CHAPTER 10
ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

TABLE OF CONTENTS

Section	Title	Page
10.0	ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION	10-1
10.1	UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS	10-3
10.1.1	CONSTRUCTION	10-3
10.1.2	OPERATION	10-5
10.2	IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES	10-29
10.2.1	IRREVERSIBLE ENVIRONMENTAL COMMITMENTS	10-29
10.2.1.1	Land Use	10-29
10.2.1.2	Hydrological and Water Use	10-31
10.2.1.3	Ecological	10-32
10.2.1.4	Socioeconomic	10-34
10.2.1.5	Atmospheric and Meteorological	10-34
10.2.1.6	Disposal of Hazardous and Radioactively Contaminated Waste	10-34
10.2.1.7	Commitment of Underground Geological Resources for Disposal of Radioactive Spent Fuel	10-35
10.2.1.8	Destruction of Geological Resources during Uranium Mining and Fuel Cycle	10-35
10.2.2	IRRETRIEVABLE MATERIAL COMMITMENTS OF RESOURCES	10-35
10.2.2.1	Construction Materials	10-36
10.2.2.2	Water Resources	10-36
10.2.2.3	Uranium Fuel and Energy Consumption	10-36
10.2.3	REFERENCES	10-37
10.3	RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT	10-43
10.3.1	CONSTRUCTION PREEMPTIONS AND PRODUCTIVITY	10-43
10.3.1.1	Land Use	10-44

TABLE OF CONTENTS (CONTINUED)

Section	Title	Page
10.3.1.2	Appurtenant Infrastructure	10-45
10.3.1.3	Relocated Infrastructure	10-46
10.3.1.4	Air	10-46
10.3.1.5	Water	10-46
10.3.1.6	Terrestrial and Aquatic Ecosystems	10-47
10.3.1.7	Noise	10-48
10.3.1.8	Transmission Lines	10-49
10.3.1.9	Cultural Resources	10-49
10.3.1.10	Socioeconomic	10-50
10.3.1.11	Radiation	10-53
10.3.1.12	Mitigation to Lessen Impacts	10-53
10.3.2	OPERATIONS PREEMPTIONS AND PRODUCTIVITY	10-53
10.3.2.1	Land Use	10-54
10.3.2.2	Relocation and Inundation	10-55
10.3.2.3	Air	10-55
10.3.2.4	Water	10-55
10.3.2.5	Terrestrial and Aquatic Ecosystems	10-56
10.3.2.6	Noise	10-56
10.3.2.7	Transmission	10-57
10.3.2.8	Cultural Resources	10-57
10.3.2.9	Socioeconomic	10-58
10.3.2.10	Radiation	10-61
10.3.2.11	Mitigation to Lessen Impacts	10-61
10.3.3	SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY	10-61
10.3.4	REFERENCES	10-62
10.4	BENEFIT-COST BALANCE	10-64
10.4.1	BENEFITS	10-64
10.4.1.1	Need for Power	10-65
10.4.1.2	Energy Alternatives	10-66
10.4.1.3	Alternative Locations for the Proposed Facility	10-67
10.4.1.4	Benefits of the Proposed Facility	10-69
10.4.2	COSTS	10-71
10.4.2.1	Internal Costs	10-72
10.4.2.2	Monetary – Construction	10-73
10.4.2.3	Monetary – Operation	10-73
10.4.2.4	External Costs	10-75
10.4.3	SUMMARY	10-77

TABLE OF CONTENTS (CONTINUED)

Section	Title	Page
10.4.4	REFERENCES	10-77

LIST OF TABLES

Number	Title
10.1-1	Construction-Related Unavoidable Adverse Environmental Impacts
10.1-2	Operation-Related Unavoidable Adverse Environmental Impacts
10.2-1	Irreversible Environmental Commitments
10.2-2	Uranium Fuel Cycle Environmental Data
10.2-3	Irretrievable Commitments of Resources
10.4-1	Benefit and Costs of the Proposed Project Summarized

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
AADT	average annual daily traffic
ac.	acre
ALARA	as low as reasonably achievable
amsl	above mean sea level
AP1000	Westinghouse Electric Company, LLC's AP1000 Reactor
APE	area of potential effect
BMP	best management practice
CFR	Code of Federal Regulations
Ci	Curie
CO_2e	carbon dioxide equivalent
CWA	Clean Water Act
CWS	circulating water system
dBA	decibel (A-weighted scale)
DCD	Westinghouse Electric Company, LLC, AP1000 Design Control Document, Rev. 16
DSM	demand-side management
EAB	exclusion area boundary

ACRONYMS AND ABBREVIATIONS (CONTINUED)

E&E	Energy and Environmental
E&SCP	Erosion and Sedimentation Control Plan
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ER	Environmental Report
ESRP	Environmental Standard Review Plan
FHWA	Federal Highway Administration
ft.	foot
ft^2	square foot
ft^3/s	cubic foot per second
GEIS	Generic Environmental Impact Statement
gpm	gallons per minute
HAR	proposed Shearon Harris Nuclear Power Plant Units 2 and 3
HAR 2	proposed Shearon Harris Nuclear Power Plant Unit 2
HAR 3	proposed Shearon Harris Nuclear Power Plant Unit 3
HLW	high-level waste
HNP	existing Shearon Harris Nuclear Power Plant Unit 1
IRP	Integrated Resource Plan
km	kilometer
km^2	square kilometer
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour

ACRONYMS AND ABBREVIATIONS (CONTINUED)

lb.	pound
LWR	light-water reactor
m	meter
m^2	square meter
m^3/s	cubic meter per second
mi.	mile
$mi.^2$	square mile
MIT	Massachusetts Institute of Technology
MPCA	Minnesota Pollution Control Agency
msl	mean sea level
MSW	municipal solid waste
MT	Metric Tons
MW	megawatt
MWd/MTU	megawatt days per metric ton Uranium
MWe	megawatt electric
MWh	megawatt hour
MWt	megawatt thermal
NCDENR	North Carolina Department of Environment and Natural Resources
NCNHP	North Carolina Natural Heritage Program
NCUC	North Carolina Utilities Commission
NCWRC	North Carolina Wildlife Resources Commission
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NRC	U.S. Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NGVD29	National Geodetic Vertical Datum of 1929
OECD	Organisation for Economic Co-operation and Development
OSHA	Occupational Safety and Health Administration
PEC	Progress Energy Carolinas, Inc.
PV	photovoltaic
ROI	Region of Interest
ROM	Rough-Order of Magnitude
ROW	right-of-way
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Control, and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan
TLD	thermoluminescent dosimeter
TIA	Transportation Impact Analysis
UC	University of Chicago
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WCPSS	Wake County Public School System

10.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

In accordance with NUREG-1555, Section 10.0, this section provides the environmental consequences of the proposed action. Section 102(c) of the National Environmental Policy Act (NEPA) specifies three special NEPA requirements that an Environmental Impact Statement (EIS) must evaluate. This chapter provides an evaluation of these three requirements, as well as a benefit-cost balance associated with constructing and operating the proposed Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR). The three requirements are evaluated in the following four sections:

- Section 10.1 — Unavoidable Adverse Environmental Impacts
- Section 10.2 — Irreversible and Irretrievable Commitments of Resources
- Section 10.3 — Relationship between Short-Term Uses and Long-Term Productivity of the Human Environment
- Section 10.4 — Benefit-Cost Balance

Sections 10.1, 10.2, and 10.3 are based on the environmental impact evaluations presented in Chapters 4 and 5 of this Environmental Report (ER). This chapter is intended to provide decision-makers with an analysis of issues beyond the evaluation of direct and indirect effects. The information is intended for the decision-maker's use when making decisions regarding the course of action and determining mitigation measures that may be required.

For the purposes of this discussion and consistent with the information presented in other chapters of this ER, the following terms are used:

- **Plant Site**. The plant site is the area within the fence line (Figure 4.0-2). This area includes the footprint of the HAR, including the reactor buildings and generating facilities.
- **HAR Site**. The HAR site is an irregularly shaped area comprised of the following site components: the plant site (area within the fence line), Harris Reservoir, Harris Reservoir perimeter, the dam at Harris Reservoir, the pipeline corridor, and the intake structure and pumphouse (Figure 2.0-2). The HAR site is located within Wake and Chatham counties.
- **Exclusion Zone**. The area within the exclusion area boundary (EAB). The exclusion zone is represented by two circles, each with a radius of 1245 meters (m) (4085 feet [ft.]), centered on the reactor building of each unit (Figure 4.0-3).
- **Pipeline Corridor**. The pipeline corridor includes the Harris Lake makeup water system pipeline and corridor connecting the Harris Reservoir and

the Cape Fear River. The pipeline components will transport makeup water from the Cape Fear River to the Harris Reservoir (Figure 4.0-4).

- **Intake Structure and Pumphouse**. The Harris Lake makeup water system intake structure and pumphouse will be constructed on the Cape Fear River (Figure 4.0-5).

- **Harris Lake**. Harris Lake includes both the Harris Reservoir and the Auxiliary Reservoir.

- **Harris Reservoir**. The Harris Reservoir is also known as the Main Reservoir. It does not include the affiliated Auxiliary Reservoir.

- **Harris Reservoir Perimeter**. The Harris Reservoir perimeter describes the area impacted by the 6-m (20-ft.) change in the reservoir's water level.

- **Transmission Corridors and Off-Site Areas**. Transmission corridors and off-site areas describe areas outside the site boundary that may fall within the footprint of new or existing transmission line corridors.

- **Vicinity**. The vicinity is a band or belt 9.7 kilometers (km) (6 miles [mi.]) wide surrounding the HAR site (Figure 2.0-6). The vicinity includes a much larger tract of land than the HAR site. The vicinity is located within four counties: Wake, Chatham, Harnett, and Lee.

- **Region**. The region applies to the area within an 80-km (50-mi.) radius from the center point of the HAR power block footprint, excluding the site and vicinity (Figure 4.0-6). The following counties are located entirely within the region: Chatham, Durham, Harnett, Lee, Orange, and Wake. The following counties are located partially within the region: Alamance, Caswell, Cumberland, Franklin, Granville, Guilford, Hoke, Johnston, Montgomery, Moore, Nash, Person, Randolph, Richmond, Robeson, Sampson, Scotland, Vance, Wayne, and Wilson. The region includes the economic centers of Raleigh, Durham, Fayetteville, Cary, and Chapel Hill.

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

In accordance with NUREG-1555, Section 10.1, this section provides a summary description of the predicted adverse environmental effects of plant construction and operation that cannot be avoided and for which there are no practical means of mitigation. This section presents the unavoidable adverse impacts that may result from construction and operation of the HAR. The potential environmental consequences of the construction of the HAR and the Harris Lake makeup water system pipeline, as well as those that may occur during regular operation of the facility are identified. After consideration of mitigation procedures, unavoidable adverse impacts that remain are identified and discussed.

Throughout this section, environmental impacts will be assessed using the NRC's three-level standard of significance — SMALL, MODERATE, or LARGE. This standard of significance was developed using the Council on Environmental Quality guidelines 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 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.

10.1.1 CONSTRUCTION

The evaluation in ER Chapter 4 details the potential adverse environmental effects that may be encountered during construction activities and identifies measures to reduce or eliminate these impacts. Progress Energy Carolinas, Inc. (PEC) is committed to limiting, minimizing, and reducing adverse environmental effects during construction activities to the degree possible. In addition, local, state, and federal regulations and guidelines, as well as permit and license requirements, will be met during pre-construction and construction phases. For many of the impacts related to construction activities, mitigation measures that will be applied are referred to as best management practices (BMPs). Typically, BMPs are based on the types of activities that are to be performed and are often implemented through construction planning procedures and permitting requirements. Environmental requirements will be incorporated into construction contracts.

Land Use: Unavoidable adverse impacts associated with construction of the HAR include ground disturbances from grading and recontouring; removal of vegetation; potential degradation of wetlands, streams and rivers, floodplains, and open water shorelines; stockpiling of soils; construction of new structures and the addition of surfaces more impervious to water infiltration, such as parking lots, storage yards, and laydown areas; potential construction of new transmission lines; construction/improvements to area roads and bridges; and generation of waste material. As outlined in ER Chapter 4, approximately 47 hectares (ha) (117 ac. or 0.18 square miles [mi.^{2}]) will be permanently resurfaced for the construction of HAR, and the associated infrastructure and approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) or will be inundated by the proposed increase in the water level of Harris Reservoir. Overall land use impacts would be SMALL.

Water-Related: Unavoidable adverse hydrologic impacts associated with construction of the HAR include alteration of some watershed surfaces; temporary disturbances to the ground surface due to stockpiling soils and construction materials; construction of new structures such as the intake structure, pumphouse, and cofferdams; construction of new impervious surfaces including temporary access roads; removal of vegetation; and dewatering and dredging operations that would potentially affect groundwater levels and surface water drainage characteristics temporarily causing erosion, sedimentation, and subsidence. Aside from the possible lowering of the water table due to the dewatering process, unavoidable adverse effects on water use are limited to those associated with sedimentation in stormwater resulting from construction activities.

Water will be used for construction activities of the HAR. A specific quantity of water usage is not known at this time. However, proper mitigation and management methods implemented during construction will limit the potential water quantity and quality effects to surface water and groundwater. Construction-related effects to surface water resources are relatively small, but represent a natural resource that may no longer be available for use. However. as part of the natural hydrologic cycle, this water is eventually recycled through the ecosystem. Overall construction-related water use impacts will be minimized through the implementation of BMPs during the construction process. Overall water-related impacts would be SMALL.

Terrestrial and Aquatic Ecology: Unavoidable adverse impacts on the terrestrial ecosystem associated with construction of the new unit include noise, clearing and grading, potential collisions of birds with new structures, and the loss of nest boxes and a blue heron rookery along the reservoir's perimeter. Unavoidable adverse impacts to the aquatic ecology include loss of wetlands around the perimeter of the reservoir and temporary loss of habitat and short-term degradation of water quality in isolated areas due to in-water and shoreline work associated with the intake structure, outfalls, and stream crossings. Streams currently flowing into Harris Reservoir will also be inundated due to the increased water level. There is a potential for effects related to

sedimentation or disturbance to spawning or migration of fish in the Cape Fear River; however, these effects will likely be avoided by implementing BMPs during planning and construction. Impacts to vegetative communities associated with clearing 1641 ha (4055 ac. or 6.3 mi.^{2}) around the perimeter of Harris Reservoir will result in MODERATE impacts that will be noticeable but will not destabilize the resource. Impacts on wildlife and aquatic ecology will result in SMALL impacts.

Socioeconomic: None of the socioeconomic effects related to construction of the new unit are expected to be permanent. Temporary unavoidable adverse effects that may occur during construction include minor increases in noise, dust, and fuel emissions that may migrate from the construction sites; an increase in traffic and accidents due to the movement of construction workers, materials, and equipment; and effects to aesthetic, visual, and recreational effects at Harris Reservoir and near the Cape Fear River pumphouse and intake structure. Overall socioeconomic impacts are expected to be SMALL.

Radiological: Unavoidable adverse radiological effects during construction of the new unit are minor and are limited to construction workers. No atmospheric or meteorological effects and no effects to environmental justice are predicted due to the construction of the new reactors and appurtenant structures. Radiological effects would be SMALL.

Environmental Justice: Some of the construction activities may affect minority or low income populations. However, there is no disproportionately high effect on minority or low income populations. Thus, there are no unavoidable adverse environmental effects; therefore, overall environmental justice effects would be SMALL.

Table 10.1-1 provides a summary of the potential environmental effects that could occur during pre-construction and construction of the HAR facility, as well as actions that will be taken to mitigate such effects.

10.1.2 OPERATION

Adverse environmental effects that may be encountered during operation, and the mitigation measures and controls used to reduce or eliminate adverse effects, are discussed in Chapter 5. Operation of the new units is expected to have minor additional effects on the site over those associated with construction. Effects due to appurtenant structures will be primarily attributed to the installation of these features. Operational effects of appurtenant structures are minimal and mostly associated with the cooling system. The expected effects and the mitigation measures that are available to reduce these effects are summarized in Table 10.1-2.

Land Use: Unavoidable adverse effects of operations and land use include an increase in impervious surfaces at the site; minor effects of salt drift, fogging, and icing associated with the cooling towers; and changes in land use associated

with increased operating level of Harris Reservoir. As discussed in Subsection 5.7.4.1, approximately 40.5 ha (100 ac.) of land are committed for fuel cycle activities (Table 10.2-2). As discussed in Subsection 5.5.1.2.1, cold waste will be generated during HAR operation activities that will need to be disposed of in area landfills. It is estimated that employees typically generate approximately 4.8 kg (10.5 pounds [lb.]) of cold waste per employee per day or conversely, 5.9 kg (13 lb.) of waste per 92 square meters (m^2) (1000 square feet [ft^2]) of working area per day, in a commercial environment such as the HAR. Segregation and recycling of waste will be practiced to the greatest extent practical. It is expected that PEC will contract with an outside vendor who will perform weekly collections and disposal at area landfills. The waste is not expected to affect site terrestrial ecology, soil, or groundwater. Finally, land use may be restricted after decommissioning. Overall land use effects would be SMALL.

Water-Related Effects: Unavoidable adverse effects on hydrology and water use are primarily associated with water withdrawal from the Cape Fear River. These effects would be minimized by meeting permit requirements for flow levels, limiting the amount of water withdrawn, and abstaining from water withdrawal during periods of drought. Discharge of cooling water to the Harris Reservoir during operation of the new units will result in a small thermal plume and create the potential for adverse effects. Ensuring permitted limits are met through operational controls and monitoring will minimize the potential for adverse impacts. Water-related impacts would be SMALL.

The proposed project is to install and operate two new Westinghouse Electric Company, LLC (Westinghouse) AP1000 reactors at the HNP. As discussed in Subsection 3.3.2.1, adding the two reactors will require additional water supply for cooling tower evaporation, cooling tower blowdown, service water tower evaporation, service water tower blowdown, sanitary waste discharge, raw water use, demineralizer water discharge, raw water makeup to the demineralizer, and fire protection. It is estimated that the normal consumptive water usage for these activities is approximately 1.77 m^3/sec (62.66 cubic feet per second [ft^3/s]) or 28,122 gallons per minute (gpm). Also, water consumption for fuel cycle activities would require approximately 43,067 million liters (11,377 million gallons) of water (Table 10.2-2).

Terrestrial and Aquatic Ecology: Operation of the new units will result in the discharge of small quantities of chemicals to the Harris Reservoir. Operational controls and monitoring will ensure permit conditions are met, thus minimizing potential effects to aquatic ecology. Unavoidable adverse effects to the terrestrial ecosystems in the vicinity are associated with limited maintenance of access roads and vegetation along the pipeline and transmission line corridors. Unavoidable adverse effects to aquatic ecology in the Cape Fear River and in Harris Reservoir include the potential for transfer and introduction of species due to the Harris Lake makeup water system pipeline. Erosion and sedimentation associated with the Harris Lake makeup water system pipeline and the cooling system may also occur under limited circumstances but will be minimized by use

of appropriate control structures. There will also be unavoidable adverse effects to the forested habitat along the shoreline of Harris Reservoir, including plants that inhabit the land and the displacement of wildlife that use the land, and complete inundation of some stream segments due to the increase in the operating level of the reservoir. Impacts to vegetative communities within the 1641 ha (4055 ac. or 6.3 mi.^{2}) will occur as a result of clearing, as described in Chapter 4, but will be permanently lost once they are inundated. Inundation of forested habitat around the perimeter of Harris Reservoir will result in MODERATE impacts that will be noticeable but will not destabilize the resource. Impacts on wildlife and aquatic ecology will result in SMALL impacts.

Socioeconomic: Unavoidable adverse operational effects are associated primarily with the increased water level in Harris Reservoir and include flooding and relocation of recreational facilities, roads, and training areas. Because these facilities will be relocated, the effects will be minor. In addition, the operation of the new units will create new jobs, which will lead to an increase in traffic on local roads. This is expected to be offset by the increase in tax base associated with the new units. Overall, socioeconomic effects would be SMALL.

Radiological: Unavoidable adverse radiological effects associated with the fuel cycle are insignificant in comparison to background radiation. Control actions such as monitoring and the ongoing collection of air and water samples will ensure that radiological effects are minimized during operation. Landfills and other site uses may be restricted after decommissioning. Radiological effects are expected to be SMALL.

Environmental Justice: Some of the activities affect minority or low income populations. However, there is no disproportionately high effect on minority or low income populations. Thus, there are no unavoidable adverse effects with respect to the goals of Environmental Justice and are therefore SMALL.

Table 10.1-2 provides a description of the potential minor environmental effects that may occur during regular facility operations, as well as actions that will be taken to mitigate such effects. A more detailed discussion of the proposed potential effects during normal facility operation can be found in ER Chapter 5.

Table 10.1-1 (Sheet 1 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Land Use	• Removal of existing vegetation. • Potential impacts to wetlands, intermittent and perennial streams, rivers, 100-year floodplains, and open water shoreline. • Stockpiling of soils on site. • Storage yards and laydown areas of construction materials. • Construction of new structures, new roads/bridges, and impervious surfaces (e.g., parking lots, laydown areas). • Generation of waste material from construction and right-of-way (ROW) clearing operations. • Ground-disturbing activities including grading, excavation, and re-contouring. As outlined in Chapter 4, approximately 47 ha (118 ac. or 0.18 mi.^{2}) will be permanently re-surfaced for the construction of HAR 2, HAR 3, and associated infrastructure and approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) or will be inundated by the proposed increase in the water level of Harris Reservoir. SMALL	• Conduct ground-disturbing activities in accordance with regulatory and permit requirements. • Use adequate and approved erosion controls and stabilization measures to minimize impacts as described in the Erosion and Sedimentation Control Plan (E&SCP). • Follow procedures in Spill Prevention, Control, and Countermeasures Plan (SPCC) to address the handling of fuel and other materials. • Minimize potential impacts to HAR site through avoidance and compliance with applicable permitting requirements and BMPs. • Restrict construction activities to HAR site. • Use local Native Plant Rescue Group, when appropriate, to relocate sensitive vegetative species from construction zones. • Control access of construction traffic to HAR site. • Develop and implement a blasting plan addressing scheduling, charge size, noise, and other procedures, if necessary. • Avoid disturbance of critical or sensitive habitats/species. • Maximize practical use of existing ROW access roads. • Use existing property, to the extent possible, already in service for HAR construction and at existing substations for storage and material laydown areas. • Adhere to applicable federal, state, and local regulations and permit requirements with regard to seasonal restrictions for in-water work, installation of appropriate erosion control measures, drainage controls to convey stream flow, and construction stormwater management. • Limit vegetation cutting and removal and herbicide application. • Retain vegetated screen at ROW and other linear junctions. • Dispose of clearing waste material at landfill, use as windrow along ROW or as ground cover to prevent erosion. • Use existing PEC procedures that require contacting the appropriate federal, state, or tribal regulatory agencies following a discovery of potential historic or archeological resources.	• Ground disturbances associated with grading and re-contouring. As outlined in Chapter 4, approximately 0.48 km^2 (118 ac. or 0.18 mi.^{2}) will be permanently re-surfaced for the construction of HAR 2, HAR 3, and associated infrastructure. Approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) or will be inundated by the proposed increase in the water level of Harris Reservoir. • Removal of existing vegetation. • Impacts to wetland, streams and rivers, floodplains, and open water shoreline. • Stockpiling of soils. • Construction of new structures, new roads/bridges, and impervious surfaces. • Storage yards and laydown areas. • Potential construction of new transmission lines. SMALL

Table 10.1-1 (Sheet 2 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Land Use (cont.)		• Conduct a cultural resource assessment and consult with State Historic Preservation Office (SHPO). • If necessary, conduct sub-surface testing prior to initiating ground-disturbing activities to identify any buried historic or archeological resources. • Take appropriate actions (e.g., stop work) following discovery of potential historic or archeological resources.	
Water-Related Impacts	• Alteration of existing watershed surface, including buildings, structures, and impervious surfaces (e.g., parking lots, laydown areas). • Temporary disturbance of ground surface for soil stockpiles and construction material storage. • Dewatering, dredging, and other operations temporarily affecting water levels. • Removal of existing trees and vegetation. • Potential changes in surface water drainage characteristics and groundwater levels from dewatering. • Erosion and sedimentation and subsidence from construction groundwater dewatering. • Potential impacts from releases of fuel, oils, or other chemicals associated with construction to surface or ground water.	• Adhere to applicable federal, state, and local regulations and permit requirements with regard to seasonal restrictions for in-water work, installation of appropriate erosion control measures, drainage controls to convey stream flow, and construction stormwater management. • Limit tree and vegetation cutting and removal to the minimum necessary to satisfy construction access and clearance for construction zones. • Install drainage controls (e.g., channels) to direct stormwater runoff. • Install temporary sump pump system for intermittent use for excavation dewatering control during construction. • Design and install appropriate barrier (e.g., turbidity curtain in Cape Fear River near intake structure work location and in Harris Reservoir near HAR site work location) to prevent turbid water from migrating into the Cape Fear River and Harris Reservoir. • Conduct ground-disturbing activities in accordance with regulatory and permit requirements.	• Alteration of some watershed surfaces such as buildings and other impervious surfaces. • Water used for construction-related activities of the HAR and associated structures. • Temporary disturbances to the ground surface for the purpose of stockpiling soils and construction materials. • Construction of new structures such as the intake structure, pumphouse, and cofferdams. • Construction of new impervious surfaces including temporary access roads. • Removal of vegetation. • Dewatering and dredging operations that will potentially temporarily affect groundwater levels and surface water drainage characteristics and may cause erosion, sedimentation, and subsidence. • Sedimentation in stormwater and potential releases of fuels, oils, or other chemicals during construction activities. SMALL

Table 10.1-1 (Sheet 3 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impact	Potential Mitigation Measures	Unavoidable Adverse Impact
Water-Related Impacts (cont.)	• Potential impacts from increased sediment loading in stormwater runoff to Harris Reservoir, Cape Fear River, and intermittent and perennial streams. • Potential effect to local water table because of construction dewatering activities. SMALL	• Use adequate and approved erosion controls and stabilization measures to minimize impacts and control sediment loads and dust from the construction zones as described in the E&SCP. • Follow procedures in SPCC to address the handling of fuel and other materials. • Develop and implement a blasting plan addressing scheduling, charge size, noise, and other procedures, if necessary. • Develop and implement a construction stormwater pollution prevention plan (SWPPP) and spill response plan during construction at the HAR site and at construction zones. • Implement an E&SCP that describes use of approved/recognized BMP. • Limit dewatering activities only to those necessary for construction. • Install system of on-site monitoring. • Install wells and piezometers to evaluate local groundwater resources.	
Terrestrial and Aquatic Ecology	• Clearing and grading activities and habitat loss will displace existing mobile animals such as birds and larger mammals from construction zones. Wildlife (e.g., birds, small mammals) may be startled or frightened away by noisy construction activities. • Potential impacts from avian collisions with manufactured structures (e.g., cranes, buildings) during construction.	• Conduct ground-disturbing activities in accordance with federal, state, and local regulatory and permit requirements. • Minimize potential effects to construction zones through avoidance and compliance with applicable permitting requirements and BMPs.	• Noise. • Loss of terrestrial habitat resulting from clearing and grading. • Potential collisions of birds with new structures. • Loss of nest boxes and a blue heron rookery along the reservoir's perimeter. • Loss of wetlands around the perimeter of the reservoir and temporary loss of habitat and degraded water quality due to in-water and shoreline work associated with the intake structure, outfalls, and stream crossings.

Table 10.1-1 (Sheet 4 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Terrestrial and Aquatic Ecology (cont.)	• Construction zone impacts to vegetative diversity, wildlife habitat, sensitive wildlife species (e.g., red-cockaded woodpeckers), and loss of North Carolina Waterfowl Association bird nesting boxes around the shore of Harris Reservoir. • Loss of blue heron rookery along shore of Harris Reservoir. • Potential impacts on surface water from releases of fuel, oils, or other chemicals associated with construction to surface water. • Potential impacts on the Cape Fear River, Harris Reservoir, and intermittent and perennial streams from increased sediment loading. • Temporarily degraded water quality because of in-water and shoreline work for the proposed intake structure, pumphouse, outfall/discharge structure, and Harris Lake makeup water system pipeline. • Temporary loss of benthic habitat and organisms near proposed intake structure and at stream crossings. • Permanent loss of wetlands in Harris Reservoir. • Potential impact from re-entrainment of sediments into the water column. • Impacts to overwintering fish and spawning fish in Cape Fear River. • Terrestrial ecology impacts would be SMALL for wildlife and MODERATE for the clearing of 1641 ha (4055 ac. or 6.3 mi.^{2}) of vegetative communities around the perimeter of Harris Reservoir. • Aquatic ecology impacts would be SMALL. SMALL to MODERATE	• Limit tree and vegetation removal to the minimum necessary to satisfy construction access and clearance for construction zones, restrict soil stockpiling and re-use, and restrict construction activities to construction zones. • Avoid interfering with red-cockaded woodpeckers (federally protected) by limiting timber harvesting near nesting areas and educating timber harvesters. • Coordinate with U.S. Fish and Wildlife Service (USFWS) and North Carolina Wildlife Resources Commission (NCWRC) to identify other federally or State-listed species within HAR site and vicinity. • Locate culvert crossings strategically and establish corridors to reduce wildlife fragmentation effects. • Adhere to seasonal restrictions on in-water construction activities to minimize effects in surface water bodies and wetlands. • Consult with USFWS and NCWRC about blue heron rookery prior to initiating construction. • Consider limiting logging and construction activities near the existing blue heron rookery during nesting season. • Develop and implement a construction SWPPP and spill response plan during construction at the HAR site and other construction zones. • Implement an E&SCP that adequately describes use of approved/recognized water quality BMP for addressing potential effects in construction zones.	• Potential sedimentation, or fuel or chemical release. • Disturbance to spawning or migration of fish in the Cape Fear River. • Terrestrial ecology impacts would be SMALL for wildlife and MODERATE for clearing of 1641 ha (4055 ac.) of vegetative communities around the perimeter of Harris Reservoir. • Aquatic ecology impacts would be SMALL. SMALL to MODERATE

Table 10.1-1 (Sheet 5 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Terrestrial and Aquatic Ecology (cont.)		• Design and install appropriate barriers (e.g., turbidity curtain in Cape Fear River near intake structure work location and in Harris Reservoir near HAR site work location) to prevent turbid water from migrating into the surface water bodies. • Consult with USFWS and NCWRC about federally listed fish and mussel species, and critical fish spawning times, prior to initiating construction. • Consult with USFWS and NCWRC for consideration of appropriate fish aversion technologies to reduce fish impingement and entrainment, and measures to minimize impacts to fish movement, as needed.	
Socioeconomic	• Potential temporary and limited impact to sensitive populations because of noise, fugitive dust, and gaseous emissions resulting from construction activities. • Potential for traffic accidents with increased construction traffic near the construction zones. • Temporary aesthetic and visual impacts at Harris Reservoir and Cape Fear River. • Potential impacts on existing transportation network near the construction area. • General increase in construction equipment and material deliveries. • Temporary impacts to recreation uses on Harris Reservoir, Cape Fear River, and Harris County Lake Park. • Construction will have a MODERATE beneficial impact on the local economy. SMALL to MODERATE	• Train and appropriately protect HAR site and temporary construction personnel (i.e., those most directly and frequently affected by construction noise, dust, and gaseous emissions) to reduce the risk of potential harmful exposures from noise, dust, and gaseous emissions. • Provide on-site services for emergency first aid care and conduct regular health and safety monitoring for affected personnel on site. • Post signs at or near construction entrances and exits to make the public aware of potentially high construction traffic areas. • Make public announcements and/or notifications before conducting atypical or noisy construction activities (e.g., pile driving). • Use normal dust control measures (e.g., watering, stabilizing disturbed areas, covering truckloads).	• Noise, dust, and fuel emissions that may migrate from the construction sites. • Increase in traffic and accidents due to the movement of construction workers, materials, and equipment. • Impacts to aesthetic, visual, and recreational impacts at Harris Reservoir and near the Cape Fear River pumphouse and intake structure. • Construction will have a MODERATE beneficial impact on the local economy. SMALL to MODERATE

Table 10.1-1 (Sheet 6 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Socioeconomic (cont.)		• Manage concerns from adjacent residents, business owners, or landowners, on a case-by-case basis through a PEC-prepared concern resolution process. • Design and install appropriate barrier (e.g., turbidity curtain in Cape Fear River near intake structure work location and in Harris Reservoir near HAR site work location) to prevent turbid water from migrating into the surface water bodies. • Develop a construction traffic management plan prior to construction to address potential impacts on local roadways. • Encourage the use of shared (e.g., carpooling) and multi-person transport (e.g., buses) of construction personnel to the construction sites. • Coordinate schedules during workforce shift changes to limit impacts on local roads. • Schedule delivery of larger pieces of equipment or structures on off-peak traffic hours (e.g., at night) or through other transportation modes. • Consider coordinating with local planning authorities for the upgrading of local roads, intersections, and signals to handle increased traffic loads, if necessary. • Provide local planning and recreation agencies with normal operation construction schedule prior to construction to allow for notification to local recreation users.	

Table 10.1-1 (Sheet 7 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Radiological	• Potential for radiological dose effects to HAR site construction workers because of construction activities within the HNP restricted area boundary. • Potential for exposure of construction workers to direct radiation and to the radioactive effluents from sources resulting from HNP routine operation (e.g., cycled condensates and concentrates, N-16 radiation from the turbine building). SMALL	• Establish administrative controls and plant procedures for maintaining the doses from radiation sources and facilities during normal operations within regulatory limits and as low as reasonably achievable (ALARA). • Locate temporary facilities (such as trailers, tents, and Sea-Land containers) in areas outside of plant structures. • Provide on-site services for emergency first aid care and conduct regular health and safety monitoring for affected personnel on-site. • Use 16 protected area fence line thermoluminescent dosimeter (TLD) locations as the basis for monitoring construction workers because, for the majority of time during construction, workers will be located much farther from the HNP operating radiation sources than the distances reflected in the protected area fence TLD locations.	• Potential for radiological exposure limited to construction workers. SMALL
Environmental Justice	• Some activities affect minority or low income populations. SMALL	• There is no disproportionate high impact on minority or low income populations.	• No unavoidable adverse impacts. SMALL

Table 10.1-2 (Sheet 1 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Land Use	• Impacts from operation of the proposed facility and appurtenant facilities. • Cooling and heat dissipation systems impacts. • Secondary impacts to structures and facilities in the vicinity of the proposed facility by the inundation of Harris Reservoir including, but not limited to, park land, picnic areas, firing ranges, roads, structures, and transmission tower bases. • Operation impacts within transmission corridors and off-site areas. • Historic property impacts. • Approximately 40.5 hectares (100 acres) of land is committed for fuel cycle activities. • It is estimated that employees typically generate approximately 4.8 kg (10.5 lb.) of cold waste per employee per day or conversely, 5.9 kg (13 lb.) of waste per 92 m^2 (1,000 ft^2) of working area per day, in a commercial environment such as the HAR. SMALL	• Transport impervious surface (e.g., parking lots, laydown areas) runoff and/or sediment to adjacent areas as defined in the National Pollutant Discharge Elimination System (NPDES) permit. • Install stormwater ditches and storm sewers to collect the increased runoff from impervious areas. • Follow procedures in SPCC to address the handling of fuel and other materials. • Minimize potential impacts through avoidance and compliance with applicable federal, state, and local regulations and permit requirements and the use of BMPs. • Segregate and recycle waste to the greatest extent practical. It is expected that PEC will contract with an outside vendor who will perform weekly collections and disposal at area landfills. • Potential impacts to land use from cooling towers are primarily related to salt drift. It is assumed that new cooling towers would produce salt concentrations similar to the existing cooling tower at the site. • Limit impacts to maintenance of access roads and vegetation, as required, for maintenance and repair of the pipeline. These maintenance activities will take place on pre-exiting road and transmission line ROWs, and are not expected to cause any significant land use impacts. • Monitor the pipeline to ensure erosion control measures are in place (i.e., impacts from runoff are minimized and restoration activities are adequate and effective).	• Increase in impervious surfaces at the site. • Salt drift, fogging, and icing associated with the cooling towers. • Changes in land use associated with lake level rise. • Approximately 40.5 hectares (100 acres) of land are committed for fuel cycle activities. • It is estimated that employees typically generate approximately 4.8 kg (10.5 lb.) of cold waste per employee per day or conversely, 5.9 kg (13 lb.) of waste per 92 m^2 (1000 ft^2) of working area per day, in a commercial environment such as the HAR. • Restricted land uses after decommissioning. SMALL

Table 10.1-2 (Sheet 2 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Land Use (cont.)		• Design and operate the discharge in a manner that would ensure dissipation of water energy so that erosion of the surrounding area and suspension of bottom sediments is prevented. • Use adequate and approved erosion controls and stabilization measures to minimize impacts, as described in the E&SCP, such as stabilization methods or seeding and erosion control matting that will be installed immediately following construction. • Perform monitoring that will be required per the NPDES permit during operations to ensure appropriate controls are in place to prevent sedimentation of the Cape Fear River. • Perform monitoring that will be required to determine effects of water withdrawal on population dynamics in the Cape Fear River from the intake structure and pumphouse. • Ensure all operational monitoring, as well as monitoring of wetland areas created for mitigation purposes, will be designed to Clean Water Act (CWA) 404/401 permit requirements. • Follow specific monitoring requirements for operational activities affecting wetlands, floodplains, and other natural areas that will require monitoring as specified in the permits, or as designated by appropriate agencies. • Replace the affected infrastructure features with similar infrastructure in non-affected areas nearby. The result of these mitigation efforts would be no net loss in the resource area or associated functional value.	

Table 10.1-2 (Sheet 3 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Land Use (cont.)		• Ensure relocation and/or rebuilding of structures occurs prior to or after inundation. Long-term land-use impacts are expected to be insignificant after these facilities have been relocated. • Construct flood protection dyke. A flood protection dyke is proposed to be built around the PEC Energy and Environmental (E&E) Center. This will prevent the need for relocation of some facilities at the E&E Center. • Ensure towers are relocated to an existing corridor or ROW. If a tower must be relocated, the new tower would be placed in an existing corridor or ROW. These structures might require relocation and/or new foundations depending on future soil conditions. Impacts to land use due to transmission line modifications are expected to be minimal. • Place permanent buoys and warning signs in appropriate locations if transmission towers that are going to be inundated will pose either a permanent threat to boaters or a threat during low water events. • Ensure PEC finds an alternate location for the impacted portions of the park, as close to the original location as possible. The potential sites of park relocation are composed of U.S. Geological Survey (USGS) land use designations that are very similar to the current location (primarily evergreen forest, deciduous forest, and mixed forest). Therefore, there would be no long-term effect on land use from relocating park infrastructure. Short-term impacts on land use are expected to be minor and temporary until the permanent locations can be established.	

Table 10.1-2 (Sheet 4 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
		• Provide local planning and recreation agencies with normal operation schedule to allow for notification to local recreation users of any potential change in land usage • Manage concerns from adjacent residents, business owners, landowners, and/or recreation users on a case-by-case basis through a PEC-prepared concern resolution process. • Design specific monitoring requirements for new transmission lines and corridors, and associated switchyards to meet conditions of permits, to minimize adverse environmental impacts, and to ensure that organisms are protected against transmission line alterations. • Conduct seasonally appropriate annual surveys for species of interest that inhabit areas and habitat types bisected by current and proposed transmission lines. • Follow applicable procedures to address the handling of fuel and other materials. Use adequate and approved erosion controls and stabilization measures to minimize impacts. • PEC will consult with the North Caroline SHPO to comply with Section 106 of the National Historic Preservation Act. • Conduct investigations to identify the full extent of historic properties and cultural resources in the area of potential effects (APE).	•

Table 10.1-2 (Sheet 5 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Water-Related Impacts	• Adequate water supply from freshwater streams, lake, impoundment, and groundwater to meet water withdrawal criteria. • It is estimated that the normal consumptive water usage for the HAR is approximately 1.77 m^3/s (62.66 ft^3/s) or 28,122 gpm. Also, water consumption for fuel cycle activities would require approximately 43,067 million liters (11,377 million gallons) of water. • Diminished water quality. • Potential impacts to wetlands, intermittent and perennial streams, rivers, 100-year floodplains, and open water shoreline, and protected mussels and fish. • Hydrodynamic impacts. • Aquatic impacts. • Thermal discharge. SMALL	• Adhere to applicable federal, state, and local regulations and permit requirements with regard to water usage. The plant will be required to register their withdrawal with the North Carolina Department of Environment and Natural Resources (NCDENR). • Use the hydrologic model developed by the North Carolina Division of Water Resources, the Cape Fear River Basin Model, to help evaluate operational withdrawals under different conditions such as with a severe drought similar to one that occurred in 2002. • Avoid removal of water from the Cape Fear River and Buckhorn Creek during sensitive spawning periods and/or during drought conditions. During severe drought periods, plant water use requirements would be met for a period of time by using available reservoir storage. • Design operational monitoring for Harris Lake to identify impacts from the operation of the HAR. • Monitor for changes in the discharge from Harris Reservoir to Buckhorn Creek. Minimum water flow levels will be adhered to in order to protect sensitive habitat areas. • Conduct operational monitoring to detect any chemical impacts to surface water and groundwater that could result from facility operation.	• Alteration of flow in the Cape Fear River due to water withdrawals. • It is estimated that the normal consumptive water usage for the HAR is approximately 1.77 m^3/s (62.66 ft^3/s) or 28,122 gpm. Also, water consumption for fuel cycle activities would require approximately 43,067 million liters (11,377 million gallons) of water. • Thermal discharge from operation of the HAR units will be maintained below permitted limits. SMALL

Table 10.1-2 (Sheet 6 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Water-Related Impacts (cont.)		• Develop specific elements for the assessment of surface water quality in consultation with the NCDENR, relative to NPDES permit requirements (renewal) and with consideration of monitoring presently being conducted for HNP. • Perform monitoring which will provide data necessary to assess alterations of surface water flow fields in Harris Reservoir (namely the cooling loop), sediment transport, floodplains or wetlands. Monitoring in compliance with the CWA 404/401 permits would be required for any future post- construction dredging activities occurring on the Cape Fear River to protect affected mussel species. • Coordinate with state agencies that may require a minimum flow in freshwater streams to maintain habitat. Harris Reservoir will also need to be maintained as fully supporting aquatic life. • Determine other operations that require monitoring. Other operations that may require monitoring include intake and discharge of cooling water and intake of makeup water. Permits will be required for operation activities, and specific monitoring requirements will be listed in the permits. • Monitor drawdown during operation to ensure water quality is not affected adversely. • Perform monitoring to determine effects of water withdrawal on population dynamics in the Cape Fear River from the intake structure and pumphouse. Design all operational monitoring, as well as monitoring of wetland areas created for mitigation purposes, to meet CWA 404/401 permit requirements.	

Table 10.1-2 (Sheet 7 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Water-Related Impacts (cont.)		• Follow specific monitoring requirements for operational activities affecting wetlands, floodplains, and other natural areas that will require monitoring as specified in the permits, or as designated by appropriate agencies. Monitoring may include seasonally appropriate surveys conducted for species of interest which inhabit areas and habitat types, yearly monitoring of stream crossings, and yearly monitoring for potential receptors and target species. • Coordinate with USFWS and NCWRC to identify other federally or State-listed species within HAR site and vicinity. • Design specific monitoring requirements to meet conditions of the CWA 316b permit to minimize adverse environmental impact and to ensure that organisms will be protected against the cooling water intake structures. • Perform monitoring to provide data to help assess overall water quality of Harris Reservoir, identify any natural or power plant-induced effects on reservoir water quality, document introduction and expansion of nonnative plant and animal populations in the reservoir, determine aquatic flora and fauna, evaluate sensitive habitat and species of interest, and monitor reasonable recreational fishery. • Design all operational monitoring, as well as monitoring of wetland areas created for mitigation purposes, to meet CWA 404/401 permit requirements. • Minimize potential impacts through avoidance, compliance with applicable federal, state, local regulations and permit requirements, and use of BMPs.	

Table 10.1-2 (Sheet 8 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Water-Related Impacts (cont.)		• Implement operational monitoring to establish changes in water temperature resulting from HAR facility operation. The specific operational monitoring requirements will be developed in consultation with NCDENR, relative to NPDES permit requirements and the monitoring requirements for HNP and the HAR. • Minimize potential impacts through avoidance, compliance with applicable federal, state, and local regulations and permit requirements, and the use of BMPs. • Coordinate with USFWS and NCWRC to identify other federally or State-listed species within the HAR site and vicinity to avoid potential impacts.	
Terrestrial and Aquatic Ecology	• Aquatic impacts from construction at HAR site, Cape Fear River and clearing around Harris Reservoir will be SMALL. • Terrestrial ecosystem impacts will be MODERATE due to inundation of 1641 ha (4055 ac.) around the perimeter of Harris Reservoir. • Radiation impacts to the biota will be SMALL. • Impacts from transmission lines SMALL. SMALL to MODERATE	• Develop the aquatic monitoring program for Harris Reservoir and associated streams to support and satisfy various environmental regulations, licenses, and permits associated with operation. • Monitoring will provide data to help assess overall water quality of Harris Reservoir, identify any natural or power plant-induced effects on reservoir water quality, document the introduction and expansion of nonnative plant and animal populations in the reservoir, determine aquatic flora and fauna, evaluate sensitive habitat and species of interest, and monitor reasonable recreational fishery. • Permits will be required for operation activities, and specific monitoring requirements will be listed in the permits. Harris Reservoir will be monitored during operation to ensure that water withdrawal remains within operating parameters. Drawdown will be monitored during operation to ensure water quality is not affected adversely.	• Discharge of small quantities of chemicals to Harris Reservoir. SMALL • Discharges will be maintained below permitted levels to minimize adverse impacts. SMALL • Limited maintenance of access roads and vegetation along the pipeline and transmission line corridors. SMALL • Transfer and introduction of species due to the Harris Lake makeup water system pipeline. SMALL • Erosion and sedimentation associated with the Harris Lake makeup water system pipeline and the cooling system. SMALL • Terrestrial ecosystem impacts will be MODERATE due to inundation of 1641 ha (4055 ac.) around the perimeter of Harris Reservoir. SMALL to MODERATE

Table 10.1-2 (Sheet 9 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Terrestrial and Aquatic Ecology (cont.)		• Monitoring will be required to determine effects of water withdrawal on population dynamics in the Cape Fear River from the intake structure and pumphouse. • Design all operational monitoring, as well as monitoring of wetland areas created for mitigation purposes, to meet CWA 404/401 permit requirements. • Follow specific monitoring requirements for operational activities affecting wetlands, floodplains, and other natural areas that will require monitoring as specified in the permits, or as designated by appropriate agencies. • Minimize potential impacts through avoidance, compliance with applicable federal, state, and local regulations and permit requirements, and the use of BMPs. • Conduct surveys to monitor soil and terrestrial plant and animal communities as needed to supplement the existing program. • Perform operational monitoring which will consist of specific permit requirements such as air and effluent monitoring, and specifically follow NPDES and CWA permit requirements. • Perform monitoring which will provide data to help assess overall water quality of Harris Reservoir, identify any natural or power plant-induced effects on reservoir water quality, document the introduction and expansion of nonnative plant and animal populations in the reservoir, determine aquatic flora and fauna, evaluate sensitive habitat and species of interest, and monitor reasonable recreational fishery. • Collect aquatic vegetation, fish, and sediments to detect the presence of any radioisotopes related to the operation of the HAR.	

Table 10.1-2 (Sheet 10 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Terrestrial and Aquatic Ecology (cont.)		• Limit impacts from maintenance of access roads and vegetation as required for maintenance and repair of the pipeline. These maintenance activities will take place on pre-existing road and transmission line ROWs, and are not expected to cause any significant impacts. • Design specific monitoring requirements for new transmission lines and corridors and associated switchyards to meet conditions of permits, minimize adverse environmental impacts, and ensure that organisms are protected against transmission line alterations. • Conduct seasonally appropriate annual surveys for species of interest that inhabit areas and habitat types bisected by current and proposed transmission lines. • Design specific monitoring requirements for new transmission lines and corridors, and associated switchyards to meet conditions of permits, to minimize adverse environmental impacts, and to ensure that organisms are protected against transmission line alterations. • Obtain federal, state and local permits before installation of transmission lines at wetland and stream crossings. Wetlands would be delineated and regulatory status determined according to CWA 404/401permit requirements; regulated wetlands would be mitigated in accordance with these permit requirements. Stream and channel crossings will be monitored to ensure that adequate restoration has been implemented.	

Table 10.1-2 (Sheet 11 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Impact
Socioeconomic	• Impacts to the public. SMALL • Impacts from transmission systems. SMALL • Noise. SMALL • Visual Intrusion. SMALL • Traffic. SMALL • Potential impacts on existing transportation network, public services/facilities, infrastructure (transportation, roads, housing, schools, and recreation facilities). SMALL • Tax impacts during operation of the HAR will result in SMALL beneficial impacts. • Beneficial impacts on economic productivity will be MODERATE. SMALL to MODERATE	• Monitor salt drift from cooling towers and regulate per regulations and permitting requirements to avoid impacts to the general public. • Make public announcements and/or notifications prior to undertaking necessary activities if atypical or noisy. • Manage concerns from adjacent residents, business owners, or landowners, on a case-by-case basis through a PEC-prepared concern resolution process. • Train and appropriately protect HAR site personnel (i.e., those most directly and frequently affected by operation activities) to reduce the risk of potentially harmful exposures from noise or gaseous emissions. • Provide on-site services for emergency first aid care and conduct regular health and safety monitoring for affected personnel on-site. • Base operation of transmission lines on the guidance provided by the National Electric Safety Code, state and local regulations, and any other permitting requirements. • Design transmission towers and lines to include lights and markers, where appropriate, to alert helicopter traffic to potential hazards created by the proposed structures. The towers will not be excessively high such that aircraft safety is compromised or unnecessary visual impacts result from excessive tower height. • Design induced currents resulting from high electric fields created by overhead transmission lines in accordance with the National Electric Safety Code. • The transmission lines will be designed and operated to minimize corona discharge and electromagnetic interference. It is expected that radio and television interference from the proposed new lines will be minimal.	• Lake level increase including flooding and relocation of recreational facilities, roads, and training areas. SMALL • Increase in traffic on local roads. SMALL • Tax impacts during operation of the HAR will result in SMALL beneficial impacts. • Beneficial impacts on economic productivity will be MODERATE. SMALL to MODERATE

Table 10.1-2 (Sheet 12 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Impact
Socioeconomic (cont.)		• The transmission lines will be designed and operated with hardware and conductors that have features for eliminating corona discharge to mitigate noise impacts. • The plant, appurtenant facilities, and off-site areas will be operated similar to the existing Unit 1 reactor. • The Occupational Health and Safety Administration (OSHA) noise exposure limits will be met for all worker personnel. • Noise levels will be controlled by compliance with federal, state, and local regulatory requirements. • Traffic noise will be limited to normal weekday business hours. Traffic control and administrative measures, such as staggered shift hours, will reduce traffic noises. • Visual intrusions from the new facility are anticipated to have minimal adverse impact because the site is already aesthetically altered by the presence of the existing plant and appurtenant facilities. • Visual intrusion from the plume will vary depending on the viewpoint location, but it will be temporary. • Encourage the use of shared (e.g., carpooling) and multi-person transport (e.g., buses) of workers. • Coordinate schedules during workforce shift changes to limit impacts on local roads. • Schedule delivery of larger pieces of equipment or structures on off-peak traffic hours (e.g., at night) or through other transportation modes. • Consider coordinating with local planning authorities for the upgrading of local roads, intersections, and signals to handle increased traffic loads, if necessary. • Provide local planning and recreation agencies with normal operation schedule to allow for notifying local recreational users.	

Table 10.1-2 (Sheet 13 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Radiological	• Exposure pathway. • Potential for radiation exposure. • Radiation impacts to the public. • Uranium fuel cycle impacts. • Decommissioning. SMALL	• Monitor for potential radiological exposures to workers, the general public, and the surrounding environment during facility operations. • Several types of measurements will be performed to provide information about the types of radiation and radionuclides present. • A network of active air samplers will be used to monitor the vent stacks. Air sampling stations will be strategically located in areas that are most likely to reveal any measurable effects resulting from the release of radioactive effluents from the HAR. • Water monitoring (e.g., the collection of drinking water, surface water, and groundwater [well water] samples) will be used to detect the presence of any radioisotopes relative to the operation of the HAR. • Samples of shoreline sediments will be collected at Harris Reservoir. Radiological analyses will provide information on any potential shoreline exposure to humans. • Quality assurance program monitoring will be conducted to the standards established in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 4.15, “Quality Assurance for Radiological Monitoring Programs. • The environmental impacts from the uranium fuel cycle and the transportation of fuel and radioactive wastes are bounded by the values given in 10 CFR 51.51, Table S-3 and 10 CFR 51.52(c), Table S-4.	

Table 10.1-2 (Sheet 14 of 14)
Operation-Related Unavoidable Adverse Environmental Impacts

Impact Category	Potential Adverse Impacts	Potential Mitigation Measures	Unavoidable Adverse Impacts
Radiological (cont.)		• A Post Shutdown Decommissioning Activities report will be prepared and submitted per applicable federal laws and regulation. • Appropriate segregation and shielding of buildings/rooms and system designs minimize the radiation zones and helps facilitate decommissioning. • Applicable federal, state, and local environmental compliance laws and permitting regulations will be adhered to for the decommissioning of the facility. • Train and appropriately protect HAR site personnel (i.e., those most directly and frequently affected by operation activities) to reduce the risk of potentially harmful exposures from noise or gaseous emissions. • Establish administrative controls and plant procedures for maintaining the doses from radiation sources and facilities during normal operations within regulatory limits and as low as reasonably achievable.	
Environmental Justice	• Some activities affect minority or low income populations. SMALL	• There is no disproportionate high impact on minority or low income populations.	• No unavoidable adverse impacts. SMALL

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

In accordance with NUREG-1555, Section 10.2, this section provides a summary of the irreversible and irretrievable material commitments of resources associated with the construction and operation of the HAR facility. “Irreversible” refers to environmental resource commitments that cannot be altered to restore the present condition. “Irretrievable” refers to material resources that, once used, cannot be recycled or restored for other uses.

The section is organized into the following subsections:

- Subsection 10.2.1 — Irreversible Environmental Commitments
- Section 10.2.2 — Irretrievable Material Commitments of Resources

10.2.1 IRREVERSIBLE ENVIRONMENTAL COMMITMENTS

Table 10.2-1 summarizes the irreversible environmental commitments that are expected to result from the construction and operation of the HAR and the associated structures. The following areas are evaluated below for irreversible environmental commitments:

- Land use
- Hydrological and water use
- Ecological (terrestrial and aquatic)
- Socioeconomic
- Radiological
- Atmospheric and meteorological

10.2.1.1 Land Use

The proposed location of the site is currently in partial use by HNP. The site, on the Harris Reservoir, is zoned for industrial use and was designed to accommodate additional units. As discussed in Section 4.3, the existing HNP encompasses 1.78 km^2 (0.69 $mi.^2$) or 440 ac. and the HAR would require an additional 0.78 km^2 (0.3 $mi.^2$). or 192 ac. This area experiences a high degree of anthropogenic disturbance due to activities at the existing plant. Due to the current condition of this site, no irreversible environmental commitments are expected to result from the construction or operation of the HAR in this location.

As discussed in Subsection 3.7.1.1, seven transmission lines presently connect the HNP to the Progress Energy Carolinas, Inc. (PEC) electrical grid through the

existing switchyard. These seven transmission lines, along with an eighth line planned for 2011, will also connect HAR 2 through the existing Shearon Harris Nuclear Power Plant Unit 1 (HNP) common expanded switchyard to the PEC electrical grid. The proposed routing of the transmission lines for HAR 2 is to use the existing HNP rights-of-way (ROWs).

Three new transmission lines will connect the HAR 3 switchyard to the PEC grid. The proposed routing of the new lines for HAR 3 are being evaluated to be adjacent to or within the existing maintained transmission corridors for the HNP. The new corridors for HAR 3 are conservatively estimated to require an additional 100 feet (ft.) of width. The three new lines will originate at the HAR 3 switchyard and terminate at the following existing substations:

- **Erwin (New)** – This new line will terminate at the Erwin substation. It will be approximately 48.3 kilometers (km) (30 miles [mi.]) long.

- **Fort Bragg–Woodruff Street (New)** – This new line will terminate at the Woodruff Street substation on the Fort Bragg post.

- **Wake (New)** – This new line will terminate at the Wake substation.

Most corridors pass through land that is primarily agricultural and forest land. The areas are mostly remote, with low population densities. The longer lines cross numerous state and United States highways. The effect of these corridors on land usage is minimal; farmlands that have corridors passing through them generally continue to be used as farmland.

PEC designed and constructed all HNP transmission lines in accordance with industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of HNP-related transmission facilities ensure continued conformance to design standards. These maintenance practices also examine the conformance of the lines with the National Electrical Safety Code requirements on line clearance to limit shock from induced currents. Therefore, environmental impacts from expansion efforts are anticipated to be small.

New land use commitments will be associated with the Harris Lake makeup water system pipeline and pumphouse. The majority of the pipeline will follow existing transmission and road ROWs, and will not significantly alter land use. A more significant alteration of land use will be the relatively small area associated with the portion of the Harris Lake makeup water system pipeline near the Cape Fear River and the area surrounding the new pumphouse. As described in Section 4.3, these structures will require less than 0.02 km^2 (0.0078 $mi.^2$) or 5 ac. The pumphouse is proposed to be located in a small cove on the east side of the Cape Fear River, just north of Buckhorn Dam. At this location, an intake channel will be dredged into the cove. The channel will consist of reinforced concrete slab with sloped riprap sides. Currently, no federal, state, or regional land use plans apply to the area where the intake structure and pumphouse will be located.

Furthermore, this alteration is not irreversible since the structure could be dismantled and the habitat restored, if necessary.

Long-term changes in land use from the operation of the HAR will be primarily associated with the increase in the water level of the Harris Reservoir. Long-term physical land use changes will result from inundating the land located between the existing normal pool elevation and the proposed pool elevation of 73.2 meters (m) (240 ft.) National Geodetic Vertical Datum of 1929 (NGVD29). Approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) will be inundated, changing the area from terrestrial to aquatic habitat. The current use of much of the land proposed to be inundated is designated as forest. The U.S. Geological Survey (USGS) land use designation for this land will change from the current designation to open water. Once the vegetation has been cleared and the lake level has been increased, the terrestrial habitat is considered lost. The process of lowering the lake and restoring the land around Harris Lake to the original forested habitat would be impractical to implement due to conditions on the perimeter of the lake and vegetation recovery would take decades.

In addition to the loss of land that will result from the increase in water level, there is a small amount of existing infrastructure (a county park, boat ramps, existing transmission towers, portions of roads) that will need to be relocated. The commitment of land required for these relocations is not large. Large areas of forested habitat exist in proximity to the site, making it possible for wildlife to relocate. In addition, all permit and regulatory requirements will be met in order to minimize the impact to this area.

10.2.1.2 Hydrological and Water Use

No significant chemical contaminants are expected to be released into the groundwater or surface water during the operation of the HAR. Chlorination will be required to maintain the cooling towers, but discharge waters will meet all requirements in the National Pollutant Discharge Elimination System (NPDES) permit. The only heated water discharged to the Main Reservoir will be from blowdown of the cooling towers to control dissolved solids in the closed-cycle system. Discussion of thermal impacts of the heated discharge is provided in Subsection 5.3.2.1.

PEC has monitored water quality in Harris Reservoir quarterly since the creation of the reservoir in the early 1980s, in order to evaluate the water body's health and track changes in water quality. This monitoring will continue throughout the life of the plant and efforts will be made to minimize impacts and changes that may take place due to the construction and operation of the HAR. Impacts of heated water discharge to the reservoir will be limited to the vicinity of the discharge structure. These impacts will not be significant in the reservoir as a whole and are not irreversible because the effects will be localized and only occur during operation of the cooling towers. No heated water will be discharged once plant operations permanently cease.

As discussed in Subsection 3.3.2.1, consumptive water use in the operation of the cooling towers and other systems will vary throughout the year. On average, the makeup requirement to the cooling tower from the Main Reservoir constitutes a major plant use during normal plant operation. Cooling tower makeup is estimated to be 2.54 cubic meters per second (m^3/sec) (89 cubic feet per second [ft^3/s]) or 40,220 gallons per minute (gpm) operating at peak evaporative rates (evaporation, blowdown, drift-based on two AP1000 units). Additional quantities of Harris Reservoir water pumped by the raw water intake pumps will be diverted for use as makeup water to compensate for raw water use, raw water to the demineralizers, fire protection, strainer backwash, and filter backwash. The net consumptive use of Harris Reservoir water is estimated to be 1.77 m^3/sec 62.66 ft^3/s or 28,122 gpm (that is, cooling tower makeup water plus raw water use plus service water tower makeup water plus demineralization makeup water minus sanitary discharge minus demineralization system water discharge minus cooling tower blowdown minus service tower blowdown – based on two AP1000 units). Total flow to the raw water intake structure from the Main Reservoir is anticipated to be 2.65 m^3/sec (93.74 ft^3/s) or 42,074 gpm (cooling tower makeup water plus raw water use plus service tower makeup water plus demineralization makeup water – based on two AP1000 units).

In addition, the normal net consumptive water usage from Harris Reservoir to support the service water tower is estimated to be 0.13 m^3/sec (17.53 ft^3/s) or 2079 gpm (evaporative losses plus raw water to demineralizers, plus potable water supply minus sanitary discharges minus demineralizer discharge). Total flow to the service water raw water intake structure from the reservoir is anticipated to be 0.29 m^3/sec (10.27 ft^3/s) or 4610 gpm (service water tower makeup water plus raw water to demineralizers plus potable water supply plus service water strainer backwash plus filter backwash). Also, water consumption for fuel cycle activities would require approximately 43,067 million liters (11,377 million gallons) of water (Table 10.2-2).

Water withdrawals from the Cape Fear River and Harris Reservoir will be monitored and limited to eliminate any potential effects to other water users. No groundwater will be withdrawn for use at the site; therefore, no impacts to groundwater are anticipated.

10.2.1.3 Ecological

Ecological inventories have been conducted at the site. Section 4.3 provides a discussion about sensitive species that can be found in or near the affected areas. Surveys for sensitive species will be conducted as necessary and all mitigation requirements and permit conditions will be met in order to minimize risk of loss. Therefore, construction and operation of the new units and associated off-site structures is expected to have a minimal short- or long-term effect on terrestrial ecology.

Because the area where the new units will be located is already disturbed, the terrestrial ecosystem in this location is already adapted to anthropogenic

disturbance. No irreversible effects to the terrestrial ecology will occur due to construction or operation at this location. The primary off-site land that is expected to be utilized during construction of the Harris Lake makeup water system pipeline is the existing transmission corridor and a road ROW. The new transmission lines are also expected to follow existing corridors. A small amount of clearing activities will take place near the shore of the Cape Fear River where the new pumphouse will be located. This area has previously been disturbed from past construction and decommissioning of utility facilities. The habitat in this location is already edge habitat, so although the ecosystem in the cleared area will be altered, this clearing action will not cause a significant effect to the terrestrial ecosystem in the vicinity. These areas will be disturbed only for occasional maintenance once construction is complete, so the irreversible environmental commitment associated with these structures will be relatively small.

The largest irreversible environmental effect associated with the construction and operation of the HAR is the loss of land and terrestrial habitat that will be submerged as a result of the increase in the water level in Harris Reservoir. The fauna of the area will be displaced and the flora will become submerged. There is ample available land in the vicinity and region for terrestrial species to relocate, and water levels will increase slowly, allowing sufficient time for these organisms to adjust. Portions of the stream channels of the Harris Reservoir's tributaries, as well as several wetlands adjacent to the streams and the lake, will be flooded; however, some new wetlands will also be created as the water level increases. Chapter 5 discusses several mitigation measures that will be encompassed in order to minimize the degree of impact on the flora and fauna in the area to be inundated.

HAR plant operation should not have significant effects to aquatic/marine ecology and water quality. A small area along the banks of the Cape Fear River below the water surface will be temporarily disturbed for the installation of the new intake structure. However, construction of the intake structure is anticipated to have a minimal effect on aquatic life, and therefore, no irreversible ecological commitment. The thermal effect from this plant on the Harris Reservoir is minimized through plant design and compliance with NPDES permit requirements. There will be no thermal effects beyond some thermally-sensitive species possibly avoiding the immediate area of the discharge opening. This should not affect the general community structure or ecology in the remaining areas of the reservoir. No important aquatic species or its habitat will be affected. PEC has monitored biological communities in the Harris Reservoir quarterly since the creation of the reservoir in the early 1980s, in order to document the appearance of non-native plants and animals and assess the state of recreational fishery. Continued monitoring will occur and additional measures will be taken to reduce effects and minimize opportunities for species introduction into the Harris Reservoir from the Cape Fear River. No irreversible effects to aquatic ecology in the Harris Reservoir or the Cape Fear River are expected to occur due to operation and construction of the HAR.

10.2.1.4 Socioeconomic

The HAR facility will not draw from the community's socioeconomic standing, but will produce jobs and tax revenues. According to Section 5.8 the operations workforce for the HAR will consist of approximately 773 employees. Approximately 75 percent of these new employees are expected to come from within the region; therefore, the additional workforce will not have a significant impact on the regional population. No impacts to agriculture, structures, residences, public services, educational facilities, hospitals, or other institutional facilities or any noise, air, or aesthetic disturbances are anticipated. Temporary impacts to recreational facilities will occur due to the increase in water level in Harris Reservoir; however, once these facilities are relocated, there will be no further effect on recreation in the region. There will be a small increase in traffic on local roads, which will be divided over three shifts. Improvements to roadways are expected to offset any effects of this increase. The HAR will provide a new source of reliable electricity to the region, which may result in the introduction of new industries in the region or expansion of existing industries. Operation of the new facilities will have an economic impact on the local communities through the generation of tax income. The positive economic impact of the local expansion of industry and the increase in tax revenue will be significant. These impacts on the economy are expected to persist after plant decommissioning.

10.2.1.5 Atmospheric and Meteorological

When the HAR is in operation, atmospheric emissions other than water vapor will be minimal. Water vapor from the natural draft cooling towers will be the main constituent of emissions during operation. This water vapor will at times form a visible plume of varying lengths and opacity. The frequency of occurrence and length of these visible plumes will be greatest during winter months when ambient air temperatures are cool and the air is moist. The HAR will also utilize back-up diesel-fueled generators to provide a backup source of electrical power and during periodic testing performed as required by the plant's Technical Specifications, as referenced in the Westinghouse Electric Company, LLC, AP1000 Design Control Document, Rev. 16 (DCD) Subsection 8.3.1.1.2.1. Minor emissions of volatile organic compounds (VOCs) may be released from the storage tanks used to supply diesel fuel to this equipment. However, federal, state, and local guidelines and regulations that apply to the operation of these tanks will be met, and any necessary air permits will be secured before operations begin. Air emissions from HAR during normal operation of the facility are not expected to have a significant or measurable impact on local or regional meteorological conditions; therefore, there will be no irreversible atmospheric or meteorological commitments.

10.2.1.6 Disposal of Hazardous and Radioactively Contaminated Waste

The HAR will generate radioactive, hazardous, and nonhazardous waste that will require disposal in permitted hazardous, mixed, or radioactive landfills. Land committed to the disposal of radioactive and non-radioactive wastes is an

irreversible impact because it is committed to that use, and can be used for few other purposes.

10.2.1.7 Commitment of Underground Geological Resources for Disposal of Radioactive Spent Fuel

After uranium is utilized in the HAR facility as fuel for the new reactors, the waste will be considered a high-level radioactive waste and referred to as “spent nuclear fuel.” If no options are available to reprocess the uranium, the spent nuclear fuel must be isolated from the environment for a period of time ranging from thousands to tens of thousands of years. Proposed disposal options call for the disposal in a deep underground geological repository. This long-term commitment makes the surrounding geological resource unusable for thousands or tens of thousands of years and is considered an irreversible commitment of geologic resources.

10.2.1.8 Destruction of Geological Resources during Uranium Mining and Fuel Cycle

The mining of uranium is required to generate uranium for use as fuel in the HAR facility. Impacts from mining are considered an indirect impact of the construction and operation of the HAR facility. Mining can result in the destruction of geologic resources and the pollution of surrounding soil. Impacts to surrounding lakes, streams, and groundwater can also result from pollutants released during mining. During the mining process and for some period of time following the mining operation, aesthetic impacts result from changes in the natural landscape.

Table 10.2-2 presents environmental data on the uranium fuel cycle. This data describes the contribution of the environmental effects related to uranium fuel cycle activities associated with licensing a nuclear power reactor. Specifically, this data describes the contribution of environmental effects associated with uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes.

10.2.2 IRRETRIEVABLE MATERIAL COMMITMENTS OF RESOURCES

Irretrievable environmental commitments resulting from the HAR facility include the following:

- Construction materials.
- Water consumption.
- Uranium fuel and energy consumption.

10.2.2.1 Construction Materials

This report discusses the proposition of building the facility at the selected site, but does not discuss the actual construction details. It can be assumed that the irretrievable commitment of resources would be similar to that required for any similarly sized, multi-year construction project. The amounts and types of material required should be comparable to those that would be necessary for the construction of any type of power plant or other large industrial facility including materials such as concrete, steel and other metals, glass, and several forms of plastics as identified in Table 10.2-3. According to a recent U.S. Department of Energy (USDOE) study, each new reactor would require approximately 9356.6 cubic meters (m^3) (12,239 cubic yards [yd^3]) of concrete, 2818.6 metric tons (3107 tons) of rebar, 2,743,200 m (9,000,000 ft.) of cable, and 83,820 m (275,000 ft.) of piping (Reference 10.2-001). However, the amount of materials that would be irretrievably committed to the project should be insignificant in relation to the availability of these materials on the national or global market.

10.2.2.2 Water Resources

During operation of the HAR, some of the cooling water taken from Harris Reservoir will be lost through the cooling towers through evaporation or as drift. Small amounts of potable water are also used during construction and operation of the HAR. Impacts to water resources are expected to be small and may be replenished through the natural hydrologic cycle. The use of water does represent an irretrievable commitment of water resources.

10.2.2.3 Uranium Fuel and Energy Consumption

Irreversible and irretrievable commitments of resources during operation would consist primarily of the uranium used for fuel. A study of available uranium by the World Nuclear Association projects the availability of a 50-year supply of low-cost uranium. The World Nuclear Association study also projects that increased market prices will drive additional exploration and could result in a tenfold increase in available uranium (Reference 10.2-002). The uranium used by the HAR units to produce nuclear power would be irretrievable, but would have a small impact on the long-term availability of uranium.

Other irretrievable commitments of resources would include the energy required to produce the fuel for the reactors. Materials required for normal operation of an industrial plant like the HAR and that cannot be recycled or recovered, would also result in irretrievable commitments of resources. It is also expected that some materials will become radioactive as a result of their proximity to the fuel source. Using presently available technologies, these materials could not be recovered or recycled for other uses.

10.2.3 REFERENCES

10.2-001 U.S. Department of Energy, "Application of Advanced Construction Technologies to New Nuclear Power Plants," September 2004.

10.2-002 World Nuclear Association, "Supply of Uranium," Website, www.world-nuclear.org/info/inf75.html, accessed June 26, 2007.

Table 10.2-1
Irreversible Environmental Commitments

Land Use	Approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) is required for elevation of lake level and relocation of facilities that are currently below 73.2 m (240 ft.) NGVD29. There are no irreversible environmental commitments.
Hydrologic and Water Use	Consumptive water use from cooling tower evaporation is 1.70 m^3/sec (60.2 ft^3/s) or 27,020 gpm. Consumptive water use from service tower evaporation is 0.082 m^3/sec (2.91 ft^3/s) or 1304 gpm. Monitoring will occur to ensure permit conditions are met. Impacts would be short-term and localized. There are no irreversible environmental commitments.
Ecological	Inundation of approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) around the perimeter of Harris Reservoir, impacting terrestrial ecology and wetlands and streams. Impacts to terrestrial ecology due to clearing of approximately 0.02 km^2 (0.0078 mi.^{2}) or 5 ac. for the pumphouse and Intake structure along Cape Fear River. No irreversible environmental impacts to aquatic ecology would occur.
Socioeconomic	A positive impact due to local expansion of industry and an increase in tax revenue. Impacts from increased traffic. There are no irreversible environmental commitments.
Radiological	Use of uranium for fuel and commitment of material that will become radioactive during plant operation. There are no irreversible environmental commitments.
Atmospheric and Meteorological	There are no irreversible environmental commitments.

Table 10.2-2 (Sheet 1 of 3)
Uranium Fuel Cycle Environmental Data[a]

Environmental Consideration	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000 MWe Light Water Reactor (LWR)
Natural Resource Use		
Land (acres)		
Temporarily Committed[b]	100	
Undisturbed Area	79	
Disturbed Area	22	Equivalent to a 110-MWe coal-fired power plant.
Permanently Committed	13	
Overburden Moved (millions of MT)	2.8	Equivalent to a 95-MWe coal-fired power plant.
Water (millions of gallons)		
Discharged to Air	160	Equal to 2 percent of model 1000 MWe LWR with cooling tower.
Discharged to Water Bodies	11,090	
Discharged to Ground	127	
Total	11,377	Less than 4 percent of model 1000 MWe LWR with once through cooling.
Fossil Fuel:		
Electrical Energy (thousands of MW-hour)	323	Less than 5 percent of model 1000 MWe output.
Equivalent Coal (thousands of MT)	118	Equivalent to the consumption of a 45-MWe coal-fired power plant.
Natural Gas (millions of scf)	135	Less than 0.4 percent of model 1000 MWe energy output.
Effluents-Chemical (MT)		
Gases (including entrainment)[c]		
SO_X	4400	
NO_x [d]	1190	Equivalent to emissions from 45-MWe coal-fired plants for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1154	
Other Gases		
F	0.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards which are below the level that has effects on human health.

Table 10.2-2 (Sheet 2 of 3)
Uranium Fuel Cycle Environmental Data[a]

Environmental Consideration	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000 MWe Light Water Reactor (LWR)
HCl	0.014	
Liquids:		
SO^-_4	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are NH^3 (600 ft^3/s), NO_3 (20 ft^3/s), Fluoride (70 ft^3/s).
NO^-_3	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10.0	
Fe	0.4	
Tailing Solutions (thousands of MT)	240	From mills only—no significant effluents to environment.
Solids	91,000	Principally from mills—no significant effluents to environment.
Effluents- Radiological (curies)		
Gases (including entrainment):		
Rn-222		Presently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	0.14	
I-129	1.3	
I-131	0.83	

Table 10.2-2 (Sheet 3 of 3)
Uranium Fuel Cycle Environmental Data[a]

Environmental Consideration	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000 MWe Light Water Reactor (LWR)
Tc-99		Presently under consideration by the Commission.
Fission Products and Transuranics	0.203	
Liquids:		
Uranium and Daughters	2.1	Principally from milling—included tailing liquor and returned to ground—no effluents: therefore, no effect on the environment.
Ra-226	0.0034	From UF^6 production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants—concentration 10 percent of 10 CFR 20 for total processing, 26 annual fuel requirements for model LWR.
Fission and Activation Products	5.9×10^{-6}	
Solids (buried on-site)		
Other than High Level (shallow)	11,300	About 9100 curies (Ci) comes from low-level reactor wastes and 15,000 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—included in tailing returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and high-level waste (HLW) (deep)	1.1×10^7	Buried at federal repository.
Effluents—Thermal (billions of British thermal units)	4063	Less than 5 percent of model 1000 MWe LWR.
Transportation (person-rem):		
Exposure of Workers and General Public	2.5	
Occupational Exposure	22.6	From reprocessing and waste management.

Notes:

a) In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table is read as if a specific zero entry was made. However, there are other areas that are not addressed at all in the table.

b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of weather the plant services one reactor for one year or 57 reactors for 30 years.

c) Estimated effluents based upon combustion of equivalent coal for power generation.

d) 1.2 percent from natural gas use and process.

Table 10.2-3
Irretrievable Commitments of Resources

Material	Quantity Used [(a)]
Concrete	9357 cubic meters (12,239 cubic yards)
Rebar	2819 metric tons (3107 tons)
Steel cable	2,743,200 linear meters (9,000,000 linear feet)
Piping	83,820 meters (275,000 feet)

Notes:
a) Application of Advanced Construction Technologies to New Nuclear Power Plants, U.S. Department of Energy, MPR-2610, September 2004.

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

In accordance with NUREG-1555, Section 10.3, this section provides an analysis of the predicted short-term unavoidable environmental impacts (or environmental benefits) of plant construction and operation and the predicted long-term environmental impacts (or environmental benefits) resulting from plant construction and operation. This section also provides an evaluation of the extent to which the construction and operation of the proposed project's use of the environment will preclude any options for other future use of the environment and an evaluation of the project's impact on short-term use and long-term productivity capabilities of the human environment.

For the purpose of this section, the term "short term" represents the period from the start of construction to the end of plant life, including prompt decommissioning. In contrast, the term "long term" represents the period extending beyond the end of plant life, including the period up to and beyond that required for delayed plant decommissioning. In addition, for the analysis of long-term impacts, it was assumed that the Harris Reservoir and all appurtenant infrastructure and facilities will be maintained in the operating conditions set forth for the proposed Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR).

Throughout this section, environmental impacts will be assessed using the U.S. Nuclear Regulatory Commission's (NRC's) three-level standard of significance—SMALL, MODERATE, or LARGE. This standard of significance was developed using the Council on Environmental Quality guidelines 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 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.

10.3.1 CONSTRUCTION PREEMPTIONS AND PRODUCTIVITY

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of construction of the proposed new reactor units and ancillary structures and the measures proposed to reduce those impacts, while Section 10.2

provides a summary of the irreversible and irretrievable commitment of resources that represent short-term and long-term use of the human environment. This section provides an evaluation of the extent to which the construction of the proposed project's use of the environment will preclude any options for other future use of the environment and an evaluation of the project's impact on short-term use and long-term productivity capabilities of the human environment.

10.3.1.1 Land Use

As identified in Section 2.1, construction of the HAR reactor units and associated structures will occur at a location to the north of the existing Shearon Harris Nuclear Power Plant Unit 1 (HNP). Construction-related land use effects include any direct or indirect impacts to the HAR site, the vicinity, and appurtenant facilities including electric transmission lines, an electric switchyard, modifications to the Main Dam at Harris Reservoir, blowdown structures within Harris Reservoir, the Harris Lake makeup water system intake structure and pumphouse, and a Harris Lake makeup water system pipeline. In addition, there are indirect construction impacts associated with the proposed change in the reservoir elevation, including enhancements to area roadway infrastructure, movement of the wastewater treatment plant, and effects on other structures.

The HNP site covers 1.78 km^2 (440 ac. or 0.69 $mi.^2$). The addition of the HAR affects approximately 0.78 km^2 (192 ac. or 0.3 $mi.^2$), which primarily appear to experience ongoing disturbance resulting from the construction and operation of the HNP. One hundred percent of the land at the HAR site is classified as heavy industrial, and approximately 85 percent of the land within the vicinity is forested or agricultural. Industrial land use within the vicinity of the HAR site is limited to areas near the HNP and along adjacent highway and railroad corridors. The proposed construction site is composed of surfaces that are impervious to water infiltration (e.g., parking lots, laydown area, crushed stone, and some tree-covered areas).

Approximately 0.48 km^2 (118 ac. or 0.18 $mi.^2$) will be permanently resurfaced for the construction of the HAR and associated infrastructure. This includes asphalt or crushed stone covering 0.42 km^2 (103.5 ac. or 0.16 $mi.^2$), with seeded topsoil covering the remaining 0.059 km^2 (14.7 ac. or 0.023 $mi.^2$). Approximately 0.3 km^2 (74 ac. or 0.12 $mi.^2$) or within the plant site will be covered with crushed stone and utilized for temporary construction purposes. Portions of the areas that will be resurfaced permanently or temporarily currently contain infrastructure, parking areas, and roads associated with the HNP.

It is expected that the industrial nature of the facility will continue during construction and operation activities. Construction activities will conform to the goals and criteria set forth in applicable local, state, and federal regulatory guidelines and requirements in order to minimize adverse impacts. As a result, the effect will be SMALL.

The perimeter of Harris Reservoir and the surrounding area are currently placed in the timber production use category. A recent land use coverage analysis indicates more than 70 percent of the land contained in the watershed is forested (Reference 10.3-001).

Harris Reservoir will be filled to its original design capacity. According to ER Chapter 2, approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) will be inundated by the proposed increase in the water level of Harris Reservoir. Following inundation, the shoreline of Harris Reservoir will change from its current perimeter length of 139,379 meters (m) (457,281 feet [ft.]) to 239,063 m (784,327 ft.). Land within the perimeter will be cleared before increasing the water level so that debris in the water will not interfere with future boating activities. Consequently, land use will change from forested areas to cleared and inundated shoreline.

No areas within the HAR site boundary have been identified as wetlands, although approximately 0.47 km^2 (0.18 mi.^{2}) or 117 ac. of wetlands exist along the perimeter of the reservoir and near the dam. These wetland areas were created or modified during the construction of the HNP (Reference 10.3-002). These wetlands will be inundated because of the increased water level of the reservoir. However, inundation will also create new wetlands.

Construction and clearing around the Harris Reservoir perimeter is expected to have a SMALL impact on land use within the vicinity and along the shoreline.

10.3.1.2 Appurtenant Infrastructure

According to Chapter 5, operations at the HAR will require additional makeup water from Harris Reservoir. A new intake structure and pumphouse will be required to move water from the Cape Fear River to Harris Reservoir to support the initial lake level increase (if natural fill is not adequate) and maintain the reservoir level at approximately 73.2 m (240 ft.) NGVD29 above mean sea level (msl) to support the operation of the HAR. The intake structure will be constructed immediately upstream of the Buckhorn Dam within the Cape Fear River channel. The pumphouse will be on the northern bank of the Cape Fear River adjacent to the existing discharge canal and remnants of the abandoned hydropower system that was located on the Buckhorn Dam. The proposed Harris Lake makeup water system pipeline will extend along existing rights-of-way (ROWs) to the shore of Harris Reservoir upstream of the Main Dam. Effects from construction to the current land use in the ROW are expected to be SMALL, short-term, and minimal.

A blowdown pipeline will be constructed to discharge water from the HAR. This pipeline will be placed adjacent to the existing blowdown pipeline that services the HNP in a trench. During trenching for the installation of this pipeline, turbidity barriers will be implemented to minimize increases in water column turbidity resulting from bottom disturbance.

10.3.1.3 Relocated Infrastructure

Infrastructure affected by the increase in water level will be relocated or reconstructed above the new water level. Current infrastructure proposed for removal or modification includes structures within Harris Lake County Park, the Wake County Fire Training Facility, the Shearon Harris firing range, several Progress Energy Carolinas, Inc. (PEC) facility buildings, four boat launches, multiple segments of roadway, and transmission towers (Reference 10.3-003). Relocation areas above the 73.2-m (240-ft.) NGVD29 contour have not been determined yet. Relocation activities will comply with relevant regulations and BMPs to minimize the potential for adverse effects.

Multiple roadways exist within the 67.1-m to 73.2-m (220-ft. to 240-ft.) NGVD29 contours((Reference 10.3-003). Roadways that will be directly impacted, along with associated infrastructure (bridges and culverts), will be modified in their current locations to accommodate for the rise in the reservoir's elevation. These roadways have a total length of 4873 m (15,988 ft.). Modification of roadways, ridges, and culverts will comply with relevant regulations and permits. Appropriate best management practices (BMPs) will be implemented to minimize the potential for erosion and sedimentation. Effects from road reconstruction would be limited to clearing and placing fill to expand the road base supporting the new elevated roadway. Local traffic on these roads would be temporarily disrupted while the modifications are implemented. Temporary detours and traffic control flaggers would be used, as appropriate, to maintain traffic flow during road modifications. Therefore, any disruptions to local traffic resulting from road modifications to accommodate the new Harris Reservoir water level would be temporary and SMALL.

10.3.1.4 Air

A SMALL increase in air emissions may occur during timber removal and HAR site preparation activities required for the Harris Reservoir perimeter, transmission corridors, pipeline corridor, and/or installation of the intake structure and pumphouse. Currently, timber is being harvested near the HAR site, and continued harvest activities near Harris Reservoir are likely (Reference 10.3-004). During construction activities at the HAR site, controls will be implemented to mitigate potential air emissions from construction sources.

10.3.1.5 Water

Clearing trees along the Main Reservoir edge prior to raising the Main Reservoir elevation to 73.2 m (240 ft.) NGVD29 will have one of the largest effects on Harris Lake. Forestry BMP guidelines will be followed to minimize the effects of erosion and sedimentation on Harris Lake. Barriers such as silt fences will be used to prevent sediment from reaching the lake. In addition, to the maximum extent practicable, construction activities will be scheduled to minimize the time the land is cleared. The land will be divided into small manageable areas,

cleared, and then reseeded as quickly as possible. Impacts related to the clearing of existing trees and vegetation along the Main Reservoir will be SMALL.

10.3.1.6 Terrestrial and Aquatic Ecosystems

The existing industrial portion of the HAR site is located on a peninsula extending into Harris Reservoir. No natural habitat remains in this area. Small fragmented woodlots are present in the industrial portion, but limited habitat is available (Reference 10.3-001). The HAR reactor site areas are on mowed vegetation and in an area recently clear-cut and replanted to loblolly pine. The young pines are less than 10 years old and substantial herbaceous vegetation grows among the young trees.

Biologists conducting an ecological survey in August 2006 at the HAR sites observed no important vegetative or wildlife species (Reference 10.3-001). PEC contacted the U.S. Fish and Wildlife Service (USFWS), North Carolina Wildlife Resources Commission (NCWRC), and North Carolina Natural Heritage Program (NCNHP) requesting information on listed species and important habitats (Reference 10.3-005). Correspondence from NCWRC does not identify any important vegetative nor wildlife species existing within the HAR site (Reference 10.3-006). If an important terrestrial plant species is identified within the construction area, PEC will cooperate with the aforementioned agencies to determine control measures and possible mitigation, as needed.

Birds collide with many types of anthropogenic structures. Hoist cranes are the only construction infrastructure expected to pose a risk for avian collisions at the HAR construction site. The U.S. Nuclear Regulatory Commission (NRC) evaluated nuclear plants and found that avian mortality resulting from collisions with nuclear plant infrastructure does not have substantial effects on bird populations. A proactive measure to avoid avian collisions would be to illuminate construction equipment at night. Other recommendations to prevent avian collisions include avoiding areas where birds are known to congregate, enhancing power line visibility, and limiting construction to the daytime hours on days with good weather (Reference 10.3-007). The expected adverse effect to birds related to collisions is short-term.

Clearing to prepare the area surrounding Harris Reservoir for inundation will decrease the vegetation and the wildlife within the terrestrial habitat, resulting in a long-term direct effect. Because relatively large areas of undeveloped land adjoin PEC property, it is anticipated that wildlife will relocate and adapt to the altered habitat area over time. Wildlife will experience some short-term direct effects associated with clearing and construction activities and long-term direct and indirect effects from the loss of habitat. With the exception of permanent habitat loss, because of forest management, the area would experience these effects without inundation. Impacts to vegetative communities associated with clearing and inundation of 1641 ha (4055 ac. or 6.3 mi.^{2}) around the perimeter of Harris Reservoir will result in MODERATE impacts as discussed in

Subsection 4.3.1.2.1 will be noticeable but will not destabilize the resource. Impacts on wildlife and aquatic ecology will result in SMALL impacts.

HAR site preparation and construction will occur along the perimeter of Harris Reservoir. SMALL short-term adverse aquatic ecological effects stemming from runoff effluent and sedimentation will be limited or prevented through compliance with regulations, BMPs, and control measures. SMALL direct long-term adverse effects will result because of a permanent loss of habitat for aquatic vegetation and wildlife. There will be a SMALL adverse effect to stream benthic invertebrates and fish from loss of habitat. Any direct effects to species would be SMALL. The long-term aquatic effect of HAR site preparation and construction along the Harris Reservoir perimeter will be positive, increasing aquatic habitat.

10.3.1.7 Noise

Construction noise will occur during HAR site preparation activities such as clearing, and grading. Construction noise will also occur during construction activities and while installing equipment (such as turbines, generators, pumps, transformers, and switchyard equipment). Construction activities will increase ambient noise levels both on-site and off-site. Construction noise may temporarily disturb nearby residents, workers at nearby facilities, and some individuals participating in recreational activities on or surrounding Harris Reservoir. Construction noise will not be sustained for prolonged periods of time. In addition, it will vary based on the specific activities and their locations.

Typical equipment used in construction and clearing generate peak noise levels between 70 and 98 decibel (A-weighted scale) (dBA) at a distance of 15 m (50 ft.) from the equipment (Reference 10.3-008). Because multiple pieces of equipment are likely to be operating simultaneously, the total noise could exceed the peak noise level of any one piece of equipment by 1 to 3 dBA. Noise naturally attenuates over distance, typically decreasing by 3 dBA with every doubling of distance (Reference 10.3-009). Therefore, the actual noise levels experienced by wildlife after relocating from the construction area would be lower than the noise level at 15 m (50 ft.).

To minimize the increased ambient noise, mitigation measures will be implemented. In addition, noise levels are controlled by the following regulations: U.S. Occupational Safety and Health Administration (OSHA) has developed noise exposure limits (29 Code of Federal Regulations [CFR] 1910) and the federal noise pollution control regulations (40 CFR 204) identify noise emission standards for construction equipment.

Overall, construction noise will result in temporary SMALL noise impacts to surrounding residential communities and sensitive receptors, such as schools and nearby recreation areas. Noise impacts to recreational users will be SMALL during HAR site preparation activities along the Harris Reservoir shoreline. Because noise-related construction impacts are anticipated to be short in

duration, they will result in temporary adverse impacts. No direct or indirect cumulative impacts from construction noise are anticipated.

10.3.1.8 Transmission Lines

As discussed in Subsection 3.7.1.1, seven transmission lines presently connect the HNP to the PEC electrical grid through the existing switchyard. These seven transmission lines, along with an eighth line planned for 2011, will also connect HAR 2 through the HNP common expanded switchyard to the PEC electrical grid. The proposed routing of the transmission lines for HAR 2 is to use the existing HNP ROWs.

Three new transmission lines will connect the new HAR 3 switchyard to the PEC grid. The proposed routing of the new lines for HAR 3 are being evaluated to be adjacent to or within the existing maintained transmission corridors for the HNP. The new corridors for HAR 3 are conservatively estimated to require an additional 100 ft. of width. The three new lines will originate at the HAR 3 switchyard and terminate at the following existing substations:

- Erwin (New) – This new line will terminate at the Erwin substation. It will be approximately 48.3 km (30 mi.) long.
- Fort Bragg–Woodruff Street (New) – This new line will terminate at the Woodruff Street substation on the Fort Bragg post.
- Wake (New) – This new line will terminate at the Wake substation.

Most corridors pass through land that is primarily agricultural and forest land. The areas are mostly remote, with low population densities. The longer lines cross numerous state and United States highways. The effect of these corridors on land usage is minimal; farmlands that have corridors passing through them generally continue to be used as farmland.

PEC designed and constructed all HNP transmission lines in accordance with industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of HNP-related transmission facilities ensure continued conformance to design standards. These maintenance practices also examine the conformance of the lines with the National Electrical Safety Code requirements on line clearance to limit shock from induced currents. Land-clearing or construction activities in the ROWs would follow BMPs and would be mitigated to the extent possible. As a result, impacts of new transmission corridor construction will be SMALL during construction and operation of the facility.

10.3.1.9 Cultural Resources

As discussed in Subsection 4.1.3, PEC has entered into discussions with the State Historic Preservation Office (SHPO) in order to comply with Section 106 of

the National Historic Preservation Act, 16 United States Code (USC) § 470 and its implementing regulations (36 CFR 800). Archaeological investigations as required by the National Historic Preservation Act will be conducted to identify the full extent of historic properties and cultural resources and ensure appropriate follow-up investigations and data recovery actions are implemented (for example, archaeological, historical, or architectural) in the area of potential effects (APE). The APE includes all areas of direct construction impact for the two new reactor units, the areas of direct construction impact for the makeup water line and pumphouse, and all lands between the existing normal pool elevation of Harris Reservoir Lake and the proposed 100-year flood pool elevation. It is anticipated that impacts would be SMALL based on the mitigation and coordination with the SHPO.

10.3.1.10 Socioeconomic

Socioeconomic construction-related impacts are described in the subsection below.

10.3.1.10.1 Transportation

According to Section 4.4, additional traffic will be generated in the area during construction. Approximately 3150 additional vehicle trips per day would be made. This is the maximum number of vehicle trips during the peak construction period, when around 3150 construction workers are expected (The peak construction period is anticipated to occur once the HAR is 50- to 70-percent complete.). Once these tasks are complete, the workforce and average daily vehicle traffic are expected to decline steadily until the HAR is operational. During the peak construction period, approximately 3150 construction-related vehicle trips and 50 additional trips may occur per day. The increased traffic volumes on both U.S. Highway 1 and Old U.S. Highway 1 will be SMALL. Some limited congestion problems may occur as vehicles enter and exit the plant site and the HAR site when work shifts begin and end.

An increase in traffic to and from the HAR site will temporarily increase the level of vehicular noise for those residences along routes that access the HAR site. At times, the construction schedule could span 24-hour days, up to 7 days per week. Standard noise control devices (such as mufflers and sound-proofing) will be used to reduce noise impacts to nearby residences and other sensitive receptors.

If construction supplies are brought in by rail, additional train traffic may occur during construction. However, because the rail line is currently in use, periodic train traffic to deliver construction supplies will result in a SMALL noise impact, if at all.

10.3.1.10.2 Aesthetics

The HNP uses vegetation as a visual screen or buffer from surrounding land uses. Construction activities at the plant site will not be visible to nearby residences. However, during construction, the plant site and other project components may be visible to boaters or other individuals conducting water-based recreational activities on Harris Reservoir. The HAR sites are on the opposite side of the HNP. Because the main portion of Harris Reservoir is south of the HNP, those pursuing water-based activities will have minimal visual exposure to construction activities.

10.3.1.10.3 Labor

As discussed in Section 5.8, it is estimated that a maximum of 3150 workers will be employed to construct the HAR. This maximum construction workforce would occur only for a short duration during the peak construction time period.

While it is assumed that the majority of the workers needed for construction of the HAR will come from the greater Raleigh area, there will be a small in-migration of specialized construction-related workers who may relocate to the area. The in-migration of these workers will result in a SMALL indirect beneficial impact to the local economy. Skilled workers, managers, and operations personnel will temporarily reside in the region, frequent local establishments, and purchase goods and services within the vicinity and the region. There will be little change to the existing social structure and patterns of the surrounding community. No significant change in population is anticipated; therefore, the social structure will remain unchanged during construction of the HAR.

10.3.1.10.4 Tax Revenues and Economic Characteristics

Construction jobs and salaries will generate state income tax revenue. However, it is assumed that most of the construction workers will already live in the existing communities. Therefore, there will be no significant change in state income tax revenue generated from salaries paid to HAR construction workers. A small proportion of skilled craftsman are anticipated to relocate to the region during the construction period. A SMALL increase in state income tax revenue will be generated from the salaries paid to these skilled craftsmen. The skilled-craftsman jobs will account for a very small proportion of the overall workforce in the region, so no major state income tax revenue impact is anticipated.

Sales taxes will be levied on materials purchased for the HAR as well as on goods and services purchased by workers. Sales taxes on such purchases is expected to be a SMALL but beneficial impact to the local economy. Similarly, there may be SMALL direct and indirect beneficial economic impacts from sales tax revenue generated from goods and services purchased by workers who do not currently work in the region.

Construction of the HAR will have a beneficial MODERATE impact on the economic productivity of the area, particularly Wake County.

Based on the number of available year-round housing units and the expected portion of the construction workforce that may commute, constructing the HAR will not create a housing shortage. Because housing units in the region are abundant, constructing the HAR should have little impact on rents or sales prices for houses.

10.3.1.10.5 Recreation

Approximately 1.13 km^2 (0.44 $mi.^2$) or 279 ac. of recreation facilities at Harris Lake County Park and four boat ramps will be displaced by the rise in the reservoir's water level. The following PEC facilities will need to be relocated: storage and maintenance facilities, picnic areas, a restroom, a playground, and a ball field. Additionally, new park facilities will be developed to replace the recreational facilities displaced by the change in water level (Reference 10.3-010). Because these areas will be displaced by the change in water-level elevation as the HAR is being constructed, people who might have used these areas will have to relocate to other nearby recreation or related areas. During construction, recreational impacts are expected to be temporary and SMALL. Efforts will be made to mitigate those recreational resources displaced by construction activities. There will be a MODERATE beneficial impact to recreation because of the expansion of the reservoir. This expanded area will provide visitors with more boating and fishing opportunities.

10.3.1.10.6 Educational System

The HAR is located in Wake County. The Wake County Public School System (WCPSS) is currently planning an expansion program entitled "Blueprint for Excellence." This program will include new school construction and the renovation of existing facilities through the year 2011 (Reference 10.3-011). Because it is anticipated that most of the workers already live in the region, constructing the HAR should not significantly increase the number of pupils in the surrounding school systems. However, if the number of school-aged children increases slightly, the school system would have sufficient capacity to serve them. No impacts to the educational system are anticipated.

10.3.1.10.7 Environmental Justice

As stated in Subsection 4.4.2.12, no impacts to minority, ethnic, or special groups are anticipated as a result of the construction of the HAR. No impacts to low-income populations are anticipated as a result of the construction of the HAR.

10.3.1.11 Radiation

The radiological environmental data indicate that HNP operations in 2004 had no significant impact on the environment or on public health and safety (Reference 10.3-012).

Impacts to workers during construction of the HAR resulting from radiation doses from liquid and gaseous effluents from the ongoing operation of the HNP facility will be SMALL.

10.3.1.12 Mitigation to Lessen Impacts

Mitigation measures designed to lessen the impact of construction activities will be specific to erosion control, controlled access roads for personnel and vehicle traffic, and restricted construction zones. PEC and its contractors will comply with federal, state, and local regulations, ordinances, and BMPs. The HAR site preparation work will be completed in two stages. The first stage will consist of stripping, excavating, and backfilling the areas occupied by the structure and roadways. The second stage will consist of developing the HAR site with the necessary facilities to support construction, such as construction offices, warehouses, trackwork, large unloading facilities, water wells, construction power, and construction drainage. In addition, structures will be razed and holes will be filled.

Grading and drainage will be designed to avoid erosion during the construction period. Action will be taken to restore areas consistent with existing and natural vegetation. To the extent possible, HNP roads will be used for construction traffic. If necessary, temporary stone roads will be installed, along with HAR site grading and drainage facilities. This will permit all-weather use of the HAR site for travel and storage of materials and equipment during construction.

Proper mitigation, management methods, and construction erosion, sediment, and stormwater control measures implemented during construction will limit the potential water quantity and quality effects to the surface waters (e.g., Main Reservoir, stream crossings, and intermittent drainage ways) and groundwater.

10.3.2 OPERATIONS PREEMPTIONS AND PRODUCTIVITY

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of operation of the new units and measures proposed to reduce or eliminate those impacts while Section 10.2 provides a summary of the irreversible and irretrievable commitment of resources that represent short-term and long-term use of the human environment. This section provides an evaluation of the extent to which the operation of the proposed project's use of the environment will preclude any options for other future use of the environment and an evaluation of the project's impact on short-term use and long-term productivity capabilities of the human environment.

10.3.2.1 Land Use

The HAR site has been developed as a location for major energy generation facilities. In general, direct land use impacts from operation of the proposed new reactor units will be a continuation of those that currently occur at the site due to the existing unit. There will be an increase in impervious surfaces (e.g., parking lots, laydown areas) at the reactor sites due to the additional infrastructure. Stormwater ditches and storm sewers will be installed to collect the increased runoff.

Operation of the proposed facility will cause minimal impact to land use at the site and in the vicinity. Once the reactors cease to operate and the plant is decommissioned to NRC standards, the land will be available for other industrial or non-industrial uses.

The operation of the new reactor units will slightly increase air emissions as a result of burning fuel for equipment. This equipment will be operated in accordance with applicable federal, state, and local regulations and will not create any measurable impacts on regional air quality. Potential impacts to land use from cooling towers are primarily related to salt drift. It is assumed that new cooling towers would produce salt concentrations similar to cooling towers at existing nuclear power plants. According to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2), the impact of salt drift on crops, ornamental vegetation, and native plants was evaluated for existing nuclear power plants in the GEIS, and was found to be of minor significance. In addition, the potential for fogging, icing, or drift damage may also result from a cooling tower plume. While there is the potential for minor salt drift, fogging, and icing to occur, it is expected to be of such small magnitude that no land use changes will result. Normal maintenance activities and precipitation will prevent the buildup of salt in the soil at the cooling towers. No future issues for the long-term uses of the site will result from the impacts of increased air emissions or salt deposition. Once the plant ceases to operate and is decommissioned, impacts will cease.

Additional direct impacts will be primarily associated with the Harris Lake makeup water system intake structure, pumphouse, and discharge structure. The discharge structure would be designed and operated in a manner to ensure dissipation of water energy so that erosion of the surrounding area and suspension of bottom sediments is prevented. Therefore, anticipated land use impacts due to operation of the discharge structure are expected to be minimal. Once the Harris Lake makeup water system pipeline has been installed, operational impacts will be minimal. Impacts will be limited to maintenance of access roads and vegetation as required for maintenance and repair of the pipeline. These maintenance activities will take place on pre-exiting road and transmission line ROWs, and are not expected to cause any significant impacts.

Operation of the HAR and appurtenant facilities will cause SMALL land use impacts to recreational areas, roads, and ecology primarily associated with the increase in the water level of Harris Reservoir.

10.3.2.2 Relocation and Inundation

As discussed above and in Section 4.1, the increased lake level will inundate infrastructure along the shores of Harris Reservoir. The most serious impacts will be to county roads, transmission lines, boat ramps, emergency siren towers, Harris Lake County Park, the Wake County sheriff firing range, and several PEC facilities. These facilities will need to be relocated during the construction phase and prior to a rise in lake level. The affected infrastructure features will be replaced with similar infrastructure in non-affected areas nearby. The result of these mitigation efforts would be no net loss in resource area or associated functional value. Therefore, long-term land-use impacts are expected to be insignificant after these facilities have been relocated or modified.

10.3.2.3 Air

Air quality impacts to workers and nearby residents from operation of the HAR and appurtenant facilities are anticipated to be negligible. The average annual exposure at the site boundary from gaseous sources will not exceed applicable regulations during normal operation. Additionally, it is anticipated that air emission levels at the site boundary will be insignificant, as defined by U.S. Environmental Protection Agency (USEPA).

Additional air emissions from increased vehicular traffic from the new operational workforce may contribute to deteriorated air quality in Wake County. This increase in traffic from the new workforce would result in increased ozone emission on roadways and could affect whether attainment status could be maintained in the future.

10.3.2.4 Water

Operating the new reactor units will require makeup water that is withdrawn from the Harris Reservoir. Water from the Cape Fear River will be used to increase the reservoir level to provide adequate makeup water for the new reactors. SMALL secondary land use impacts will result from raising the water level elevation of the reservoir because the land use designation will change to open water. Increasing the reservoir level will have a larger impact on land use in the vicinity of the plant than the direct impact caused by just operation of the facilities. After the reactors cease to operate and the units are decommissioned, water withdrawal from the reservoir will cease.

The facility will adhere to applicable federal, state, and local regulations and permit requirements with regard to water usage to avoid removal of water from Cape Fear River and Buckhorn Creek during sensitive spawning periods and/or during draught conditions. Makeup water withdraws from the river would be

limited to only the minimum required for plant operation during periods of normal operation and low flow conditions and reduced to zero withdrawal during severe drought periods. During these severe drought periods, plant water use requirements would be met for a period of time by using available reservoir storage. Monitoring programs may be initiated to determine changes in the cooling system flows, water levels in Harris Reservoir, and discharges from Harris Reservoir to Buckhorn Creek.

10.3.2.5 Terrestrial and Aquatic Ecosystems

Terrestrial and aquatic ecosystem impacts are anticipated to be SMALL during operation of the facility. Specific monitoring requirements will be designed to minimize adverse environmental impacts and to ensure that organisms will be protected against the cooling water intake structures.

An aquatic monitoring program for Harris Reservoir and associated streams will be developed to support and satisfy various environmental regulations, licenses, and permits associated with operation. The program will build on more than 20 years of data collected by HNP and the North Carolina Division of Water Quality monitoring. Water quality will be carefully monitored at the locations expected to be impacted most heavily by operation of the HAR site, the spillway, and the Harris Lake makeup water system pipeline outfall into Harris Reservoir.

Operational monitoring will be implemented to establish changes in water temperature resulting from HAR facility operation. The specific operational monitoring requirements will be developed relative to NPDES permit requirements and the monitoring requirements for HNP and the HAR.

Surveys to monitor soil and terrestrial plant and animal communities will be conducted, as needed, to supplement the existing program. Generally, data would be collected on a seasonal basis and should be sufficient to characterize seasonal variations throughout at least one cycle. Additional data may be needed on a site-specific basis, or as directed by appropriate permit requirements. Surveys may include terrestrial field investigations and surveys for terrestrial flora and fauna, sensitive habitat and species of interest, historical properties, commercial game lands, coordination with federal and state agencies, and other special interest groups.

10.3.2.6 Noise

As stated in Section 5.8, there will be no physical noise impacts from operation of the HAR or appurtenant facilities outside of the 9.65-km (6-mi.) radius of the vicinity. Equipment used for operation of the HAR will follow all applicable federal, state, and local noise control regulations. Noise control devices will be used on equipment that exceeds noise abatement criteria. Equipment manufacturers will be required to guarantee that specifications on allowable octave bands will be met. Most equipment will be located inside structures;

therefore, building walls will reduce outside noise levels. Further, reduction in noise impacts will be achieved as noise travels out towards the property line.

10.3.2.7 Transmission

Land use impacts to transmission corridors from operation of new units will be identical to impacts from the existing unit: PEC acquires transmission line ROW (either by outright purchase of the land, easements, or permits) that give it access and control over how the land in the transmission corridor is managed. PEC ensures that land use in the corridors and underneath the high-voltage lines is compatible with the reliable transmission of electricity. Vegetation communities in these corridors are kept at an early successional stage by maintenance activities, such as mechanical clearing, hand cutting, and herbicide application. PEC's control and management of these ROWs precludes virtually all residential and industrial uses of the transmission corridors. PEC has established transmission vegetation management and line maintenance procedures that will be used to maintain the new corridors and transmission lines. Therefore, impacts to land use in transmission corridors will be SMALL and not require mitigation.

Two types of operational activities are anticipated within the transmission corridors as part of normal transmission line maintenance. These include routine vegetation inspection and clearing activities in the ROW and access road construction for temporary maintenance needs. These activities would be carried out in consultation with affected landowners and appropriate measures will be taken to minimize any disturbances.

PEC employs the most economical vegetation management techniques through communication, continuous learning, and assessment of BMPs throughout the industry. The PEC Transmission Vegetation Management Program includes visual inspection and appropriate maintenance of transmission line ROWs. Maintenance activities may include re-clearing vegetation, tree trimming/removal, danger tree cutting, and encroachment licensing/removal. For maintenance purposes, wooded sections of the ROW will be re-cleared to the full width through mechanical clearing, hand cutting, or herbicide application.

Routine inspections of the ROW will be conducted periodically to monitor vegetation growth, ROW contractor effectiveness, and encroachments within the ROW. Inspections will be conducted by aircraft and ground patrols, as needed. Maintenance and repair inspections required by cause, such as storms that may down timber on or near the lines, will be conducted by air, road, or foot, as required by the circumstances. These occurrences are expected to be few, and will have limited impact on the land.

10.3.2.8 Cultural Resources

Operation of the HAR is not expected to impact cultural resources in the area. Coordination will occur with the SHPO if cultural resources are found during operation of the new facility.

10.3.2.9 Socioeconomic

Socioeconomic operation-related impacts are described in the subsections below.

10.3.2.9.1 Transportation

As discussed in Section 5.8, roads and highways in the vicinity will not be significantly impacted by operation of the HAR. Because it is expected that most of the operational workers already live within the 80-km (50-mi.) radius of the plant site, traffic would be divided over the two primary access routes. U.S. Highway 1 and Old U.S. Highway 1 are two-lane roads or highways that should be able to handle an increase in operations worker-related vehicular traffic. At its nearest point, U.S. Highway 1 is approximately 2.1 km (1.3 mi.) from the center of the plant site. The average annual daily traffic (AADT) near the plant site is 18,000 vehicles. At its nearest point, Old U.S. Highway 1 is approximately 3.2 km (2 mi.) from the center of the plant site. The AADT for Old U.S. Highway 1 near the plant site is 1800 vehicles. The existing operation workforce for HNP consists of 754 employees. It is anticipated that approximately 773 people will be needed to operate the HAR facility. Based on the assumption that each employee will make one vehicle trip per day, it is anticipated that there would be an increase of 1269 vehicles a day.

The increased traffic volumes on both U.S. Highway 1 and Old U.S. Highway 1 will generate SMALL impacts. Some limited congestion problems may occur as vehicles enter and exit the plant site and the HAR site when work shifts begin and end.

Finally, the proposed Western Wake Parkway will provide additional transportation mobility and capacity when completed in 2011. This project will provide a new six-lane, controlled access parkway in western Wake County. The roadway will be approximately 20.3 km (12.6 mi.) and extend the Raleigh Outer Loop from NC 55 near Research Triangle Park south to the NC 55 Holly Springs Bypass.

10.3.2.9.2 Aesthetics

The existing site is already industrial in appearance; therefore, the HAR will not substantially alter this already disturbed site. The HAR will discharge two additional plumes. These plumes will be similar in size and scale to the plume which is currently discharged at the site. The visual impact of two additional plumes will be minimal as the current facility emits a similar discharge plume. Because the surrounding land is primarily undeveloped and heavily wooded, the plume is blocked from view by dense trees and is not visible from nearby roads in many areas. Based on that fact, the proposed project will have similar visual impacts as the existing facility; the proposed site will have a SMALL impact on aesthetic quality.

10.3.2.9.3 Labor

The operation workforce for the HAR will consist of approximately 773 employees. It is assumed that the majority of these workers would come from the Raleigh area. However, a small proportion of these workers with specialized skills may relocate to the Raleigh area to work at the site. It is assumed that these workers will bring families. It is assumed that these workers and families would settle in the Raleigh area. However, the overall population increase will be SMALL in relation to the existing population in the area. Overall, the economic impact from employment of workers to operate the new facilities will be SMALL.

There are approximately 55,219 people within 16 km (10 mi.) of the site. The largest cities in the area include Holly Springs (9192) located 10.92 km (6.79 mi.) east, Apex (20,212) located 13.85 km (8.61 mi.) northeast, and Fuquay-Varina (7898) located 15.73 km (9.78 mi.) east-southeast of the site. All are small towns that also serve as bedroom communities to Raleigh. These communities will not experience any physical impact from station operation. No impacts to structures, including residences near the plant site or vicinity, are anticipated. No significant impacts to hospitals or other institutional facilities are anticipated.

10.3.2.9.4 Tax Revenue and Economic Characteristics

Other potential tax impacts will include an increase in state income tax revenue generated from the additional operational jobs and indirect salaries created by operation of the facility. A SMALL increase in state income tax revenue will be generated from the salaries paid to new workers employed at the new facilities.

Sales taxes will be levied on materials purchased during operation of the new facilities as well as on goods and services purchased by new workers. Sales taxes on such purchases will be a SMALL but beneficial impact to the local economy. Similarly, there may be SMALL direct and indirect beneficial economic impacts from sales tax revenue generated from goods and services purchased by workers who do not currently work in the region.

As stated in Subsection 5.8.2.2, from 2001 and 2004, PEC paid between $7,061,685 and $8,396,063 annually in total real and personal property tax revenues to Wake County. This averages out to 2.3 percent of Wake County's total tax annual revenues. A portion of these funds is retained for county operations and the remainder is disbursed to the county's 12 cities or municipalities to fund their respective operating budgets.

Operation of the HAR will have a beneficial MODERATE impact on the economic productivity of the area, particularly Wake County.

10.3.2.9.5 Recreation

The workforce for the proposed project is expected to already live in the area. Therefore, no additional increase in recreational activities or nearby park visitors is expected as a result of the operation of the HAR and appurtenant structures and facilities. The impact on recreation from the lake level rise will be short term because PEC is committed to mitigating these losses by re-creating or designating recreational areas at higher elevations. The recreational impacts from operation will be SMALL and short-term, because PEC is committed to relocating the park services affected by the increased lake level. The increase in lake level required to support the operation of the HAR will result in increased lake area, and therefore, will provide additional recreational area for boaters and other water-related activities. The increase in lake area would result in MODERATE long-term beneficial impacts.

10.3.2.9.6 Education

It is assumed that the operation of the HAR will not result in a significant increase in school-age population in the surrounding area. The WCPSS has prepared the *Blueprint for Excellence* to address recent school system expansion plans. The Wake County voters passed a $970-million Bond Referendum in November 2006 to finance school renovations and new construction. This program will include new school construction and the renovation of existing facilities through the year 2011 (Reference 10.3-011). This plan indicates that there is sufficient capacity for a small increase in population anticipated as a result of the proposed project. No impacts to the educational system are anticipated as a result of increased operational workforce.

10.3.2.9.7 Environmental Justice

Operation of the new facilities will comply with federal, state, and local regulations. Therefore, no disproportionately high or adverse impacts on minority and low income populations are anticipated as a result of operation of the facility.

10.3.2.9.8 Public Facilities

It is anticipated that existing public facilities will be able to absorb the minor increase in load due to the small influx of people expected. A survey of local water and wastewater supply facilities in the area indicates that there is sufficient capacity to accommodate a potential increase in population in the region. No impacts to public services and facilities are anticipated as a result of the additional operational workforce.

Current public services and facilities are sufficient to absorb any incremental growth associated with a small workforce in-migration. Because there is an existing facility, local emergency management agencies have emergency response plans in place for responding to emergency situations. Therefore,

operation of the new facilities will have negligible impacts on the public and security services.

10.3.2.10 Radiation

Impacts due to radiological emissions will be small, since the operation of the new units will be in accordance with federal and state regulations and similar to the current operation of Unit 1. Radiological emissions will not contaminate the HAR property or surrounding land. Once the plant ceases to operate and is decommissioned, radiological releases will cease. The construction and operation of the HAR contributes to the long-term cumulative depletion of the global uranium supply. Over the long term, the spent fuel must be managed as a high-level radioactive waste, and either reprocessed or isolated from the biosphere for thousands or tens of thousands of years. This represents a long-term commitment of the contaminated waste disposal/repository area.

10.3.2.11 Mitigation to Lessen Impacts

PEC employees and its contractors will comply with federal, state, and local regulations, ordinances, and BMPs to mitigate and lessen potential impacts associated with the operation of the HAR.

10.3.3 SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The construction and operation of the HAR and appurtenant infrastructure and facilities results in the continued commitment of land use at the existing site. Additional land is needed for the filling of the Harris Reservoir and for the construction and operation of appurtenant infrastructure and facilities. In the short term, the project results in some potential loss of natural habitats and woodlands. Construction and operation of the HAR does not necessarily represent a long-term loss as the land might be released for other uses or returned to its natural state after the reactors are decommissioned.

Construction and operation of HAR and appurtenant infrastructure disrupts or destroys some flora and fauna on and near the HAR, at the Harris Reservoir, and in the area of the appurtenant infrastructure. However, no significant effect to species or habitats is expected to occur. After construction, some flora and fauna may recover in areas that are no longer affected by construction or plant operations. The impacts to biota and habitat are relatively small. The HAR does not result in any significant long-term detrimental disturbance to biota or their habitats.

The energy used in constructing the HAR and appurtenant infrastructure results in facilities that produce a net increase of electrical power for a period of 40 years. The use of materials in constructing the HAR is also critical to the goal of producing a clean and reliable supply of electrical power. A relatively modest quantity of cooling water is lost through evaporation and drift. In the long term,

construction and operation of the HAR contribute to the cumulative long-term irreversible use of materials, energy, and water used in the construction and operation of the facility. However, the new reactors provide far more energy than is consumed in their construction.

The project stimulates economic growth and productivity in the local area. Revenue derived from this project may fund increased infrastructure and social services. In the long term, property taxes paid by the HAR and wages spent by the operational staff may inject significant revenues into the local economy that have long-lasting economic growth and development effects that may continue after the HAR is decommissioned.

The radioactively contaminated reactor vessel and equipment are required for the short-term production of nuclear energy using uranium, which provides a short-term supply of relatively clean energy. The construction and operation of the HAR contributes to the long-term cumulative depletion of the global uranium supply. Over the long-term, the spent fuel must be managed as a high-level radioactive waste, and either reprocessed or isolated from the biosphere for thousands or tens of thousands of years. This represents a long-term commitment of the contaminated waste disposal/repository area.

In conclusion, the effects resulting from the construction and operation of the proposed new reactor units at the HAR site will result in some adverse short-term effects. The principal short-term benefit is the production of electrical energy. In addition, the economic benefit of the HAR site and the associated workforce is large compared with the economic benefit from agriculture or other likely uses for the site. The negative aspects of facility construction and operation, as they affect the human environment, are outweighed by the positive enhancement of regional productivity through the generation of electrical energy, creation of jobs, and stimulation of the local economy. Construction and operation of the HAR does not necessarily represent a long-term loss as the land might be released for other uses or returned to its natural state after the reactors are decommissioned. There will be no long-term adverse impacts to the site because of restoration of the site during decommissioning.

10.3.4 REFERENCES

10.3-001 CH2M HILL, “Ecological Field Observations: Harris Nuclear Plant,” August 2006.

10.3-002 Progress Energy Carolinas, Inc., “Applicant’s Environmental Report - License Renewal Operating Stage Shearon Harris Nuclear Plant, Unit 1,” Docket No. 50-400, License No. NPF-63, June 2006.

10.3-003 CH2M HILL, “Progress Energy – Harris Lake Infrastructure Impacts Technical Memorandum,” Prepared for Progress Energy Carolinas, Inc., May 16, 2007.

10.3-004 Kiker Forestry & Realty, Inc., "Forest Management System," prepared for Progress Energy Carolinas, Inc., June 2004.

10.3-005 Progress Energy Carolinas, Inc., "Progress Energy Carolinas, New Facility Licensing, Harris Nuclear Plant, Wake County, NC–Request of Information on Listed Species and Important Habitats," 2007, prepared for the North Carolina Natural Heritage Program, U.S. Fish and Wildlife Service, and the North Carolina Wildlife Resources Commission, January 10, 2007.

10.3-006 North Carolina Wildlife Resources Commission, "Response to Information Request," February 27, 2007.

10.3-007 Hebert, E., et al., "Avian Collision and Electrocution: An Annotated Bibliography, California Energy Commission," 1995, Website, www.energy.ca.gov/reports/avian_bibliography.html, accessed January 4, 2007.

10.3-008 Federal Highway Administration, "Special Report: Highway Construction Noise: Measurement, Prediction, and Mitigation," Website, www.199.79.179.101/environment/noise/highway/contents.htm, accessed March 19, 2007.

10.3-009 Minnesota Pollution Control Agency, "A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis, Regulation," revised March 1999.

10.3-010 CH2M HILL, "Mitigation Planning for Potential Impacts to Public Infrastructure at Harris Lake Associated with the Change in Water Level Elevation", Technical Memorandum prepared for Progress Energy Carolinas, Inc. May 16, 2007.

10.3-011 Wake County Public School System, "Blueprint for Excellence 2006," 2006, Website, www.wcpss.net/bond/, accessed December 19, 2006.

10.3-012 Progress Energy Carolinas, Inc. "Radiological Environmental Operating Amended Report 2004," Harris Nuclear Plant Carolina Power & Light Company Doing Business As Progress Energy Carolinas, Inc. 2004.

10.4 BENEFIT-COST BALANCE

In accordance with NUREG-1555, Section 10.4, this section describes the benefit-cost balance of the proposed Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR) project. Subsection 10.4.1 describes the benefits of the proposed project, Subsection 10.4.2 discusses the costs associated with the proposed project, and Subsection 10.4.3 provides a benefit-cost balance summary.

10.4.1 BENEFITS

Per guidance provided in NUREG-1555 Environmental Standard Review Plan (ESRP) 10.4.1, this section discusses the benefits resulting from the proposed construction and operation of the HAR project. Information provided in this section includes the following:

- A summary of the evaluation to determine if there is a demand for new electric power in North Carolina.
- A summary of the evaluation to determine an electric generating power source (coal, gas, nuclear, solar, wind).
- A summary of the evaluation to choose a location for the selected electric generating power source.
- A summary of the benefits that the new electric generating power facility will provide.

Table 10.4-1 summarizes the benefits of the proposed construction and operation of the HAR project including the following:

- The identification of all appropriate plant production benefits.
- The calculation of the plant average annual electrical-energy generation in kilowatt-hours (kWh).
- Evaluation of the reliability of the electrical distribution system.
- Identification of other project benefits, including state and local tax revenues, regional productivity, enhancement of recreational and aesthetic values, environmental enhancement, creation and improvement of local roads or other facilities, and intangible benefits (e.g., reduced dependence on scarce fossil fuels).
- The quantification of benefits in monetary or other appropriate terms.
- The evaluation of the significance of the benefits on a political boundary or regional basis.

- The assessment of any potential social or economic impacts as a result of the proposed project construction and operation.

10.4.1.1 Need for Power

This section summarizes the need for power in North Carolina. A detailed discussion on the need for power is provided in Section 8.4. The need for power in North Carolina is based on PEC's Integrated Resource Plan (IRP). PEC's plan is an annual report of its resource plan containing a 10-year forecast of loads and generating capacity. The report process accounts for conservation, load management, and other demand-side options along with new utility-owned generating plants, non-utility generation, and other supply-side options in order to identify the resource plan that will be most cost-effective for the ratepayers consistent with the provision of adequate, reliable service. PEC's plan is submitted to the North Carolina Utilities Commission (NCUC), which incorporates it into the NCUC Annual Report to the North Carolina Legislature. PEC submitted its latest annual plan to the NCUC in the fourth quarter of 2007.

The NCUC's August 2006 findings and order support the growing understanding that new baseload capacity may be necessary to supply consistent, reliable power (Reference 10.4-001). For example, the NCUC asserts that increasing fuel costs and waning interest in deregulation contribute to the need for additional baseload "on the horizon." This conclusion was the result of expert testimony, multiple public hearings, and consideration of the Integrated Resource Plan reports submitted pursuant to North Carolina General Statutes (G.S.) 62-110.1(c) (Reference 10.4-001). According to Table 8.1-2, PEC has planned for 3643 megawatts (MW) of new capacity by 2022. The demand calculations show a continuing annual increase in demand throughout the planning period (Reference 10.4-002). The increases show that the need for power grows by approximately 900 MW every 4 years. With PEC's ratepayer base growing by 25,000 customers annually, the utility and the NCUC recognize that demand will soon outstrip existing capacity (Reference 10.4-001).

PEC's strategic planning effort in 2006 to meet the NCUC requirements attempted to look farther ahead than ever before, considering not just the next 10 years, but the next 15 years. Through this new resource planning approach, PEC examined everything from fuel price trends to emerging technologies and environmental policies. PEC also analyzed how best to manage the very large capital requirements for new generation and transmission infrastructure as well as for additional emission-control equipment.

This new planning approach was incorporated into the 2007 IRP and enabled PEC to evaluate more long-term approaches for addressing reliability and reserve capacity concerns. PEC reached the following conclusions in the 2007 IRP:

- Continue to focus on the use of gas-fired generators for peaking and intermediate load needs, when possible, and on oil-fired units for peaking load, when necessary.

- Pursue expansion of its energy efficiency and conservation programs actively as energy efficiency is one of the most effective ways to reduce energy costs, offset the need for new power plants, and protect the environment.

- Evaluate the use of gas-fired units because PEC believes they are the most environmentally benign, economical, large-scale capacity additions available and that the advanced designs of these technologies are more efficient (as measured by heat rate) than previous designs, resulting in a smaller impact on the environment.

- Continue to invest in existing generating plants and consider plans for building a new baseload plant by evaluating the best available options for this new generation, including advanced design nuclear technologies.

- Establish a 2-year moratorium on construction of new coal-fired plants, while at the same time, continue to pursue expansion of energy efficiency and conservation programs.

- Plan to seek license renewal options for the existing hydroelectric and nuclear plants (Reference 10.4-002).

In summary, there is a need for a new generating facility in North Carolina based on the following:

- The State of North Carolina has a well defined, systematic, and comprehensive resource planning program that adequately reviews the state's resources and growing demand for additional baseload, eliminating the need for additional NRC review.

- The state IRP process gives NRC assurance that the HAR would not proceed without state concurrence that the need for power is real and that the benefits of satisfying that need would be realized.

- The NCUC Commissioners have concluded that there is a need for new baseload capacity, and the NCUC's conclusion has been given "great weight" in this ER, as allowed by NUREG-1555.

10.4.1.2 Energy Alternatives

The following paragraphs provide a summary of the evaluation that was conducted in Section 9.2, to determine a suitable electric generating power source to meet the demand for new power in North Carolina. The evaluation identified alternatives that would require the construction of new generating

capacity — such as wind, geothermal, oil, natural gas, hydropower, municipal solid wastes, coal, photovoltaic cells, solar power, wood waste/biomass, and energy crops, as well as any combination of these alternatives. In addition, alternatives that would not require new generating capacity were evaluated, including initiating energy conservation measures and Demand-Side Management (DSM), reactivating or extending the service life of existing plants within the power system, and purchasing electric power from other sources.

The analysis determined that DSM is not a feasible alternative and that extending the service life of existing plants or reactivating old plants and/or purchasing power from other utilities or power generators also are not feasible alternatives. The analysis determined that neither a coal-fired nor a gas-fired facility would appreciably reduce overall environmental impacts relative to a new nuclear plant. Furthermore, a coal-fired and a gas-fired facility would entail a significantly greater environmental impact on air quality than would a new nuclear plant. Wind and solar facilities in combination with fossil facilities could be used to generate baseload power. However, wind and solar facilities, in combination with fossil facilities, would have equivalent or greater environmental impacts, higher costs, and larger land requirements than a new nuclear facility. Based on environmental impacts and economics, PEC has concluded that nuclear power is a suitable electric generating power source.

10.4.1.3 Alternative Locations for the Proposed Facility

The following paragraphs provide a summary of the evaluation that was conducted in Section 9.3 that identified a preferred location for the new nuclear power facility. The objective of the evaluation was to verify that no obviously superior location for the site of a new nuclear unit exists. The decision to choose a new nuclear facility site was based on market factors and a comparison of the other existing nuclear sites within North and South Carolina controlled by PEC and within the identified Region of Interest (ROI). The existing sites include the HAR site, Wake County, North Carolina; the Brunswick Nuclear Power Plant, Brunswick County, North Carolina; and the H.B. Robinson Nuclear Power Plant, located in Darlington County, South Carolina. In addition, a greenfield site located in Marion County, South Carolina, was also evaluated. The sites were evaluated based on potential impacts to land use, air quality, water quality, terrestrial and aquatic ecology, sensitive species, demographics, and historic, cultural, and archeological resources.

The following environmental factors summarize the reasons the HAR is superior to the alternative sites of Brunswick and Robinson:

- The HAR site has a smaller number of listed, threatened, or endangered species and critical habitat; no spawning grounds for any state or federal threatened or endangered species; and no postulated effluent discharge beyond the limits of existing NPDES permits or regulations.

- HAR has a demonstrated advantage over Brunswick and Robinson due to larger acreage of PEC-owned property and the clear ability to accommodate additional future generation capacity. HNP was originally planned for multiple units.

- HNP was originally designed as a four reactor site, although only one reactor was built. However, certain infrastructure was built to support the four reactors, which can be used to support HAR 2 and HAR 3. The infrastructure includes transmission line corridors, a switchyard currently sized for two units, and a lake that can be modified to support multiple units.

- The lake is currently sized for one reactor and can be increased in size to support HAR 2 and HAR 3. In contrast, the Robinson site has limited water availability and the Brunswick site would use saltwater for cooling that could pose cooling tower salt drift concerns.

- Transmission deliverability analysis concluded the HAR site is best suited to the existing transmission system requirements. The HAR site has minimal transmission impact of costs for the installation of an 1100 megawatt (MW) nuclear unit. All other sites evaluated had considerable power grid challenges identified with the addition of an 1100 MW nuclear unit (during various contingency scenarios) and required significant transmission system upgrades compared with the HAR. Transmission system upgrades at the alternative sites were estimated to total $600 million for Brunswick and $286 million for Robinson. In comparison, estimated costs of transmission upgrades for the HAR site were evaluated as negligible.

- The need for transmission line upgrades is significantly less for the HAR site than for the other alternative sites. Existing transmission lines and corridors would be used for HAR 2, and existing transmission corridors would be expanded for HAR 3. Only three new lines would need to be developed for the HAR site in the existing corridors. In contrast, the Robinson site is not located near major load centers and new transmission corridors and switchyards would need to be developed. The Brunswick site is near the Wilmington, NC load center, but new transmission corridors and switchyards would need to be developed to serve other load centers on the PEC system.

The analysis indicated that the preferred location for the new nuclear facility is collocation with an existing nuclear facility. Siting a new reactor at an existing nuclear facility offers a number of benefits. By collocating nuclear reactors, the total number of generating sites is reduced. No additional land acquisitions are necessary, and the applicant can readily obtain control of the property. This reduces both initial costs to the applicant and the degree of impact to the surrounding anthropogenic and ecological communities. Site characteristics, including geologic/seismic suitability, are already known, and the site has already

undergone substantial review through the National Environmental Policy Act of 1969 (NEPA) process during the original selection procedure. No new analysis of site appropriateness is necessary, which can reduce start-up costs. In addition, the environmental impacts of both construction and operation of the existing unit are known. It can be expected that the impacts of a new unit should be comparable to those of the operating nuclear plant. Furthermore, collocated sites can share existing infrastructure, reducing both development costs and environmental impacts associated with construction of new access roads, waste disposal areas, and other important supporting facilities and structures. Finally, existing nuclear plants have nearby markets, the support of the local community, and the availability of experienced personnel.

The analysis concluded that none of the alternative sites are environmentally preferred to co-locating the new nuclear facility with the existing HNP. Construction and operation of a new nuclear facility at the alternative sites would entail environmental impacts that are equal to or greater than those at the HAR site.

10.4.1.4 Benefits of the Proposed Facility

10.4.1.4.1 Tax Payments

Locating the proposed new nuclear facility at the HNP will afford benefits to the local economy. The HAR will generate additional state income tax, sales tax, and property tax revenues. PEC will pay property taxes on the proposed new units for the duration of the operating licenses to Wake County. According to Subsection 5.8.2.2, from 2001 and 2004, PEC paid between $7,061,685 and $8,396,063 annually in total real and personal property tax revenues to Wake County. This averages out to 2.3 percent of Wake County's total tax annual revenues. Most people consider large tax payments a benefit to the taxing entity because they support the development of infrastructure that supports further economic development and growth.

Sales taxes will be levied on materials purchased for the HAR, as well as on goods and services purchased by workers. Sales taxes on such purchases are expected to be a small but beneficial impact to the local economy. Similarly, there may be small direct and indirect beneficial economic impacts from sales tax revenue generated from goods and services purchased by workers who do not currently work in the region.

10.4.1.4.2 Local and State Economy

According to Sections 4.4 and 5.8, it is estimated that a maximum of 3150 workers will be employed to construct the HAR facility and approximately 773 employees will be needed to operate both of the new reactor units. It is anticipated that construction and operation of the new facility would require a similar size and skilled workforce. New jobs within approximately 80.5 km (50-mi.) radius of the plant would be created by the construction and operation of

the new facility. Many of these jobs would be in the service sector and could be filled by unemployed local residents, lessening demands on social service agencies in addition to strengthening the economy. It is anticipated that the new jobs would be maintained throughout the life of the plant.

Construction and operation workers are expected to live and spend most of their salaries within the local area and surrounding region. In addition, these workers are likely to spend some portion of their salaries in the local area for gasoline, beverages, food, and incidental items. Because construction workers will be at this location for some time, there will be a small multiplier effect where money is spent and re-spent in the local area and later in the region. By patronizing local retail and service sector businesses, construction workers may temporarily increase sales. The economic multiplier effect is one way of measuring secondary effects and means that every dollar spent by nuclear plants results in the creation of an additional $1.13 in the community (Reference 10.4-003). Construction worker spending may have positive temporary direct and indirect impacts on the business community, sustaining existing businesses in the area and the region, while potentially providing opportunities for some new businesses. As a result, unemployment levels in the region may temporarily decrease, providing an additional indirect beneficial economic impact.

10.4.1.4.3 Non-Monetary Benefits

10.4.1.4.3.1 Recreation

PEC is committed to finding an alternate location for the impacted portions of the park (play structures, roads, recreational facilities, boat ramps) as close to the original location as possible. The potential sites of park relocation are very similar to the current location (primarily evergreen forest, deciduous forest, and mixed forest). Replacing the affected infrastructure features with similar infrastructure in non-affected areas nearby will result in no net loss in resource area or associated functional value. Short-term impacts on land-use are expected to be minor and temporary until the permanent locations can be established. Long-term land-use impacts are expected to be insignificant after these facilities have been relocated.

10.4.1.4.3.2 Regional Productivity

Construction of the proposed facility is anticipated to require approximately 3150 workers, while operation of both of the new reactor units would require approximately 773 employees. Construction workers are expected to live and spend most of their salaries within the region. In addition, these workers are likely to spend some portion of their salaries in the local area for gasoline, beverages, food, and incidental items. Because construction workers will be at this location for some time, there will be a small multiplier effect where money is spent and re-spent in the local area and later in the region. By patronizing local retail and service-sector businesses, construction workers may temporarily increase sales. Construction worker spending may have positive temporary direct and indirect effects on the business community, sustaining existing businesses in the area

and the region, while potentially providing opportunities for some new businesses. As a result, unemployment levels in the region may temporarily decrease, providing an additional indirect beneficial economic impact. Operation of the plant is anticipated to require both direct and indirect jobs that will add permanent new jobs to the region.

10.4.1.4.4 Net Electrical Generating Benefits

As described in Chapter 8, there is a growing baseload demand and growing baseload supply shortfall in the existing electric generating system. According to Subsection 3.2.2, the proposed new Westinghouse AP1000 reactors for the HAR facility have a rated core thermal power of 3415 megawatts thermal (MWt) with an associated core power of 3400 MWt and a rated net electrical output of approximately 1000 megawatts energy (MWe). These new units provide a benefit by meeting the growing industrial, commercial, and residential need for additional electrical power.

10.4.1.4.5 Air Pollution and Emissions Avoidance

Power generation plants that utilize natural gas and coal for electrical generation, produce significant air pollutant emissions (e.g., nitrogen oxides, sulfur dioxide, and carbon dioxide) or methyl mercury that adversely affect human health. Nuclear power generation results in significant local and national air quality benefits. Nuclear reactors have the added benefit that they do not contribute to smog.

Given concerns in the state about climate change and carbon emissions, the HAR serves an important environmental benefit need by reducing carbon emissions in the state. When the plant becomes operational, the HAR will add needed power in state without generating significant amounts of new carbon, compared to a coal-fired generating plant.

10.4.2 COSTS

Per guidance provided in NUREG-1555 ESRP 10.4.2, this section summarizes construction and operation costs that are predicted for the proposed project. Table 10.4-1 summarizes the costs of the proposed construction and operation of the HAR project including the following:

- Internal costs such as land, labor, materials, equipment, services, capital costs, operating and maintenance costs, fuel costs, decommissioning costs, and any other applicable identified internal costs.

- External costs such as the costs of impacts (e.g., loss of productivity, loss of wildlife habitat, land, hydrological, and water uses, terrestrial and aquatic biology impacts, socioeconomic impacts), and any other applicable external cost.

10.4.2.1 Internal Costs

Internal costs are the monetary costs of construction and operation of the proposed new reactor units at HAR. Internal costs can include capital costs of the facility and transmission lines, and operating costs (staffing, maintenance, fuel) as well as decommissioning costs.

Construction costs and operation costs are generally discussed using established cost information developed by several resources. There are many cost studies available in the literature with a wide range of cost estimates. Four studies are believed to be the most authoritative because of the breadth and depth of their analyses. These four studies are as follows:

- Organization for Economic Co-operation and Development (OECD) study of projected electricity generating costs (Reference 10.4-004).
- University of Chicago (UC) study on the economic future of nuclear power (Reference 10.4-005).
- Massachusetts Institute of Technology (MIT) study on the future of nuclear power (Reference 10.4-006).
- Energy Information Administration (EIA) annual energy outlook (Reference 10.4-007).

The four economic studies identified above provide sufficient economic information to assess and predict costs of the proposed project. By conducting a systematic review of the economics of nuclear power, the studies were able to generate a financial model that estimated the costs of new nuclear plants coming on line in the future. To develop that model, several factors were investigated:

- Factors affecting the competitiveness of nuclear power including leveled costs, comparisons with international nuclear costs, capital costs, effects of learning by doing, and financing issues.
- An analysis of technologies that could reduce the costs of gas- and coal-fired electricity, future fuel price changes, and the potential economic impact of greenhouse gas control policies and technology.
- An analysis of several federal financing policy alternatives designed to make nuclear power competitive in the future.

Using the information contained within the four studies identified above, the internal costs of constructing and operating a new nuclear facility at HAR was developed, meeting the intent of NUREG-1555. The construction and operating cost values accounted for all aspects of pertinent construction and operating practices and methods unique to nuclear generating facilities and were based on industry standards as outlined in the literature cited above.

10.4.2.2 Monetary – Construction

In evaluating the HAR nuclear facility monetary cost, a review of published literature, vendor information, internally generated general/site-specific information, and the four studies identified above was conducted. The phrase commonly used to describe the monetary cost of constructing large capital projects such as a nuclear plant is "overnight capital cost." The capital costs are those incurred during construction, when the actual outlays for equipment and construction and engineering are expended. Overnight costs are exclusive of interest and include engineering, procurement, and construction costs, owner's costs, and contingencies.

The four studies identified in Subsection 10.4.2.1 estimate overnight capital costs that range from $1100 per kilowatt (kW) to $2300 per kW, with $1500 to $2000 per kW being the most representative range. Many factors account for the range, such as the following examples: the specific technology and assumptions about the number of like units built, allocation of first-of-a-kind costs, site location and parity adjustments to allow comparison between countries, and allowances for contingencies. The estimates are not based on nuclear plant construction experience in this country, which is more than 20-years old. Actual construction costs overseas have been less than most recent domestic construction, suggesting that the industry has learned from the domestic experience. There is an assumption that the overseas experience can be applied domestically, and the studies have found the overseas experience to be most applicable to estimating the cost of the new domestic nuclear plant construction.

The four studies identified in Subsection 10.4.2.1 tend to support $2000 per kW as a reasonable high-end overnight capital cost estimate. The $2300 value presented above is based on construction in Japan (Reference 10.4-004). While no explanation is offered as to why this is so high, it is reasonable to suggest that contributing factors are the high cost of living in Japan (labor accounts for more than 20 percent of costs) and difficulties associated with construction on an island. For the purposes of analysis in this ER, to avoid understating the cost, $2000 per kW value was chosen. According to Subsection 3.2.2, it is anticipated that the HAR will each be rated at a Nuclear Steam Supply System (NSSS) power of 3415 MWt, with an associated core power of 3400 MWt and a rated net electrical output of 1000 MWe. Using the capital cost estimate value of $2000 per kW results in a HAR per unit construction cost of approximately $2.2 billion.

10.4.2.3 Monetary – Operation

Operational costs for power facilities are frequently expressed as the levelized cost of electricity, which is the price at the busbar needed to cover operating costs and annualized capital costs. Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (Reference 10.4-005). The four studies identified in Subsection 10.4.2.1 show a wide range of operation cost estimates. Levelized

cost of electricity estimates range from $36 to $83 per megawatt hour (MWh) (3.6 to 8.3 cents per kWh). Factors affecting the range include choices for discount rate, construction duration, plant life span, capacity factor, cost of debt and equity and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. Estimates include decommissioning but, because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost. According to the UC study, the projected cost associated with operating a new nuclear facility (similar to the size of the HAR) is in the range of $31 to $46 per MWh ($0.031 to $0.046 cents per kWh) (Reference 10.4-005).

In addition to nuclear plant costs, the four studies provide coal- and gas-fired generation costs for comparison. One study showed nuclear costs competitive with coal and gas (Reference 10.4-004). The other studies showed nuclear costs exceeding those of coal and gas. One study concluded that new nuclear power is not economically competitive, but went on to suggest steps that the government could take to improve nuclear economic viability (Reference 10.4-006). Since the study was issued, the government has undertaken the following steps to improve economic viability:

- The USDOE has provided financial support for plants testing the NRC licensing processes for early site permits and combined operating licenses.
- The United States government has endorsed nuclear energy as a viable carbon-free generation option.
- The Energy Policy Act of 2005 instituted a production tax credit for the first advanced reactors brought on line in the United States.

During a speech on August 8, 2005 at Sandia National Laboratory in Albuquerque, New Mexico, President Bush made the following statement regarding the signing of the Energy Policy Act of 2005:

> Nuclear power is another of America's most important sources of electricity. Of all our nation's energy sources, only nuclear power plants can generate massive amounts of electricity without emitting an ounce of air pollution or greenhouse gases. And thanks to the advances in science and technology, nuclear plants are far safer than ever before. Yet America has not ordered a nuclear plant since the 1970s. To coordinate the ordering of new plants, the bill I sign today continues the Nuclear Power 2010 Partnership between government and industry. It also offers a new form of federal risk insurance for the first six builders of new nuclear power plants. With the practical steps in this bill, America is moving closer to a vital national goal. We will start building nuclear power plants again by the end of this decade. (Reference 10.4–008)

PEC has concluded that the government's steps have negated the MIT study conclusion that new nuclear power is not economically competitive.

10.4.2.4 External Costs

External costs are the non-monetary environmental and social costs of constructing and operating the HAR. External costs can include the costs of impacts from loss of wildlife habitat, loss of land, hydrological, and water uses, terrestrial and aquatic biology impacts, and socioeconomic impacts.

10.4.2.4.1 Land Use

Loss of habitat is one of the costs of constructing the new nuclear reactor units and appurtenant structures. The land use for the HNP is industrial and locating the new reactors on an existing nuclear facility site is expected to realize minimal adverse impacts. According to Subsection 4.3.1, in order to meet the necessary water requirements of the new facilities, Harris Reservoir will be filled and expanded. Approximately 1641 ha (4055 ac. or 6.3 mi.^{2}) of additional land will be inundated by the proposed increase in the water level of Harris Reservoir which will roughly double the size of the Harris Reservoir. The shoreline of Harris Reservoir will change from its current perimeter length of 139,379 m (457,281 ft.) to 239,063 m (784,327 ft.) following inundation. Forested land use (i.e., timber harvest) will be affected in the long term on approximately 11.28 km^2 (4.35 mi.^{2}) or 2787 ac. Consequently, land use will change from forested areas to cleared and inundated shoreline. The filling of the reservoir would result in long-term impact on land use within the vicinity and along the shoreline. This area will be cleared before the water rises to allow future boating activities along the expanded shoreline.

In-use roadways, along with associated infrastructure (bridges and culverts), with a total length of 14,619 m (47,964 ft.) will be reconstructed in their current locations to accommodate the rise in the reservoir's elevation. Rough-Order of Magnitude (ROM) cost estimates have been developed for the reconstruction of the roads and associated infrastructure for the HAR. The ROM cost estimates for the raising of lake level affected roads is approximately $20 million; approximately $6 million for protecting the area at the Harris Training Facility; and for the construction laydown area, construction parking and switchyard area, and surfacing of roads within the new plant facility, it is approximately $18 million. The ROM cost estimates are not intended to be used for budgeting purposes. Project-specific considerations could drastically affect the magnitude of actual construction costs. These cost estimates will be prepared for guidance in project evaluation and implementation from the information available at the time the estimates were developed. The final costs of the projects will depend on actual labor and material cost, competitive market conditions, implementation schedule and other variable factors. PEC has initiated discussions with the State Department of Transportation (DOT) regarding county and state roadway impacts due to increased lake levels in the Harris Reservoir required for

operations of the HAR. A Transportation Impact Analysis (TIA) will be completed by PEC to evaluate construction and operational road effects.

Modification of roadways, bridges, and culverts will comply with relevant regulations and permits. Appropriate BMPs will be implemented to minimize the potential for erosion and sedimentation. Effects from road relocation or reconstruction would be limited to clearing and fill placement to expand the road base to support the new elevated roadway. Use of these structures will not be adversely affected in the long term.

10.4.2.4.2 Hydrological and Water Use

There are costs associated with providing water for various needs during construction and operation of the new facilities. The consumptive water use from the Harris Reservoir for the HAR facilities is approximately 1.77 m^3/s (62.66 ft^3/s) or 28,122 gpm (Reference 10.4-009). A portion of the cooling water is lost to evaporation, and therefore, represents a permanent consumptive loss. However, this loss represents a small fraction of the available surface water that is contained within the Harris Reservoir.

10.4.2.4.3 Terrestrial and Aquatic Biology

Some costs associated with loss of wildlife, other species, and their habitats during construction are anticipated. These potential losses are not expected to be large enough to affect the long-term stability of wildlife populations in the area. Construction of the new intake structure and pumphouse is anticipated to result in minor and temporary disruption of the aquatic environment.

10.4.2.4.4 Air Emissions

Relatively small amounts of air emissions from diesel generators and vehicles are generated during construction and operation of the facilities. Cooling tower drift deposits salt on the surrounding vicinity, but the levels are not likely to result in any measurable impact on vegetation.

10.4.2.4.5 Radioactive Emissions, Effluents, and Wastes

Minor radioactive air emissions are released into the atmosphere and back into the discharge receiving water. Low-level and high-level radioactive wastes are generated and need to be disposed of according to local, state, and federal permitting regulations.

10.4.2.4.6 Socioeconomic

It is anticipated that additional infrastructure and services would be needed to meet the demands of the people moving into the area to support the construction and operation of the new facility. However, these costs should be offset by the increased tax revenues and economic input from those individuals and families.

10.4.3 SUMMARY

Per guidance provided in NUREG-1555 ESRP 10.4.1, Table 10.4-1 summarizes the benefits and costs of the proposed project. The table also provides information regarding select mitigation measures for potential impacts. Costs that are environmental impacts are those anticipated after proposed mitigation measures are implemented. The costs of mitigation are not easily determined at this time. It is anticipated that mitigation would be built into the project design (e.g., scheduling to ensure construction is completed in the shortest possible time, using construction BMPs to limit erosion, fugitive dust, runoff, spills, and air emissions, providing first aid stations at the construction site). Relying on early and frequent communication between PEC and the effected communities will help to minimize cost and ensure effective management of the proposed project.

In summary, there is a growing baseload demand and growing baseload supply shortfall in the region of interest. PEC evaluated several energy alternatives with nuclear power being the choice to meet the energy demands in the region. PEC determined that the new nuclear facility should be co-located with the HNP site. The HAR will result in a reduction in emissions with respect to comparably-sized coal- or gas-fired alternative power generating facilities. While the additional direct and indirect creation of jobs for the construction and operation of the new facility places a temporary burden on local services and infrastructures, the annual taxes and revenue generated by the new workers contributes to the local economy and the region's productivity.

In conclusion, the construction and operation of the proposed project is needed by the service area and that the benefits outweigh the economic, environmental, and social costs.

10.4.4 REFERENCES

10.4-001 North Carolina Utilities Commission, "Order Approving Integrated Resource Plans And Requiring Additional Information In Future Reports, In the Matter of Investigation of Integrated Resource Planning in North Carolina–2005," Docket No. E-100, SUB 103, filed August 31, 2006, Website, www.ncuc.commerce.state.nc.us/docksrch.html, accessed October 23, 2007.

10.4-002 Progress Energy Carolinas, Inc., "Progress Energy Carolinas Resource Plan," North Carolina Utilities Commission, Docket E100, Sub 114, September 2007. Website, ncuc.commerce.state.nc.us/docksrch.html.

10.4-003 Southern States Energy Board, "Nuclear Energy: Cornerstone of Southern Living, Today and Tomorrow," Norcross, Georgia, July 2006.

10.4-004 Nuclear Energy Agency, Organization for Economic Cooperation and Development, an International Energy Agency, "Projected Costs of Generating Electricity," 2005. Website, www.nea.fr/html/general/press/2005/2005-02.html. Note: electronic version cannot be printed; paper version is available for purchase.

10.4-005 The University of Chicago, "The Economic Future of Nuclear Power; A Study Conducted at The University of Chicago," Website, www.ne.doe.gov/nucpwr2010/NP2010rptEconFutofNucPwr.html, August 2004, accessed May 31, 2007.

10.4-006 Massachusetts Institute of Technology, "The Future of Nuclear Power; An Interdisciplinary MIT Study," 2003, Website, www.web.mit.edu/nuclearpower/, accessed May 31, 2007.

10.4-007 U.S. Department of Energy/Energy Information Administration, Annual Energy Outlook 2004, DOE/EIA-0383(2004), January, Website, www.eia.doe.gov/oiaf/archive/aeo04/index.html, accessed October 18, 2007.

10.4-008 The White House, Office of the Press Secretary, "President Signs Energy Policy Act," Sandia National Laboratory, Albuquerque, New Mexico, August 8, 2005, Website, www.whitehouse.gov/news/releases/2005/08/20050808-6.html, accessed December 11, 2007.

10.4-009 CH2M HILL, "Progress Energy – Water Resources Regulatory Issues," Technical Memorandum prepared for Progress Energy Carolinas, Inc., May 16, 2007.

Table 10.4-1 (Sheet 1 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Project Description	The HAR site is located in Wake County, North Carolina. The site is owned and operated by PEC. The HAR site is located near the HNP.	The Brunswick Site is located in Brunswick County, North Carolina. The proposed site is owned and operated by PEC; and is located near the existing Brunswick Nuclear Power Plant.	The H.B. Robinson Site is located in Darlington County, South Carolina. The proposed site is owned and operated by PEC; and is located near the existing H. B. Robinson Nuclear Power Plant.	The Marion County Site is located in Marion County, South Carolina.
BENEFITS				
Electricity Generated and Generating Capacity	Westinghouse AP1000 reactors for the HAR has a rated core thermal power of 3415 MWt with an associated core power of 3400 MWt and a rated net electrical output of 1000 MWe.	It is assumed that the electricity generated and generating capacity would be similar to that of the HAR facility.	It is assumed that the electricity generated and generating capacity would be similar to that of the HAR facility.	It is assumed that the electricity generated and generating capacity would be similar to that of the HAR facility.
Fuel Diversity	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.
Licensing Certainty	Resolution of design criteria through certification; resolution of site, construction and operational issues in Combined Operating License Application (COLA); reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation; potential wetland issues.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation.

Table 10.4-1 (Sheet 2 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Carbon Emissions (reduction)	Coal: (1,908,000 CO_2e) Natural Gas: (623,000 CO_2e) Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to HAR. Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to HAR. Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to HAR. Nuclear: No carbon emissions.
Increased Customer Choice	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.
Local Economy	Add 3150 new employees to the workforce for construction of the new facility. It is anticipated that a workforce of approximately 773 employees would be needed for operation. Construction and operation workforce provide an economic benefit to the community.	It is assumed that similar size work force to that which is anticipated for the HAR facility.	It is assumed that similar size work force to that which is anticipated for the HAR facility.	It is assumed that a similar size work force to that which is anticipated for the HAR facility.
Aesthetic Values	Selection of design and cooling tower technology allows for minimal esthetic impacts. Site contains existing nuclear power facility structures.	Selection of design and cooling tower technology allows for minimal esthetic impacts. Site contains existing power generating facility structures.	Selection of design and cooling tower technology allows for minimal esthetic impacts. Site contains existing nuclear power facility structures.	Selection of design and cooling tower technology allows for minimal esthetic impacts. Site contains existing nuclear power facility structures.

Table 10.4-1 (Sheet 3 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Air Quality	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.
Land Use	Land to be used for new units is already owned by PEC and is already zoned for uses compatible with development of a new unit. The new reactors will be co-located with existing nuclear facility.	The Brunswick site is on land that is already owned by PEC and is already zoned for uses compatible with development of new units. The new reactors will be co-located with existing nuclear facility.	The Robinson site is located on land that is already owned by PEC and is already zoned for uses compatible with development of new units. The new reactors will be co-located with existing nuclear facility.	No positive land-use benefits associated with the use of the Marion County site.
State/Local Tax Payments during Construction and Operations	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Local government tax revenues will accrue from personnel income taxes, property taxes, and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Local government tax revenues will accrue from personnel income taxes, property taxes, and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Local government tax revenues will accrue from personnel income taxes, property taxes, and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Local government tax revenues will accrue from personnel income taxes, property taxes, and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units.

Table 10.4-1 (Sheet 4 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Effects on Regional Productivity	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a small to large positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a small to large positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a small to large positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a small to large positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.

Table 10.4-1 (Sheet 5 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Technical and Other Non-Monetary Improvements (e.g., New Recreational Facilities and Improvements to Local Facilities)	Co-located with an existing nuclear facility. The existing Police, Fire, and medical facilities and/or personnel should be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the Harris Reservoir and the surrounding area.	Co-located with an existing power generating facility. The existing Police, Fire, and medical facilities and/or personnel should be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area.	Co-located with an existing nuclear facility. The existing Police, Fire, and medical facilities and/or personnel should be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area.	Anticipate that existing local and county Police, Fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area.

Table 10.4-1 (Sheet 6 of 16)
Benefit and Costs of the Proposed Project Summarized

Benefit Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Environmental Enhancement	Reduction in carbon emissions with the use of nuclear power. PEC owns the Harris Research Tract, a 5.13-km^2 (1.98-$mi.^2$) or 1267-ac. parcel of land in the vicinity of the HAR site. North Carolina State University currently uses the Harris Research Tract for long-term forest research. PEC has enrolled in the National Wild Turkey Federation's "Energy for Wildlife" program to integrate wildlife management activities into land management program decisions at the HAR site. The HAR site has a smaller number of listed, threatened, or endangered species and critical habitat. HAR demonstrated an advantage over Brunswick and Robinson due to larger acreage of PEC-owned property and the clear ability to accommodate additional future generation capacity. HNP was originally designed as a four reactor site, although only one reactor was built.	Reduction in carbon emissions with the use of nuclear power.	Reduction in carbon emissions with the use of nuclear power.	Reduction in carbon emissions with the use of nuclear power.

Table 10.4-1 (Sheet 7 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Environmental Enhancement	The lake is currently sized for one reactor and can be increased in size to support HAR 2 and HAR 3 providing additional recreational opportunities. The need for transmission line upgrades is significantly less for the HAR site than for the other alternative sites. Existing transmission lines and corridors would be used for HAR 2, and existing transmission corridors would be expanded for HAR 3.			
INTERNAL COSTS				
Construction Cost Note: Cost value is a roll-up of the Internal Cost values for constructing the facility, which include land, labor, materials, and equipment).	The proposed reactors at HAR will each be rated with a net electrical output of 1000 MWe. Using the capital cost estimate value of $2000 per kW results in a HAR per unit construction cost of approximately $2.2 billion.	It is anticipated that the installed reactors will be similar to the proposed reactors at HAR (net electrical output of approximately 1000 MWe). Using the value of $2000 per kW results in a construction cost of approximately $2.2 billion.	It is anticipated that the installed reactors will be similar to the proposed reactors at HAR (net electrical output of approximately 1000 MWe). Using the value of $2000 per kW results in a construction cost of approximately $2.2 billion.	It is anticipated that the installed reactors will be similar to the proposed reactors at HAR (net electrical output of approximately 1000 MWe. Using the value of $2000 per kW results in a construction cost of approximately $2.2 billion.

Table 10.4-1 (Sheet 8 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Transmission System	The HAR site is located near the existing Harris Nuclear Power Plant. As such, transmission lines are located in the immediate vicinity of the proposed site. Three new transmission lines will connect the HAR 3 switchyard to the PEC grid. The proposed routing of the new lines for HAR 3 are being evaluated to be adjacent to or within the existing maintained transmission corridors for the HNP. The new corridors for HAR 3 are conservatively estimated to require an additional 100 ft. of width. Transmission system upgrades are estimated to be less than $2 million (approximately $1 million for each unit). Transmission corridors and towers would be situated (if possible) in existing ROWs to avoid critical or sensitive habitats/species as much as possible.	Required transmission system upgrades are estimated to cost approximately $309 million for the addition of an 1100 MW generating unit. Additional transmission corridors and towers would be situated (if possible) in existing ROWs to avoid critical or sensitive habitats/species as much as possible.	Required transmission system upgrades are estimated to cost approximately $143 million for the addition of an 1100 MW generating unit. Additional transmission corridors and towers would be situated (if possible) in existing ROWs to avoid critical or sensitive habitats/species as much as possible.	This site would require a transmission system. The cost of the transmission system is estimated at approximately $205 million for the addition of an 1100 MW generating unit. Transmission corridors and towers would be situated (if possible) in ROWs to avoid critical or sensitive habitats/species as much as possible.

Table 10.4-1 (Sheet 9 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Operating Cost Note: Cost value is a roll-up of the Internal Cost values for operating the facility which include labor, materials, and services).	3.1-4.6 cents per kWh.	3.1-4.6 cents per kWh.	3.1-4.6 cents per kWh.	3.1-4.6 cents per kWh.
Land Use	The existing HAR site is located on land already owned by PEC. The land is within a tract of land that includes the exclusion zone, Harris Reservoir, and some surrounding lands. Construction at the HAR site is not expected to have long-term impacts on land use. It is expected that the industrial nature of the facility will continue during construction. Siting of a new unit at the HAR site would not require significant land use changes for construction since the majority of the site has already been disturbed.	The Brunswick site is on land already owned by PEC and is already zoned for uses compatible with development of a new units. The existing facility is integrated into the surrounding land use patterns.	The Robinson site is located on approximately 24.36 km^2 (9.41 $mi.^2$) or 6020 ac. of property in northwestern Darlington and southwestern Chesterfield counties, including the 9.11-km^2 (3.52-$mi.^2$) or 2250-ac. Lake Robinson. The site area is rural, with light development. Land to be used for new units is already owned by PEC and zoned for uses compatible with development of a new unit. The existing units are integrated into the surrounding land use patterns. The new reactors will be co-located with existing nuclear facility.	The Marion County site is not owned by PEC. The site is a greenfield site that is located in a low lying area surrounded by wetlands and swamps. Site elevations appear to be at or even slightly below that of the 100-year floodplain. This presents the need to address environmental impacts on floodplains as well as the possibility that engineered flood protection features will be required to protect the plant. These factors, combined with the surrounding known swamps and shallow depth to ground water, also indicate the potential for construction dewatering problems. No current or future regulatory land-use restrictions were identified that are incompatible with locating nuclear power generation plants on the Marion site.

Table 10.4-1 (Sheet 10 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Materials	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.
Equipment	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/ treatment system, and cooling tower.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, and cooling tower.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, and cooling tower.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, and cooling tower.
Services	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.

Table 10.4-1 (Sheet 11 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Water Use	The consumptive water use from the Harris Reservoir for the HAR facilities is approximately 1.77 m^3/sec (62.66 ft^3/s) or 28,122 gpm. The Harris Reservoir will supply adequate surface water for plant use.	The Brunswick nuclear site is located on the Cape Fear River on the North Carolina coast. Due to the design of the intake and proximity of the site to the Atlantic Ocean, there are no flow constraints. The drainage area of the Cape Fear River is 23,673 km^2 (9140 $mi.^2$). In this drainage area, stream flow from about 15,540 km^2 (6000 $mi.^2$) is continuously gauged by the U.S. Geological Survey (USGS). The average daily freshwater discharge rate of the Cape Fear River at its mouth is estimated to be between 229 m^3/s and 283 m^3/s (8100 ft^3/s and 10,000 ft^3/s).	Lake Robinson, a 9.11-km^2 (3.52-$mi.^2$) or 2250-ac. impoundment on Black Creek is the cooling water source for the Robinson plant. Currently, water to cool the nuclear unit is pumped at a rate of approximately 31.92 m^3/sec 1127.37 ft^3/s or 506,000 gpm and returned to the lake through the discharge canal. The site currently contains a 710 MWe nuclear, a 174 MWe fossil, and a 15 MWe combustion turbine. Based on operation of the existing unit, there have been some restrictions based on water availability and thermal effects.	The Pee Dee River 7-day and 10-year low flow at the site is 41 m^3/s (1450 ft^3/s). The closed-cycle cooling system, cooling water supply requirements for the proposed two - unit is approximately 2.65 m^3/sec (93.58 ft^3/s) or 42,000 gpm. It appears that adequate cooling water is available to support a two-unit plant for any of the designs under consideration. However, there are potential concerns regarding adequate flow during extreme drought conditions since the water source is not on a reservoir or lake. The Marion site would likely require the construction of a reservoir, and pumping distances may be longer at that site, depending on reservoir siting.
EXTERNAL COSTS				
Air Quality	The power facility must meet all applicable federal, state, and local air quality permitting regulations.	The power facility must meet all applicable federal, state, and local air quality permitting regulations.	The power facility must meet all applicable federal, state, and local air quality permitting regulations.	The power facility must meet all applicable federal, state, and local air quality permitting regulations.

Table 10.4-1 (Sheet 12 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Terrestrial Biology	The forested and wetland habitats at the HAR site support a variety of wildlife species typically found in the Piedmont region of North Carolina. Forested areas support many species of birds, mammals, amphibians, and reptiles. There are two potentially occurring endangered or threatened species in the vicinity of the HAR plant: the red-cockaded woodpecker (*Picoides borealis*) (federally listed as endangered) and an experimental population of Michaux's sumac (*Rhus michauxii*) (federally and State-listed as endangered). PEC has procedures in place to protect endangered or threatened species, if they are encountered at the plant site (or along the transmission corridors), and provides training for employees on these procedures.	Terrestrial species that are listed as threatened or endangered by the USFWS and have potential to occur in the vicinity of the Brunswick Nuclear Power Facility site or along the transmission line ROWs are presented in Table 9.3-6. Terrestrial species listed by the State of North Carolina in the vicinity of the Brunswick Nuclear Power Facility site or along the transmission line ROWs are presented in Table 9.3-7 NRC staff conducted a review and concluded that the impacts on terrestrial endangered, threatened, proposed, or candidate species of an additional 20 years of operation and maintenance of Brunswick would be small, and no additional mitigation was needed. The operation of additional units at this site would not be expected to adversely affect any federally listed terrestrial species. Approximately 1.62 km^2 (0.63 $mi.^2$) or 400 ac. of wetlands are known to occur in the 24.28 km^2 (9.38 $mi.^2$) or 6000 ac. site area. Of these wetlands, 0.33 km^2 (0.13 $mi.^2$) or 81 ac. were found in the 1.62 km^2 (0.63 $mi.^2$) or 400 ac. power block area which would be impacted upon construction of the proposed facility.	Terrestrial species that are listed as threatened or endangered by the USFWS or the State of South Carolina and have potential to occur in the region surrounding the H.B. Robinson Nuclear Power Plant are presented in Table 9.3-10. No rare, threatened, or endangered species are known to occur in the immediate vicinity of the site. Approximately 0.2 km^2 (0.078 $mi.^2$) or 49.7 ac. of wetlands are located in the 1.62 km^2 (0.63 $mi.^2$) or 400 ac. power block area and approximately 0.43 km^2 (0.17 $mi.^2$) or 105.8 ac. of wetlands were found in the 24.28 km^2 (9.38 $mi.^2$) or 6000 ac. site area.	Both on and near the Marion site there are over 4.05 km^2 (1.56 $mi.^2$) or 1000 ac. of freshwater forested wetlands, forested/shrub wetlands, and freshwater emergent wetlands. Much of this wetland area is semi-permanently flooded, consistent with the low lying land in this area. These wetlands are jurisdictional wetlands and a permit from the USACE would be needed prior to disruption or impact. Judging from the low lying nature of the land in this area, dewatering of the site would be necessary which would most likely affect wetlands. In addition, there are no known listed state or federal threatened and endangered species in the immediate site vicinity that have been identified.

Table 10.4-1 (Sheet 13 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Aquatic Biology	There are no aquatic species in the HAR site that are included on federal or state lists of endangered or threatened species. The HAR site was evaluated with respect to relative potential for entrainment and impingement impacts to aquatic organisms for the closed-cycle cooling water system. Proposed facilities at the site will include cooling towers that will reduce the amount of cooling water withdrawal required for plant operation. Through the use of cooling towers with an appropriate intake design (Reference 9.3-001), it is anticipated that potential adverse impacts from entrainment or impingement of aquatic organism would be minor and would not significantly disrupt existing populations.	Aquatic species that are listed as threatened or endangered by the USFWS or the State of North Carolina and have potential to occur in the vicinity of the Brunswick Nuclear Power Facility are presented in Table 9.3-8. 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. In addition, 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 mitigation measures already in place at Brunswick that reduce impingement and mortality caused by impingement.	Aquatic species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) or the State of South Carolina and have potential to occur in the region surrounding the H.B. Robinson Nuclear Power Plant are presented in Table 9.3-11. However, none of these species are considered to exist on or near the site. Potential impacts of the cooling water intake on the impingement of fish and shellfish are small. Robinson will be required to comply with any future requirements imposed in its NPDES permit, thus ensuring that impingement impacts at Robinson will continue to be small in the future.	The Marion site was evaluated with respect to relative potential for entrainment and impingement impacts for the closed-cycle cooling water system. Proposed facilities at the site will include cooling towers that will reduce the amount of cooling water withdrawal required for plant operation. In addition, proper design of the water intake structure would minimize the potential adverse impacts. Because of the low flow velocities of a closed cycle plant at the site, impingement of adult fish would be expected to be minimal. Use of a deep water intake would have a minimal effect on entrainment of larval fish.

Table 10.4-1 (Sheet 14 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Aquatic Biology (cont.)	Because of the low flow velocities of a closed cycle plant at the site, impingement of adult fish would be expected to be minimal.	Based on this information, it is reasonable to assume that operation of additional reactors at the Brunswick site would not adversely affect any federally listed aquatic species.		
Socioeconomic	Wake County has a 2006 population estimate of approximately 786,522; a 25.3 percent increase from the 2000 population. The median household income is $57,846 per year. Approximately 9.2 percent of the county's population lives below the poverty level. The mean value of owner-occupied housing units was $162,900. There were 61,908 firms doing business in the county in 2002. The largest towns near the HAR site are the town of Cary (94,536) located 21.0 km (13 mi.) from the proposed site and the City of Raleigh (276,093) located approximately 34.9 km (21.7 mi.) from the site.	Brunswick County, North Carolina has a 2006 population estimate of approximately 94,945; a 29.8 percent increase from the 2000 population. The median household income is $39,379 per year. Approximately 13.2 percent of the county's population lives below the poverty level. The mean value of owner-occupied housing units was $127,400. There were 8009 firms doing business in the county in 2002. The largest town in the vicinity of the proposed site is the town of Wilmington (75,838) located 25.75 km (16 mi.) from the proposed site.	Darlington County, South Carolina has a 2006 population estimate of approximately 67,551; a 0.2 percent increase from the 2000 population. The median household income is $31,982 per year. Approximately 19.9 percent of the county's population lives below the poverty level. The mean value of owner-occupied housing units was $74,100. There were 4112 firms doing business in the county in 2002. The largest town in the vicinity of the proposed site is the town of Hartsville (7556); located 6.44 km (4 mi.) from the proposed site.	Marion County has a 2006 population estimate of approximately 34,684; a 2.2 percent decrease from the 2000 population. The median household income is $26,593 per year. Approximately 22.5 percent of the county's population lives below the poverty level. The mean value of owner-occupied housing units was $63,500. There were 1898 firms doing business in the county in 2002. The largest towns in the vicinity of the Marion Site is the town of Marion (7042) which is located 8 miles from the proposed greenfield site, and the town of Florence (30,248) which is located approximately 19.31 km (12 mi.) from the site.

Table 10.4-1 (Sheet 15 of 16)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Socioeconomic (cont.)	The overall population level is anticipated to be sufficiently large that the impact on area employment from construction and operation of the two new units would be low. It is expected that the impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	Due to the population size in the vicinity of the plant, it is expected that most construction workers would come from within the four-county region surrounding the site. Should a larger than expected number of construction workers come from outside the region, there could be a noticeable increase in population, but it would not be excessive. The overall population level is anticipated to be sufficiently large that the impact on area employment from construction and operation of the two new units would be low. It is expected that the impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	Due to the population size in the vicinity of the plant, it is expected that most construction workers would come from within the four-county region surrounding the site. Should a larger than expected number of construction workers comes from outside the region, there could be a noticeable increase in population, but it would not be excessive. The overall population level is anticipated to be sufficiently large that the impact on area employment from construction and operation of the two new units would be low. It is expected that the impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	The overall population level is anticipated to be sufficiently large that the impact on area employment from construction and operation of the two new units would be low. It is expected that the impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.

Table 10.4-1 (Sheet 16 of 17)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Housing	May be short-term negative impact on availability of housing units in the area during construction.	May be short-term negative impact on availability of housing units in the area during construction.	May be short-term negative impact on availability of housing units in the area during construction.	May be short-term negative impact on availability of housing units in the area during construction.
Local Infrastructure	The location of the site in relation to the Harris Reservoir prevents direct egress to the south. No other limiting climate or terrain conditions were identified. The proposed site is located near the HNP. As such, on-site railroad access is already provided in the immediate vicinity of the proposed site from the Seaboard rail line. It is anticipated that approximately 0.33 km (0.2 mi.) of rail would need to be constructed to link the proposed new site to the existing rail line. The cost of the constructed rail line is approximately $600,000.	The proposed Brunswick Site is located near the city of Southport, North Carolina. The site is accessed by local roads. State Highways 87, 133, and 211 provide access to the Southport area, and feed into U.S. Highway 17 (Ocean Highway East). The Atlantic Ocean and the Cape Fear River prevent egress to the east and the south. The proposed site will not need significant, if any, highway construction to accommodate construction or operation of a plant. On-site railroad access is already provided in the immediate vicinity of the proposed site; however, an additional 0.16 km (0.1 mi.) of rail would be needed to connect to the existing rail an approximate cost of $300,000.	The proposed Robinson Site is located on the southwestern side of Lake Robinson, near the town of Pine Ridge, SC. State Highway 151 provides access to the area and serves as a link to U.S. Highway 1 (northwest) or U.S. Highway 15 (southeast). The location of the site in relation to Lake Robinson prevents direct egress to the east. The proposed site would not require any highway construction to accommodate construction or operation of a plant. On-site railroad access is already provided in the immediate vicinity of the proposed site. However, an additional 0.32 km (0.2 mi.) of rail line would be needed to connect to the existing rail at an approximate cost of $600,000.	The proposed Marion Site is located near the town of Pee Dee, South Carolina on the east side of the Great Pee Dee River. The site provides direct egress from the area in three directions. No limiting climate or terrain conditions were identified. The Marion site is served by several primary access roads; however, site access will need to be constructed. It is estimated that about 1.6 to 3.2 km (1 to 2 mi.) of additional access roads will be needed to develop the Marion site. The proposed site is located approximately 2.25 km (1.4 mi.) from the existing Seaboard rail line near the town of Pee Dee, South Carolina, which is located to the east and south of the proposed site. The cost for rail construction from the site to the existing rail line is approximately $3.42 million.

Table 10.4-1 (Sheet 17 of 17)
Benefit and Costs of the Proposed Project Summarized

Cost Category	Proposed Site HAR Site	Option 1 Brunswick Site	Option 2 H. B. Robinson Site	Option 3 Marion County Site
Local Infrastructure (cont.)		Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in an urban/rural area.	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in a large urbanize area.	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in a large urbanize area.
Radiological Heath	Radiological exposure below limits to workers and public.	Radiological exposure below limits to workers and public.	Radiological exposure below limits to workers and public.	Radiological exposure below limits to workers and public.
Loss of Resources	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.
Measures and Controls to Reduce Environmental Impact	Costs associated with mitigation will be small, since these units will be built on an existing nuclear site. Existing mitigation and environmental monitoring programs will be expanded to account for the new units.	Costs associated with mitigation will be small, since these units will be built on an existing power plant site. Existing mitigation and environmental monitoring programs will be expanded to account for the new units.	Costs associated with mitigation will be small, since these units will be built on an existing nuclear site. Existing mitigation and environmental monitoring programs will be expanded to account for the new units.	Costs associated with mitigation will be moderate to large, since these units will be built on an undeveloped site. Mitigation and environmental monitoring programs will need to be implemented to account for the new units.