margins analysis developed by the Electric Power Research Institute (EPRI). This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators (EPRI 1991). The seismic IPEEE identified a number of outliers of items within the scope of the USI A-46 program. Resolution of these outliers was to be accomplished in the context of USI A-46. Given the satisfactory resolution of these outliers, BSEP found that, based on the EPRI assessment methodology, none of the plant's high confidence, low probability of failure values were less than the 0.3g review level earthquake used in the IPEEE. The NRC review and closure of USI A-46 for BSEP is documented in a letter dated August 5, 1999 (NRC 1999).

Based on the licensee's IPEEE efforts to identify and address seismic outliers and the expected large costs associated with further seismic risk analysis and potential seismic-related plant modifications, the staff concludes the opportunity for seismic-related SAMAs has been adequately explored, and it is unlikely that cost-effective SAMAs that address seismic vulnerabilities will exist. This conclusion is based on the high cost of the required structural modifications compared to the benefits expected.

The BSEP fire analysis was based on EPRI's Fire-Induced Vulnerability Evaluation methodology. The methodology employs a graduated focus on the most important fire zones using qualitative and quantitative screening criteria (EPRI 1992). The fire zones or compartments were subjected to at least two screening phases. In the first phase, a compartment was screened out if it was found to not contain any equipment or cables associated with safe shutdown or an initiating event. In the second phase, CP&L used the IPE model of internal events to quantify the CDF resulting from a fire-initiating event. The conditional core damage probability associated with each fire compartment was based on the equipment and systems unaffected by the fire. The CDF for each compartment was obtained by multiplying the frequency of a fire in a given fire compartment by the conditional core damage probability associated with that fire compartment.

After the assessment was completed, six fire compartments remained that contributed more than 1×10^{-6} per year. These compartments are:

Fire Compartment	Compartment Description	CDF
CB-21, CB-23	Southwest control room area	1.93×10^{-5}
RB2-1g(NC)	20-ft level reactor building north central area	3.14×10^{-6}
RB2-1g(NW)	20-ft level reactor building north west area	1.58×10^{-6}
CB-06	Unit 2 cable spreading room	1.56×10^{-6}
DG-14	E4 switchgear room	1.10×10^{-6}
DG-9	E8 switchgear room	1.07×10^{-6}

The resulting fire CDF was estimated as 3.62×10^{-5} per year (CP&L 1996a).

The fire CDF is approximately 85 percent of the current internal events CDF. In its ER, CP&L described each of the fire compartments listed above and identified candidate SAMAs to potentially reduce the associated fire risk. As a result, CP&L identified the following potential enhancements that it further considered as SAMAs:

- improvements to the alternate shutdown panel

- improvements to the training operators receive on operating the plant from outside the control room and improvements to ex-control room communications equipment

- addition of automatic fire-suppression system to control room cabinets, in the 20-ft level of the reactor building (north-central and northwest), and in switchgear rooms (E4 and E8)

- prohibiting transient combustibles in the cable spreading room and/or requiring fire-suppression personnel to be present during work that may cause a fire

- improvements to fire barriers between cabinets in the cable spreading room.

The IPEEE analysis of other external events is an update of that performed as part of the 1988 BSEP PSA. The total high-wind-induced CDF was determined to be 4 x 10^{-6} per year. All other external events were determined to contribute less than 1 x 10^{-6} per year to CDF. The high-wind contribution to CDF was caused by failure of the switchyard and the resulting long-term loss of offsite power. While not considered a vulnerability, CP&L reviewed the existing procedures and training and concluded that the ability to cope with a long-term SBO event was adequately addressed (CP&L 1996b). In its ER, CP&L considered enhancements to the switchyard and offsite power connections to prevent damage from high winds; however, such modifications are very expensive (> $25 million). CP&L concluded that no further modifications would be cost-effective for high-wind events.

Because of relatively low contributions from the fire CDF value and other external events, CP&L doubled the benefit derived from the internal events model to account for the contribution from external events. This doubling was not applied to those SAMAs that specifically addressed fire risk (i.e., Phase II SAMAs 30-33). Doubling the benefit for Phase II SAMAs 30-33 is not appropriate because these SAMAs are specific to fire risks and would not have a corresponding benefit on the risk from internal events. The risks discussed above that are caused by external events are the results of analyses that were performed at various times prior to the current BSEP internal events PSA. The methodologies also vary in their degree of completeness and conservatism. Consequently, the results cannot be directly compared with those from the current PSA. Regardless of the above, the staff agrees with CP&L's conclusion that the risks posed by external events is roughly equivalent to the risks from internal events. Therefore, the staff concludes that CP&L's use of a multiplier of two to account for external events is reasonable for the purposes of the SAMA evaluation.

The staff reviewed the general process used by CP&L to translate the results of the Level 1 PSA into containment releases, as well as the results of this Level 2 analysis. CP&L characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 12 release categories, which are defined by the timing and magnitude of the release. The frequency of each release category was obtained from the quantification of a containment event tree for each Level 1 accident sequence. The release characteristics for each release category were obtained from the results of MAAP 4.0.4 analyses of conservatively determined representative sequences for each category. The process for assigning accident sequences to the various release categories and selecting a representative accident sequence for each release category is described in the ER and in response to RAIs (Progress Energy 2005a). The release categories and their frequencies are presented in Tables F-2 through F-4 of the ER (CP&L 2004). In response to an RAI, CP&L described the basis for some of the more significant results. The source terms used to characterize fission product releases for the applicable containment release category are given in Table F-5 of the ER and are stated to be best estimates for the selected sequences. All releases were modeled as occurring at ground level and with a thermal content the same as ambient. CP&L assessed the impact of alternative assumptions (e.g., releases at higher elevations and thermal contents). The results of these sensitivity studies showed that the 50-mi population dose would increase by less than 4 percent. This small increase has a negligible impact on the analysis and its results. The staff concludes that the process used for determining the release category frequencies and source terms is reasonable and appropriate for purposes of the SAMA analysis.

As mentioned previously, the reactor core radionuclide inventory used in the consequence analysis is based on the generic BWR inventory provided in the MACCS2 manual, adjusted to represent the BSEP uprated power level of 2923 MW(t)h. In response to an RAI concerning the impact of current and future fuel management practices, CP&L performed an additional BSEP-specific MACCS2 sensitivity calculation assuming a 65 percent increase in the inventories for strontium-90, cesium-134, and cesium-137. This level of increase was based on a prior calculation for the Nine Mile Point Nuclear Station in which the end-of-cycle activity levels for a bounding case of 1400 effective full-power days were compared to the reference BWR inventories. Use of this increased inventory results in about a 30-percent increase in the total costs associated with a severe accident. Using realistic mid-life or average conditions would result in a smaller increase. CP&L assessed the impact that this change might have on the SAMA screening process and determined that two SAMAs (Phase II SAMAs 13 and 34) could become marginally cost-beneficial. However, these two SAMAs were already identified as potentially cost-beneficial when using a 3-percent real discount rate, as discussed in Section G.6.2. Based on this limited impact, the staff concludes that the scaling based on the plant-specific power level yields sufficiently accurate and reasonable results for the dose assessment.

The staff reviewed the process used by CP&L to extend the containment performance (Level 2) portion of the PSA to an assessment of offsite consequences (essentially a Level 3 PSA). This included consideration of the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within a 50-mi radius for the year 2036, emergency evacuation modeling, and economic data. This information is provided in Appendix F of the ER (CP&L 2004).

CP&L used site-specific meteorological data processed from hourly measurements for the 2001 calendar year as input to the MACCS2 code. The hourly data were collected from the onsite meteorological tower. Data from 1997 through 2001 were also considered, but the 2001 data was found to result in the largest risk and was subsequently used in all MACCS2 risk calculations. The staff concluded that use of the 2001 meteorological data in the SAMA analysis is reasonable.

The population distribution CP&L used as input to the MACCS2 analysis was estimated for the year 2036, based on the U.S. Census population data for 2000 and the expected annual population growth rate (USCB 2000a). The 1990 and 2000 county-level census data were used to estimate the annual population growth rate (USCB 2000b). It was assumed that the growth rate would remain the same as that reported between 1990 and 2000. Using sector-specific population growth rates, projections were made by linearly extrapolating the 2000 sector population data to year 2036. The staff concluded the methods and assumptions for estimating population are reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending 10 mi from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 0.24 meters per second with a delayed start time of 30 minutes (CP&L 2004). This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone. The staff concluded that the evacuation assumptions and analysis are deemed reasonable and acceptable for the purposes of the SAMA evaluation.

Site-specific economic data requiring spatial distributions as input to MACCS2 were prepared by specifying the data for each of the eight counties within 50 mi of the plant. The values used in each of the 160 sectors surrounding the plant corresponded to the county that made up a majority of the land in that sector. For eight sectors, no county encompassed more than two-thirds of the area, conglomerate data (weighted by the fraction of each county in the sector) were defined for these sector. In addition, generic economic data that applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. These included value of farm and non-farm wealth and fraction of farm wealth from improvements (e.g., buildings, equipment). The agricultural economic data were updated using available data from the 1997 Census of Agriculture (USDA 1998). Information on the duration of growing seasons for some crops was obtained from the North Carolina Department of Agriculture, while for other crops the data were taken to be the same as used previously in Southern Nuclear Operating Company's ER for the Edwin I. Hatch Nuclear Plant (SNC 2000).

The staff concludes that the methodology used by CP&L to estimate the offsite consequences for BSEP provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses reported by CP&L.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by CP&L are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

CP&L's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- review of the most significant basic events from the BSEP MOR03 Levels 1 and 2 PSA
- review of Phase II SAMAs from license renewal applications for six other U.S. nuclear sites
- review of potential plant improvements identified in the BSEP IPE and IPEEE
- review of each of the dominant fire compartments, and SAMAs that could potentially reduce the associated fire risk.

Based on this process, an initial set of 43 candidate SAMAs, referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, CP&L performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- the SAMA is not applicable at BSEP because of design differences
- the SAMA would require extensive changes that would involve implementation costs known to exceed any possible benefit
- the SAMA would cost more than $9.6 million to implement (the modified maximum averted cost-risk, which represents the dollar value associated with completely eliminating all internal and external event severe accident risk at both BSEP units).

Based on the above criteria, seven SAMAs were eliminated, leaving 36 for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table F-16 of the ER (CP&L 2004), and were subjected to further evaluation. During Phase II of the evaluation, CP&L screened out some of the remaining SAMA candidates based on plant-specific insights regarding the low-risk significance of systems affected by the SAMA. Seven such SAMAs were screened from further evaluation. Additionally, it was determined that one SAMA had already been implemented, and one SAMA was subsumed by another SAMA. A detailed cost-benefit analysis was performed for each of the 27 remaining SAMA candidates. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of two (except for those SAMAs specific to fire risks because those SAMAs would not have a corresponding benefit on the risk from internal events.)

Of the 27 SAMAs evaluated in the final phase, seven were identified as potentially cost-beneficial in the baseline analysis. Several additional SAMAs were determined to be potentially cost-beneficial when using a 3-percent real discount rate or when accounting for the impact of uncertainties. The remaining SAMAs were evaluated and subsequently eliminated, as described in Sections G.4 and G.6 below.

G.3.2 Review of CP&L's Process

CP&L's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events and fires. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating events and risk-reduction-worth perspectives at BSEP. Selected SAMAs from other nuclear plants were included.

The preliminary review of CP&L's SAMA identification process raised some concerns regarding the completeness of the set of SAMAs identified and the inclusion of plant-specific risk contributors. The staff requested information on certain risk-important events that did not appear to be addressed by a candidate SAMA (NRC 2005). In response to the RAI, CP&L updated tables in its ER to provide a more complete accounting of the SAMAs associated with each of the important basic events (CP&L 2005a). Based on this additional information, the staff concludes that the set of SAMAs evaluated in the ER addresses the major contributors to CDF and offsite dose, and the review of the top risk contributors does not reveal any new SAMAs.

Although the IPE did not identify any vulnerabilities, several procedural improvements and hardware modifications were identified for implementation (NRC 2000). Subsequently, a decision was made by CP&L not to implement two of these improvements (a fifth diesel generator and a dedicated DC power supply for the switchyard breakers). These two improvements were included in the initial list of candidate SAMAs (CP&L 2004).

CP&L identified BSEP-specific candidate SAMAs for fire events using a combination of the BSEP PSA models and the IPEEE. The fire risk at BSEP has been shown to be dominated by control room fires, though several other major contributors were also identified. As a result, six SAMAs were identified and retained for evaluation. Potential plant enhancements for other external events (e.g., high-wind events and transportation and nearby facility accidents) were determined to be too expensive, sufficiently addressed by existing requirements, or bounded by existing scenarios. The staff concludes that CP&L's rationale for eliminating these enhancements from further consideration is reasonable.

By letter dated, February 24, 2005, the staff sent CP&L an RAI about several other candidate SAMAs that were identified as potentially cost-beneficial at other BWR plants but not addressed by CP&L (NRC 2005). In response to the RAI, CP&L provided an assessment of the applicability/feasibility of each of the specific enhancements identified at BSEP by the staff, and concluded that these SAMAs either would not provide a significant benefit at BSEP or are addressed by existing SAMAs for BSEP (Progress Energy 2005a).

The staff notes that the set of SAMAs submitted is not all-inclusive, because additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The staff concludes that CP&L used a systematic and comprehensive process for identifying potential plant improvements for BSEP, and the set of potential plant improvements identified by CP&L is reasonably comprehensive and, therefore, acceptable. This search included reviewing insights from the plant-specific risk studies, reviewing plant improvements considered in previous SAMA analyses, and using the knowledge and experience of its PSA personnel.

G.4 Risk Reduction Potential of Plant Improvements

CP&L evaluated the risk-reduction potential of the 27 remaining SAMAs that were applicable to BSEP. The changes made to the model to quantify the impact of the SAMAs are detailed in Section F.6 of Appendix F to the ER (CP&L 2004) and in the response to an RAI (Progress Energy 2005a). Most of the SAMA evaluations were performed using realistic assumptions with some conservatism. For several of the SAMAs, the risk reduction was based on more bounding assumptions; for example, Phase II SAMA 18 (provide alternate feeds to essential loads directly from an alternate emergency bus) assumes that all loss of emergency 4-kV bus initiating events are eliminated.

CP&L used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the MOR03 version of the BSEP Unit 2 PSA.

Table G-4 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

For those SAMAs that specifically address fire events (i.e., Phase II SAMAs 30-33), the reduction in CDF and population dose was not directly calculated. For these SAMAs, a bounding estimate of the impact of the SAMA was made based on general assumptions regarding the approximate contribution to total risk from external events (relative to that from internal events), the fraction of the external event risk attributable to fire events, and the fraction of the fire risk affected by the SAMA and associated with each fire compartment (based on information from the IPEEE). For example, it is assumed that the contribution to risk from external events is approximately equal to that from internal events, and that fires contribute 75 percent of the external-events risk. The IPEEE fire analysis was then used to identify the fraction of the fire risk that could be eliminated by potential enhancements in various fire compartments. A similar process was applied to the proposed fire enhancements for each fire compartment considered.

The staff reviewed CP&L's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and somewhat conservative (i.e., the estimated risk reduction is similar to what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on CP&L's risk-reduction estimates.

G.5 Cost Impacts of Candidate Plant Improvements

CP&L estimated the costs of implementing the 27 candidate SAMAs through the application of engineering judgement, use of estimates from other licensees' estimates for similar improvements, and development of site-specific cost estimates. To ensure conservatism, the cost estimates did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles. The cost estimates provided in the ER did not generally

Table G-4. SAMA Cost/Benefit Screening Analysis for BSEP

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
1 - Portable generator for DC power	**Increases time available for AC power recovery from time based on loss of turbine-driven injection at battery depletion to the time based on loss of turbine-driven injection at heat capacity temperature limit (HCTL). Credit for portable generator also taken for non-SBO with loss of normal DC supply. A lumped failure probability of 1 x10^{-2} is used to represent operator alignment errors and hardware failure of the portable generator.**	**21**	**18**	**1,613,000**	**2,048,000**	**489,300**
3 - Provide the main control room with the capability to align the required to align the unit auxiliary transformer (UAT) to the emergency buses	Reduces the manipulation time required to align the UAT to the emergency buses following failure of the startup auxiliary transformer from 40 min to 20 min. The human error probability (HEP) for the action was reduced from 1.8 x 10^{-1} to 4.1 x10^{-2} based on reduced time and improved man-machine interface.	0.5	0.7	54,000	70,000	434,800
4 - Direct drive diesel injection pump	Supplements existing high-pressure injection sources and is capable of operating during an SBO. The injection path is defined to be through an existing feedwater injection line. Division II DC power is required for success. A lumped failure probability of 5 x 10^{-2} is used to represent operator alignment errors and hardware failures of the pump.	15	12	1,085,000	1,370,000	4,000,000
5 - Enhanced CRD flow	Results in an increase in the CRD injection flow rate such that it is capable of making up for boil-off even in the early time frame for transient sequences.	13	9	896,000	1,115,000	>1,000,000[1]

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
6 - Proceduralize all potential 4-kV AC bus cross-tie actions	Abnormal operating procedures are updated such that instructions are available to provide power from any given emergency 4-kV AC bus to any other emergency 4-kV AC bus in accident conditions. The existing inter-divisional, cross-tie HEP is used to represent the failure probability of the inter-unit cross-tie actions based on the procedure improvements.	0.7	0.6	51,000	64,000	100,000
10 - Improve procedures/equipment to prevent boron dilution	Upgrades the low-pressure coolant injection controls to allow more precise control over the injection flow rate in an ATWS. The HEP for the flow control action was reduced from 4.3×10^{-2} to 3.4×10^{-2}. The corresponding dependent HEPs were also adjusted to account for the change in the base HEP.	0.5	1	64,000	84,000	434,800
11 - Enhance the main control room (MCR) to include capability to perform 480-V AC substation cross-tie	Improves the HEPs governing the 480-v AC cross-tie actions by reducing the time required to perform the action and by improving man-machine interface of the controls used in the action. The HEP for the cross-tie action was reduced from 6.9×10^{-2} to 2.1×10^{-2}. The corresponding dependent HEPs were also adjusted to account for the change in the base HEP.	1	3	185,000	245,000	434,800

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
12 - Enhance the MCR to include capability to align the alternate DC power supply to specific DC panels	Reduces the HEPs governing the DC alternate power alignment actions by reducing the time required to perform the action and by improving man-machine interface of the controls used in the action. The HEP for the alternate alignment action was reduced from 1.2×10^{-1} to 8.4×10^{-2}. The corresponding dependent HEPs were also adjusted to account for the change in the base HEP.	1	2	115,000	148,000	434,800
13 - Install an inter-unit CRD cross-tie	Credits the use of the opposite unit's CRD system as an additional means of providing high-pressure injection. While not credited for preventing a loss of CRD initiating event or for providing injection during an ATWS, the cross-tie is assumed to be capable of providing makeup for transient cases. A lumped failure probability of 5×10^{-2} is used to represent operator alignment errors and hardware failures of the cross-tie flow path.	6	9	727,000	951,000	836,900
15 - Diverse emergency diesel generators (EDG) HVAC logic	Reduces the failures of EDG HVAC initiation caused by malfunction of the logic systems through the addition of a redundant logic train. A lumped failure probability of 1×10^{-2} is used to represent hardware and support system failures for the alternate logic train.	3	2	226,000	285,000	200,000

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
16 - Diverse swing diesel generators air compressor	Provides a diverse, diesel-driven air compressor that can be used to start any/all of the EDGs given a common cause failure of the normal starting system. Eliminates the common cause failure to start term of EDG starting air compressors.	1	1	111,000	140,000	159,100
17 - Provide alternate feeds to panels supplied only by DC bus 2A-1	**Allows directly supplying the loads for DC Bus 2A-1 with a portable generator given failure of the bus. Only supplies the 2A-1 loads and can be used when the bus has failed. The alignment action is assigned the same 1.2 x 10^{-1} failure probability that is used for similar alternate power source alignments in the model.**	**19**	**13**	**1,287,000**	**1,607,000**	**489,300**
18 - Provide alternate feeds to essential loads directly from an alternate emergency bus	Loss of emergency 4-kV bus initiating events were eliminated.	3	4	315,000	409,000	434,800
19 - Provide an alternate means of supplying the instrument air header	**A portable compressor can be used to mitigate a loss of the instrument air compressors due to either compressor failure or support system failure. A lumped failure probability of 1 x 10^{-2} is used to represent hardware and operator failures to align the portable compressor.**	**4**	**8**	**580,000**	**772,000**	**489,300**
20 - Enhance the MCR to include capability to swap AC power supplies to the battery chargers	Allows the operator to swap AC supplies to the battery chargers from the control room. An HEP of 1 x 10^{-2} is assigned to the action.	1	2	141,000	183,000	434,800

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
21 - Enhance CRD logic	Reduces the probability of loss of CRD system flow by allowing the automatic bypass of the drive path and suction filters given plugging/clogging. The bypass path failure probabilities include events for logic/support system failures (i.e., 5×10^{-4}) and motor-operated valve failures (i.e., 3×10^{-3}).	3	2	202,000	254,000	500,000
22 - Install self-cooled CRD pumps	Eliminates the cooling dependency for the CRD pumps.	1	2	139,000	182,000	500,000
25 - Proceduralize battery charger high-voltage shutdown circuit inhibit	**Allows the operators to prevent the loss of the battery chargers as a DC source when the batteries have failed or are unavailable. A failure probability of 5×10^{-2} is assigned to the HEP used to represent high-voltage shutdown circuit inhibit.**	**9**	**0.5**	**334,000**	**378,000**	**50,000**
29 - Portable EDG fuel oil transfer pump	**Reduces the contribution of sequences involving failure of the existing EDG fuel oil transfer pumps. A lumped failure probability of 1×10^{-2} is used to represent hardware and operator failures for the alignment and operator of the portable fuel transfer pumps.**	**3**	**2**	**207,000**	**260,000**	**186,900**
30 - Improve alternate shutdown panel	Improves operator reliability over the use of the current panel by a factor of five for all control room fire scenarios.	not estimated	not estimated	1,047,000	1,334,000	1,531,900

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
31 - Improved alternate shutdown training and equipment	Improves operator reliability over the use of the current panel by 10 percent for all control room fire scenarios.	not estimated	not estimated	131,000	167,000	250,000
32 - Add automatic fire suppression system	Suppression system is 95 percent effective in eliminating the risk of fires in the 20-ft elevation of the north-central and northwest areas of the reactor building.	not estimated	not estimated	379,000	483,000	750,000
33 - Improve fire barriers between cabinets in the cable spreading room	Eliminates the risk associated with all fires in non-critical cabinets. Prevents the spread of fires to cabinets containing equipment required for the safe shutdown of the plant.	not estimated	not estimated	3,700	4,700	100,000
34 - Provide supplemental power supplies for offsite power recovery after battery depletion during SBO	**Ensures that a means of operating the switchyard circuit breakers is available to recover offsite power after the station batteries have been depleted. Represented by crediting the boildown and fuel heat-up time in the offsite power recovery calculations for long-term SBO calculations (i.e., injection is lost at the time of battery depletion).**	**6**	**5**	**409,000**	**516,000**	**489,300**

Table G-4. (contd)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate ($)	Total Benefit Using 3% Discount Rate ($)	Cost ($)
		CDF	Population Dose			
35 - Use fire-fighting water as a backup for EDG cooling	Reduces the contribution of most loss of EDG cooling sequences by crediting the alignment of fire-fighting water to the EDG cooling system. A lumped failure probability of 1×10^{-2} is used to represent the operator alignment errors and hardware failures of the fire-fighting water cross-tie.	1	0.7	70,000	88,000	2,000,000
36 - Use fire-fighting water as a backup for containment spray	**Reduces the probability of sequences including containment spray failures in the Level 2 PSA model. A lumped failure probability of 5×10^{-1} is used to represent the operator alignment errors and hardware failures of the fire-fighting water cross-tie.**	**1**	**2**	**161,000**	**224,000**	**100,000**
37 - Low-pressure RCIC operation	Credits operation of reactor core isolation cooling (RCIC) after reactor coolant system depressurization at HCTL when power is available for flow control. Operators are always successful in implementing low pressure RCIC injection.	0.4	0.7	53,000	70,000	200,000

SAMAs in bold are potentially cost-beneficial when either a 7-percent or 3-percent real discount rate is used in staff's analysis.

[1] The staff judges the cost of this SAMA to be on the order of $5 million to $10 million.

account for inflation. When using costs estimates prior to 1995, CP&L applied a 2.75 percent per year inflation rate to arrive at year 2003 estimated costs. All cost estimates were indicated to be on a site basis.

The staff reviewed the bases for the CP&L's cost estimates (presented in Section F.3 of Appendix F to the ER). For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The staff reviewed the costs and found them to be consistent with estimates provided in support of other plants' analyses.

The staff questioned CP&L about the cost estimate for Phase II SAMA 1, portable generator for DC power. In the ER, the implementation cost for Phase II SAMA 1 is stated to be for a single-unit site; however, the estimated benefit is based on the risk reduction achieved at both units. In response to the RAI, CP&L stated that it assumed that power cables were installed that could be used to align a portable generator to either unit; however, it was also assumed that the generator would only be used at one unit at a time. Because credit was taken for the enhancement in dual-unit SBO sequences, two generators or a single, larger-capacity generator would be required to achieve the estimated benefit in these events. Because dual-unit SBO accounts for 37 percent of the total CDF compared with only 2.3 percent from single-unit SBO, the design of the SAMA would need to account for simultaneous use at both units to derive the full benefit. CP&L concluded that the cost estimate was, therefore, conservative. The staff considers the cost estimate value in Table G-4, which reflects the cost for one generator, to represent a lower-bound cost.

The staff notes that the cost estimate for Phase I SAMA 1 was also used for several other SAMAs (i.e., Phase II SAMAs 17, 19, and 34) because the cost of those SAMAs was considered to be equivalent to the cost of using portable generators to back up the station batteries. Phase II SAMA 17 – provide alternate feeds to panels supplied only by DC bus 2A-1, and Phase II SAMA 19, provide an alternate means of supplying the instrument air header – would derive most of their benefits from single-unit events. Thus, the cost estimate, which is based on a single, portable generator (or air compressor) that could be connected to either unit, is reasonable for these SAMAs. Phase II SAMA 34 – supplemental power supplies for offsite power recovery after battery depletion during SBO – obtains much benefit from dual-unit SBO events. This SAMA involves providing portable power supplies for the switchyard. DC generators would be used to provide power to operate the power control breakers, while a 480-V AC generator would be used to supply line compressors for breaker support. While one set of power supplies may be sufficient to deal with dual-unit SBO events, both a DC and an AC power supply would be needed. The cost estimate addresses providing only a DC power supply. Consequently, the staff considers the cost estimate for Phase II SAMA 34 to also represent a lower-bound cost.

The staff concludes that the cost estimates provided by CP&L are sufficient and appropriate for use in the SAMA evaluation.

G.6 Cost-Benefit Comparison

CP&L's cost-benefit analysis and the staff's review are described in the following sections.

G.6.1 CP&L's Evaluation

The methodology used by CP&L was based primarily on NRC's guidance for performing cost-benefit analysis, *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184 (NRC 1997a). The guidance involves determining the net value for each SAMA according to the following formula:

$$\text{Net Value} = (\text{APE} + \text{AOC} + \text{AOE} + \text{AOSC}) - \text{COE}$$

where

APE	=	present value of averted public exposure ($)
AOC	=	present value of averted offsite property damage costs ($)
AOE	=	present value of averted occupational exposure costs ($)
AOSC	=	present value of averted onsite costs ($)
COE	=	cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. CP&L's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 was recently revised to reflect the agency's policy on discount rates. Revision 4 states that two sets of estimates should be developed – one at 3 percent and one at 7 percent (NRC 2004). CP&L provided both sets of estimates and indicated that it would consider for further evaluation any SAMA that was cost-beneficial using a 3-percent discount rate (CP&L 2004).

<u>Averted Public Exposure (APE) Costs</u>

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem per year)
x monetary equivalent of unit dose ($2000 per person-rem)
x present value conversion factor (10.76 based on a 20-yr period with a 7-percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997a), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk resulting from a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the license renewal term) of the facility. Thus, it reflects the expected annual loss resulting from a single accident, the possibility that such an accident could occur at any time over the license renewal term, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, CP&L calculated an APE of approximately $632,000 for the 20-yr license renewal term, which assumes elimination of all severe accidents.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

APE = Annual CDF reduction
x offsite economic costs associated with a severe accident (on a per-event basis)
x present value conversion factor.

For the purposes of initial screening, which assumes all severe accidents are eliminated, CP&L calculated an annual offsite economic risk of about $49,000 based on the Level 3 risk analysis. This results in a discounted value of approximately $522,000 for the 20-year license renewal term.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor.

CP&L derived the values for averted occupational exposure from information provided in Section 5.7.3 of NUREG/BR-0184, the regulatory analysis handbook (NRC 1997a). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-yr cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 7-percent, and a time period of 20 yr to represent the license renewal term. For the purposes of initial screening, which assumes all severe accidents are eliminated, CP&L calculated an AOE of approximately $16,000 for the 20-yr license renewal term.

Averted Onsite Costs (AOSC)

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. CP&L derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184 (NRC 1997a).

CP&L divided this cost element into two parts: (1) the onsite cleanup and decontamination cost, commonly referred to as averted cleanup and decontamination costs (ACC), and (2) the replacement power cost.

ACC were calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in NUREG/BR-0184 to be $\$1.1 \times 10^9$ (discounted over a 10-yr cleanup period). This value was integrated over the term of the proposed license extension. For the purposes of the initial screening, which assumes all severe accidents are eliminated, CP&L calculated an ACC of approximately $496,000 for the 20-yr license renewal term.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor.

CP&L based its calculations on the value of 1006 megawatts-electric (MW(e)), which is the current electrical output for BSEP. Therefore, CP&L applied a power scaling factor of 1006 MW(e)/910 MW(e) to determine the RPC. Additionally, CP&L multiplied the RPC by a factor of two based on a conservative assumption that a severe core damage event in one unit would result in shutting down the second unit. This was done to maximize the RPC and provide a slightly conservative assessment of the maximum averted cost risk (MACR). For the purposes of initial screening, which assumes all severe accidents are eliminated, CP&L calculated the RPC to be approximately $731,000 for the 20-yr license renewal term.

Using the above equations, CP&L estimated the total present dollar value equivalent associated with completely eliminating severe accidents at BSEP to be about $2,397,000 for a single unit. Because all SAMA costs and benefits were provided on a site basis, CP&L doubled this value to obtain the two-unit site value of $4,794,000. To account for additional risk reduction in external events, CP&L doubled this value again (to $9,588,000), to provide the modified maximum averted cost risk (MMACR), which represents the dollar value associated with completely eliminating all internal and external event severe accident risk at both BSEP units.

CP&L's Results

If the implementation costs for a candidate SAMA were greater than the MMACR of $9,588,000, then the SAMA was screened from further consideration. A more refined look at the costs and benefits was performed for the remaining SAMAs. If the expected cost for those SAMAs exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 7-percent discount rate), CP&L identified seven potentially cost-beneficial SAMAs. These SAMAs are:

- SAMA 1 – Portable generator for DC power: This SAMA involves the use of a portable generator to supply DC power during an SBO.

- SAMA 15 – Diverse EDG HVAC logic: This SAMA involves the installation of a diverse set of fan actuation logic, which would reduce the reliance of operators to perform a fan start on loss of the automatic actuation logic.

- SAMA 17 – Provide alternative feeds to panels supplied only by DC bus 2A-1: This SAMA involves the installation of alternate DC feeds, which may reduce plant risk through diversification of the power supplies.

- SAMA 19 – Provide an alternate means of supplying the instrument air header: This SAMA involves procurement of an additional portable compressor to be aligned to the supply header to reduce the risk associated with loss of instrument air.

- SAMA 25 – Proceduralize battery charger high-voltage shutdown circuit inhibit: This SAMA involves disabling the charger high-voltage trip circuit when the batteries are disconnected from the DC circuit, thereby preventing the trip and allowing the chargers to remain online.

- SAMA 29 – Portable EDG fuel oil transfer pump: This SAMA provides additional means of supplying the EDG day tank in the event a common cause failure prevents operation of the existing pumps.

- SAMA 36 – Use fire-fighting water as a backup for containment spray: This SAMA would provide redundant containment spray function without the cost of installing a new system.

CP&L performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (CP&L 2004). Based on an analysis using a 3-percent real discount rate, as recommended in NUREG/BR-0058 (NRC 2004), several additional SAMA candidates were determined to be potentially cost-beneficial. If the benefits are increased by approximately a factor of two to account for uncertainties, six additional SAMA candidates (beyond those identified in the 3-percent discount rate case) were determined to be potentially cost-beneficial. The potentially cost-beneficial SAMAs, and CP&L's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of CP&L's Cost-Benefit Evaluation

The cost-benefit analysis performed by CP&L was based primarily on NUREG/BR-0184 (NRC 1997b) and was executed consistent with this guidance.

To account for external events, CP&L multiplied the internal-event benefits by a factor of two for each SAMA, except those SAMAs that specifically address fire risk (Phase II SAMAs 30-33). Doubling the benefit for SAMAs 30-33 is not appropriate because these SAMAs are specific to fire risks and would not have a corresponding benefit on the risk from internal events. Given that the CDF from fires and other external events as reported by CP&L is approximately the same as the CDF for internal events, the staff agrees that the factor of two multiplier for external events is reasonable.

As discussed in Section G.6.1, CP&L applied a multiplier of two to the replacement power cost based on a conservative assumption that a core damage accident in one unit would result in permanent shutdown of the remaining unit. The staff questioned CP&L about the rationale for doubling this cost. In response, CP&L stated this was done to maximize the replacement power costs and provide a slightly conservative assessment of the MACR. CP&L indicated the benefit would be reduced by about 15 percent if loss of power generation from only one unit was assumed in its calculation (Progress Energy 2005a). The staff considers the assumption regarding loss of the second unit to be conservative, because in the majority of events (e.g., those involving an intact containment) the unaffected unit can eventually return to service. For purposes of its evaluation, the staff reassessed the benefits for each SAMA assuming replacement power costs for only a single unit. Table G-4 reflects these adjusted values. The effect of considering replacement power for only one unit does not change the cost-effectiveness of any SAMAs in the baseline analysis; that is, the same seven SAMAs identified as potentially cost-beneficial in Section G.6.1 remain potentially cost-beneficial.

When benefits were evaluated using a 3-percent discount rate, two additional SAMAs were determined to be potentially cost-beneficial in the staff's assessment (i.e., Phase II SAMAs 13 and 34):

- SAMA 13 – Install an inter-unit CRD cross-tie as a potential means of recovering from a loss of CRD at a given unit.

- SAMA 34 – Use DC generators to provide power to operate the power control breakers while a 480-V AC generator could supply the air compressors for breaker support.

In the 3-percent discount rate case presented in its ER, which assumed replacement power costs for both units, CP&L identified these SAMAs as well as SAMAs 16 and 18 as potentially cost-beneficial. Although the latter two SAMAs are not cost-beneficial when replacement power costs are based on loss of a single unit, they become potentially cost-beneficial when the impact of uncertainties is considered, as discussed below.

CP&L considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. Information regarding the uncertainty distribution of the internal events CDF is summarized in Section F.7.2 of the ER (CP&L 2004). In the uncertainty assessment described therein, the 95th percent confidence level for the internal events CDF is approximately 2.35 times the point estimate CDF, while the mean CDF is approximately 2.1 times the point estimate. CP&L re-examined the initial set of SAMAs to determine if any additional Phase I SAMAs would be retained for further analysis if the benefits (and MMACR) were increased by a factor of 2.35. One such SAMA was identified (i.e., Phase I SAMA 25 – additional diesel generator), but based on further consideration of its costs and its limited effectiveness due to common cause failure, CP&L concluded that this SAMA could not be cost-beneficial even if the system was 100 percent reliable. CP&L also considered the impact on the Phase II screening if the estimated benefits were increased by a factor of 2.35 in addition to the factor of two multiplier already included in the baseline benefit estimates to account for external events. Six additional SAMAs became potentially cost-beneficial in CP&L's analysis.

The staff noted that the mean CDF value (8.85 x 10^{-5} per year) and the 95th percentile CDF value (9.83 x 10^{-5} per year) reported in the ER are much closer than typical. Furthermore, the staff noticed that a potentially large number of events were assigned an error factor of 10 in CP&L's uncertainty calculation. Depending on the event, this may be conservative and can skew the results (including the mean and 95th percentile) towards higher values. Therefore, the staff requested an assessment of the impact if the mean rather than the point estimate CDF value were used in the cost-benefit analysis, and if an error factor of 3 instead of 10 were used for these events.

In response to the RAI, CP&L stated that the use of point estimate values is standard practice for the BSEP PSA, and that the 95th percentile value was computed by inputting an error factor of 10 for basic events where a common cause failure, initiator, operator action, or maintenance unavailability event did not have a pre-determined error factor (Progress Energy 2005a). CP&L performed an additional uncertainty analysis in which those error factors initially set at 10 were reset to 3. It stated the purpose of this calculation was to provide a firmer basis for the uncertainty multiplier that is applied to the baseline benefits in the SAMA analysis and the calculation does not necessarily provide a true statistical assessment of data uncertainties in the PSA model. The reduction in the assumed default error factor from 10 to 3 resulted in a 95th percentile value-to-point estimate CDF ratio of 1.89 instead of the factor of 2.35 identified previously, and a reduction in the ratio of the mean-to-point estimate from 2.1 to 1.2. In the staff's view, these results are more typical of the uncertainty distribution from other PSAs; therefore, the staff suggests the use of a multiplier of about two to account for uncertainties is reasonable. Accordingly, the staff assessed the potential impact of uncertainties by applying a multiplier of 2.0 to the estimated benefits in the baseline analysis (based on a 7-percent discount rate). If benefits were doubled to account for uncertainties, six additional SAMAs (beyond the nine SAMAs identified above as potentially cost-beneficial in the baseline and 3-percent discount rate cases) could be cost-beneficial. These additional SAMAs are Phase II SAMAs 6, 16, 18, 30, 31, and 32.

In its ER, CP&L stated that several SAMAs are potentially cost-beneficial and warrant further review for potential implementation; however, it did not specifically identify which SAMAs would be pursued (CP&L 2004). In response to an RAI on this subject, CP&L stated that the SAMAs identified as cost-beneficial in the baseline analysis (i.e., Phase II SAMAs 1, 15, 17, 19, 25, 29, and 36) had been reviewed by the BSEP Plant Review Group (PRG) prior to the submittal of the license renewal application (Progress Energy 2005a). The PRG recognized the high positive impact of implementing SAMA 1, which could affect the cost-effectiveness of the remaining cost-beneficial SAMAs. As a result, CP&L performed a probabilistic evaluation to investigate the impact on the remaining cost-beneficial SAMAs if SAMA 1 were to be implemented. Based on the information provided by CP&L in the RAI response, implementation of SAMA 1 would alter the cost-effectiveness of the remaining SAMAs such that:

- SAMA 17 would no longer be cost-beneficial when a 7-percent discount rate was used; however, it could become cost-beneficial when uncertainties were considered.

- SAMAs 19 and 36 would no longer be cost-beneficial when a 7-percent discount rate was used, nor would they become cost-beneficial when uncertainties were considered.

Also, SAMA 13, which was originally identified as potentially cost-beneficial when a 3-percent discount rate was used, would no longer be cost-beneficial if SAMA 1 is implemented, nor would it become cost-beneficial when uncertainties are considered.

The balance of the SAMAs that were cost-beneficial in the baseline analysis (i.e., Phase II SAMAs 15, 25, and 29) would remain potentially cost-beneficial after implementation of SAMA 1. Although implementation of SAMA 1 may also impact the net value of some of the SAMAs that became cost-beneficial at 3 percent (i.e., Phase II SAMA 34) or when uncertainties were considered (i.e., Phase II SAMAs 6, 16, 18, 30, 31, and 32), CP&L has not completed its assessment of this impact. Thus, these SAMAs may also remain potentially cost-beneficial.

CP&L indicated that a further evaluation of the potentially cost-beneficial SAMA will be performed (Progress Energy 2005b). This assessment will focus on SAMA 1, and those baseline case SAMAs that would remain cost-beneficial if SAMA 1 were implemented (i.e., Phase II SAMAs 15, 25, and 29). In response to the staff's notation that SAMAs other than those in the baseline case may become cost-beneficial when a 3-percent discount rate is used, or when uncertainties are considered, CP&L stated that it will include these SAMAs (i.e., Phase II SAMAs 6, 16, 18, 30, 31, 32, and 34) in the assessment that will make recommendations for the further evaluations of SAMAs (Progress Energy 2005b). Completion of the evaluations is being tracked in the BSEP action tracking system.

The staff notes that all of the potentially cost-beneficial SAMAs identified in either the baseline case or the 3-percent discount rate case (see bolded entries in Table G-4) are included within the set of SAMAs that CP&L plans to further evaluate, with the exception of Phase II SAMAs 13, 19, and 36. As discussed in Section G.2.2, SAMAs 13 and 36 could be impacted by resolution of PSA peer review comments (Phase II SAMAs 6 and 34 would also be impacted but are already among the set of SAMAs to be further evaluated by CP&L). Also, as discussed in Section G.5, the cost estimate for SAMA 19 was based on that for SAMA 1. SAMA 19 involves the addition of an engine-driven air compressor capable of supplying the full instrument air system load. Because the extent of the modifications to accommodate an additional compressor were not detailed in the ER, actual costs may be higher or lower. (Phase II SAMAs 17 and 34 are similarly affected, but are already among the set of SAMAs to be further evaluated by CP&L). Finally, if SAMA 1 is not implemented, these three SAMAs would remain cost-beneficial. Accordingly, the staff recommends these three SAMAs (i.e., Phase II SAMAs 13, 19, and 36) also be further assessed by CP&L as part of its evaluation.

The staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

CP&L compiled a list of 43 SAMAs based on a review of the most significant basic events from the plant-specific PSA, Phase II SAMAs from license renewal activities for other plants, and insights from the plant-specific IPE and IPEEE. A qualitative screening removed SAMA candidates that (1) were not applicable at BSEP because of design differences, (2) would require extensive changes that involve implementation costs known to exceed any possible benefit, or (3) would cost more than $9.6 million to implement (the MMACR). Seven SAMAs were eliminated, leaving 36 for evaluation. Further screenings resulting in removal of nine additional SAMAs, leaving 27 SAMAs for further evaluation.

For each of the remaining 27 SAMA candidates, a more detailed design and cost estimate was developed as shown in Table G-4. The cost-benefit analyses showed that seven of the SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 1, 15, 17, 19, 25, 29, and 36). CP&L performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, eight additional SAMAs were identified as potentially cost-beneficial (SAMAs 6, 13, 16, 18, 30, 31, 32, and 34). CP&L has committed to further evaluate SAMA 1 and SAMAs that may remain potentially cost-beneficial if SAMA 1 is implemented (SAMAs 6, 15, 16, 17, 18, 25, 29, 30, 31, 32, and 34). The staff concluded all of these SAMAs are potentially cost-beneficial. In addition, the staff concluded that SAMAs 13, 19, and 36 are potentially cost-beneficial and may remain so even if SAMA 1 is implemented.

The staff reviewed the CP&L analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by CP&L are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PSA, the likelihood of there being cost-beneficial enhancements in this area was minimized by inclusion of several candidate SAMAs related to dominant fire events, improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The staff concurs with CP&L's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the staff agrees that further evaluation of these SAMAs by CP&L is warranted. However, none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

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Docket Nos. 50-324 and 50-325

11. ABSTRACT *(200 words or less)*

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by the Carolina Power & Light Company (CP&L) (now doing business as Progress Energy Carolinas, Inc.) to renew the OLs for Brunswick Steam Electric Plant, Units 1 and 2 (BSEP) for an additional 20 years under 10 CFR Part 54. This SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

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

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