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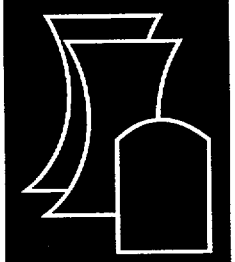

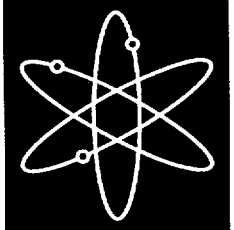

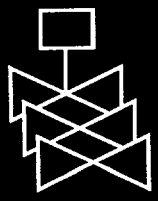

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 4

Regarding the Edwin I. Hatch Nuclear Plant, Units 1 and 2

Final Report

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

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NUREG-1437
Supplement 4

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 4

Regarding the Edwin I. Hatch Nuclear Plant, Units 1 and 2

Final Report

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Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
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Abstract

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

This supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by Southern Nuclear Operating Company (SNC) to renew the operating licenses (OLs) for Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2, for an additional 20 years under 10 CFR Part 54. This SEIS includes the staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental effects of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

Neither SNC nor the staff has identified significant new information for any of the 69 issues for which the GEIS reached generic conclusions and which apply to HNP. Therefore, the staff concludes for these issues that the impacts of renewing the HNP OLs will not be greater than the impacts identified in the GEIS for these issues. For each of these issues, the GEIS conclusion is that the impact is of SMALL significance (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel, which were not assigned a single significance level) and that additional mitigation measures are likely not to be sufficiently beneficial to be warranted.

Each of the remaining 23 issues that applies to HNP is addressed in this SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental effects of renewal of the OLs is SMALL. The staff has not identified any new issue applicable to HNP that has a significant environmental impact. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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Executive Summary

By letter dated February 29, 2000, Southern Nuclear Operating Company (SNC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2, for an additional 20-year period. If the operating licenses are renewed, Federal (other than NRC) agencies, State regulatory agencies, and the owners of the plant will ultimately decide whether the plant will continue to operate. This decision will be based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the operating licenses are not renewed, HNP, Units 1 and 2, will be shut down on or before the expiration dates of the current operating licenses, which are August 6, 2014, and June 13, 2018, respectively.

Under the National Environmental Policy Act of 1969 (NEPA), an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor operating license; 10 CFR 51.95(c) states that the EIS prepared at the operating license renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437.[(a)]

Upon acceptance of the SNC application, the NRC staff began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and to conduct scoping. The staff visited the HNP site in May 2000 and held public scoping meetings on May 10, 2000, in Vidalia, Georgia. The staff reviewed the SNC Environmental Report (ER) and compared it with the GEIS; consulted with Federal, State, and local agencies; conducted an independent review of the issues following the guidance set forth in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, NUREG-1555, Supplement 1; and considered the public comments received during the scoping process for preparation of the draft supplemental environmental impact statement (SEIS) for HNP. Two public meetings were held in Vidalia, Georgia, on December 12, 2000. During that time, the staff described the preliminary results of the NRC environmental review and were available to answer questions related to it in order to provide members of the public with information to assist them in formulating their comments. All of the comments received on the draft SEIS were considered by the staff in developing the final document and are presented in Appendix A, Part II.

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

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

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

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

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

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

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether HNP continues to operate beyond the period of the current operating licenses.

The GEIS contains the results of a systematic evaluation of the consequences of renewing an operating license and operating a nuclear power plant for an additional 20 years. It contains a summary of the evaluation of 92 environmental issues using a three-level standard of significance—SMALL, MODERATE, or LARGE—based on Council on Environmental Quality guidelines. These significance levels are as follows:

> SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

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

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

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

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

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

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

This SEIS documents the staff's evaluation of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that are considered include the no-action alternative (not renewing the HNP operating licenses) and alternative methods of power generation. Among the alternative methods of power generation, coal-fired and gas-fired generation appear to be the most likely if the power from HNP is replaced. These alternatives are evaluated assuming that the replacement power-generation plant is located at either the HNP site or an unspecified "greenfield" site (an undisturbed, pristine site).

SNC and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither SNC nor the staff has identified any significant new information related to Category 1 issues

that would call into question the conclusions in the GEIS. Similarly, neither SNC nor the staff has identified any new issue applicable to HNP that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all 69 Category 1 issues.

The staff has reviewed the SNC analysis for each Category 2 issue and conducted an independent review of each issue. Five Category 2 issues are not applicable to HNP because they are related to plant design features or site characteristics not found at HNP. Four Category 2 issues are not discussed in this SEIS because they are specifically related to refurbishment. Five additional Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in relation to operation during the renewal term. SNC has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of HNP beyond the end of the existing operating licenses. In addition, routine replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the final environmental statements for HNP.

Twelve Category 2 issues, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. For all 12 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff concluded that a consensus has not been reached by appropriate Federal health agencies that there are adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs and that none of the candidate SAMAs is cost-beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted. In addition, no new issues that were not considered in the GEIS have been identified.

In the event that the HNP operating licenses are not renewed and the units cease operation on or before the expiration of their current operating licenses, the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of HNP. The impacts may, in fact, be greater in some areas.

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

Abbreviations/Acronyms

AC	alternating current
ACC	averted cleanup and decontamination costs
ADAMS	Agencywide Document Access Management System
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ALI	annual limit on intake
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOSC	averted onsite costs
APE	averted public exposure
ATWS	Anticipated Transient Without Scram
BTU	British thermal unit
BWR	boiling-water reactor
CAA	Clean Air Act
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
CoE	U.S. Army Corps of Engineers
COE	cost of enhancement
CWA	Clean Water Act
DAC	derived air concentration
DBA	design-basis accident
DC	direct current
DOE	U.S. Department of Energy
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Division (of GADNR)
EPRI	Electric Power Research Institute
ER	Environmental Report
ESA	Endangered Species Act of 1973

ESRP	Environmental Standard Review Plan, NUREG-1555, Supplement 1, Operating License Renewal
FERC	Federal Energy Regulatory Commission
FES	final environmental statement
FR	Federal Register
ft	feet
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act of 1977)
FWS	U.S. Fish and Wildlife Service
GADNR	Georgia Department of Natural Resources
GDA	Georgia Department of Audits
GDCA	Georgia Department of Community Affairs
GDL	Georgia Department of Labor
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437
GOPB	Georgia Office of Planning and Budget
GPC	Georgia Power Company
gpd	gallons per day
gpm	gallons per minute
GTC	Georgia Transmission Company
ha	hectare
HEPA	high-efficiency particulate air (filter)
HLW	high-level waste
HNP	Edwin I. Hatch Nuclear Plant
HPCI	high-pressure coolant injection
in.	inch
IPA	integrated plant assessment
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination for External Events
ISLOCA	Interfacing System Loss of Coolant Accident
kg	kilogram
km	kilometer
kV	kilovolt
kWh	kilowatt hour

L	liter
LERF	Large Early Release Frequency
LOCA	loss-of-coolant accident
m^3/d	cubic meters per day
mA	milliampere
MAAP	Modular Accident Analysis Program
m	meter
MACCS	Melcor Accident Consequence Code System
mi	mile
min	minute
mrem	special unit of radiation dose equivalent, equal to 0.001 rem
MTHM	metric tonnes of heavy metal
MT	metric ton (or tonne)
MTU	metric ton-uranium
MW	megawatt
MW(e)	megawatt electric
MW(t)	megawatt thermal
MWh	megawatt hour
MWd/MTU	megawatt-days per metric ton of uranium
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NO_x	nitrogen oxide(s)
NRC	U.S. Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OL	operating license
PARS	Publicly Available Records (a component of ADAMS)
PM_{10}	particulate matter, 10 microns or less in diameter
ppm	parts per million
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSW	plant service water

RAI	request for additional information
RCRA	Resource Conservation and Recovery Act
rem	special unit of dose equivalent, equivalent to 0.01Sv
REMP	radiological environmental monitoring program
RPC	replacement power cost
ry	reactor year
SAMA	Severe Accident Mitigation Alternative
SEIS	supplemental environmental impact statement
SNC	Southern Nuclear Operating Company
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
STI	Southeastern Technical Institute
Sv	Sievert, metric unit of dose equivalent
TCDA	Toombs County Development Authority
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture

1.0 Introduction

Southern Nuclear Operating Company (SNC) operates the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2, in Appling County, Georgia, under operating licenses (OLs) DPR-57 and NPF-5 issued by the U.S. Nuclear Regulatory Commission (NRC). These OLs will expire on August 6, 2014, and June 13, 2018, respectively. By letter dated February 29, 2000, SNC submitted an application to the NRC to renew the HNP OLs for an additional 20 years under Title 10 of the Code of Federal Regulations (CFR) Part 54. SNC is a *licensee* for the purposes of its current OLs and an *applicant* for the renewal of the OLs. HNP is co-owned by Georgia Power Company (GPC), Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and the city of Dalton, Georgia. Southern Company, based in Atlanta, Georgia, is the parent company of SNC. SNC provides services to Southern Company's nuclear power plants. Southern Company is also the parent company of five electric utilities, including GPC.

The National Environmental Policy Act (NEPA) requires an environmental impact statement (EIS) for major Federal actions significantly affecting the quality of the human environment. As provided in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 (NRC 1996; 1999),[a] under NRC's environmental protection regulations in 10 CFR Part 51 implementing NEPA, renewal of a nuclear power plant operating license is identified as a major Federal action significantly affecting the quality of the human environment. Therefore, an EIS is required for a plant license renewal review. The EIS requirements for a plant-specific license renewal review are specified in 10 CFR Part 51. Pursuant to 10 CFR 54.23 and 51.53(c), SNC submitted an Environmental Report (ER; SNC 2000a) in which SNC analyzed the environmental impacts associated with the proposed action, considered alternatives to the proposed action, and evaluated any alternatives for reducing adverse environmental effects.

As part of NRC's evaluation of the application for license renewal, the NRC staff is required under 10 CFR Part 51 to prepare an EIS for the proposed action, issue the statement in draft form for public comment, and issue a final statement after considering public comments on the draft. This report is the final plant-specific supplement to the GEIS (supplemental environmental impact statement [SEIS]) for the SNC license renewal application for HNP, Units 1 and 2. The EIS is a supplement to the GEIS because it relies in part on the findings of the GEIS. The staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

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

The following sections of this introduction describe the background and the process used by the staff to assess the environmental impacts associated with license renewal, describe the proposed Federal action, discuss the purpose and need for the proposed action, and present the status of compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that have responsibility for environmental protection. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4 discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term, respectively. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management, and Chapter 7 discusses decommissioning. The alternatives to license renewal are considered in Chapter 8. Finally, Chapter 9 summarizes the findings of the prior chapters, draws conclusions related to the adverse impacts that cannot be avoided (the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible or irretrievable commitments of resources), and presents the recommendation of the staff with respect to the proposed action. Additional information is included in Appendices. Appendix A contains a discussion of comments obtained during the public scoping meetings and the public meetings held to discuss the draft SEIS. Appendix B lists preparers of this supplement, and Appendix C lists the chronology of correspondence between NRC and SNC with regard to this supplement. The remaining appendices are identified in subsequent sections.

Generic Environmental Impact Statement

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

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

The NRC established its standard of significance using the Council on Environmental Quality (CEQ) terminology for "significantly" (40 CFR 1508.27) for assessing environmental issues. Using the CEQ guidelines, the NRC established three significance levels, as follows:

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

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

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

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

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

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

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

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

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

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

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The latter two issues, environmental justice and chronic effects of electromagnetic fields, are to be addressed in a plant-specific analysis. Of the 92 issues, 10 are related to refurbishment, 74 are related to operations during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues of the GEIS is codified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.

License Renewal Evaluation Process

An applicant seeking to renew its OL is required to submit an ER as part of its application. This ER must provide an analysis of the issues listed as Category 2 in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 in accordance with 10 CFR 51.53(c)(3)(ii). The ER must include a discussion of actions to mitigate adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action. In accordance with 10 CFR 51.53(c)(2), the ER need not consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either essential for determination of whether an alternative should be included in the range of alternatives considered, or relevant to mitigation. Section 51.53(c)(2) also provides that certain other issues, including the need for power and other issues not related to the environmental effects of the proposed action, need not be considered in the ER. In addition, the ER need not discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b). Pursuant to 10 CFR 51.53(c)(3)(iii) and (iv), the ER is not required to contain an analysis of any Category 1 issues unless there is significant new information on a specific issue. New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding different from that codified in 10 CFR Part 51.

In preparing to submit its application to renew the HNP OLs, SNC developed a process to ensure that new and significant information regarding the environmental impacts of license renewal for HNP would be properly reviewed before submitting the ER and to ensure that new and significant information related to renewal of the HNP licenses would be identified, reviewed, and addressed during the period of NRC review. SNC reviewed the Category 1 issues appearing in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, to verify that the conclusions of the GEIS remained valid with respect to HNP. This review was performed by personnel from SNC's Corporate Environmental Services Organization and HNP staff.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (ESRP), NUREG-1555, Supplement 1 (NRC 2000a). The search for new information includes a review of an applicant's ER and process for discovering and evaluating the significance of new information; review of records of public meetings and correspondence; review of environmental quality standards and regulations; coordination with Federal, State, and local environmental protection and resource agencies; and review of the technical literature. Any new information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information. Neither SNC not the staff has identified any new issue applicable to HNP that has a significant environmental impact.

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

The NRC prepares an independent analysis of the environmental impacts of license renewal as well as a comparison of those impacts with the environmental impacts of alternatives to license renewal. The evaluation of SNC's license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the *Federal Register* (65 FR 17543, April 3, 2000). The staff then published a notice of intent to prepare an EIS and to conduct scoping (65 FR 19797, April 12, 2000).

Two public scoping meetings were held on May 10, 2000, in Vidalia, Georgia. The comments received during the scoping meeting and comment period are summarized in the *Environmental Impact Statement Scoping Process, Hatch Nuclear Station, Units 1 and 2, Summary Report*, August 23, 2000 (NRC 2000b).

The staff visited the HNP site on May 10 and 11, 2000, reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D of this document. Other documents related to HNP were also reviewed and are referenced.

The staff followed the review guidance contained in the ESRP. The staff issued requests for additional information to SNC by letters dated May 30, 2000 (NRC 2000c) and June 23, 2000 (NRC 2000d). SNC provided its responses in letters dated July 26, August 11, and August 31, 2000 (SNC 2000b, 2000c, and 2000d). The staff reviewed this information and incorporated it into its analysis. The results of the staff evaluation and its recommendation are contained in this SEIS.

On the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS (November 9, 2000), a 75-day comment period commenced, during which members of the public could comment on the preliminary results of the NRC staff's review. During this comment period, two public meetings were held in Vidalia, Georgia, on December 12, 2000. During these meetings, the staff described the preliminary results of the NRC environmental review and was available to answer questions related to it to provide members of the public with information to assist them in formulating their comments. The comment period for the HNP draft SEIS ended January 24, 2001.

This SEIS presents the staff's analysis that considers and weighs the environmental effects of the proposed renewal of the HNP licenses, the environmental impacts of alternatives to license renewal, and alternatives available for avoiding adverse environmental effects. The staff considered the comments that were received during the comment period, and the disposition of the comments is addressed in Appendix A of this final SEIS. The staff modified the analysis set forth in the draft SEIS to address certain comments, as appropriate. A vertical bar in the margin indicates where the staff made changes to the draft SEIS. In addition, Chapter 9, Summary and Conclusions, provides the NRC staff's final recommendation to the Commission on whether the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

1.1 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for HNP, Units 1 and 2. HNP is located in Appling County, Georgia, approximately 18 km (11 mi) north of Baxley, Georgia. The plant has two boiling-water reactors, each with a design rating for a net electrical power output of 860 megawatts (MW[e]). Plant cooling is provided by a cooling-tower heat dissipation system. The current OL for Unit 1 expires on August 6, 2014, and for Unit 2 on June 13, 2018. By letter

dated February 29, 2000 (SNC 2000a), SNC submitted an application to renew these OLs for an additional 20 years of operation (i.e., until August 6, 2034, for Unit 1 and June 13, 2038, for Unit 2).

1.2 Purpose and Need for the Action

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

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

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

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

1.3 Compliance and Consultations

SNC is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. SNC provided a list in its ER of the status of authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with HNP license renewal. Authorizations most relevant to the proposed license renewal action are summarized in Table 1-1.

The staff reviewed the list and has consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. Correspondence related to these consultations is provided in Appendix E. The staff has also not identified any new and significant environmental issues.

Table 1-1. Federal, State, and Local Authorizations

Agency	Authority	Requirement	License Permit Number	Permit Expiration or Consultation Date	Activity Covered
NRC	Atomic Energy Act, 10 CFR Part 50	Operating license	DPR-57 (Unit 1) NPF-5 (Unit 2)	August 6, 2014 (Unit 1) June 13, 2018 (Unit 2)	Operation of HNP, Units 1 and 2
FWS and NMFS	Endangered Species Act, Section 7	Consultation Informal consultation	NA	Consultation initiated by NRC August 31, 2000	Operation during the renewal term
EPA and GADNR	Clean Air Act, Section 112	State air quality permit	4911-001-0001-V-01-0	February 4, 2004	Air quality permit
EPA and GADNR	Safe Drinking Water Act, 42 U.S.C. 300f	State drinking water quality	PG0010005 and NG0010011	March 31, 2009	SNC has a drinking water permit for two wells and a separate permit for a third well
GADNR	Georgia Water Quality Control Act	State surface water withdrawal	001-0690-01	January 1, 2010	Authorized withdrawal of Altamaha River water for cooling water
EPA and GADNR	FWPCA (33 U.S.C.) Section 402	State storm water discharge permit	GAR000000	May 31, 2003	General storm water permit
EPA and GADNR	FWPCA (33 U.S.C.) Section 402	State NPDES discharge permit	GA0004120	August 31, 2002	Discharges of process waste water (NPDES permit)
EPA and GADNR	RCRA Section 3005	State solid waste landfill	001-004 D(L)(I)	Upon closure	Part A Hazardous Waste Permit, Interim Storage Facility for Mixed Wastes
GADNR	National Historic Preservation Act, Section 106	Consultation	NA	Licensee consulted with GADNR, completed October 29, 1999	Operation during the renewal term

EPA - U.S. Environmental Protection Agency
FWPCA - Federal Water Pollution Control Act (also known as the Clean Water Act)
FWS - U.S. Fish and Wildlife Service
GADNR - Georgia Department of Natural Resources
NMFS - National Marine Fisheries Service
NPDES - National Pollutant Discharge Elimination System
RCRA - Resource Conservation and Recovery Act
NA - Not applicable

1.4 References

10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 51, Subpart A, Appendix B, "Environmental effect of renewing the operating license of a nuclear power plant."

10 CFR 51.23, "Temporary storage of spent fuels after cessation of reactor operation - generic determination of no significant environmental impact."

10 CFR 51.53(c), "Operating license renewal stage."

10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR 54.23, "Contents of application - environmental information."

40 CFR 1508.27, "Terminology and Index - Significantly."

65 FR 17543, "Notice of Acceptance for Docketing of the Application, and Notice of Opportunity for a Hearing Regarding Renewal of Licenses Nos. DPR-57 and NPR-5, for an Additional Twenty-Year Period." April 3, 2000.

65 FR 19797, "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." April 12, 2000.

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

Clean Air Act (CAA), as amended, 42 USC 7401, et seq.

Endangered Species Act of 1973, as amended, 16 USC 1531, et seq.

Federal Water Pollution Control Act (FWPCA) of 1977, as amended, 33 USC 1251, et seq. (also known as the Clean Water Act).

Georgia Water Quality Control Act, Georgia Law 1964, et seq.

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

National Historic Preservation Act of 1966, as amended, 16 USC 470, et seq.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended, 42 USC 6901, et seq.

Safe Drinking Water Act of 1974, as amended, 42 USC 300f, et seq.

Southern Nuclear Operating Company (SNC). 2000a. *Application for License Renewal for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. Appendix D, Applicant's Environmental Report–Operating License Renewal Stage, Edwin I. Hatch Nuclear Plant.*

Southern Nuclear Operating Company (SNC). 2000b. Letter from Mr. H. L. Sumner, Jr., Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission. Subject: Edwin I. Hatch Nuclear Plant, Additional Information Related to the Staff's Review of Severe Accident Mitigation Alternatives (TAC Nos. MA8096 and MA8098). July 26, 2000.

Southern Nuclear Operating Company (SNC). 2000c. Letter from Mr. H. L. Sumner, Jr., Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission. Subject: Edwin I. Hatch Nuclear Plant, Additional Information Related to the Staff's Review of the License Renewal Environmental Report (TAC Nos. MA8096 and MA8098). August 11, 2000.

Southern Nuclear Operating Company (SNC). 2000d. Letter from Mr. H. L. Sumner, Jr., Southern Nuclear Operating Company to U.S. Nuclear Regulatory Commission. Subject: Edwin I. Hatch Nuclear Plant, Additional Information Related to the Staff's Review of Severe Accident Mitigation Alternatives (TAC Nos. MA8096 and MA8098). August 31, 2000.

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

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

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

U.S. Nuclear Regulatory Commission (NRC). 2000b. *Environmental Impact Statement Scoping Process, Hatch Nuclear Station, Units 1 and 2, Summary Report.* Washington, D. C. August 23, 2000.

U.S. Nuclear Regulatory Commission (NRC). 2000c. Letter from Mr. James H. Wilson, U.S. NRC, to Mr. H. L. Sumner, Jr., Southern Nuclear Operating Company. Subject: Request for Additional Information Related to the Staff's Review of Severe Accident Mitigation Alternatives for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. May 30, 2000.

U.S. Nuclear Regulatory Commission (NRC). 2000d. Letter from Mr. James H. Wilson, U.S. NRC, to Mr. H. L. Sumner, Jr., Southern Nuclear Operating Company. Subject: Request for Additional Information Related to the Staff's Review of the License Renewal Environmental Report for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. June 23, 2000.

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

The Edwin I. Hatch Nuclear Plant (HNP) is located in Appling County, Georgia, southeast of where U.S. Highway 1 crosses the Altamaha River. It is approximately 18 km (11 mi) north of Baxley, Georgia; 32 km (20 mi) south of Vidalia, Georgia; 160 km (98 mi) southeast of Macon, Georgia; 120 km (73 mi) northwest of Brunswick, Georgia; and 107 km (67 mi) southwest of Savannah, Georgia, as shown in Figure 2-1. HNP is a two-unit steam-electric generating plant. Each unit is equipped with a General Electric Nuclear Steam Supply System that uses a boiling-water reactor with a Mark I containment design. The plant uses a closed-loop cooling-tower system for main condenser cooling that withdraws makeup water from and discharges to the Altamaha River via shoreline intake and offshore discharge structures. The electricity generated is transferred to the switchyards located at the HNP site. Each unit is licensed for 2763 megawatts-thermal (MW[t]) and rated at 860 megawatts-electric (MW[e]), for a combined power output of 1720 MW(e).[(a)] The amount of electricity produced by HNP can supply the needs of more than 540,000 homes. Descriptions of the plant and its environs follow in Section 2.1 and the plant's interaction with the environment is presented in Section 2.2.

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

HNP is jointly owned by Georgia Power Company (GPC), Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and the city of Dalton, Georgia. The HNP site is located in a rural part of southeastern Georgia, and totals approximately 910 ha (2240 acres). The area is characterized by low, rolling sandy hills that are predominantly forested. Figure 2-1 shows the location of HNP in relationship to Georgia, South Carolina, and the Atlantic Ocean. Figure 2-2 shows the details of the 16-km (10-mi) region surrounding HNP. A property plan is shown in Figure 2-3. The property includes approximately 360 ha (900 acres) north of the Altamaha River in Toombs County and approximately 540 ha (1340 acres) south of the river in Appling County.

HNP lies on the southern shore of the Altamaha River, which runs eastward past the plant. The Altamaha is the largest river of the Georgia coast and the second largest basin in the eastern United States. Located in southeastern Georgia, the river drains an area of approximately 30,000 km^2 (11,600 mi^2). It is formed by the confluence of the Ocmulgee and Oconee rivers about 32 km (20 mi) upstream from HNP and ultimately discharges into the Atlantic Ocean just south of Darien, Georgia, approximately 190 river km (117 river mi) downstream of HNP.

(a) For purposes of comparison of alternatives in Chapter 8, the staff conservatively used 1690 MW(e) as the net output for HNP based on actual generation data for HNP.

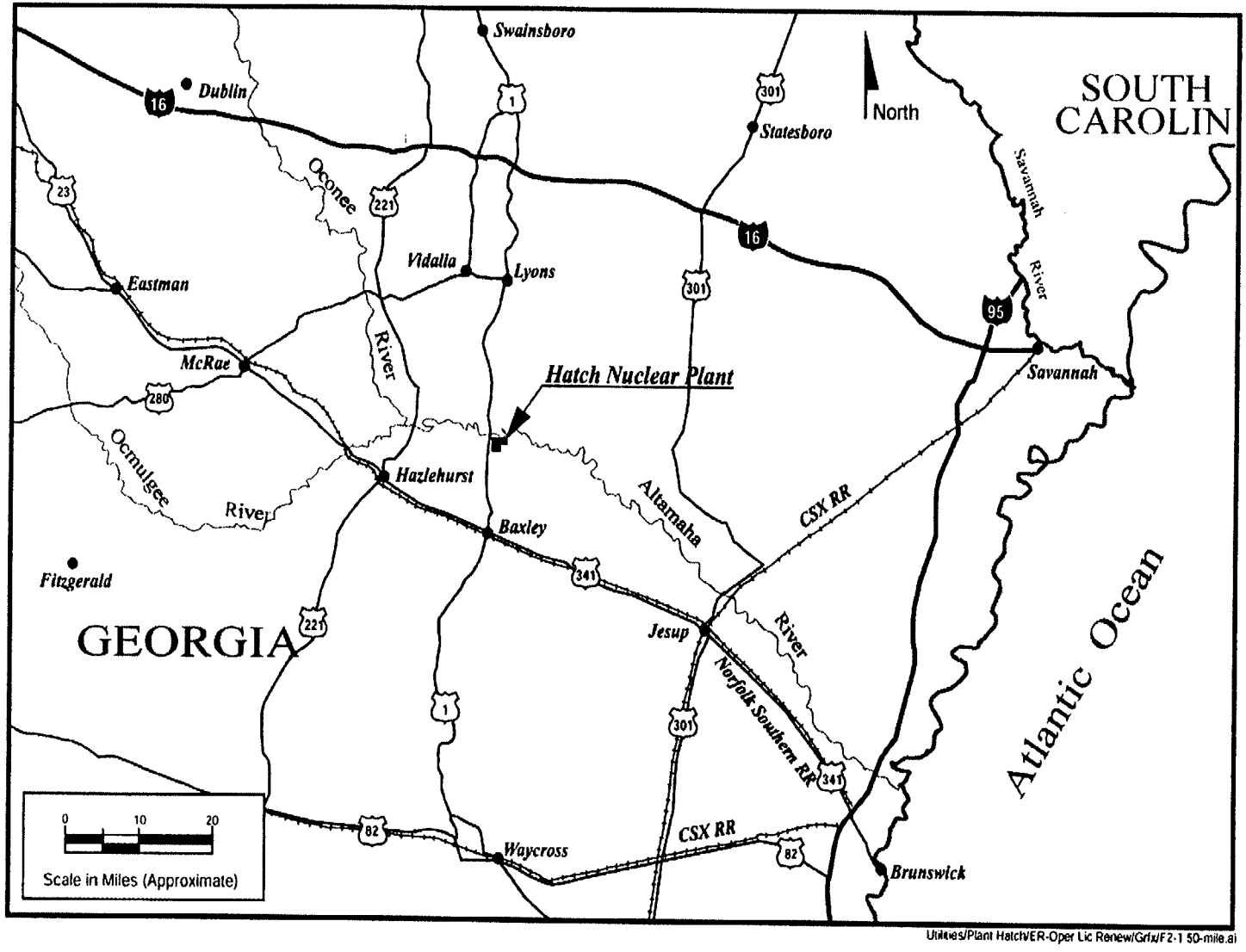

Figure 2-1. Location of Hatch Nuclear Plant in Southeast Georgia

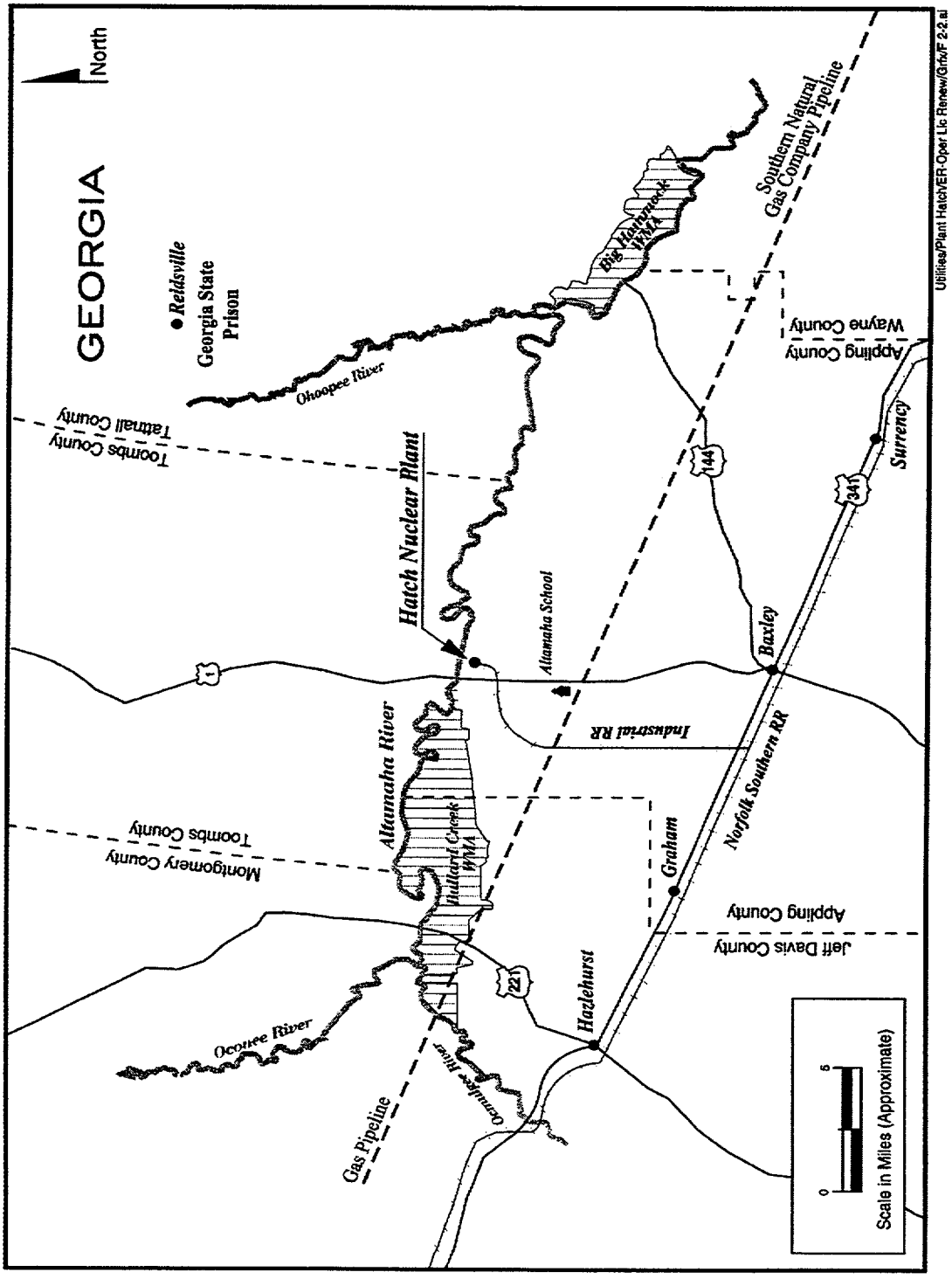

Figure 2-2. Region Surrounding Hatch Nuclear Plant

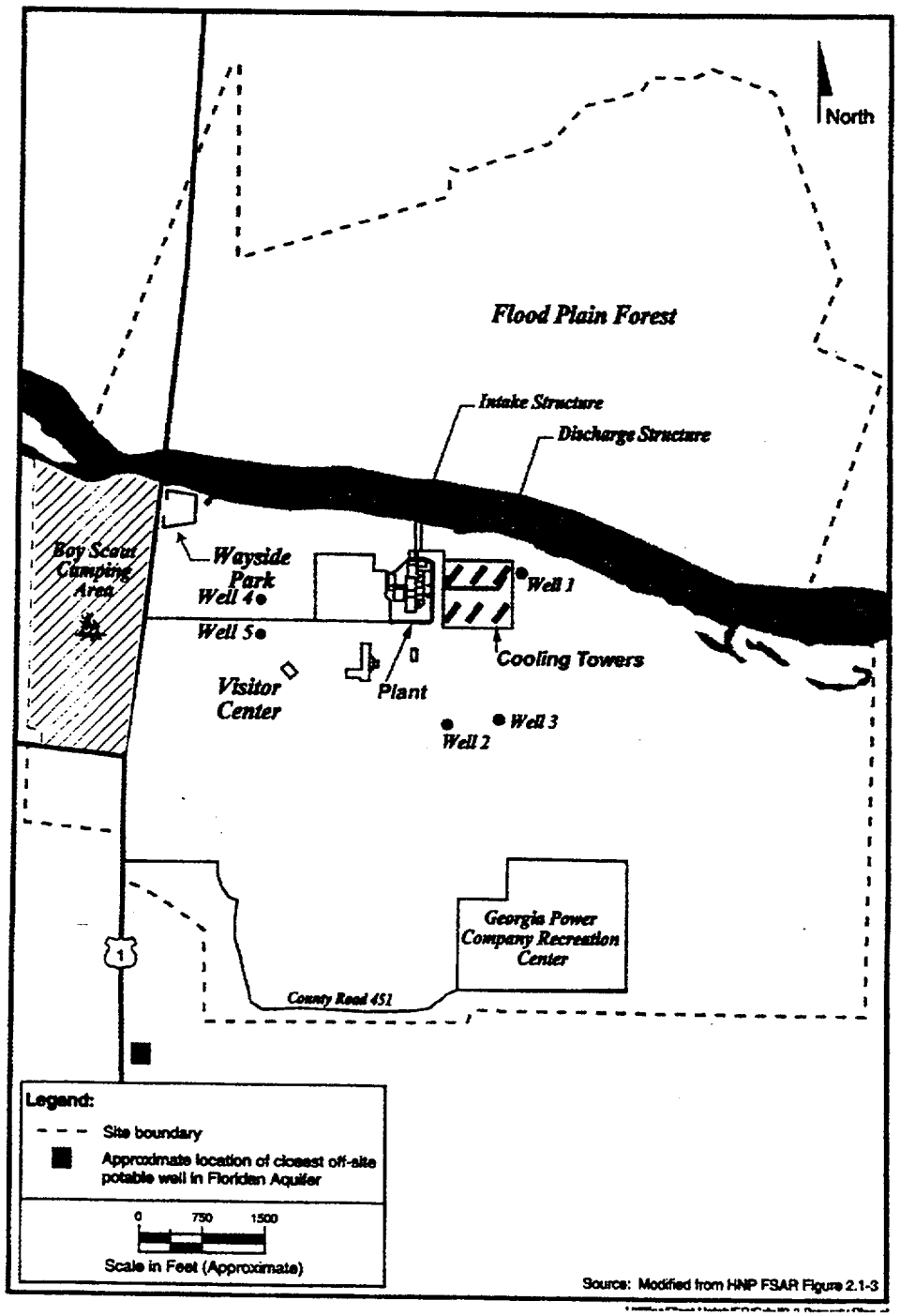

Figure 2-3. Hatch Nuclear Plant Property Plan

The region surrounding HNP was identified by the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 (NRC 1996; 1999),[a] as having a low population density. Approximately 975 persons make up the non-outage workforce at HNP. Up to an additional 800 workers are onsite during plant outages.

All industrial facilities associated with the site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling-tower area, and associated facilities, is approximately 120 ha (300 acres) (Figure 2-4). Approximately 650 ha (1,600 acres) are managed for timber production and wildlife habitat.

Controlled areas available for use with prior permission include 30 ha (75 acres) of wetlands wildlife habitat area and a 40-ha (100-acre) tract of land west of U.S. Highway 1 (Figure 2-3) used as a Boy Scout camp. Uncontrolled areas available to the public include a wayside park, a recreation area, and Visitors Center (Figure 2-3).

HNP is one of three nuclear plants operated by the Southern Nuclear Operating Company (SNC). The others are the Joseph M. Farley Nuclear Plant and the Alvin W. Vogtle Electric Generating Plant. Combined, these three plants provide over 20 percent of the electricity used in Georgia and Alabama. Construction of HNP Unit 1 began in 1968, and commercial operation began in December 1975. Unit 2 construction began in 1972 and commercial operation began in September 1979. GPC constructed the units and had sole responsibility for their operation until March 21, 1997, at which time SNC became the exclusive operating licensee.

2.1.1 External Appearance and Setting

The main generating facilities at HNP (including reactor buildings, turbine buildings, and control buildings) are relatively unobtrusive, neutral-colored buildings, but are visible from portions of U.S. Highway 1 and from the adjacent reach of the Altamaha River. The central area of HNP consists of the two reactor buildings, two control buildings, and two turbine buildings clustered in the center. Around the perimeter are the cooling towers and switchyards. Various other buildings and facilities are located at HNP to support the plant (Figures 2-4 and 2-5). The existing HNP reactor building and single main exhaust stack are approximately 61 m (200 ft) and 120 m (393 ft) tall, respectively. The mechanical draft cooling towers are approximately 18 m (60 ft) tall.

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

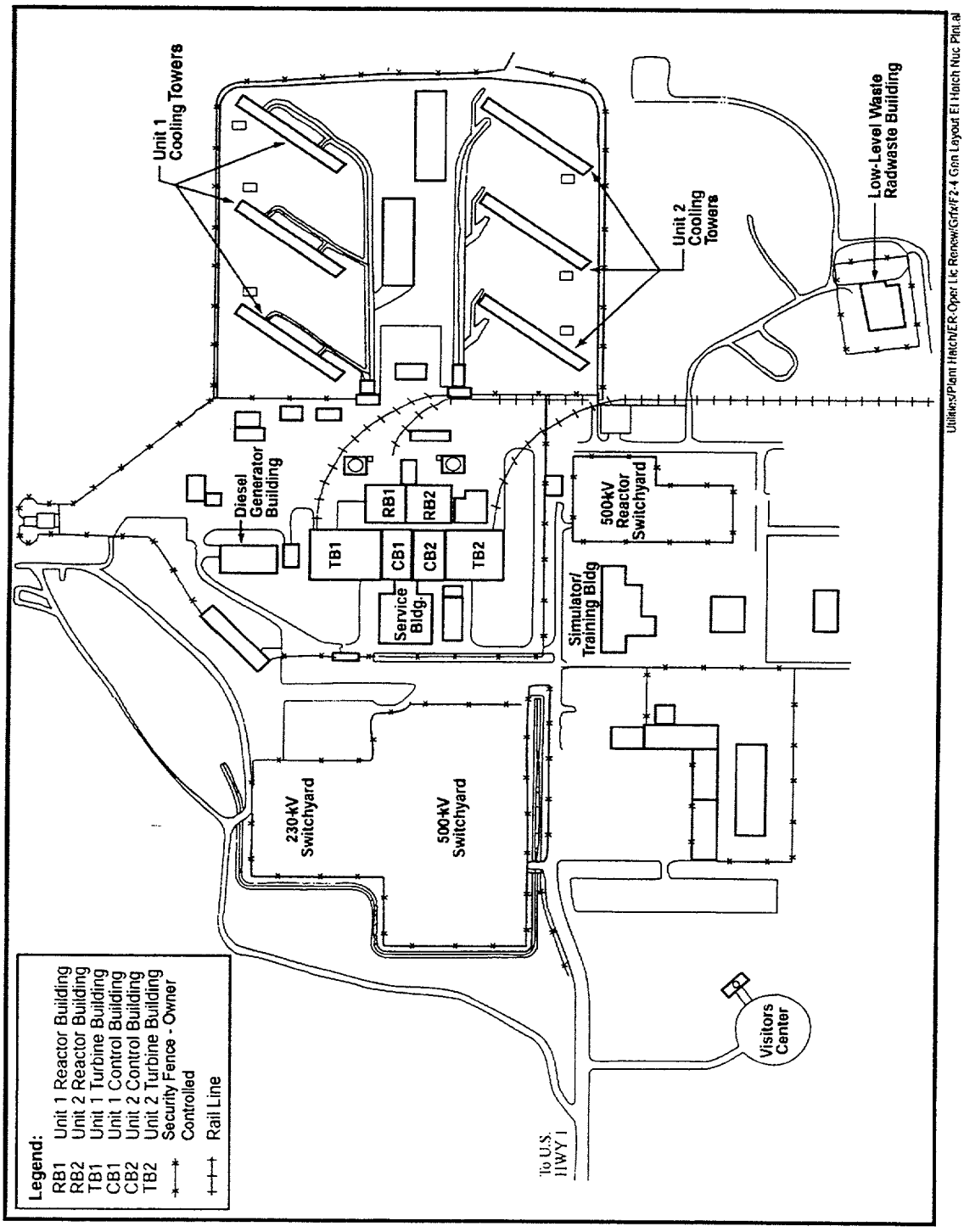

Figure 2-4. Hatch Nuclear Plant Site Plan

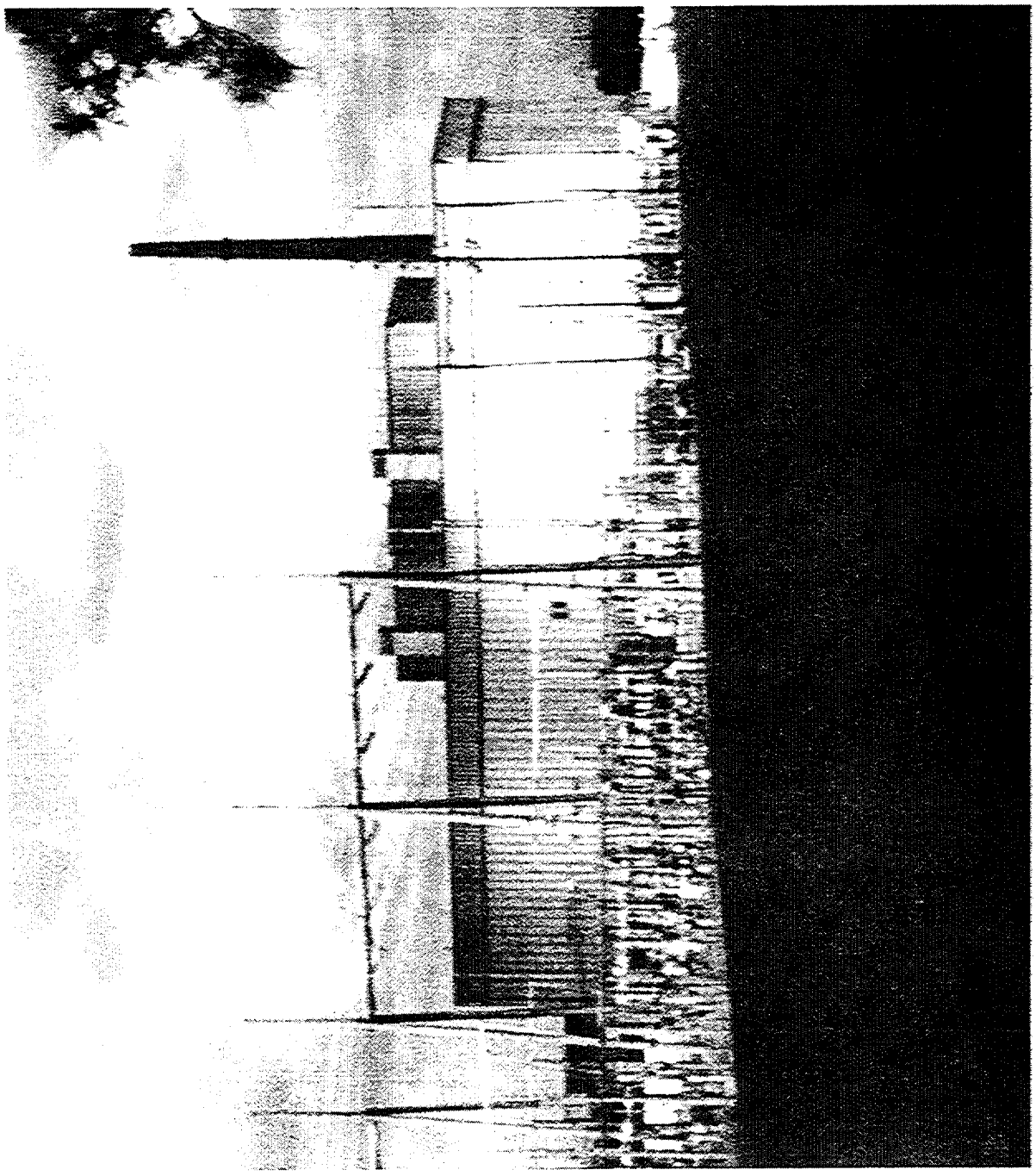

Figure 2-5. Hatch Nuclear Plant

HNP stores its spent nuclear fuel onsite in a spent fuel pool and in dry storage casks. The dry storage pad has room for up to 48 dry storage casks.

In addition to the restricted operations facilities, areas controlled by GPC include a wetlands wildlife habitat area and a Boy Scout camp. The wetlands have been certified as wildlife habitat since 1994 by the Wildlife Habitat Council. A lease agreement with the Area Council of the Boy Scouts of America allows scouting groups to use the Boy Scout Camping Area. In the past, the area has been used on weekends by scouts, with the number using the area ranging between 25 and 50 per weekend. The area may be used in the future for Boy Scout Camporees that involve as many as 400 to 500 scouts.

Uncontrolled areas available to the public include a wayside park, a recreation area, and a Visitors Center. The wayside park, east of U.S. Highway 1 and south of the river, provides simple recreational facilities overlooking the Altamaha River. The area has parking and picnicking facilities, and can accommodate up to 10 groups at a time. The 5.3-ha (13-acre) GPC Recreation Area includes softball fields, tennis courts, an archery range, a swimming pool, and an office building that houses a multipurpose activities room. The Visitors Center is reached from the main plant access road that originates at U.S. Highway 1. The Visitors Center houses hands-on exhibits on nuclear power and exhibits depicting the history of nuclear power, the history of HNP, and an environmental exhibit featuring the Altamaha River. The Visitors Center also houses conference rooms and an auditorium that seats approximately 70 people. The typical number of visitors is approximately 50 daily and 12,000 annually.

The HNP site lies within the Coastal Plain physiographic province and is underlain by approximately 1200 m (4000 ft) of relatively unconsolidated Mesozoic and Cenozoic sand, gravel, clay, marl, claystone, sandstone, and limestone. These strata overlie basaltic basement rock of pre-Cretaceous age, and dip and thicken seaward. There was no evidence of faulting during the exploratory drilling and construction of the facility. The formations at the site, of interest due to their water-bearing characteristics, consist of the alluvium beneath the Altamaha River floodplain, the Brandywine Formation (the perched aquifer), the Hawthorn Formation, the Tampa Formation, the Suwanee Formation, the Ocala Formation, and the Lisbon Formation. The Brandywine Formation caps the upland areas adjacent to the stream drainage areas.

The perched water aquifer at the site (Brandywine) is approximately 3 m (10 ft) thick. This aquifer is recharged through direct precipitation. A few springs exist approximately 2.4 km (1.5 mi) southwest of the site at the base of the Brandywine Formation. Discharge is to the ground surface or to streams that have cut through the confining layer at the base of the formation. These springs are dry during droughts. No permeability or safe-yield data are available for this aquifer.

The water table in the unconfined aquifer is the surficial unit south of the Altamaha River. This aquifer unit is 14 to 15 m (45 to 50 ft) thick and yields less than 38 L/min (10 gpm). The water table reflects the topography of the site area. High water levels underlie the surrounding hills and low water levels are near valleys. The flow direction beneath the plant site is north and east toward the Altamaha River floodplain, along gradients ranging from 4 to 24 m/km (14 to 80 ft/mi). High-clay-content soils near the top of the aquifer and at the ground surface locally form a discontinuous, relatively impermeable zone. Recharge to the unconfined aquifer is by the infiltration of precipitation through and around the leaky clay zones.

The minor confined aquifer is recharged locally in the southwest portion of the site where the middle portion of the Hawthorn Formation is exposed. Natural discharge of the aquifer takes place where the aquifer comes into contact with the alluvium of the Altamaha River. Permeability of the aquifer increases with depth. The potentiometric surface of the aquifer has a gradient of 7 m/km (23 ft/mi) to the north, toward the Altamaha River. The aquifer unit is approximately 20 m (65 ft) thick and can yield up to 38 L/d (10 gpd). A confining unit separates the minor confined aquifer from the underlying aquifer.

The principal artesian aquifer (Floridan) beneath the site is approximately 305 m (1000 ft) thick. It is the major aquifer of interest. Recharge to the aquifer is about 97 km (60 mi) northwest of the site at the outcrop area for the formations that comprise the aquifer. The potentiometric surface of the aquifer slopes gently to the southeast beneath the site. The aquifer is isolated from the overlying aquifers and this prevents a downward migration of groundwater.

Within the immediate vicinity of HNP, the primary use of groundwater is for domestic needs, with a limited amount for livestock. Most domestic wells are screened within the unconfined aquifer. The closest offsite well that is screened to the principal aquifer is located approximately 305 m (1000 ft) southwest of the site (Figure 2-3). Currently, there is no industrial demand for groundwater within the vicinity of the site, and no groundwater is used for irrigation. The nearest appreciable demand is 16 km (10 mi) south of the site, where the town of Baxley has four wells withdrawing approximately 5300 m^3/d (1.4 million gallons per day [gpd]) from the principal aquifer.

2.1.2 Reactor Systems

The two HNP reactors are boiling-water reactors operated by SNC with steam-electric turbines manufactured by General Electric Company. Both units were originally rated at 2436 MW(t) and designed for a power level corresponding to approximately 2537 MW(t). Each unit is now licensed to operate at a maximum core thermal power output level of 2763 MW(t) (63 FR 53473). Each unit is rated for a net electrical output of 860 MW(e).

HNP fuel is slightly enriched (currently 3.8 percent uranium-235 by weight, with an anticipated increase to 4.2 percent by weight) uranium dioxide in the form of high-density ceramic pellets. Each fuel rod consists of fuel pellets stacked in a Zircaloy-2 cladding tube, which is evacuated, back-filled with helium, and sealed by welding Zircaloy plugs in each end. SNC currently operates HNP at an equilibrium core average fuel discharge burnup rate of 42,100 megawatt-days per metric ton uranium (MWd/MTU), and plans to operate at 45,000 MWd/MTU in the future.

Reactor containment structures are designed with engineered safety features to protect the public and plant personnel from an accidental release of radioactive fission products, particularly in the unlikely event of a loss-of-coolant accident (LOCA). These safety features function to localize, control, mitigate, or terminate such events to limit exposure levels to below applicable dose guidelines. The reactor is controlled using control rods containing a neutron absorber material and by controlling the flow rate through the reactor.

2.1.3 Cooling and Auxiliary Water Systems

HNP withdraws groundwater for potable and process use from the Floridan Aquifer and surface water from the Altamaha River for cooling-tower makeup water. The excess heat produced by HNP's two nuclear units is absorbed by cooling water flowing through the condensers and the service water system. Main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating-water system is a closed-loop cooling system that uses one counter-flow and three cross-flow cooling towers for dissipating waste heat to the atmosphere. The cooling water does not come into contact with the water that passes through the reactor.

Cooling-tower makeup water is withdrawn from the Altamaha River through a single intake structure. The intake structure is located along the shoreline of the Altamaha River and is positioned so that water is available to the plant at both minimum flow and probable flood conditions. The intake is approximately 46 m (150 ft) long, 18 m (60 ft) wide, and the roof is approximately 18 m (60 ft) above normal river level. To account for varying river stages, the water passage entrance extends from 4.6 m (16 ft) below to 10 m (33 ft) above normal water levels.

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 107-cm (42-in.) lines extending 37 m (120 ft) out from the south shore at an elevation of 17 m (54 ft) mean sea level. The point of discharge is 380 m (1260 ft) downriver from the intake structure and approximately 1.2 m (4 ft) below the surface when the river is at its lowest level.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

HNP uses liquid, gaseous, and solid radioactive waste management systems to collect and treat the radioactive materials that are produced as a by-product of plant operations. These systems reduce radioactive liquid, gaseous, and solid effluents to levels as low as reasonably achievable (ALARA) before they are released to the environment. The HNP waste processing systems meet the design objectives of 10 CFR Part 50, Appendix I, and control the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. Radioactive material in the reactor coolant is the primary source of gaseous, liquid, and solid radioactive wastes in light-water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination.

Non-fuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design and operations modifications and routine maintenance activities. Solid wastes are shipped to a waste processor for volume reduction before disposal or are sent directly to the licensed disposal facility. Spent resins and filters are dewatered and stored or packaged for shipment to licensed offsite processing or disposal facilities; currently, solid wastes are shipped to Barnwell, South Carolina.

Reactor fuel assemblies that have exhausted a certain percentage of their fissile uranium content are referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced by fresh fuel during routine refueling outages. HNP currently operates on an 18-month refueling cycle for its two units. The spent fuel assemblies are currently stored onsite in a spent fuel pool and in dry storage casks. The dry storage pad has space for up to 48 dry storage casks.

HNP also provides for accumulation and temporary onsite storage of mixed wastes, which contain both radioactive and chemically hazardous waste. Storage of radioactive material is regulated by the NRC under the Atomic Energy Act of 1954 (AEA), and accumulation and temporary storage of hazardous wastes is regulated by the U.S. Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act of 1976 (RCRA).

The HNP Offsite Dose Calculation Manual (ODCM) provides the methodology that the licensee uses to calculate offsite doses based on gaseous and liquid effluent releases from the plant. These releases are reported in the licensee's annual radioactive effluent release report, which

also includes the ODCM as an appendix if it is revised during the year covered by the report (Southern Company 2000a). The ODCM specifies the parameters to be used to calculate potential offsite doses due to radioactive liquid and gaseous effluents and to ensure compliance with the following limits:

- The concentration of radioactive liquid effluents released from the site to the unrestricted area will be limited to levels that meet regulatory requirements.
- The exposure to any individual member of the public from radioactive liquid effluents will not result in doses greater than the design objectives of 10 CFR Part 50, Appendix I.
- The exposure to any individual member of the public from radioactive gaseous effluents will not result in doses greater than the design objectives of 10 CFR Part 50, Appendix I.
- The dose to any individual member of the public from the nuclear fuel cycle will not exceed the limits in 40 CFR Part 190 and 10 CFR Part 20.
- The dose rate from radioactive gaseous effluents at any time at the site boundary will be limited to (a) less than or equal to 5 mSv/yr (500 mrem/yr) to the whole body and less than or equal to 30 mSv/yr (3000 mrem/yr) to the skin for noble gases, and (b) less than or equal to 15 mSv/yr (1500 mrem/yr) to any organ for iodine-131 and -133, tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days.

The systems used for processing liquid waste, gaseous waste, and solid waste are described in the following sections.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

HNP, Units 1 and 2, have separate liquid radwaste treatment systems and release waste to separate discharge lines. Based on the water source and process train, radioactive liquid wastes from the operation of HNP are accumulated in storage tanks (i.e., waste collector tank, floor drain collector tank, and chemical waste tank). These wastes are collected in the Auxiliary Building and transferred to the radwaste facility for processing by filtration or demineralization or both. The radwaste facility processes high-activity, low-activity, and chemical liquid wastes from the Auxiliary Building.

HNP liquid wastes are disposed of by one of the following three methods based on the concentration of radioactive material in the waste:

- collected, sampled, analyzed, and then discharged directly to the discharge line, which flows into the Altamaha River

- processed by filtration or demineralization or both, collected, sampled, and then released to a condensate storage tank for re-use as makeup water

- processed by filtration or demineralization or both, collected, sampled, analyzed with the filters or resins or both; and then dewatered, packaged, and shipped to a licensed disposal facility or an offsite vendor waste processor.

The actual liquid waste generated in 1999 is reported in the licensee's annual radioactive effluent release report (Southern Company 2000a). For 1999, approximately 19,500 m^3 (688,000 ft^3) of prediluted liquid waste were released, which is within the range of liquid wastes generated annually at other boiling-water reactors.

The ODCM prescribes the effluent release rate that will ensure that offsite doses attributable to radioactive liquid effluents released from the site to the unrestricted area satisfy regulatory requirements. In addition, the ODCM provides calculations for the radiation monitor alarm/trip set points that define the relationship between the measured effluent activity, the maximum allowable effluent activity, and the effluent flow rate needed to ensure that an instantaneous release rate is not exceeded as well.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

Radioactive gases are generated by fission and neutron activation of materials in the plant. Gaseous wastes are monitored and released to the atmosphere at a permissible rate prescribed by the ODCM to ensure compliance with regulatory limits. HNP has four continuously monitored gaseous discharge points. The discharge points are (1) the Unit 1 reactor building vent stack, (2) the Unit 2 reactor building vent stack, (3) the Unit 1 recombiner building vent, and (4) the main stack. The maximum flow rate for the reactor building vents (Units 1 and 2) is 140 m^3/s (300,000 ft^3/min) for each vent; 0.24 m^3/s (500 ft^3/min) for the Unit 1 recombiner building vent (there is no such vent for Unit 2); and 9.4 m^3/s (20,000 ft^3/min) for the main stack. The reactor building vent stack is the discharge point for the following release sources: reactor building, refueling floor ventilation, turbine building, and radwaste facility. The main stack is the discharge point from the following release sources from each unit: mechanical vacuum pumps, off-gas treatment system, gland seal exhaust, and standby gas treatment system. All release points except the main stack are considered ground-level releases. At a height of 120 m (393 ft), the main stack is considered an elevated release point. Each of the four release points is continuously monitored for radioactive material.

The off-gas treatment system treats noncondensible off-gas that is continuously removed from the main condenser by air ejectors during plant operations. The gaseous effluent treated by this system is the major gaseous release source from the plant, larger than all others combined. The system uses catalytic recombination and charcoal adsorption. The major system components are located in the turbine building, in the offgas recombiner building, and in the waste gas treatment building. The catalytic recombiner recombines radiolytically dissociated hydrogen and oxygen from the air ejector system. Air cooling strips the condensible gases and reduces the volume of material to be released. The remaining noncondensible gases (e.g., krypton, xenon) are delayed in the hold-up system to permit additional radioactive decay prior to release. The off-gas then passes through a charcoal adsorber, which further reduces the off-gas activity. The off-gas is monitored as it exits the charcoal adsorber, passes through the high-efficiency particulate air (HEPA) filter, and is then released through the monitored main stack.

Other gaseous effluent releases may occur from the reactor building, turbine building, and radwaste building. These effluents are either treated by hold-up or filtration prior to being released through the Unit 1 or Unit 2 reactor building vent stack.

The ODCM prescribes the effluent release rate to ensure that releases are less than the regulatory limits. In addition, the ODCM provides the calculational methodology for the radiation monitor alarm/trip set points that defines the relationship between the measured effluent activity, the maximum allowable effluent activity, and the effluent flow rate to ensure that the instantaneous release rate is below the licensed limit. For 1999, no gaseous release limits were exceeded at HNP (Southern Company 2000a).

2.1.4.3 Solid Waste Processing and Handling

Solid low-level radioactive waste at HNP is generated by removal of radionuclides from liquid waste streams, filtration of airborne gaseous emissions, and removal of contaminated material from the plant. Concentrated liquids, filter sludges, waste oils, and other liquid sources are segregated by type, flushed to storage tanks, stabilized for packaging in a solid form by dewatering, slurried into an appropriate container (i.e., carbon steel or high-integrity container), and stored onsite until suitable for offsite disposal. HEPA filters are compacted in volume-reduction facilities and disposed of as solid wastes. Dry active waste includes contaminated protective clothing, paper, rags, glassware, trash, and non-fuel irradiated reactor components. Volume reduction is performed both onsite and offsite.

Solid waste is packaged in containers to meet the U.S. Department of Transportation requirements in 49 CFR Parts 171 through 180. Disposal and transportation are performed in accordance with the applicable requirements of 10 CFR Part 61, Part 71, and 49 CFR Parts 171-180. There are no releases to the environment from radioactive solid wastes created

at HNP. During 1999, 34 shipments of solid radwaste were made to Barnwell, South Carolina. The radwaste shipments may be shipped to a waste processor to reduce the volume before disposal or may be sent directly to a licensed disposal facility.

From year to year, the volume of radioactive contaminated waste generated will vary. The average volume of disposal waste at HNP over a recent 5-year period (1995-1999) is about 320 m^3 (11,300 ft^3), which is comparable to waste volumes generated at other boiling-water reactors based on information in the GEIS.

2.1.5 Nonradioactive Waste Systems

The primary nonradioactive chemical wastes generated at HNP are from reactor coolant system makeup water and water-treatment demineralizers. Nonsanitary, nonradioactive wastes are neutralized, routed to holding ponds, and eventually discharged to the Altamaha River. Sanitary wastes from the HNP are treated in a secondary treatment plant that was designed and constructed, and is operated according to applicable State and Federal water-quality standards. The plant chlorinates the effluent prior to discharge. The plant can treat up to 28,400 L (7500 gal) of raw sewage per day and would use about 4.5 kg (10 lb) of chlorine at maximum volume. The plant operation is regulated so that the effluent contains no more than 2 parts per million (ppm) of chlorine. The effluent from this treatment plant is discharged into the Altamaha River. Solid wastes (i.e., paper, metals, garbage, and other nonradioactive items) are collected and removed to a landfill.

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear power plant. Some of the maintenance activities conducted at HNP include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and public safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant be shut down. HNP units are on an 18-month refueling interval, and SNC generally schedules outages on staggered schedules, resulting in one outage per year for 2 years and two outages in the third year (cycle repeats).

SNC performed an aging management review and developed an integrated plant assessment (IPA) for managing the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. The IPA identified the programs and inspections that are managing the effects of aging at HNP. SNC determined that no refurbishment activities will be required for license renewal. Existing programs for surveillance, monitoring, inspections, testing, and modifications to plant systems, structures, and components will continue through the period of

extended operations as part of normal maintenance activities. Continuation of these programs will result in modifications to plant systems, structures, and components that are required to achieve performance improvements in the plant systems or by changes in regulations. The existing programs that control modifications at the plant require a review for environmental impact for each modification. SNC does not anticipate that any additional personnel or resources above the current plant staffing will be required for the performance of the identified aging management programs.

During the license renewal period, SNC does not anticipate the need to increase onsite or offsite personnel and expects the outage workforce to be within the range supporting current operations. Strategic planning for HNP projects a constant or slightly reduced workforce in the future based on industry benchmarks for boiling-water reactor units similar to HNP.

2.1.7 Power Transmission System

According to the SNC Environmental Report (ER; SNC 2000), six transmission lines were built by GPC to connect the HNP to the transmission system. Four of the lines—Eastman, S. Hazlehurst (Douglas), North Tifton, and Bonaire—were evaluated as part of the HNP Final Environmental Statement (FES; AEC 1972). The first three of these lines were built in 1971 to support HNP Unit 1 operation, and the last was built in 1976 to support HNP Unit 2 operation. Two additional lines were built in 1981 to support expansion of the GPC transmission system to Florida. All six lines, including those that were not evaluated in the 1972 FES, are evaluated in this supplemental environmental impact statement (SEIS).

The six transmission lines lie in four corridors as shown in Figure 2-6. Statistics associated with these corridors are listed in Table 2-1. SNC has stated that GPC plans to maintain these transmission lines indefinitely as a permanent part of the transmission system after HNP is decommissioned (SNC 2000).

The 1972 FES (AEC 1972) states that GPC used criteria published by the U.S. Department of the Interior to minimize the environmental effects resulting from the construction of its transmission lines. In general, routes are selected to minimize land-use conflicts, including selection to avoid all known national forests, areas of historical significance, and areas of archaeological significance. To minimize adverse visual effects, routes are selected to cross roads at an angle, where practical. When possible, trees and ground cover are left undisturbed near road crossings to provide additional visual protection. All rights-of-way are seeded with grasses, or other forage game foods after they are cleared. Owners of rights-of-way are encouraged to plant the rights-of-way in pasture, crops, or game-food plots. Uncultivated rights-of-way are cleared of brush about every 3 years.

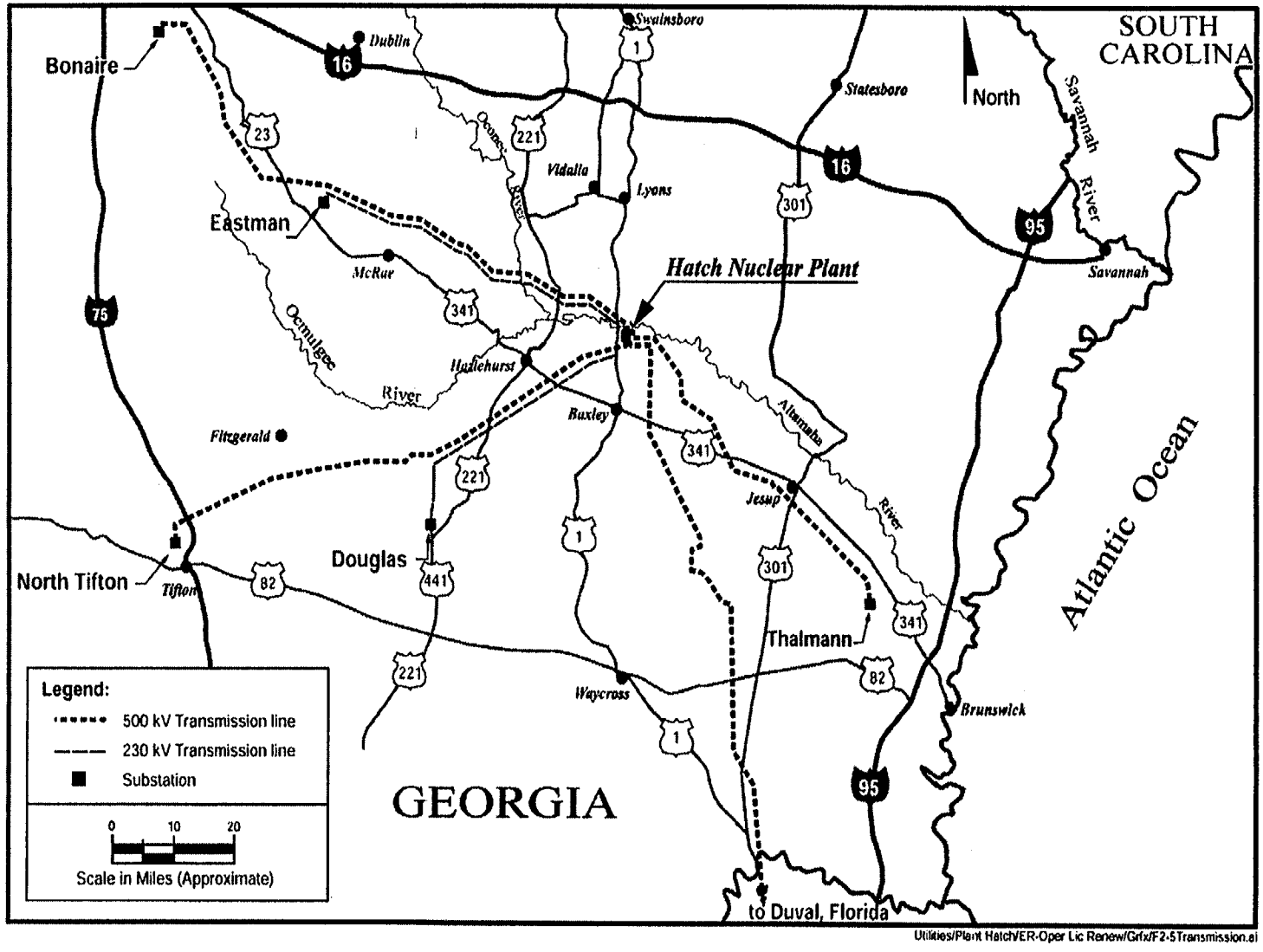

Figure 2-6. Hatch Nuclear Plant Transmission Lines

According to the SNC ER (SNC 2000), GPC sold the Eastman, Douglas, North Tifton, and Bonaire lines to Oglethorpe Power Corporation (OPC). As part of restructuring, OPC transferred ownership and maintenance responsibility for its transmission system to the Georgia Transmission Corporation (GTC). GTC uses maintenance practices similar to those used by GPC. The ER states that

> HNP transmission line corridors pass through land that primarily is a mixture of cultivated land, grazing land, and managed timberlands (paper and pulp stock). Corridors that pass through farmlands generally continue to be used in this fashion. Corridors in timberlands and in the vicinity of road crossings are maintained on a 3-year cycle by mowing or, if inaccessible to mowers, by use of non-restricted herbicides.

These practices are consistent with the practices described in the FES (AEC 1972).

Table 2-1. Transmission Lines from Hatch Nuclear Plant (SNC 2000)

Corridor	kV	Date Built	Distance km	Distance (mi)		Right-of-way Width m	Right-of-way Width (ft)	Area ha	Area (acres)
Eastman	230	1971	85	(53)	joint	76	(250)	654	(1610)
Bonaire	500	1976	6	(4)	Eastman	38	(125)	25	(61)
			60	(37)	Bonaire	46	(150)	274	(673)
Douglas	230	1971	55	(34)	joint	76	(250)	419	(1030)
North Tifton	500	1971	16	(10)	Douglas	38	(125)	62	(152)
			77	(48)	North Tifton	46	(150)	355	(873)
Duval	500	1981	140	(87)		46	(150)	644	(1580)
Thalmann	500	1981	105	(65)		46	(150)	481	(1180)
Total			544	(338)				2914	(7159)

2.2 Plant Interaction with the Environment

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

2.2.1 Land Use

HNP is located in Appling County, Georgia, southeast of where U.S. Highway 1 crosses the Altamaha River. The plant site is approximately 18 km (11 mi) north of Baxley, Georgia, which is the county seat of Appling County.

The HNP site consists of two tracts of land. The first is an approximately 360-ha (900-acre) parcel located north of the Altamaha River in Toombs County. The second is an approximately 540-ha (1340-acre) parcel south of the Altamaha River on which the plant is sited. All industrial facilities associated with the site are located in Appling County.

Of the approximately 910 ha (2240 acres) that make up the site, approximately 120 ha (300 acres) are committed to generation facilities, parking lots, laydown areas, roads, and maintenance facilities. Approximately 140 ha (350 acres) comprise wetlands and/or transmission corridors. The remaining 650 ha (1600 acres) are actively managed for wildlife and timber production.

The HNP site is not subject to the Georgia Coastal Zone Management Act because the plant is not sited on tidally influenced waters where the tide ebbs and floods daily and because the site is not within one of the designated Georgia coastal zone counties (Official Code of Georgia Annotated, §12-5-322).

The HNP site is not in an incorporated area of Appling County. There are no land-use or zoning restrictions applicable to land within unincorporated portions of Appling County.

2.2.2 Water Use

The Altamaha River is the major source of water for the plant. The Altamaha River is approximately 150 m (500 ft) wide and a maximum of 9 m (30 ft) deep at HNP. The river remains relatively undisturbed and has no major channelization, dredging, or major reservoirs. The U.S. Geological Survey maintains a gauging station (Number 02225000) on the right bank of the river 121 m (400 ft) downstream from the U.S. Highway 1 bridge, approximately 160 m (530 ft) upstream from HNP. Based on 49 years of record, the average annual flow rate at this station is 328 m^3/s (11,580 ft^3/s). Highest monthly flows normally occur in March and lowest monthly flows normally occur in September. The historical single day low flow is 46 m^3/s (1620 ft^3/s).

Presently there are no other competing industrial consumptive users of water from the Altamaha River in the vicinity of HNP, nor are there plans for any new major consumptive users

in the foreseeable future. There are no water-quality issues with the river in the vicinity of HNP and no restrictions have been imposed on HNP during low-flow periods.

Water is withdrawn from the river to provide cooling for certain once-through loads and makeup water to the cooling towers. SNC is permitted (Georgia Department of Natural Resources [GADNR] Permit 001-0690-01) to withdraw a monthly average of up to 322,000 m^3/d (85 million gpd) with a maximum 24-hour rate of up to 392,000 m^3/d (104 million gpd). As a condition of this permit, SNC is required to monitor and report withdrawals. Based on reported withdrawals for the years 1989 through 1997, HNP withdraws an annual average of 216,000 m^3/d (57 million gpd). Using the average water withdrawal rate, the velocity of the water approaching the intake screen is approximately 0.094 m/s (0.31 ft/s). At the extrapolated low river flow rate of 25 m^3/s (900 ft^3/s), the approach velocity is approximately 0.2 m/s (0.8 ft/s).

Water vapor is lost to the atmosphere ("consumed") through the evaporative cooling process. Thus the volume of water returned to the river (approximately 95,000 m^3/d [25 million gpd]) is less than the volume withdrawn. The average HNP surface water consumption rate is approximately 123,000 m^3/d (33 million gpd). When compared to the average river discharge, the consumptive loss represents about 0.44 percent of river flow. During minimum river discharge periods, the consumptive loss amounts to 3.1 percent.

The evaluation of surface water use in the 1978 FES (NRC 1978) concluded that the consumptive losses would be approximately 46 percent of the total water withdrawn from the river. In NRC's environmental assessment for an extended power uprate (63 FR 53474), NRC concluded that the necessary increase in makeup water to support the higher heat load would be insignificant and that cooling-tower discharge back to the river would decrease by approximately 2.4 m^3/min (626 gpm).

HNP withdraws groundwater for potable and process use from the Floridan Aquifer. HNP is permitted (GADNR Permit 001-0001) to withdraw a monthly average of 4200 m^3/d (1.1 million gpd) or 2.9 m^3/min (764 gpm) with an annual average of 2.1 m^3/d (0.5 million gpd) from its wells. Although the current permit indicates six onsite wells, there are actually only three wells that provide groundwater for domestic and process use. Wells 4 and 5 provide water for irrigation of ornamental vegetation. The sixth well was intended to provide makeup water for a wildlife habitat pond that was not completed; therefore, the well has not been installed.

Site Well 3 provides water for potable use only at the site recreational facility. Operation of this well as the source water supply for the GPC Recreation Facility potable water system is conducted under GADNR Permit NG0010011. Site Wells 1 and 2 provide water for potable use, sanitary facilities, and process use (e.g., demineralized water, fire protection). Operation

of these wells as the source water supply for the plant is conducted under GADNR Permit PG0010005. Figure 2-3 shows the locations of the three production wells.

GADNR requires SNC to monitor and report withdrawals from these five wells. Based on the reported withdrawals from 1990 to 1997, the two-unit operation requirements for this period averaged 0.48 m^3/min (126 gpm) with a high month (January 1992) average of 0.89 m^3/min (236 gpm).

2.2.3 Water Quality

Pursuant to the Federal Water Pollution Control Act of 1977 (FWPCA), commonly known as the Clean Water Act (CWA), the water quality of plant effluent discharges is regulated through the National Pollutant Discharge Elimination System (NPDES). The Environmental Protection Division (EPD) of GADNR is the State of Georgia agency delegated by EPA to issues discharge permits.

The NPDES permit for HNP (GA0004120), issued by GADNR's EPD in 1997, requires weekly monitoring of discharge temperatures, but it does not stipulate a maximum discharge temperature or maximum temperature rise across the condenser. Maximum discharge temperatures in the mixing box, which are reported to EPD quarterly, range from 17°C (62°F) in winter to 34°C (94°F) in summer.

To control biofouling of cooling system components, such as condenser tubes and cooling towers, an oxidizing biocide (typically sodium hypochlorite or sodium bromide) is injected into the system, as needed, to maintain a concentration of free oxidant sufficient to kill most microbial organisms and algae. When the system is being treated, blowdown is secured to prevent the discharge of residual oxidant into the river. After biocide addition, water is recirculated within the system until residual oxidant levels are below the discharge limits specified in the NPDES permit (GA0004120).

There are no water-quality issues related to the river in the vicinity of HNP. GADNR is unaware of any major issues likely to prevent renewal of the HNP NPDES permit due to expire in 2003. Any new regulation promulgated by EPA or GADNR would be included in future permits.

2.2.4 Air Quality

HNP is located on the Altamaha River between Savannah and Macon in south-central Georgia. It is approximately 18 km (11 mi) north of Baxley and 32 km (20 mi) south of Vidalia.

Climatological records for Macon, Georgia,[a] which should be generally representative of the site, show normal daily maximum temperatures ranging from about 14°C (57°F) in January to about 33°C (92°F) in July; normal daily minimum temperatures range from about 1°C (34°F) in January to about 21°C (70°F) in July. Precipitation averages about 115 cm (45 in.) per year.

Severe storms occur occasionally in the area, with thunderstorms occurring on about 40 percent of the days from June through August. Because of its distance from the coast, hurricanes do not generally pose a direct threat to HNP, although secondary effects may be felt at the site. Based on statistics for the 30 years from 1954 through 1983 (Ramsdell and Andrews 1986), the probability of a tornado striking the site is estimated to be approximately 9×10^{-5} per year.

The wind resource in Georgia near HNP is limited. The annual average wind power is rated as 1 on a scale of 1 to 7 with 1 being the lowest (Elliott et al. 1987). The closest region with a significant wind resource is the southern Appalachian Mountains in northeastern Georgia. Even there, the resource is limited because the area is highly confined and represents an extremely small percentage of the exposed land.

HNP has several diesel generators and boilers. Emissions from these generators and boilers are covered by a GADNR permit (4911-001-0001-V-01-0) under the Clean Air Act (CAA). Typically each source is operated 1 to 2 hr/month. In addition, the emergency diesel generators are operated for a 24-hour period each fuel cycle.

During most of the year, the region is under the influence of the Bermuda high-pressure system. High-pressure systems are typically associated with low winds and increased potential for air pollution problems. However, the region of Georgia in which HNP is located is in attainment of the National Ambient Air Quality Standards (40 CFR 81.311). The closest nonattainment area is the Atlanta area, which is more than 160 km (100 mi) to the northwest. The wilderness areas closest to HNP, designated in 40 CFR 81.408 as mandatory Class I Federal areas in which visibility is an important value, are the Okefenokee and Wolf Island wilderness areas. These wilderness areas are more than 80 km (50 mi) south and southeast, respectively, from HNP.

2.2.5 Aquatic Resources

The fish of the Altamaha River in the vicinity of HNP were characterized by the fish collections made during the monitoring of entrained and impinged fish at the water-intake structure. Five

(a) Climatological data for Macon, Georgia are available at http://www.ncdc.noaa.gov/ol/climate/climatedata.html

years (1975, 1976, 1977, 1979, and 1980) of impingement samples were collected at the plant (Nichols and Holder 1981). One hundred and sixty-five fish representing twenty-two species were collected (Table 2-2). The lowest rate of impingement during the 5-year study was 0.4 fish per day. The highest for the same period was 1.2 fish per day. The hogchoker, *Trinectes maculatus*, was the most abundant and the only species collected consistently each year. Most species were only collected once during the 5 years.

Table 2-2. Scientific and Common Names of Fish Collected During Entrainment and Impingement Studies at Hatch Nuclear Plant

Scientific Name	Common Name
Alosa aestivalis	Blueback herring
Alosa sapidissima	American shad
Dorosoma spp.	Shad
Clupeidae	Herring and shad
Esox spp.	Pickerel
Esox americanus	Redfin pickerel
Hybognathus nuchalis	Silvery minnow
Notropis chalybaeus	Ironcolor shiner
Notropis petersoni	Coastal shiner
Cyprinidae	Minnows
Carpiodes velifer	Highfin carpsucker
Minytrema melanops	Spotted sucker
Moxostoma anisurum	Silver redhorse
Ictalurus brunneus	Snail bullhead
Ictalurus nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Noturus gyrinus	Tadpole madtom
Aphredoderus sayanus	Pirate perch
Labidesthes sicculus	Brook silverside
Strongylura marina	Atlantic needlefish
Lepomis spp.	Sunfish
Lepomis auritus	Redbreast sunfish
Micropterus salmoides	Largemouth bass
Pomoxis spp.	Crappie
Perca flavescens	Yellow perch
Percidae	Darters
Trinectes maculatus	Hogchoker

One Federal-listed aquatic species, the anadromous shortnose sturgeon, *Acipenser brevirostrum*, is known to occur in the Altamaha River in the vicinity of HNP. During the

preoperational monitoring near HNP, one adult shortnose sturgeon was collected from the river channel by gill net. Other sampling efforts during 1973 to 1975 resulted in the collection of three other subadult specimens. The subadult specimens were only identified to genus (NUREG-0417). No sturgeon were collected during entrainment and impingement sampling conducted while HNP was operating (Nichols and Holder 1981).

SNC has committed to the conservation of significant natural habitats and protected species (SNC 1999). SNC has no plans to alter current patterns of operation over the license renewal period. SNC states that (1) any maintenance activities necessary to support license renewal would be limited to previously disturbed areas, (2) no expansion of existing facilities is planned, and (3) no major structural modifications are anticipated in support of license renewal.

The shoreline of the Altamaha River in the vicinity of HNP and immediately downstream for several miles is characterized by steep bluffs, floodplain forests, and sandbars. The riparian communities experience an average annual surface elevation fluctuation of approximately 2.7 m (9 ft). This conclusion is based on average daily flows for a 1-month period over the last 22 years. The consumptive loss incurred by plant operations has the greatest effect on surface elevation during low-flow periods. The duration of low-flow conditions is approximately 2 to 3 months during the late summer. The shoreline exposed during these periods is under water during the other 9 to 10 months of the year. Vegetation is found at elevations that are not flooded for most of the year by the river.

2.2.6 Terrestrial Resources

The HNP site encompasses approximately 910 ha (2240 acres), including 360 ha (900 acres) in southern Toombs County and 540 ha (1340 acres) south of the Altamaha River in northern Appling County, Georgia. Approximately 120 ha (300 acres) are used by SNC for general operation and maintenance of HNP (i.e., generation facilities, roads, parking lots, support buildings, laydown areas, etc). Approximately 140 ha (350 acres) are composed of wetlands and transmission corridors, and approximately 650 ha (1600 acres) are actively managed for wildlife and timber production (SNC 2000).

The largest wetland area covers approximately 40 ha (100 acres) just east of the generating facilities and cooling towers. Wetlands on the site are typically dominated by cypress and black gum. There are approximately 280 ha (700 acres) of deciduous floodplain forest in the Altamaha River floodplain; this forest is dominated by black gum, cypress, oak, and hickory trees. There are approximately 160 ha (400 acres) of planted pine forests (Loblolly and long-leaf pines) on the HNP site, mostly south and southwest of the generating facilities.

The HNP transmission lines are primarily within the Coastal Plain physiographic province, but the western portion of the Bonaire 500-kV line enters the Sandhills physiographic province. These lines extend for a distance of nearly 160 km (100 mi) in several different directions from the plant site, and therefore traverse the full range of habitat types and geophysical conditions typically found in south-central Georgia.

SNC commissioned a survey of the HNP site and transmission lines to evaluate the presence of plant and animal species listed or proposed by the U.S. Fish and Wildlife Service (FWS) as endangered or threatened, or listed by GADNR as endangered, threatened, rare, or unusual. This survey also included several 115-kV transmission lines that are not considered elsewhere in this SEIS; these lines were in place prior to plant construction and extend to the vicinities of Vidalia and Baxley, Georgia. Tables 2-3 and 2-4 list the plant and animal species that are

Table 2-3. Federal- and State-Listed Plant Species Evaluated as Potentially Occurring at the HNP Site or Within the Associated Transmission Line Rights-of-Way

Species	Common Name	Federal Status[a]	State Status[a]
Baptisia arachnifera	Hairy rattleweed	E	E
Echinacea laevigata	Smooth purple coneflower	E	E
Lindera melissifolia	Pondberry	E	E
Oxypolis canbyi	Canby dropwort	E	E
Ptilimnium nodosum	Mock bishop-weed	E	E
Rhus michauxii	Dwarf sumac	E	E
Sarracenia oreophila	Green pitcherplant	E	E
Schwalbea americana	Chaffseed	E	E
Thalictrum cooleyi	Cooley meadowrue	E	E
Trillium reliquum	Relict trillium	E	E
Hymenocallis coronaria	Shoals spiderlily	SC	E
Panicum hirstii	Hirst panic grass	SC	E
Sarracenia leucophylla	Whitetop pitcherplant	SC	E
Sideroxylon thornei	Swamp buckthorn	SC	E
Asplenium heteroresiliens	Wagner spleenwort	SC	T
Calamintha ashei	Ohoopee dunes wild basil	SC	T
Cuscuta harperi	Harper dodder	SC	T
Hartwrightia floridana	Hartwrightia	SC	T
Litsea aestivalis	Pondspice	SC	T
Matelea alabamensis	Alabama milkvine	SC	T
Myriophyllum laxum	Lax water-milfoil	SC	T
Scutellaria ocmulgee	Ocmulgee skullcap	SC	T
Stylisma pickeringii var. pickeringii	Pickering morning-glory	SC	T
Balduina atropurpurea	Purple honeycomb head	SC	R
Marshallia ramosa	Pineland barbara buttons	SC	R

(a) Status Codes: E= Endangered, T = Threatened, R = Rare, SC = Federal species of concern (unofficial category, primarily former Category 2 candidates).

Table 2-4. Federal- and State-Listed Terrestrial Animal Species Evaluated as Potentially Occurring at the HNP Site or Within the Associated Transmission Line Rights-of-Way

Species	Common Name	Federal Status[a]	State Status[a]
Dendroica kirtlandii	Kirtland's warbler	E	E
Mycteria americana	Wood stork	E	E
Myotis sodalis	Indiana myotis	E	E
Picoides borealis	Red-cockaded woodpecker	E	E
Vermivora bachmanii	Bachman's warbler	E	E
Sterna antillarum	Least tern	E	R
Haliaeetus leucocephalus	Bald eagle	T	E
Ambystoma cingulatum	Flatwoods salamander	T	R
Drymarchon couperi	Eastern indigo snake	T	T
Alligator mississippiensis	American alligator	T(S/A)	-
Falco peregrinus	Peregrine falcon	SC*	E
Gopherus polyphemus	Gopher tortoise	SC**	T
Macroclemys temminckii	Alligator snapping turtle	SC	T
Neofiber alleni	Round-tailed muskrat	SC	T
Aimophila aestivalis	Bachman's sparrow	SC	R
Corynorhinus rafinesquii	Rafinesque's big-eared bat	SC	R
Notophthalmus perstriatus	Striped newt	SC	R

(a) Status Codes: E= Endangered, T = Threatened, T(S/A) = Threatened due to similarity of appearance, R = Rare, U = Unusual, SC = Federal species of concern (unofficial category, primarily former Category 2 candidates), SC* = the Peregrine falcon was removed from the Federal list of threatened or endangered species (64 FR 46541), SC** = gopher tortoise is not listed in the State of Georgia, but is listed as threatened in other parts of its range, - = no listing status.

either listed or proposed for listing by FWS or species that are listed by the State of Georgia and are former FWS candidate species that were considered in the field evaluations. The complete list of species evaluated, including a number of additional State-listed species was provided in the threatened and endangered species survey report commissioned by SNC (Tetra Tech, Inc. 1999).

The applicant's survey identified several Federal- and State-listed species of concern on the HNP site or within the transmission corridors (Table 2-5). Bald eagles and wood storks were not detected during the 1998 and 1999 field surveys. They have been observed near the HNP site at other times, but are not considered residents of the area (SNC 2000).

GPC participates in several cooperative wildlife management programs, and maintains numerous feed plots for deer and turkey within transmission corridors as well as on portions of the HNP site. HNP also has an active onsite program to encourage wildlife usage of the HNP site, including the construction and monitoring of numerous nest boxes for song birds, kestrels, and wood ducks, as well as bat boxes (Southern Company 1999).

Table 2-5. Federal- or State-Listed Species Identified Within the HNP Site or Associated Transmission Line Rights-of-Way

Species	Common Name	Federal Status[a]	State Status[a]	Location[b]
PLANTS				
Balduina atropurpurea	Purple honeycomb head	SC	R	T, V, F
Penstemon dissectus	Cutleaf beardtongue	-	R	Th
Sarracenia flava	Yellow pitcherplant	-	U	B, T, Th, V, HNP
Sarracenia minor	Hooded pitcherplant	-	U	B, T, Th, V, Bx
Sarracenia psittacina	Parrot pitcherplant	-	T	F, T
Sioxylon sp. nov.	Ohoopee bumelia	-	N	F, T, V
ANIMALS				
Picoides borealis	Red-cockaded woodpecker	E	E	F
Drymarchon corais couperi	Eastern indigo snake	T	T	T
Haliaeetus leucocephalus	Bald eagle	T	E	HNP
Mycteria americana heronry	Wood stork	E	E	HNP
Gopherus polyphemus	Gopher tortoise	SC*	T	F, T, D, Th, B, V, HNP
Aimophila aestivalis	Bachman's sparrow	SC	R	F, Th
Alligator mississippiensis	American alligator	T(SA)	-	B, T, Th

(a) Status Codes: E= Endangered, T = Threatened, T(S/A) = Threatened due to similarity of appearance, R = Rare, U = Unusual, SC = Federal species of concern (unofficial category, primarily former Category 2 candidates), SC* = gopher tortoise is not listed in the State of Georgia, but is listed as threatened in other parts of its range, N = species new to science - = no listing status.

(b) Location codes: HNP = Hatch Nuclear Plant Site, B = Bonaire 500-kV transmission line, T = North Tifton 500-kV transmission line, Th = Thalmann 500-kV transmission line, F = Florida (Duval) 500-kV transmission line, D = Douglas (South Hazlehurst) 230-kV transmission line, V = Vidalia 115-kV transmission line, Bx = Baxley 115-kV transmission line.

2.2.7 Radiological Impacts

SNC and its predecessor organizations have conducted a Radiological Environmental Monitoring Program (REMP) around the HNP site since 1974. The radiological impacts to the public and the environment have been carefully monitored, documented, and compared with the appropriate standards. The purposes of the REMP are to

- verify that radioactive materials and ambient radiation levels attributable to plant operation are within the NRC regulatory limits and the U.S. Environmental Protection Agency environmental radiation standards in 40 CFR Part 190
- detect any measurable buildup of long-lived radionuclides in the environment
- monitor and evaluate ambient radiation levels
- determine whether any statistically significant increase occurs in the concentration of radionuclides in important pathways.

Radioactivity levels in the environment that are measured as part of the REMP are reported in the licensee's annual radiological environmental operating report (e.g., Southern Company 2000b). The REMP includes monitoring of the aquatic environment (aquatic organisms, shoreline sediment and water samples from the Altamaha River), atmospheric environment (air particulates and iodine), and terrestrial environment (vegetation, milk, and direct radiation).

Review of historical data on releases and the resultant dose calculations revealed that the doses to the maximally exposed individual for each pathway in the vicinity of HNP were a small fraction of the limits specified in EPA's environmental radiation standards, 40 CFR Part 190, as required by 10 CFR 20.1301(d). For 1999, dose estimates were calculated based on 1999 liquid and gaseous effluent release data. Calculations were performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM.

Southern Company reported the following estimated whole body doses to the most limiting member of the public for 1999:

- approximately 0.00074 mSv/yr (0.074 mrem/yr) based on gaseous and liquid effluent releases (Southern Company 2000a).

Cesium-137 was the major contributing radionuclide. These doses, which are representative of the doses from the period 1995-1999, are illustrative of the fact that doses are very small fractions of the 40 CFR Part 190 limits.[a]

For 1999, dose estimates were also calculated based on radioactivity detected in the environment and attributed to plant operation a part of the REMP. Southern Company reported the following potential whole body doses to the most limiting member of the public for 1999:

(a) Annual dose equivalent not to exceed 0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ of any member of the public.

- approximately 0.00046 mSv/yr (0.046 mrem/yr) based on vegetation, 0.00013 mSv/yr (0.013 mrem/yr) based on fish, and 0.000049 mSv/yr (0.0049 mrem/yr) based on sediment results from the HNP environmental monitoring program (Southern Company 2000b)

In addition to the SNC REMP, GADNR conducts an environmental surveillance program around the HNP site and to a distance of up to 140 km (90 mi) for different sample types. The State program monitors the following: direct radiation, air, precipitation, vegetation, soil, groundwater, Altamaha River water, river sediment, and fish.

In its *Environmental Radiation Surveillance Report, 1997-Mid 1999* (GADNR 1999), GADNR found only trace quantities of zinc-65, manganese-54, and cesium-137 within 8 km (5 mi) downstream of the plant. In addition, trace quantities of cobalt-60 were observed over a 140-km (90-mi) stretch of the Altamaha River downstream to Darien, Georgia. GADNR concluded that measured concentrations were well below levels of concern and that there was no measurable impact on water, fish, or seafood downstream of HNP.

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from HNP operations during the renewal period and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the applicant's ER and information obtained from several county staff members, local real estate agents/appraisers, and social services providers during the May 2000 site visit. The following sections describe the community and its housing, public services, offsite land use, visual aesthetics, noise, demography, and economy near HNP. The discussion is limited primarily to Toombs and Appling counties, which are the most impacted by actions undertaken by SNC.

2.2.8.1 Housing

Housing availability in Appling and Toombs counties is not limited by growth-management measures. The total housing and vacant units in Toombs and Appling counties in 1990 are shown in Table 2-6. More recent information is not available.

SNC has approximately 950 employees at HNP during routine operations. The number of onsite vendor and contract staff varies throughout the year by as many as 50 workers, yielding a total onsite workforce that ranges between 925 and 975 during routine operations. The onsite workforce increases by up to 800 temporary duty employees for a period of 1 to 2 months

Table 2-6. Housing Units and Housing Units Vacant (Available) by County (1990)

	Appling	Toombs
Housing Units	6629	9952
Occupied Units	5843	8804
Vacant Units	795	1148

Source: SNC 2000.

during refueling outages, which are on an 18-month cycle (SNC 2000). In addition to the site employees, there are approximately 130 corporate staff dedicated to HNP who are located offsite in Birmingham, Alabama.

The SNC employees employed at the site reside in 33 Georgia counties. More than 85 percent of the employees reside in the five counties shown in Table 2-7. Seventy-one percent of those employees live in Appling (30 percent) and Toombs (41 percent) counties. The remaining employees' residences are distributed throughout the remaining 28 counties, mostly within 80 km (50 mi) of the site.

Table 2-7. Hatch Nuclear Plant—Employee Residence Information

County	Number of Personnel	Percent of Total Personnel
Tombs	367	41
Appling	290	30
Montgomery	61	6
Tattnall	46	5
Jeff Davis	40	4
Other	129	14
Total (approximately)	950	100

Source: SNC 2000.

As displayed in Table 2-8, the 1970 resident population in Appling County was 12,726. In 1980, the population was 15,565, rising to 15,744 by 1990 (Georgia Department of Community Affairs [GDCA] 2000a) and increasing to an estimated 16,675 by July 1, 1999 (U.S. Census Bureau [USCB] 2000), or 5.9 percent over 1990 values. The 2010 population projection is 18,318 (Georgia Office of Planning and Budget [GOPB] 2000) or 9.9 percent over 1999.

Table 2-8. Population Growth in Appling and Toombs Counties, Georgia (1970-2010)

	Appling		Toombs	
Year	Population	Growth %	Population	Growth %
1970	12,726	--	19,151	--
1980	15,565	22.3	22,592	18
1990	15,744	1.2	24,072	6.6
1999 (estimated)	16,675	5.9	25,990	8
2010 (estimated)	18,318	9.9	28,934	11.3

Sources: GDCA 2000a; GDCA 2000b; USCB 2000; GOPB 2000.

Table 2-8 also contains data on Toombs County population growth and projections. The 2010 population projection is 28,934 (GOPB 2000) or 11.3 percent over 1990 values. It was only during the 1970 to 1980 period that Appling County had a higher percentage population growth rate than Toombs County. One potential reason for the higher growth rate was the construction of HNP, Units 1 and 2, during the decade of the seventies.

2.2.8.2 Public Services

- **Water Supply**

Table 2-9 provides a summary of water supply, use, and reserve capacity for public water supplies in Appling and Toombs counties. In Appling County, the municipalities of Baxley and Surrency are the only county areas served by public water supply systems. Baxley provides water service within the city and outside the city limits in certain areas through a distribution system that currently uses four wells screened to the Floridan Aquifer. The wells can produce approximately 11,800 m^3/d (3.1 million gpd). The estimated demand on

Table 2-9. Groundwater Supply and Use

County	Town	Capacity (million gpd)	Use (million gpd)	Reserve Capacity (million gpd)
Appling	Baxley	3.1	0.6	2.5
	Surrency	0.3	Unknown	Unknown
Toombs	Lyons	4.3	0.7	3.6
	Santa Claus	Unknown	Unknown	Unknown
	Vidalia	4.9	2	2.9

Source: SNC 2000.

the wells is 2300 m^3/d (600,000 gpd). Considering the current demand, Baxley has approximately 9500 m^3/d (2.5 million gpd) of available capacity (SNC 2000). The town of Surrency has two wells also pumping from the Floridan Aquifer. These wells are capable of producing 1100 m^3/d (290,000 gpd) (SNC 2000).

Toombs County has three municipal water systems—Vidalia, Lyons, and Santa Claus. All three municipalities withdraw their water from the Floridan Aquifer. Lyons has a capacity of 16,300 m^3/d (4.3 million gpd), with current demand of 2700 m^3/d (700,000 gpd). This leaves a reserve capacity of 14,000 m^3/d (3.6 million gpd). Vidalia has the capacity to pump 18,500 m^3/d (4.9 million gpd). Current demands require 7600 m^3/d (2.0 million gpd), leaving a reserve capacity of approximately 11,000 m^3/d (2.9 million gpd). Santa Claus is served by one well. Its current demand was not available (SNC 2000).

- **Education**

Appling County has four elementary schools, one middle school, and one high school. Total enrollment in all the schools was 3510 during the 1998-1999 school year. Appling County is considering building a new high school because of the condition of the high school's aging physical plant (SNC 2000).

Toombs County has two elementary schools, one middle school, and one high school. Total enrollment for the 1998-1999 school year was approximately 2660 (SNC 2000). The city of Vidalia has its own school system. It has primary, elementary, and middle schools, and one high school. Total enrollment in the Vidalia school system for the 1999-2000 school year for preschool through grade twelve is 2367 students.[a]

The Southeastern Technical Institute (STI) is located in Vidalia. The mission of the Institute "...is to contribute to the economic, educational, and community development of Montgomery, Tattnall, and Toombs counties by providing quality technical education, adult literacy education, continuing education, and customized business training" (STI 2000). Total enrollment for the 1999-2000 school year at the main and branch campuses in Vidalia and Toombs County averaged 864.[b]

Of the adult population (age 25 and over) in Toombs County in 1990, at least 59.0 percent had completed high school, compared with the Georgia State average of 70.9 percent. A total of 27.4 percent of the county's population had at least some college education compared with the State average of 41.3 percent. Between 1990 and 1994, Toombs

(a) Personal Communication, Lucy Calroni, Curriculum Director, June 2, 2000.
(b) Personal Communication, Diana Lang (Registrar), STI, August 24, 2000.

County spent an average of $3413 per pupil per year for public education, which was less than the statewide average of $4002 for the same period (GDCA 2000b).

In contrast, at least 57.2 percent of the adult population (age 25 and over) in Appling County had completed their high school education. A total of 22.7 percent of the county's population had at least some college-level education. Appling County spent an average of $4150 per pupil per year for the period 1990 through 1994, higher than Toombs County by 22 percent (GDCA 2000a). One reason for the higher expenditure is that HNP is located largely in Appling County. HNP is the largest contributor to the ad valorem property tax base of the county (see discussion in Section 2.2.8.6 of this report).

- **Transportation**

U.S. Highway 1 is the major north-south highway route bisecting Appling and Toombs counties. U.S. Highway 1 is a four-lane highway from Baxley past HNP where it enters Toombs County and becomes a two-lane road north of HNP to Interstate 16. Interstate 16 is the major east-west freeway serving the area. In 1998, the annual average daily traffic count for the highway south of the HNP site was 5314 vehicles and 4339 vehicles north of the site (SNC 2000). The State plans to widen the entire highway to four lanes, which would provide four-lane access from Baxley all the way to Interstate 16. The widening project is anticipated to begin within 5 years (SNC 2000).

U.S. Highway 341 runs east-west, linking the municipalities and developed areas of Appling County. It and U.S. Highway 1 are part of the Governor of Georgia's Economic Development System established to provide access to smaller cities and to encourage economic development. U.S. Highway 280 and State Highway 292 are the major east-west highways in Toombs County.

2.2.8.3 Offsite Land Use

- **Appling County**

Land-use projections for the county show that new commercial and industrial developments are expected to concentrate in Baxley and along the U.S. Highway 341 corridor, which parallels the Norfolk Southern rail line. New residential development is being encouraged near the cities of the county, particularly Baxley. The rest of the county is expected to remain in agricultural and forest use. Appling County does not have specific regulations concerning zoning, subdivisions, or land-use controls to implement or control development (SNC 2000).

The Appling County Joint Planning Board has prepared a comprehensive plan to guide county development and growth. The county has an industrial park of approximately 30 ha (77 acres) with water, natural gas, and sewer available. Sites are available in the industrial park adjacent to the Norfolk Southern rail line. Fiber-optic lines and industrial buildings are also available.

The county's property tax rate is among the lowest 10 percent in Georgia (due in part to the presence of HNP in the county). Appling County has established incentives to assist industry in locating to the county, including, but not limited to, tax incentives, reduced interest loans, relocation assistance for equipment and facilities, and one-stop county permitting (Appling County Development Authority, Not Dated).

The county also can avail itself of Georgia State incentive programs, including job tax credits, a $2 million revolving loan fund for wastewater treatment and pretreatment facilities, and education tax credits, among other incentives (Appling County Development Authority, Not Dated)

- **Toombs County**

Toombs County has an agricultural and industrial base. The most well-known agricultural crop in the county is the Vidalia sweet onion. Other crops contributing to the agricultural base include row crops, livestock, dairy products, poultry, eggs, and timber. The industrial base includes manufacturing facilities that in the past have focused on the textile industry. This is now changing, with more economic diversification taking place in the areas of retail trade, medical services, and non-textile manufacturing.

Toombs County has made an assertive effort to promote economic development. The county is the regional retail, wholesale, transportation, and distribution center for a population base of 126,000 in a 10-county area. Vidalia is the regional shopping center for a 48-km (35-mi) radius.[a]

The Toombs County Development Authority (TCDA) and the Toombs County Chamber of Commerce promote economic development through programs that focus on expansion and leveraging of the existing industrial base. The TCDA has a new industrial park available in Lyons of 110 ha (260 acres) near U.S. Highway 1. The Toombs Corporate Center has a 5600-m^2 (60,000-ft^2) speculative building expandable to 6500 m^2 (70,000 ft^2). The Center is

(a) Personal Communication. May 11, 2000. John Ladson, Chairman, Toombs County Economic Development.

located on 80-plus ha (200-plus acres), most of which are developed. The county does not have growth-control measures that limit housing development (SNC 2000).

2.2.8.4 Visual Aesthetics and Noise

Access to the site is provided by U.S. Highway 1, which runs north-south by the plant site. The buildings on the site are largely screened from public view by the woods that surround the plant. Travelers on U.S. Highway 1 from the north, heading south, can see the steam rising from the cooling towers from several miles north of the plant site and entrance.

Because of the woods, topography, and lack of any close neighbors, noise from HNP is generally not an issue. The only sounds that may be heard offsite are the plant loudspeakers and gun firing range.

2.2.8.5 Demography

Resident and transient populations are described in the following sections.

- **Resident Population Within 16 km (10 mi)**

  Table 2-10 shows the estimated population distribution in a 16 km (10 mi) radius of the HNP site in the 16 sectors centered on the points of the compass. Of note is the fact that there is zero population within 1.6 km (1 mi) of the site. In several sectors, there is zero or little population living within the sectors up to approximately 6.5 km (4 mi) to 8 km (5 mi) from the plant.

  Table 2-11 shows the estimated population within a 16-km (10-mi) radius of the HNP site in 2030. Of note is the fact that, just as in 1990, there is little expected increase in population (in absolute, not percentage, terms) within the first 8 km (5 mi) of the site. Again of note is the fact that there is zero population within 1.6 km (1 mi) of the site. And, as before with the 1990 population data (Table 2-10), the same sectors have zero or little population in them out to approximately 6.5 km (4 mi) to 8 km (5 mi) from the plant.

- **Resident Population Within 80 km (50 mi)**

  The population for the 80-km (50-mi) radius surrounding HNP in 1970 was 211,145 (NRC 1978). Total population within the 80 km (50-mi) radius increased 1.9 percent between 1970 and 1975.

Table 2-10. Estimated Population Distribution in 1990 Within a 16-km (10-mi) Radius of HNP

Sector	0 - 1 Miles	1 - 2 Miles	2 - 3 Miles	3 - 4 Miles	4 - 5 Miles	5 - 10 Miles	10-Mile Total
N	0	10	26	0	81	378	495
NNE	0	1	0	0	6	280	287
NE	0	0	0	15	27	259	301
ENE	0	0	0	0	3	108	111
E	0	0	0	0	22	23	45
ESE	0	0	34	0	0	229	263
SE	0	0	19	12	45	275	351
SSE	0	0	38	24	122	428	612
S	0	21	137	53	46	1900	2157
SSW	0	27	82	62	32	313	516
SW	0	55	23	15	9	218	320
WSW	0	0	32	0	14	372	418
W	0	72	0	128	0	103	303
WNW	0	0	0	38	0	324	362
NW	0	0	0	8	21	384	413
NNW	0	2	95	70	40	343	550
Total	0	188	486	425	468	5937	7504

Source: SNC 2000.

Table 2-11. Estimated Population Distribution in 2030 Within a 16-km (10-mi) Radius of HNP

Sector	0 - 1 Miles	1 - 2 Miles	2 - 3 Miles	3 - 4 Miles	4 - 5 Miles	5 - 10 Miles	10-Mile Total
N	0	14	38	0	116	540	708
NNE	0	1	0	0	10	400	411
NE	0	0	0	23	39	370	432
ENE	0	0	0	0	3	155	158
E	0	0	0	0	30	30	60
ESE	0	0	46	0	0	306	352
SE	0	0	27	16	61	368	472
SSE	0	0	50	32	163	573	818
S	0	29	185	70	62	2545	2891
SSW	0	35	109	83	44	420	691
SW	0	74	31	19	13	312	449
WSW	0	0	44	0	20	542	606
W	0	97	0	180	0	150	427
WNW	0	0	0	51	0	445	496
NW	0	0	0	12	29	534	575
NNW	0	2	136	100	57	490	785
Total	0	252	666	586	647	8180	10,331

Source: SNC 2000.

The 1990 resident population distributed between zero and a 80-km (50-mi) radius of HNP is shown by Table 2-12. By 1990, the total population living within a 80-km (50-mi) radius of HNP had increased to over 336,600—an increase of more than 125,500 (or 60 percent) since 1970 (SNC 2000). Populations for the sectors were calculated using population values at the census block level, the smallest enumeration used by the USCB. The 80-km (50-mi) radius from HNP contained 78 census blocks. The census blocks were included in the analysis if 50 percent of their area lay within the 80-km (50-mi) radius. Census blocks with less than 50 percent of their area within the 80-km (50-mi) radius were excluded from the analysis (SNC 2000).

Table 2-12. Estimated Population Distribution in 1990 Within a 80-km (50-mi) Radius of HNP

Sector	0 - 10 Miles	10 -20 Miles	20 - 30 Miles	30 - 40 Miles	40 - 50 Miles	50-Mile Total
N	495	10,706	4375	1239	11,652	28,525
NNE	287	1007	1932	6657	5207	15,090
NE	301	3812	2833	2505	29,497	38,948
ENE	111	3008	4120	3916	5369	16,524
E	45	748	6868	1348	38,160	47,169
ESE	263	448	1278	3538	8931	14,458
SE	351	275	2002	15,477	881	18,986
SSE	612	922	1221	3880	2446	9081
S	2157	6646	1693	1983	32,090	44,569
SSW	516	1210	6203	2758	2193	12,880
SW	320	1457	1113	5178	18,479	26,547
WSW	418	7510	1041	2262	2407	13,638
W	303	2156	1654	1407	2682	8202
WNW	362	585	2308	6376	2721	12,352
NW	413	1335	4589	985	4347	11,669
NNW	550	4351	3802	5250	4040	17,993
Total	7504	46,176	47,032	64,817	171,102	336,631

Source: SNC 2000.

The projected population for 2030 within the 80-km (50-mi) radius is 498,834, or an increase of 48 percent over the 40-year period (SNC 2000). The distribution of the population is shown in Table 2-13. Total population by age distribution for 1990 (as of July 1, 1990) is shown in Table 2-14 for Appling and Toombs counties and the State of Georgia.

- **Transient Population**

Data on the transient population in the vicinity of HNP and Appling and Toombs counties were generally not available in the SNC ER application. The onsite workforce increases by as many as 800 temporary (1 to 2 months) duty employees during refueling outages. HNP

Table 2-13. Estimated Population Distribution in 2030 Within a 80-km (50-mi) Radius of HNP

Sector	0 - 10 Miles	10 - 20 Miles	20 - 30 Miles	30 - 40 Miles	40 - 50 Miles	50-Mile Total
N	708	15,316	5979	1566	15,056	38,625
NNE	411	1439	2575	7994	7051	19,470
NE	432	5199	3784	3409	51,355	64,179
ENE	158	3997	5356	5603	10,224	25,338
E	60	1051	8894	2100	77,421	89,466
ESE	352	949	1657	4272	11,779	18,657
SE	472	840	2740	21,220	1215	26,015
SSE	818	2053	1619	5407	3601	12,680
S	2891	11,745	1923	2541	45,212	61,421
SSW	691	2186	7126	3286	2800	15,497
SW	449	2537	1666	8278	28,568	41,049
WSW	606	11,559	1510	3476	3366	19,911
W	427	3392	2292	1948	3462	11,094
WNW	496	1241	2985	8320	3088	15,634
NW	575	2327	5818	1400	6530	16,075
NNW	785	6691	4985	6450	5597	23,723
Total	10,331	63,999	60,909	87,270	276,325	498,834

Source: SNC 2000.

Table 2-14. July 1, 1990, Population Estimates for Appling and Toombs Counties and the State of Georgia by Age Group

	Appling County	Toombs County	Georgia
Total Population	15,761	24,116	6,506,377
0 - 4	1100	1954	509,661
5 - 17	3519	5222	1,236,115
18 - 24	1552	2249	741,018
25 - 44	4715	7258	2,198,561
45 - 64	2970	4431	1,166,470
65+	1905	3002	654,552

Source: USCB 1999.

units are on an 18-month refueling interval, and SNC generally schedules outages on staggered schedules, resulting in one outage per year for 2 years and two outages in the third year (cycle repeats). The 800 temporary employees include contractors, employees from other SNC nuclear facilities, and corporate support staff.

Agriculture dominates the economy of Appling and Toombs counties (primarily row crops and the Vidalia sweet onion). Some transient population is required to support agricultural activities. In addition, there is some transient population related to the weekly and seasonal use of recreational facilities near and on the HNP site.

2.2.8.6 Economy

Between 1990 and 1997, Appling County marginally improved its position relative to State per capita income figures, while Toombs County's position worsened. These differences partly reflect the economic boom in Atlanta, and other places in northern and coastal Georgia, while the south-central Georgia region continues to be economically disadvantaged.

Toombs County had a number of manufacturing firms (mostly textile firms) leave the county during the 1990s. The per capita income gap between the two counties narrowed from 15 percent in 1990 to 6 percent in 1997. But replacement industry moving into Toombs County has kept employment in the county growing slowly, despite the loss of the textile firms.

The top three industrial sectors in Appling County in 1998 were manufacturing, transportation, and public utilities and services. SNC is the fifth largest employer (Georgia Department of Labor [GDL] 1998a) and is a high-wage employer for this area. The top three industrial sectors in Toombs County in 1998 were manufacturing, services, and retail trade (GDL 1998b).

In 1990, there were 6470 employed residents of Appling County, of which 78 percent or 5059 residents, were employed within the county (GDL 1998a). In 1998, the unemployment rate in Appling County was 10 percent compared to the State of Georgia at 4 percent (GDL 1998a). In 1990, there were 9843 employed residents in Toombs County, of which 77 percent worked within the county. Approximately 9 percent of the residents work in Appling County, and many of these are probably employed at the HNP (GDL 1998b). In 1998, the unemployment rate in Toombs County was 9 percent.

In 1990, the county's per capita income was $11,702. Georgia's per capita income in 1990 was $17,123 or 46 percent higher. In 1996, Appling's per capita income was $16,318, while Georgia's per capita income was $23,028 or 41 percent higher. While the gap between Appling's per capita income level and the State's is closing, it is still substantial (GDL 1998a; Georgia Department of Audits [GDA] 1999). Per capita income in Appling County was $16,998 in 1997.

Per capita income in Toombs County was $17,950 in 1997, or 6 percent higher than Appling County. Part of the reason for the higher per capita income of Toombs County is the fact that many of the highly paid executives and operators employed by HNP reside in Vidalia in Toombs County. In 1990, the county's per capita income was $13,477. This is 15 percent higher than Appling County. The State of Georgia per capita income was 27 percent higher (GDL 1998a; GDA 1999).

HNP is a major contributor to the taxes collected by Appling County. Table 2-15 presents the taxes paid to Appling County by HNP between 1994 and 1998. The "Appling County Digest" is the total property tax revenue that the county collects. The payments attributed to HNP come from three entities: Georgia Power, Oglethorpe Power, and the City of Dalton. During 1994, the total HNP tax payment represented $7,430,139 or 74 percent of the payments to the Digest. By 1998, the payments had increased to $8,484,489, or an increase of 14 percent when compared to 1994. HNP contributed 68 percent of the tax funds collected by the Digest in 1998, or a decline of 6 percent when compared to 1994 (SNC 2000). The reason for the decline is the depreciation of the HNP's physical plant and the fact that other businesses have contributed more to the assessed property rolls of Appling County.

Table 2-15. HNP Tax Payments to Appling County (in millions of dollars)

	1994	1995	1996	1997	1998
Appling County Digest	$10.0	$10.1	$11.5	$11.6	$12.4
Georgia Power	$4.2	$4.1	$4.5	$4.5	$4.6
Oglethorpe Power	$3.0	$3.0	$3.5	$3.5	$3.7
City of Dalton	$0.2	$0.2	$0.2	$0.1	$0.2
Total HNP Tax Payment	$7.4	$7.3	$8.2	$8.1	$8.5
HNP Percent of County Digest	74 percent	73 percent	71 percent	70 percent	68 percent

Source: SNC 2000.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the HNP site and in the surrounding area.

2.2.9.1 Cultural Background

The region around the HNP site is rich in prehistoric and historic Native American and historic Euroamerican resources. This part of southeastern Georgia has an archaeological sequence that extends back about 12,000 years, although human use of the central Altamaha River

drainage basin seems to have been limited throughout much of this sequence. Similar to much of the surrounding southeastern states, archaeological eras defined for this part of Georgia fall into several sequential cultural periods of Native American occupation: the Paleo-Indian era (about 10,000 B.C. to 7800 B.C.); the Archaic era (7800 B.C to 500 B.C.); the Woodland era (500 B.C. to A.D. 1000); the Mississippian era (A.D. 1000 to A.D. 1541); and the Historic era, initiated by the initial intrusion of Spanish explorers into the area (A.D. 1541 to A.D. 1850). The prehistoric eras were marked by initial reliance on big game hunting subsistence, followed by increased use of smaller game animals and plant foods in the Archaic era. Beginning late in the Woodland era, and increasing in importance in the following Mississippian era, were trends toward more sedentary villages, with more reliance on cultivated crops.

Occupation of the immediate vicinity of the HNP area seems to have been continuous in prehistoric times, although somewhat limited. According to Gresham (1996), nearly all prehistoric sites recorded in Toombs and Appling counties occur within or adjacent to the Altamaha River floodplain, with a near void of prehistoric sites away from the river. Barron (1981) discusses several Native American mound sites and cemeteries occurring a few miles downriver from HNP in Appling County.

At the time of contact by Euroamerican explorers, the Native American populations in the vicinity of the project area were generally attributed to groups of the larger Creek Indian Confederacy, although specific information for the central Altamaha River is scant. Swanton (1922) generally notes the presence of two Creek groups, the Hitchiti and the Tamati, near the confluence of the Ocmulgee and Oconee Rivers that combine to form the Altamaha River. However, the major concentrations of Creeks were upriver on the Ocmulgee and Oconee, and downriver near the coast.

Through a series of land cessions by the Creeks to the U.S. Government between 1790 and 1827, Creek occupation of Georgia ended with their removal to Indian Territory, where the Creeks exist today as the Muskogee Nation (Debo 1941; Green 1982). Appling County was formed after a Creek cession in 1818 (Barron 1981). Teasley (1940) has identified three periods in the history of Toombs County that apply to Appling County as well. These include an initial farming and stock-raising period from the late 1700s to about 1880; the timber and turpentine period of 1880 to about 1910; and finally an agricultural period from 1910 to the present.

The Altamaha River that runs through HNP has figured prominently in the history of the area (Barron 1981). During the early history of Georgia, the river was used to float oak masts to Darien for the ships of the English Navy. Subsequently, the river was used to transport cotton and lumber to the coast, by pole boats, rafts, and steamboats. Crossings played an important historical role as well, including several ferries. Adjacent to HNP, U.S. Highway 1 was preceded by a short-lived wooden road across the swamp in 1924, followed by the first bridge and concrete highway in 1927. The present Altamaha River Bridge was built in 1948 when the highway was enlarged (Gresham 1996).

2.2.9.2 Historic and Archaeological Resources at HNP

Historic and archaeological site file searches were conducted at the Georgia Historic Preservation Division, University of Georgia State Archaeological Site Files, the National Park Service's National Register Information System, and National Archaeological Database. In addition, sources at the University of Hargrett Rare Book and Manuscript Library, the Map Library at the University of Georgia Science Library, the Vidalia Public Library, and Appling County Heritage Center holdings were examined for literature and/or maps that would indicate the potential for historical and archaeological sites at HNP.

No historic or archaeological sites have been recorded on the HNP site, although no cultural resource inventories have been completed for any of the plant site acreage. Three archaeological surveys conducted within a mile of the HNP site indicate the potential existence of archaeological and historical sites in unsurveyed areas. In a larger area survey of the lower Ocmulgee River drainage, Snow (1977) recorded four archaeological sites about 0.8 km (0.5 mi) west of the HNP boundary in the Altamaha River Park. In a more recent survey of the same area, Wood (1984) relocated two of Snow's sites and discovered another three in the same vicinity. Wood evaluated two of these archaeological sites as being potentially eligible for listing on the National Register of Historic Places. The archaeological sites recorded by these two surveys reflected a Native American presence in this area that extends back some 4000 years, from the Late Archaic to the Mississippian eras. One of the sites yielded early historic era artifacts dating to the middle 1800s.

The third cultural resource survey was conducted for the widening of U.S. Highway 1; it included a stretch of the highway along the western plant site boundary starting northward from the road entering the plant site from the highway (Gresham 1996). No historical or archaeological sites were noted along the small segment south of the Altamaha River. North of the river, 11 historical sites were recorded, including 2 cemeteries and 9 19th-20th century houses.

The closest historical sites to HNP formally listed on the National Register of Historic Places include four in Appling County, all within the town of Baxley, and eight in Toombs County, two in the town of Lyons and the rest in Vidalia. A nomination for the Moody Farm Complex, located about 6.4 km (4 mi) southeast of the plant site is also on file at the Georgia Historic Preservation Division.

Only one site of potential historical significance is known to exist on the HNP site. This is the Bell Cemetery that is indicated on the U.S. Geological Survey Baxley NE quadrangle map. The cemetery is presently located within the HNP family recreation area, and is fenced and maintained by plant site personnel.

Reviews of historic maps and early aerial photographs and highway maps for the area did not indicate a potential for homesteads, at least during the 19th century. Although most early maps show primary transportation routes following the north bank of the Altamaha River (Georgia Department of Transportation, no date), two maps did indicate the presence of historic trails that extended along the south bank, and presumably through or very close to HNP property. These include Bernard's Path, which paralleled the south bank of the river eastward from Fort James (ca. 1793-1820) (Georgia Department of Archives and History, no date), and a road shown on an 1878 hand-drawn map on file at the Appling County Heritage Center that is labeled as the "public road from Macon to Darien."

2.2.10 Related Federal Project Activities

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating license (OL) for HNP. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparation of the SEIS.

The staff did not receive any comments from other Federal agencies regarding related Federal project activities. Based on its review, the staff is not aware of any Federal project activities directly related to renewal of the OL for HNP that could result in cumulative environmental impacts or that would make it desirable for another Federal agency to become a cooperating agency for preparation of the SEIS.

2.3 References

10 CFR Part 20, "Standards for Protection Against Radiation."

10 CFR 20.1301(d), "Dose limits for individual members of the public."

10 CFR Part 50, Appendix I, "Numerical guides for design objectives and limiting conditions for operation to meet the criterion 'as low as is reasonably achievable' for radioactive material in light-water-cooled nuclear power reactor effluents."

10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR 81.311, "Section 111 Attainment Status Designations: Georgia."

40 CFR 81.408. "Identification of Mandatory Class 1 Federal Areas Where Visibility is an Important Value: Georgia."

40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

49 CFR Subtitle B, Chapter 1, "Research and Special Programs Administration, Department of Transportation," Parts 171 through 180.

63 FR 53473-53478, "Southern Nuclear Operating Company, Inc., Edwin I. Hatch Nuclear Plant, Units 1 and 2; Environmental Assessment and Finding of No Significant Impact." October 5, 1998.

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3.0 Environmental Impacts of Refurbishment

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

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

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

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

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

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

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

Environmental issues related to refurbishment considered in the GEIS for which these conclusions could not be reached for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2. Category 1 and Category 2 issues related to refurbishment that are not applicable to the Edwin I. Hatch Nuclear Plant (HNP) because they are related to plant design features or site characteristics not found at HNP are listed in Appendix F.

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

Table 3-1. Category 1 Issues for Refurbishment Evaluation

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

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. The Southern Nuclear Operating Company (SNC) indicated that it has performed an evaluation of structures and components pursuant to 10 CFR 54.21 to identify activities that are necessary to continue operation of HNP, Units 1 and 2, during the requested 20-year period of extended operation. SNC indicated that existing plant programs will result in modifications to plant systems, structures, and components that are required by changes in regulations or to achieve performance improvements in the plant systems (SNC 2000).

However, SNC stated that the modifications of these components are within the bounds of normal plant maintenance activities; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statements (FESs) (AEC 1972; NRC 1978). In addition, the SNC evaluation of structures and components,

Table 3-2. Category 2 Issues for Refurbishment Evaluation

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

as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of HNP beyond the end of the existing operating licenses. Therefore, refurbishment is not considered in this supplemental environmental impact statement.

3.1 References

10 CFR Part 51, Subpart A, Appendix B, "Environmental effect of renewing the operating license of a nuclear power plant."

10 CFR 54.21, "Contents of application - technical information."

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4.0 Environmental Impacts of Operation

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

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

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

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

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

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

This chapter addresses those issues related to operation during the renewal term that are listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to HNP. Section 4.1 addresses the Category 1 issues applicable to the HNP cooling-tower-based heat dissipation system, while Category 2 issues applicable to the HNP cooling system are discussed at greater length in Sections 4.1.1 and 4.1.2. Section 4.2 addresses Category 1 issues related to transmission lines and land use, while a Category 2 issue is discussed in Section 4.2.1, and another issue requiring plant-specific review is discussed in Section 4.2.2. Section 4.3 addresses the radiological impacts of normal operation. There are no Category 2 issues related to radiological impacts of normal operation. Section 4.4 addresses the Category 1 issues related to the socioeconomic impacts of normal operation during the renewal term.

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

Category 2 socioeconomic issues are discussed in Sections 4.4.1 through 4.4.5. Environmental justice, an uncategorized issue, is discussed in Section 4.4.6. Section 4.5 addresses the Category 1 issues related to groundwater use and quality. Category 2 groundwater use and quality issues are discussed in Sections 4.5.1 and 4.5.2. Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species, a Category 2 issue. Section 4.7 addresses new information that was raised during the scoping period. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.8. Finally, Section 4.9 lists the references for Chapter 4.

4.1 Cooling System

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to the HNP cooling system operation during the renewal term are listed in Table 4-1. The Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP operating licenses (OLs). No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that "Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered current patterns during the renewal term beyond those discussed in the GEIS.

- Temperature effects on sediment transport capacity. Based on information in the GEIS, the Commission found that "These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1; 4.3.2.2; 4.4.2
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.2.2.
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.2.2
Eutrophication	4.2.1.2.3; 4.4.2.2
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2
Discharge of other metals in waste water	4.2.1.2.4; 4.3.2.2; 4.4.2.2
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.3; 4.4.2.2
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER-BASED HEAT DISSIPATION SYSTEMS)	
Entrainment of fish and shellfish in early life stages	4.3.3
Impingement of fish and shellfish	4.3.3
Heat shock	4.3.3
TERRESTRIAL RESOURCES	
Cooling-tower impacts on crops and ornamental vegetation	4.3.4
Cooling-tower impacts on native plants	4.3.5.1
Bird collisions with cooling towers	4.3.5.2
HUMAN HEALTH	
Microbial organisms (occupational health)	4.3.6
Noise	4.3.7

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that "Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of scouring during the renewal term beyond those discussed in the GEIS.

- Eutrophication. Based on information in the GEIS, the Commission found that "Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that "Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for HNP. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that "Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the NPDES permit for HNP. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in waste water. Based on information in the GEIS, the Commission found that "These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the NPDES permit for HNP. Therefore, the staff concludes that there are no impacts of discharges of other metals in waste water during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that "Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that "Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that "Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that "Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of thermal plumes during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that "Thermal discharge may have localized effects but is not expected to effect the larger geographical distribution of aquatic organisms." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on the distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that "Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that "Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that "Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not

expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that "These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that "Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the 316(a) demonstration report (Wiltz 1981). Therefore, the staff concludes that there are no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Entrainment of fish and shellfish in early life stages (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of fish and shellfish in early life stages with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system

and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of impingement with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Heat shock (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of heat shock with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Cooling-tower impacts on crops and ornamental vegetation. Based on information in the GEIS, the Commission found that "Impacts from salt drift, icing, fogging, or increased humidity associated with cooling-tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cooling-tower operation on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling-tower impacts on native plants. Based on information in the GEIS, the Commission found that "Impacts from salt drift, icing, fogging, or increased humidity associated with cooling-tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cooling-tower operation on native plants during the renewal term beyond those discussed in the GEIS.

- Bird collisions with cooling towers. Based on information in the GEIS, the Commission found that "These collisions [of birds with cooling towers] have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process,

its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that "Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of microbiological organisms during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that "Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

Category 2 issues related to cooling system operation during the renewal term that are applicable to HNP are discussed in the sections that follow. These issues are listed in Table 4-2.

4.1.1 Water-Use Conflicts

Surface-water withdrawals may impact riparian and instream habitat. Section 2.2.2 describes HNP surface-water withdrawals.

The impact of consumptive loss on the downstream riparian communities is associated with the small difference it causes in the river surface elevation. SNC has calculated the reduction in surface-water elevation resulting from HNP withdrawals (SNC 2000a, Attachment B). During periods of average river discharge, consumptive loss amounts to about a 0.01 m (0.03 ft) decrease in the downstream surface elevation. During periods of minimum river discharge, consumptive loss results in a lowering of the downstream surface elevation by approximately 0.02 m (0.08 ft).

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SURFACE WATER QUALITY, HYDROLOGY AND USE (FOR ALL PLANTS)			
Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	4.3.2.1; 4.4.2.1	A	4.1.1
HUMAN HEALTH			
Microbiological organisms (public health)	4.3.6	G	4.1.2

The shoreline of the Altamaha River in the vicinity of HNP and immediately downstream for several miles is characterized by steep bluffs, floodplain forests, and sandbars. Based on average daily flows for a 1-month period over the last 22 years, the riparian communities experienced an average annual surface elevation fluctuation of approximately 2.7 m (9 ft). The consumptive loss incurred by plant operations has the greatest effect on surface elevation during low-flow periods. The duration of low-flow conditions is approximately 2 to 3 months during late summer. The shoreline exposed during these periods is under water during the other 9 to 10 months of the year.

Vegetation is found at elevations that are not flooded for most of the year by the river. When the river stage is high enough to flood the riparian communities, the impact of consumptive loss from plant operations is negligible.

Consumptive loss from plant operations during the low-flow periods would have the greatest impact on instream biological communities (e.g., mussels and fish) if it occurred during the spawning season. For example, if a reduction in flow (or river level) were enough to hinder upstream or downstream movement of anadromous fish or the movement of resident fish into shallow sloughs and oxbows to spawn, then there could be a reduction in spawning success. The spawning season for fish in the Altamaha River occurs in the spring and early summer, the period of highest flows in the Altamaha (SNC 2000a). Consumptive loss from plant operations is not expected to have any impact on instream communities, because the lowest average daily flow for a 1-month period occurs in September, and the highest average daily flow for a 1-month period occurs in March.

Freshwater mussels vary in their ability to withstand emersion (exposure to air). Some species have adapted to withstand prolonged periods of emersion, while others are emersion-intolerant. Mussels move over and through the substrate by means of a protrusible muscular foot. Some species are known to move several feet per hour in response to stagnant conditions or falling water levels. Other species respond to falling water levels by burrowing more deeply into the substrate, seeking moisture. However, most riverine species have evolved under seasonally fluctuating water-level conditions and are unaffected by small fluctuations in water level. Under worst-case conditions, consumptive losses would result in a 0.02-m (0.08-ft) lowering of water level downstream of HNP.

The staff reviewed the Clean Water Act 316(a) demonstration for HNP and the ER relative to potential water-use conflicts due to consumptive loss of stream flow. Based on this review, the staff has concluded that the potential impacts are SMALL, and mitigation is not warranted.

4.1.2 Microbiological Organisms (Public Health)

For plants discharging cooling water to cooling ponds, lakes, canals, or small rivers, the effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of *Naegleria fowleri* and could not be determined generically (NRC 1996). The Nuclear Regulatory Commission (NRC) noted that the impacts of nuclear plant cooling towers and thermal discharges are considered to be of small significance if they do not enhance the presence of microorganisms that are detrimental to water quality and public health (NRC 1996). The assessment criteria relate to thermal discharge temperature, thermal characteristics, thermal conditions for the enhancement of *N. fowleri*, and impacts to public health.

HNP withdraws water for cooling from the Altamaha River via a shoreline intake and discharges it via offshore discharge structures. The cooling-water systems for Units 1 and 2 are identical. A mixing box for the river discharge receives cooling-tower blowdown, demineralized waste, cooling-tower overflow, and excess service water from both units. From the mixing box, two 1.1-m (42-in.) lines run down to the river and extend about 37 m (120 ft) into the river from the shoreline. The point discharge is about 384 m (1260 ft) downriver from the intake structure and about 1.2 m (4 ft) below the surface when the river is at its lowest level.

HNP discharge temperatures are monitored weekly by plant personnel and reported to the Watershed Planning and Monitoring Program of the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GADNR). Discharge temperatures range from about 17 to 34°C (62 to 94°F) when the plant is operating. During summer months, when thermophilic organisms are most likely to occur, discharge temperatures have averaged 29 to 32°C (85 to 89°F) over the last 2 years. HNP discharge temperatures are below those known

to be optimal for growth and reproduction of pathogenic microorganisms but could theoretically permit limited survival of these organisms in summer months. Temperatures in the Altahama River immediately downstream of the HNP discharge structure are several degrees cooler than the temperatures in the immediate area of the discharge outfall (NRC 1978).

Another factor limiting concentrations of pathogenic microorganisms in the HNP discharge is the absence of a seed source or inoculant. Waste water is the usual source of pathogens in natural waters. The sewage-treatment plant has been upgraded and expanded to accommodate the sewage demand at HNP. HNP sewage treatment consists of two approximately 130 m^3/d (35,000 gpd) extended aeration-activated sludge-treatment plants. Disinfection in the sewage-treatment plant reduces coliform bacteria and other microorganisms to levels that meet state water-quality standards. The circulating water is also chlorinated to control microbial organisms. Additionally, the Altamaha River upstream of HNP flows through a largely rural area and receives no substantial discharges of municipal, industrial, or agricultural wastes.

The staff has reviewed the thermal characteristics of the Altamaha River and the HNP discharge, and does not expect HNP operation to stimulate growth and reproduction of pathogenic microorganisms in the Altamaha River downstream of the plant. Under certain circumstances, the organisms might be present in the immediate area of the discharge outfall but would not be expected in sufficient concentrations to pose a threat to downstream water users. Many of these pathogenic microorganisms are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds, but are usually only a problem when the host is immunologically compromised. Although there is a potential for deleterious thermophylic microorganisms to be associated with the cooling system, the actual hazard to public health has not been documented or substantiated. The thermal characteristics of the HNP discharge would not promote the growth of microorganisms that are detrimental to water and public health. Thus, the staff concludes that the potential impacts of microbial organisms on human health resulting from the operation of the plant's cooling-water discharge to the aquatic environment on or in the vicinity of the site are SMALL, and mitigation is not warranted.

4.2 Transmission Lines

The final environmental statement (FES; AEC 1972) described four transmission lines that were built to connect HNP with the Georgia Power Company (GPC) transmission system. These transmission corridors cover approximately 1790 ha (4400 acres) over a total corridor length of approximately 299 km (186 mi). Since the start of operation of HNP Unit 2, two additional lines were constructed to connect the GPC transmission system to Florida. These additional lines, which cover an area of approximately 1120 ha (2760 acres) with a total transmission corridor length of approximately 245 km (152 mi), have also been included in this evaluation.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to the HNP transmission lines are listed in Table 4-3. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

- Power line right-of-way management (cutting and herbicide application). Based on information in the GEIS, the Commission found that "The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the U.S. Fish and Wildlife Service (FWS) and GADNR, or its evaluation of other information.

Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that "Impacts [of bird collisions with power lines] are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the FWS and GADNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that "No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetland on power line right-of-way. Based on information in the GEIS, the Commission found that "Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the FWS and GADNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts on floodplains and wetlands on the power line right-of-way during the renewal term beyond those discussed in the GEIS.

- Air quality effects of transmission lines. Based on the information in the GEIS, the Commission found that "Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- Onsite land use. Based on the information in the GEIS, the Commission found that "Projected onsite land use changes required during ... the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no onsite land-use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right-of-way (land use). Based on information in the GEIS, the Commission found that "Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no impacts on use of power line rights-of-way during the renewal term beyond those discussed in the GEIS.

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

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

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

4.2.1 Electromagnetic Fields—Acute Effects

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

In the ER, SNC states:

> GPC designed and constructed all HNP transmission lines in accordance with the edition of the National Electrical Safety Code...and industry guidance that was current when the line was built. Ongoing right-of-way supervision and maintenance of HNP transmission facilities ensures continued conformance to governing standards and includes routine aerial patrol, helicopter inspection, and ground inspection. At this time, aerial patrols of all corridors are conducted every other month and include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Slow helicopter inspections (45 miles per hour or less) are conducted annually for 500-kV lines to allow more careful checks of facilities and rights-of-way. Currently all lines are inspected from the ground and measured for clearance at questionable locations every 6 years. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

According to the ER, there have been no upgrades in line voltage on the HNP transmission lines since they were constructed.

In 1977, the NESC was revised to include identification of the method for establishing minimum vertical clearances for electric lines having voltages exceeding 98 kV. The clearance must be sufficient to limit the induced current due to electrostatic effects to 5 milliamperes (5 mA) if the largest anticipated truck, vehicle, or equipment parked beneath the line were shorted to ground. The Duval and Thalmann transmission lines constructed in 1981 were designed to this limit. However, the four transmission lines initially constructed for HNP were built before this guidance was adopted. Nevertheless, the SNC ER (SNC 2000a) states that the 5-mA limit was used in the design of the 500-kV North Tifton and Bonaire lines because the limit was used by industry for high-voltage lines when the lines were designed.

GPC had not modeled the 230-kV Eastman and Douglas lines to evaluate the maximum induced current in those lines against the 5-mA limit, and computer-modeling capabilities have improved significantly since the 500-kV lines were designed. SNC stated (SNC 2000a) that SNC and GPC conducted an evaluation of all of the lines' adherence to the 5-mA induced current limit (GPC 1999a; 1999b) using the Electric Power Research Institute (EPRI) EFION computer program (EPRI High Voltage Transmission Research Center 1991), which is a generally accepted analytical methodology. The largest vehicle that SNC anticipates being under the HNP transmission lines is a tractor trailer parked on a public highway. Based on GPC minimum line vertical clearance design criteria of 10.3 m (33.7 ft) for 230-kV lines and 12.6 m (41.4 ft) for 500-kV lines at a conductor temperature of 48.9°C (120°F), the maximum induced currents were 1.25 mA for 230-kV lines and 3.84 mA for 500-kV lines for a 16.8-m (55-ft) long tractor trailer, 2.4 m (8 ft) wide and 4.1 m (13.5 ft) high.

The induced currents calculated in this evaluation were reported to be less than the NESC limit of 5 mA. Therefore, the staff concludes that the impact of the potential for electrical shock is SMALL, and mitigation is not warranted.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of electromagnetic fields from power lines were given a finding of "not applicable" rather than a Category 1 or 2 designation until a scientific consensus is reached on the health implications of these fields.

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

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

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

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to HNP in regard to radiological impacts are listed in Table 4-5. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that "Radiation doses to the public will continue at current levels associated with normal operations." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that "Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its

evaluation of other available information. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Period

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-6. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that "Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC

ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that "Only impacts of small significance are expected." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that "No significant impacts are expected during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that "No significant impacts are expected during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

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

4.4.1 Housing Impacts During Operations

While determining housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS, Section C.1.4). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS, Table C.1), and a matrix

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SOCIOECONOMICS			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services, transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
ENVIRONMENTAL JUSTICE			
Environmental Justice	Not evaluated		4.4.6

is used to rank the population category as "low," "medium," or "high" (GEIS, Figure C.1). The population in the HNP area was categorized by the NRC as "low" (GEIS, Table C.2). Table 2-12 provides the population distribution for the area surrounding HNP, Units 1 and 2, based on 1990 census data. The population density within a 32-km (20-mi) radius of HNP is approximately 17 persons/km^2 (43 persons/mi^2) and there is no city with a population of 25,000 within 32 km (20 mi), giving the site a Sparseness Category of 2. The population density within an 80-km (50-mi) radius is approximately 17 persons/km^2 (43 persons/mi^2), and there is no city with a population of 100,000 within 80 km (50 mi), giving the site a Proximity Category of 1. These values combine to give the surrounding HNP population a category measure of 2.1; a "low" category as defined by GEIS Figure C.1.

In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, the NRC concluded that impacts on housing availability are expected to be MODERATE to LARGE at plants located in "low" population areas or in areas where growth control measures are in effect. SMALL impacts result when no discernable change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversions are needed to meet the demand. I

During the license renewal period, SNC does not anticipate the need to increase onsite or offsite personnel, and expects the outage workforce to be within the range supporting current operations. Strategic planning by SNC projects a constant or slightly reduced workforce in the future based on industry benchmarks for boiling-water reactors similar to those employed at HNP. SNC determined that no refurbishment was necessary at HNP. Thus, SNC concludes that there would be no refurbishment-related impacts to area housing (SNC 2000a). Even

establishing an upper bound on employment, applying an analysis used by the NRC in the GEIS,[a] of 60 permanent workers during the license renewal period (plus 185 indirect jobs) would result in an increased demand for housing in Toombs and Appling counties of 174 units or 9 percent of available housing (see Table 2-6). In its ER, SNC concluded that even with the resulting decrease in housing availability for the bounding case scenario of 60 additional workers, there would not be a discernable change in housing availability, rental rates, and housing values. Nor would such hires spur housing construction or conversion. In addition, the staff did not identify any Federal projects or other activities that would add to housing impacts. As such, SNC concluded that license renewal impacts to housing would be SMALL, and would not warrant mitigation (SNC 2000a). The staff has reviewed the available information relative to housing impacts. Although HNP is located in a low-population area, there are no growth-control measures that limit housing development in effect and little or no change in the size of the plant workforce is anticipated. Based on its review, therefore, the staff concludes that the impact on housing during the license renewal period would be SMALL, and mitigation is not warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

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

As described in the SNC ER, a municipal water supply is not used at the plant site; therefore, the plant operations do not directly affect any public water supply system. The ER states that operations at the plant site do not have a noticeable impact on offsite wells drawing from the Floridan Aquifer. Because plant demand is not expected to alter offsite groundwater use in the Floridan Aquifer, operations at HNP will not indirectly impact public water supply systems located in the vicinity of the plant (SNC 2000a).

(a) NRC applies a bounding workforce estimate of 60 license renewal workers per nuclear unit to estimate potential housing impacts. These workers are required to conduct increased inspections, surveillance, testing, and maintenance. The NRC uses this estimate as a conservative value to represent the upper bound of potential socioeconomic impacts. SNC anticipates that the increased inspection and maintenance would be performed mostly during the outages that are staggered so they do not coincide, thus making it unreasonable that each unit would require 60 additional workers. Instead, as a reasonably conservative estimate, SNC assumed that only 60 workers (not 120) would at most be required at HNP.

Another concern is the potential indirect impact resulting from additional workers moving to the area and placing additional demands on public water supply systems. As described in the ER, SNC does not anticipate the need to increase the onsite workforce during the license renewal period, and therefore, anticipates no impact on the public water systems as a result of license renewal. However, to demonstrate potential population-related impacts to area public water services, SNC used the upper-bound license renewal workforce of 60 additional full-time workers generating an additional indirect workforce of 185 jobs in the surrounding communities (described in Section 4.4.1 of this report). If each new worker represents one new family, the population in the area could increase by approximately 785, based on a family size of 3.2. SNC assumes that the residential distribution of the workers would be similar to the current worker distribution of 71 percent in Appling and Toombs counties. Thus, 560 of the new residents (out of the 785), would live in Appling and Toombs counties (SNC 2000a).

Section 2.2.8.2 describes the water supply system utilities in Appling and Toombs counties. For Appling and Toombs counties combined, the total available, reserve water service capacity is approximately 36,000 m^3/d (9.4 million gpd). Continuing with the "upper bound" analysis, SNC estimated the plant-related population increase would generate a demand on public water supply systems of 170 m^3/d (45,000 gpd), assuming that 100 percent of the growth attributable to license renewal are served by these municipal systems. This represents approximately 0.5 percent of the available reserved capacity in the two counties. Based on the level of demand that would be placed on the public water systems serving Appling and Toombs counties, SNC concludes that plant-related population growth (even given the upper bound analysis) would require no additional increase in municipal water supply capacity (SNC 2000a). No other projects were identified that would add significantly to water demand in the two counties.

The NRC staff concludes that impacts on groundwater during the license renewal period would be SMALL, either not detectable or so minor that they would not destabilize nor noticeably alter any important attribute of the resource, and that mitigation is not necessary. This conclusion is based on the fact that HNP's use of groundwater does not have a noticeable impact on offsite wells drawing from the Floridan Aquifer, SNC does not anticipate an increase in the workforce if the license is renewed, and the "upper bound analysis" of 560 new residents represents approximately 0.5 percent of the available water-use capacity in the two counties.

4.4.3 Offsite Land Use During Operations

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

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

> SMALL, where there is very little new development and minimal changes to an area's land-use pattern
>
> MODERATE, where there is considerable new development and some changes to the land-use pattern
>
> LARGE, where there is large-scale new development and major changes in the land-use pattern.

SNC has not identified any increases in plant staffing related to the license renewal application; consequently, there are no population related land-use impacts during the license renewal term.

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

Appling County is the only jurisdiction that taxes HNP directly, and it is the principal jurisdiction that receives direct tax revenue as a result of HNP's presence. Because there are no major refurbishment activities and no new construction as a result of the license renewal, no new sources of plant-related tax payments are expected that could significantly influence land use in Appling County. However, during the license renewal term, new land-use impacts could result from the use by Appling County of the tax revenue paid by SNC for HNP. As discussed in

Section 2.2.8.6 and as shown in Table 2-15, SNC paid Appling County $8.5 million in 1998 for HNP. This amount represented approximately 68 percent of the Appling County tax revenue, which, for the purpose of this analysis, is considered large relative to the county's total tax revenue.

Notwithstanding the high proportion of Appling County tax revenue paid by SNC, Appling County has experienced a minor population increase of 5.9 percent over the last decade. Toombs County has experienced a growth of 8 percent over this period (Table 2-8). Appling and Toombs counties do not have growth-control measures that limit housing. Land-use projections for Appling County show that new commercial and industrial developments are expected to concentrate in Baxley and along the U.S. Highway 341 corridor, which runs parallel to the Norfolk Southern rail line. New residential development is being encouraged near the cities of the county, particularly Baxley. The remainder of Appling County is expected to remain in agricultural and forest use.

Continuation of Appling County's tax receipts from HNP keeps tax rates below what they otherwise would have to be to fund the county's government and also provides for a higher level of public infrastructure and services than otherwise would be possible. Both Appling and Toombs counties' property tax rates are among the lowest 10 percent in Georgia. Appling County directly benefits from the location of the HNP site in the county while Toombs County benefits from having a greater percentage of the HNP workforce living in the county (see Table 2-7). Continued operation of HNP provides significant economic stability to the two counties and is likely to encourage new business development in the counties. Overall, this effect is positive because Appling and Toombs counties have higher unemployment rates and lower per capita income levels than the statewide averages (see Section 2.2.8.6).

Based on review of the issues related to land use and the criteria in the GEIS, the staff concludes that the net impact of plant-related population increases is likely to be SMALL. The staff also concludes that tax-related land-use impacts are likely to be SMALL. There are several reasons for these conclusions. First, SNC does not intend to refurbish HNP, Units 1 and 2, in conjunction with license renewal. Thus, there will be no increase in employment at the HNP site as a result of license renewal activities. Second, SNC has stated that the permanent workforce at HNP will remain stable during the renewed license operating period of 20 years (SNC 2000a). Third, the population increase in Appling County, not related to HNP employment, between 1990 and 1999 was only 5.9 percent (see Table 2-8). Finally, visual inspection by the staff and discussions with real estate agents in Baxley did not reveal significant housing development in Appling County. Approximately 150 new housing units (or two percent of the available housing stock in 1990 [Table 2-6]) are being developed in Appling County (30 stick-built and 120 manufactured homes) each year. Most of these units are being located in rural

parts of the county.[a] Additional mitigation for land-use impacts during the license renewal term does not appear to be warranted.

4.4.4 Public Services: Transportation Impacts During Operations

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

Moderate population growth (less than 12 percent) is expected in Toombs and Appling counties between 1999 and 2010 (see Table 2-8). Even if there were an increase in plant employment of 60 workers (the upper bound), there would only be an approximate 1.4 percent increase in traffic volume on U.S. Highway 1 north of the HNP site and approximately 1.1 percent increase in traffic volume south of the plant. However, none of the expected growth identified in Table 2-8 will be due directly to increases in employment at HNP. Future general population increases may increase highway congestion at specific locations.

There are plans to widen U.S. Highway 1 to four lanes from Baxley to Interstate 16 within 5 years (SNC 2000a). Given these facts, the NRC staff concludes that any impact of HNP on transportation service degradation is likely to be SMALL and not require mitigation.

4.4.5 Historic and Archaeological Resources

The SNC license renewal application for HNP does not include plans for future land disturbances or structural modifications beyond routine maintenance activities at the plant. Therefore, there would be no identifiable adverse effects to known historic and archaeological resources. Consultation between the license renewal applicant and the Georgia State Historic Preservation Office resulted in a determination by the State office that no known historic properties included in or eligible for inclusion in the National Register of Historic Places would be affected by the proposed action (SNC 1999a; GADNR 1999a).

Continued operation of the power plant and protection of the natural landscape and vegetation within the site boundaries would provide *de facto* protection during the term of the license renewal period for known or undiscovered resources located in an undisturbed area with secured access. HNP's commitment to continue conservation and security of the Bell Cemetery will continue to enhance long-term preservation of that property.

(a) Based on an interview with a group of real estate agents in Baxley, May 9, 2000.

However, additional care should be taken during normal operational and maintenance conditions to ensure that historic properties are not inadvertently impacted. These activities may include not only operation of the plant itself, but also land management-related actions such as recreation, wildlife habitat enhancement, or maintaining/upgrading plant access roads throughout the plant site. The environmental impacts of activities undertaken by SNC are managed through the Environmental Protection Plan (Appendix B to each units' technical specifications) and the licensee's program to implement the requirements of 10 CFR 50.59, "Changes, tests, and experiments." Based on the finding that SNC did not identify any major refurbishment activities related to the renewal of the HNP OLs and that operation will continue within the bounds of plant operations as evaluated in the FESs (AEC 1972 and NRC 1978), it is the staff's conclusion that the potential impacts on historic and archaeological resources are expected to be SMALL, and mitigation is not warranted.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy in which Federal actions should not result in disproportionately high and adverse impacts on minority or low-income populations. Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. Specific guidance is provided in NRC Office of Nuclear Reactor Regulation Office Letter 906, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" (NRC 1999b).

The staff examined the geographic distribution of minority and low-income populations recorded during the 1990 Census (U.S. Census Bureau [USCB] 1991) within 80 km (50 mi) of HNP, supplemented by field inquiries to the local planning departments and social service agencies in Toombs and Appling counties.

A minority population is defined to exist if the percentage of minorities within the census blocks affected by the proposed action exceeds the percentage of minorities in the entire State of Georgia by 20 percent, or if the percentage of minorities within the census block is at least 50 percent. Generally, minority populations are small and dispersed in an 80-km (50-mi) radius around the HNP site. Identified concentrations of minority populations are located primarily in the small towns in the area, including Vidalia, Baxley, Douglas, and Waycross (see cross-hatched areas in Figure 4-1). When individual minority populations are present, these are Black populations (SNC 2000a). Other minorities are present, including substantial numbers of Hispanics in Long and Liberty counties, but they do not meet the criterion of "minority populations" in the staff guidance (NRC 1999b).

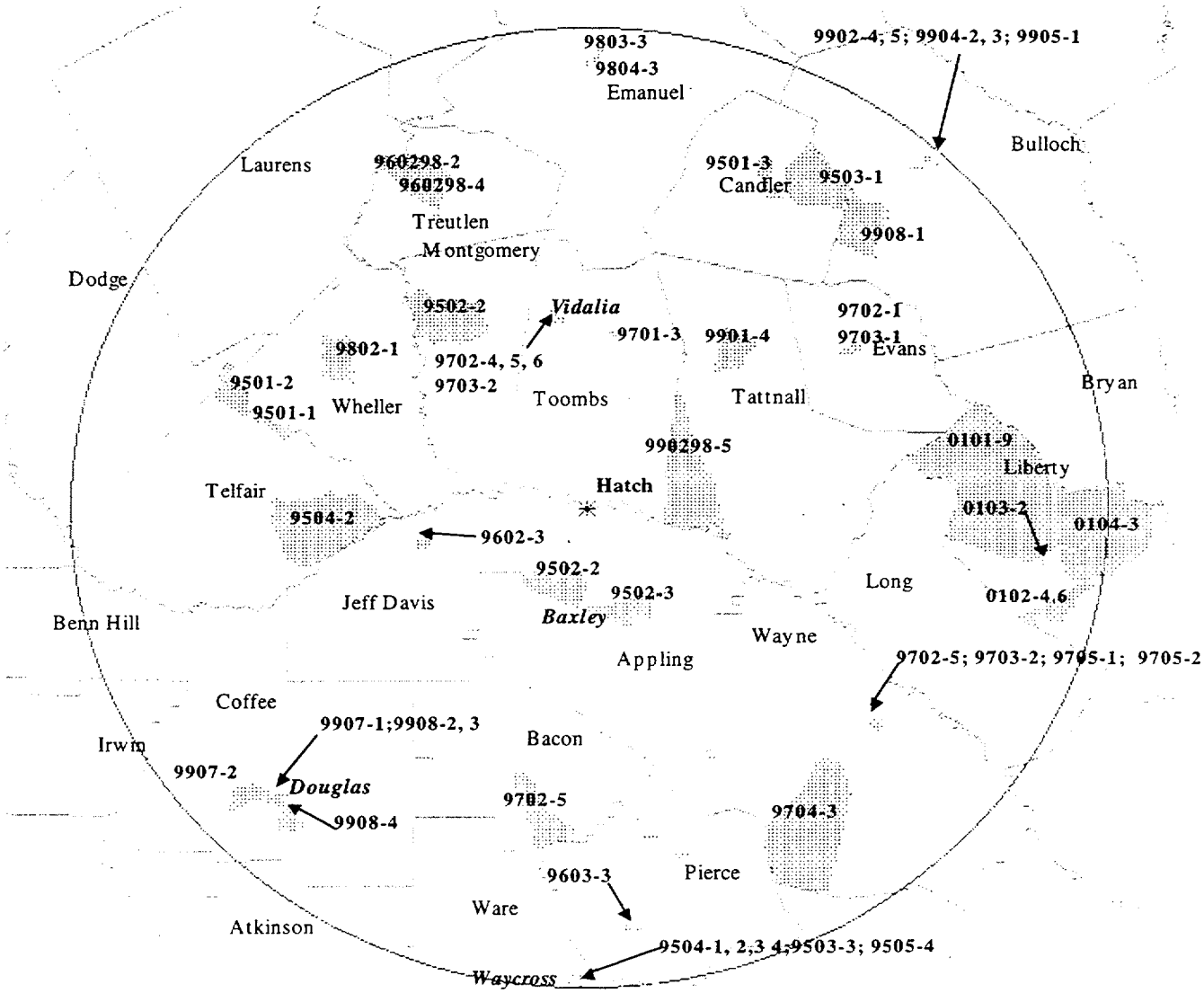

Figure 4-1. Geographic Distribution of Populations Classified as Minority Populations (Shown in Shaded Areas) -- 80 km (50-mi) Radius

A low-income population is defined to exist if the percentage of households below the poverty level is 20 percentage points or more above the percentage of households below the poverty level in the entire State of Georgia. Figure 4-2, also based on the 1990 Census (USCB 1991),

shows the geographic distribution of low-income populations (cross-hatched census blocks) within the 80-km (50-mi) radius of the plant. The largest concentrations of low-income populations within the 80-km (50-mi) radius are located in the counties of Wheller, Montgomery, Bulloch, and Wayne and the towns of Vidalia, Baxley, Douglas, and Waycross. Some small groups are scattered throughout the rural areas of Emanuel, Chandler, Tattnall, and Bacon counties.

With the locations of minority and low-income populations identified, the staff proceeded to evaluate whether any of the environmental impacts of the proposed action could affect these populations in a disproportionate manner. Based on staff guidance (NRC 1999b), air, land, and water resources within about 80 km (50 mi) of HNP were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population. These include:

- groundwater-use conflicts (discussed in Section 4.5)
- electric shock (discussed in Section 4.2.1)
- microbial organisms (discussed in Section 4.1.2)
- postulated accidents (discussed in Chapter 5.0 of this SEIS and Chapter 5 of the GEIS)
- surface water-use conflicts (discussed in Section 4.1.1)

The pathways through which the environmental impacts associated with HNP license renewal can affect human populations are discussed in each associated section (e.g., Section 4.1.1 for surface water-use conflicts). The staff then evaluated whether these impacts could have a disproportionately high and adverse effect on the minority and low-income populations. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that HNP offsite impacts to minority and low-income populations would be SMALL, and no special mitigation actions are warranted.

4.5 Groundwater Use and Quality

There are no Category 1 issues applicable to HNP groundwater use and quality during the renewal term. Category 2 issues related to groundwater use and quality during the renewal term that are applicable to HNP are discussed in the sections that follow. These issues, listed in Table 4-8, require plant-specific analysis.

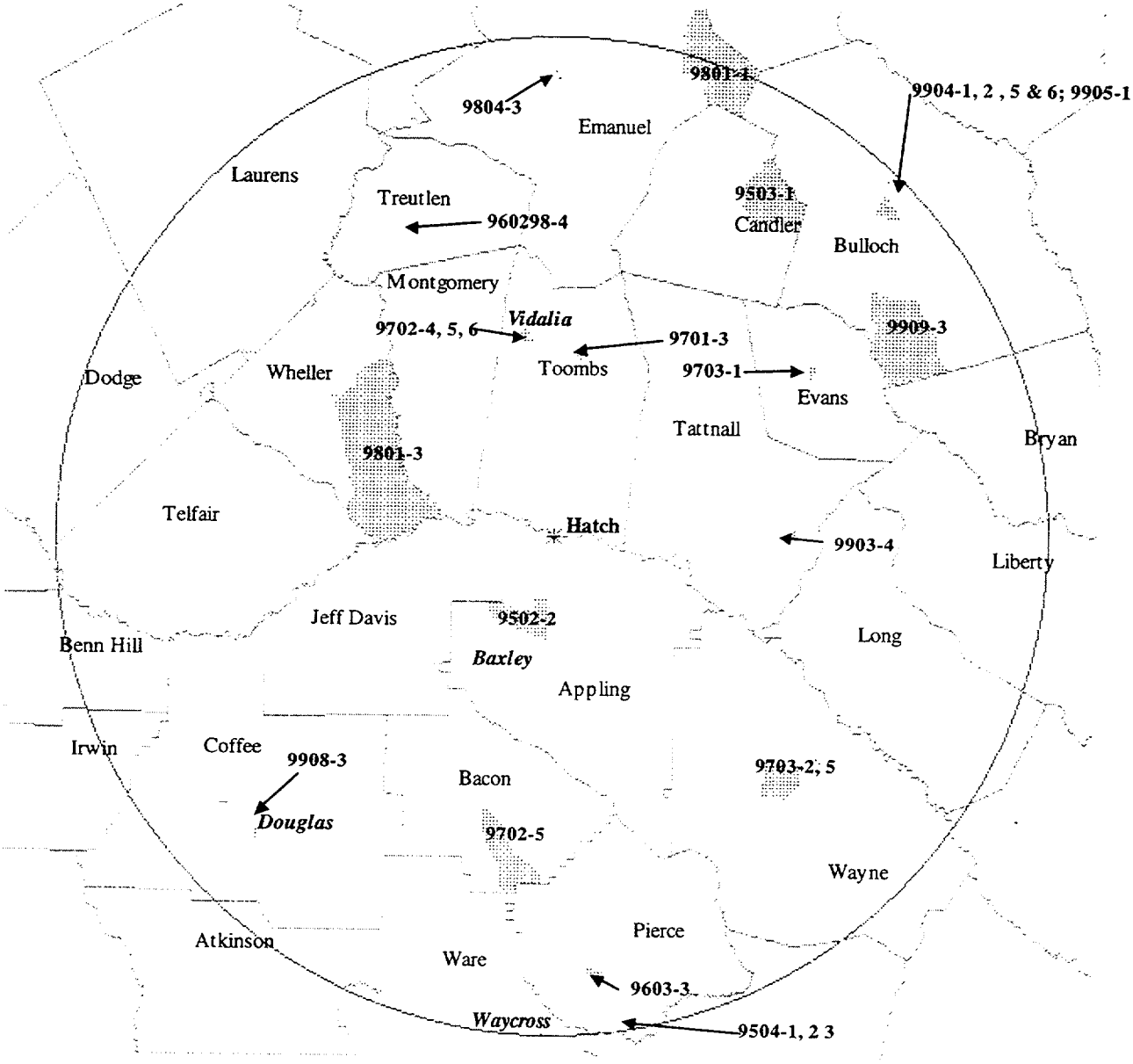

Figure 4-2. Geographic Distribution of Populations Classified as Low-Income Populations (Shown in Shaded Areas)—80-km (50-mi) Radius

4.5.1 Groundwater-Use Conflicts (Potable and Service Water)

Site Wells 1 and 2, described in Section 2.2.2, are screened in the principal artesian (Floridan) aquifer. During HNP construction, pump tests were conducted to determine the groundwater characteristics for this unit. The wells pumped for 9 hours at rates of approximately 2.85 m^3/min (752 gpm) (Well 1) and approximately 3.02 m^3/min (797 gpm) (Well 2). Drawdown in the wells stabilized at 1.5 m (5 ft) in Well 1 and 2.4 m (8 ft) in Well 2. Based on published literature, the transmissivity in the vicinity of the site is approximately 0.019 m^3/s/m (130,000 gpd/ft) and the effective permeability is 0.03 and 0.06 m/min (0.1 and 0.2 ft/min). Data gathered during pumping tests and existing data for this aquifer indicate that a properly designed well installed within this aquifer unit can safely yield over approximately 4.2 m^3/min (1100 gpm). A third site well, Well 3, was added to supply domestic water to the recreation facility. The well yield for Well 3 (less than 3.8 m^3/d [1000 gpd]) will not significantly impact the water usage of the aquifer. Two smaller wells for irrigation of ornamental vegetation were placed in service in early 2000. Those wells typically draw 34 m^3/d (9000 gpd) each and are used as needed.

Table 4-8. Category 2 Issues Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
GROUNDWATER USE AND QUALITY			
Groundwater-use conflicts (potable and service water; plants that use >379 L/min [>100 gpm]).	4.8.1.1 4.8.2.1	C	4.5.1
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	4.8.1.3 4.4.2.1	A	4.5.2

Within the immediate vicinity of the site, the primary use of groundwater is for domestic needs, with a limited amount for livestock. Most domestic wells are screened within the unconfined aquifer. The closest offsite well that is screened to the principal aquifer is located approximately 300 m (1000 ft) southwest of the site (Figure 2-3). Currently, there is no industrial demand for groundwater within the vicinity of the site, and no groundwater is used for irrigation. The nearest appreciable demand is 16 km (10 mi) south of the site, where the town of Baxley has four wells withdrawing approximately 5,300 m^3/d (1.4 million gpd) from the principal aquifer.

As described above, each of the onsite production wells is capable of producing approximately 2.8 m^3/min (750 gpm). The pump test conducted during construction demonstrated that at this rate of pumping there was no interference between site Wells 1 and 2. These two wells are

located approximately 542 m (1780 ft) apart, therefore, the effective radius is conservatively assumed to be approximately 600 m (2000 ft). The onsite well closest to the facility boundary is Well 1 at approximately 1000 m (3400 ft). Based on the conservative pumping rate of 2.8 m^3/min (750 gpm) and a conservative effective radius of 600 m (2000 ft), the resulting drawdown in Well 1 would not extend to the facility boundary. Given that the actual plant groundwater requirements, approximately 0.48 m^3/min (126 gpm), are about one fifth of that used to determine the effective radius, the drawdown of the groundwater potentiometric surface attributable to plant operations would be substantially less than that demonstrated by the original site pump test data, creating no interference with offsite wells.

The site production wells are located in the Floridan Aquifer. This aquifer unit is isolated geologically from the minor confined aquifer by a confining unit that is approximately 30 m (100 ft) thick. Since monitoring began at the facility in 1969, there has been little to no fluctuation of the water level in the minor confined aquifer. Water levels in the unconfined aquifers have been observed to vary according to normal seasonal fluctuations. There have been no observed effects in the monitoring wells installed in the shallow onsite aquifers from the pumping of groundwater from the Floridan onsite wells. Irrigation Wells 4 and 5 are also located in the Floridan Aquifer. A sixth well has been permitted in the formation above the Floridan Aquifer but has not been constructed.

Due to the high potential yields of the Floridan Aquifer and the low production yields required by HNP, HNP will have little effect on the regional water table. There is some limited domestic and agricultural use of groundwater in rural areas surrounding the site, but no groundwater-use conflicts have been identified as a result of current withdrawals. Therefore, the continued operation of HNP is considered to have a SMALL impact on regional groundwater use and does not require mitigation.

4.5.2 Groundwater-Use Conflicts (Makeup Water)

The alluvial aquifer at the site is primarily south of the Altamaha River within the facility boundary, and consists of approximately 16.7 m (55 ft) of poorly sorted sand, gravel, and clay. The alluvial aquifer contains groundwater under water table conditions. Clayey soils dominate in the upper portion of the aquifer. Recharge to the aquifer is mainly through the infiltration of local precipitation. Recharge is also provided in a limited amount by discharge from the Altamaha River during high stages and by the minor confined aquifer of the Hawthorn Formation, to which the alluvium is hydraulically connected. Groundwater typically discharges to the Altamaha River. Although no aquifer data exist for the unit, the alluvium in the region is considered to be a large potential source of water.

Based on the information provided in Section 4.1.1, the consumptive use of HNP is estimated to lower the river elevation by 0.02 m (0.08 ft) during low-flow conditions. Such a small change

would not appreciably alter the potentiometric gradient in the alluvial aquifer. Therefore, the impact to the groundwater resource from the reduced streamflow is SMALL and does not require mitigation.

4.6 Threatened or Endangered Species

Threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as shown in Table 4-9. This issue requires consultation with appropriate agencies (FWS or National Marine Fisheries Service [NMFS]) to determine if threatened or endangered species are present and whether they would be adversely affected during the license renewal term.

Table 4-9. Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term

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

Assessment of the potential occurrence of endangered or threatened species in the vicinity of HNP was initiated in December 1997 when SNC requested database information from GADNR concerning known occurrences of State- or Federal-listed species in the vicinity of HNP (GPC 1997). SNC commissioned a field survey of the HNP site and all of the transmission lines associated with HNP, as well as a freshwater mussel survey in a 19-km (12-mi) reach of the Altamaha River up and downstream of HNP (Law 1998). The draft of the terrestrial survey was completed in September 1999 (Tetra Tech, Inc. 1999). These surveys detected the presence of several Federal-listed species and a number of State-listed species of concern (Table 2-5). Most of the documented occurrences were within transmission corridors well away from the HNP site, but a few species were documented at or near the HNP site. SNC determined that its operation and maintenance procedures would remain unchanged during the license renewal term, and did not threaten the existence of the listed species at HNP or in associated transmission corridors.

SNC forwarded the results of the freshwater mussel and terrestrial surveys to FWS and GADNR in September 1999 (SNC 1999b; 1999c), along with a request for concurrence with a "no effect" determination regarding license renewal.

GADNR concurred with the SNC conclusions (GADNR 1999b), but FWS did not (FWS 1999). FWS indicated that it could not concur with a "no effect" determination, and requested

additional information about the plant operations, and how these operations may affect the shortnose sturgeon. FWS also requested that SNC further investigate the potential occurrence of the flatwoods salamander in the vicinity of HNP or associated transmission lines.

SNC representatives met with FWS during November 1999 and provided a biological information update concerning the flatwoods salamander and shortnose sturgeon in December 1999 (SNC 1999d). Based on the information provided by the applicant, FWS concurred with a no adverse affect determination regarding endangered or threatened species under the purview of FWS in January 2000 (FWS 2000).

SNC contacted NMFS during September 1999 requesting concurrence with a "no effect" determination concerning the shortnose sturgeon in the Altamaha River (SNC 1999e). NMFS determined that, based on the information provided, it was unable to concur with a "no effect" determination concerning the potential effects of license renewal on the shortnose sturgeon (NMFS 1999). SNC representatives met with NMFS and provided additional information concerning shortnose sturgeon near HNP and operational effects of HNP on the Altamaha River in October 1999 (GPC 1999c) and February 2000 (SNC 2000b). On August 31, 2000, the NRC staff submitted its biological assessment of the impact of HNP operations on shortnose sturgeon to NMFS's Southeast Regional Office, in St. Petersburg, Florida (NRC 2000), initiating an informal consultation under Section 7 of the Endangered Species Act. This consultation is continuing and will be concluded in the future.

During its preparation of the biological assessment, the staff collected and evaluated information related to the shortnose sturgeon's life cycle, range, migration patterns, and spawning. The staff also evaluated potential impacts related to (1) entrainment and impingement of shortnose sturgeon at the HNP intake structure and (2) thermal effects.

The staff found no evidence that the water-intake operations and thermal effects of the HNP license renewal will adversely impact the shortnose sturgeon. There is no evidence that HNP operations have influenced the migration of shortnose sturgeon to and from spawning grounds upstream of the plant. Monitoring of entrainment and impingement at HNP indicate that few, if any, sturgeon are impinged at the intake screens or entrained in the water pumped to the cooling towers. In its biological assessment, the staff concluded that operation of HNP may affect, but is not likely to adversely affect, the shortnose sturgeon. When NMFS provides its conclusions, any remaining issues will be resolved as operating plant issues because any impacts on the shortnose sturgeon are occurring now, as well as in the future.

In a letter dated April 25, 2001 (SNC 2001), SNC updated the biological status information it had supplied to NMFS in a letter dated February 2, 2000 (SNC 2000b). The additional information provided in the update is consistent with previous information supplied by SNC and further supports the conclusion the staff reached in its biological assessment. In its April 25,

2001, letter, SNC also offered to participate in the existing Shortnose Sturgeon Recovery Team and agreed to include a description of the shortnose sturgeon in plant training for the intake structure screen operation. SNC's participation on the recovery team will assist those who are working to promote the recovery of this species. The training will help to ensure that operators are able to recognize a shortnose sturgeon if one is ever impinged at the plant intake structure.

Based on the results of its assessment for the shortnose sturgeon and its review of freshwater mussels and terrestrial surveys, the staff concludes that the impacts of an additional 20 years of operation and maintenance of HNP and its associated transmission lines would be SMALL, and further mitigation is not warranted.

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

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

4.8 Summary of Impacts of Operations During the Renewal Term

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

Plant-specific environmental evaluations were conducted for 11 Category 2 issues applicable to HNP operation during the renewal term and for environmental justice. For all these issues, the staff concluded that the potential environmental impact of renewal term operations of HNP would be of SMALL significance in the context of the standards set forth in the GEIS and that mitigation would not be warranted.

In addition, for chronic effects from electromagnetic fields, the staff concluded that a consensus has not been reached by appropriate Federal health agencies that there are adverse effects from electromagnetic fields. The staff considers the GEIS finding of "not applicable" still appropriate, and therefore, no further evaluation of this issue is required.

4.9 References

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5.0 Environmental Impacts of Postulated Accidents

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

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

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

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

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

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

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

5.1 Postulated Plant Accidents

A Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to postulated accidents that is applicable to Edwin I. Hatch Nuclear Plant (HNP) is listed in Table 5-1. The Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2000a) that it is not aware of any new and significant information associated with the renewal of

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

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
POSTULATED ACCIDENTS	
Design-Basis Accidents (DBAs)	5.3.2; 5.5.1

the HNP operating licenses (OLs). No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS. For this issue, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, follows.

Design-Basis Accidents (DBAs). Based on information in the GEIS, the Commission found that "The NRC staff has concluded that the environmental impacts of design- basis accidents are of small significance for all plants." The staff has not identified any significant new information during its independent review of the SNC ER, the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of DBAs beyond those discussed in the GEIS.

A Category 2 issue related to postulated accidents that is applicable to HNP is listed in Table 5-2.

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

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

Severe Accidents. Based on information in the GEIS, the Commission found that "The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives."

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

5.2 Severe Accident Mitigation Alternatives

Title 10 of the Code of Federal Regulations, Part 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant design changes with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for HNP; therefore, the following sections address those alternatives.

5.2.1 Introduction

SNC submitted an assessment of SAMAs for HNP as part of the ER (SNC 2000a). This assessment was based on the *Hatch 1 Probabilistic Safety Assessment* (PSA), Revision 0 (an updated version of the Individual Plant Examination [IPE, SNC 1992]) for core damage frequency (CDF) estimation and containment performance, and a separate Level 3 model for the ER SAMA risk determination. In identifying and evaluating potential SAMAs, SNC considered the insights from the HNP IPE and Individual Plant Examination for External Events (IPEEE, SNC 1996a) as well as several recent SAMA analyses for other plants (Limerick, Watts Bar, and Comanche Peak) and other industry documentation, such as NUREG-1560 (NRC 1997a), NUREG-1462 (NRC 1994a), and the GEIS (NRC 1996; 1999), that discuss potential plant improvements. SNC identified and evaluated 114 SAMA candidates. As discussed below, this list was reduced to 42 unique SAMA candidates because the remainder were either not applicable to boiling-water reactors (BWRs), related to phenomena that are not risk-significant in BWRs, or similar to other SAMAs being considered. Other SAMAs were excluded

because they had already been implemented at HNP to address insights and recommendations from the HNP PSA and IPE. The study concluded that none of the remaining SAMAs was cost-beneficial.

Based on a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to SNC by letter dated May 30, 2000 (NRC 2000a). Major issues concerned the process used by the license renewal applicant to identify potential SAMAs, the determination and documentation of the risk profile used in the analysis process, the determination of the risk benefits, and the bases for the SAMA implementation costs. SNC submitted additional information by letters dated July 26, 2000 (SNC 2000b), and August 31, 2000 (SNC 2000c), clarifying its approach for SAMA identification, risk quantification and documentation, and SAMA implementation and benefit quantification. This response addressed the staff's concerns and reaffirmed that none of the remaining SAMAs would be cost-beneficial.

An assessment of SAMAs for HNP is presented below.

5.2.2 Estimate of Risk for HNP

SNC's estimates of offsite risk at HNP are summarized in Section 5.2.2.1. The summary is followed by a review of SNC's risk estimates in Section 5.2.2.2.

5.2.2.1 SNC's Risk Estimates

The SAMA analysis is based on two distinct analyses: (1) the HNP PSA, Revision 0 (an update of the HNP Probabilistic Risk Assessment (PRA)/IPE model), and (2) a Level 3 analysis developed specifically for the ER SAMA analyses. The HNP PSA is a conversion of the IPE from the "large event tree, small fault tree" approach to the "linked fault tree" approach. The new model incorporated new information on equipment performance, plant configuration changes, and refinements in PRA modeling techniques. It contains a Level 1 analysis to determine the CDF and a Level 2 analysis to determine containment performance during severe accidents. The Level 1 analysis includes only internal events. Although SNC did not include the results of the IPEEE, it did review the IPEEE as part of Phase I of its SAMA evaluation. The total CDF for internal events is 1.6E-5 per reactor year (ry) and the Large Early Release Frequency (LERF) is 2.7E-6/ry. The breakdown of CDF is provided in Table 5-3. As shown in this table, the current analyses show that Loss of Feedwater events are a dominant contributor to CDF, followed by Loss of Station Battery A and Loss of Offsite Power.

Table 5-3. HNP Core Damage Frequency Profile

Accident Category	PSA % Total CDF
Loss of Offsite Power	16.7
Loss of 600V AC Bus C	8.4
Loss of Feedwater	20.2
Loss of Station Battery A	18.0
Main Steam Isolation Valve Closure	7.3
Anticipated Transient Without Scram (ATWS)	4.3

The Level 3 analysis uses the MELCOR Accident Consequence Code System 2 (MACCS2) code, Version 1.12, to determine the offsite risk impacts on the surrounding environment and public. Inputs for the Level 3 analysis include the HNP core radionuclide inventory, the Level 2 release fractions, site meteorological data, projected population distribution for the year 2030, emergency response evacuation modeling, and economic data.

SNC estimates the dose to the population within 80 km (50 mi) of the HNP site from internal initiators to be 3.5 person-rem per year. Table 5-4 shows the distribution of containment performance contributions to the population dose. The current submittal indicates that early containment failure releases dominate. The early release category includes Sequence 2, a station blackout event; Sequence 4, a loss of containment heat removal/drywell failure event; and Sequence 11, an ATWS with drywell failure event. As noted by SNC, risk is dominated by Sequence 2 because it is estimated to result in a higher dose (1.9 person-rem) and because it has a relatively high estimate for its probability of occurrence (1.79×10^{-6}/yr).

Table 5-4. Containment Failure Profile

Contributor	Submittal % Contribution to Population Dose
Bypass	5.4
Early	91.2
Late	3.3
Intact (venting)	<0.1

5.2.2.2 Review of SNC's Risk Estimates

SNC's estimate of offsite risk at HNP is based on the HNP PSA and a separate Level 3 MACCS2 analysis. This review considered the following major elements:

- the Level 1 and 2 risk models that form the bases for the December 1992 IPE submittal (SNC 1992)
- the major modifications to the IPE model that have been incorporated in the HNP PSA
- the Level 3 analyses performed to translate fission product release frequencies from the Level 2 PRA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of SNC's risk estimates for the SAMA analysis, as summarized below.

The staff's review of the HNP IPE is described in an NRC safety evaluation dated July 18, 1995 (NRC 1995). In that review, the staff evaluated the methodology, models, data, and assumptions used to estimate the CDF and characterize containment performance and fission product releases. The staff concluded that SNC's analysis met the intent of Generic Letter 88-20 (NRC 1988); that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. Although the staff reviewed certain aspects of the IPE in more detail than others, the review primarily focused on the licensee's ability to examine HNP for severe accident vulnerabilities and not specifically on the detailed findings or quantification estimates. Overall, the staff believed that the HNP IPE was of adequate quality to be used as a tool in searching for areas with high potential for risk reduction and to assess such risk reductions, especially when the risk models are used in conjunction with insights, such as those from risk importance, sensitivity, and uncertainty analyses.

As mentioned earlier, the HNP PSA is an update and conversion of the original IPE submitted to the NRC. It was reviewed by the SNC PSA engineering staff. Because the model was developed from the original IPE, SNC determined that all reviews from the original IPE were still applicable.

A comparison of risk profiles between the original IPE (which was reviewed by the NRC staff) and the current version indicated several changes. First, the overall CDF has decreased. As discussed below, this result is due to several factors. In addition, the dominance of certain events (e.g., Loss of Feedwater, Loss of Station Battery, etc.) has increased, while the importance of other events (e.g., Loss of Offsite Power) has decreased. Nevertheless, the results confirm that the overall risk for the plant is low.

One major group of changes in the model from the IPE to the PSA is the addition of more details to the support system models, especially the electrical systems. However, perhaps the greater impact on the results is due to the conversion of the risk model from the large event tree method to the linked fault tree method. The original IPE fault trees were quantified using very small truncation values to capture as much of the failure probabilities as possible in the event tree split fractions. The event trees were then quantified at much higher truncation values to speed up the quantification process. In the PSA, a single truncation value was used throughout the quantification process. The differences in the quantification methods largely account for the differences in the estimates for the overall CDF and LERF.

The revised CDF estimated for HNP is still comparable to values estimated for other BWR/3 and BWR/4 model plants. Figure 11.2 of NUREG-1560 (NRC 1997a) shows that the total CDFs for these plants range from 9E-8/ry to 8E-5/ry, with an average value of 2E-5/ry.

SNC submitted an IPEEE by letter dated January 26, 1996 (SNC 1996a), in response to Supplement 4 of Generic Letter 88-20. SNC did not identify fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, high winds, floods, transportation and nearby facility accidents, and other external hazards. In a letter dated October 23, 2000, the staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20 (NRC 2000b). SNC chose not to include the results of its analysis in the estimate of CDF. In its response to an RAI on how plant-specific external event insights were considered, SNC stated that, based on its review of the HNP IPEEE and NUREG-1560 (NRC 1997a) during Phase I of the SAMA evaluation, it identified three SAMAs associated with external events. Two had already been implemented at HNP and one did not pass the initial screening criteria. The largest CDF contributor examined in the IPEEE was internal fires, which contributed 7.5 E-06/ry for HNP Unit 1 and 5.4 E-06/ry for HNP Unit 2. A staff review of the risk-dominant fire zones revealed that the CDF from a fire in a single zone was typically an order of magnitude less than the CDF calculated for internal events. Therefore, there is reasonable assurance that the risk associated with a fire would be bounded by the CDF calculated for internal events. The staff also reviewed the Fire Submittal Screening Review of HNP (an attachment to NRC 2000b) and did not identify additional alternatives that needed to be further evaluated by the applicant. The staff finds SNC's consideration of external events for the purpose of this SAMA review acceptable.

The HNP IPE model included Level 2 components. Hence, the conversion to the linked fault tree method impacted the Level 2 results. Differences in the Level 2 results were also impacted by factors such as: (1) a power uprate, and (2) a new version of the Modular Accident Analysis Program (MAAP) code, which was used to estimate release fractions and provide containment analysis details.

The process used by SNC to extend the containment performance (Level 2) portion of the PSA to the offsite consequence (Level 3) assessment was reviewed. This included consideration of the source terms used to characterize fission product releases for each containment release mode and the major inputs and assumptions used in the offsite consequence analyses. SNC used Version 3.0B BWR, Revision 10, of the MAAP code to analyze postulated accidents and develop radiological source terms for each of the 15 bins into which the Containment Event Tree endstates had been grouped. In reviewing the submittal, the staff noticed that the predicted timing for various events, and in particular for Sequence 2, which was a dominant contributor to plant risk, differed significantly from MAAP results presented in the IPE. In response to an RAI, SNC clarified that the IPE results were based on calculations using MAAP 3.0B BWR, Revision 8.01. Differences between results for Sequence 2 in the new submittal and the IPE were attributed to changes in MAAP system models (e.g., improved modeling of the automatic depressurization system, which prolongs operation of the reactor core isolation cooling system) and to changes to the MAAP input parameter file to reflect plant modifications (e.g., the power uprate, instrument setpoint modifications, etc.). Source terms calculated for this submittal were incorporated as input to the NRC-developed MACCS2 code.

SNC's point-estimate source term for selected sequences was reviewed and found to either be in reasonable agreement with or higher than the NUREG-1150 (NRC 1990) Peach Bottom estimates for the closest corresponding release scenarios.

The MACCS2 input used site-specific meteorological data processed from measurements taken hourly in 1997. These data were collected at the site meteorological tower. Hence, the meteorological data are applicable to the site. In addition, SNC performed calculations comparing meteorological data for the years 1995 through 1997. Results indicate that 1997 data were conservative for the 3-year period from 1995 through 1997.

The population distribution used as input to the MACCS2 analyses is based on the 1990 sector population data for HNP provided in NUREG/CR-6525 (SECPOP90; NRC 1997b). Transient populations were not considered because of the rural setting of HNP and the small assumed transient population within 80 km (50 mi) of the site. The site-specific growth rates for the period between 1990 and 2000, which were obtained from census information,[a] were used to estimate a constant growth rate applicable out to 2040. Population growth within a 80-km (50-mi) radius of the site was projected by using the SECPOP90 computer program.

(a) Personal communications on April 2, 1999, between M. Sik, Georgia Governor's Office of Planning and Budget, and J. B. Hovey, Tetra Tech NUS, Inc., Aiken, South Carolina; Subject: 1980 and 1990 Census Counts and 2000 and 2010 Population Projections, 1997 Estimates.

In the original submittal, SNC only projected the population growth out to the end of 2030. At the request of the NRC, SNC projected the population growth out to the end of the license renewal period (2034 for HNP Unit 1 and 2038 for HNP Unit 2), assuming the same constant growth rate. This resulted in a greater population than that used in the SAMA analysis (4 percent higher for 2034 and 8 percent higher for 2038, relative to 2030). Correspondingly, a SAMA analysis using this larger population would result in a 4 percent greater benefit for HNP Unit 1 and an 8 percent greater benefit for HNP Unit 2. However, this would not change the conclusions of the SAMA analyses.

The staff concludes that the above methods and assumptions for the population growth estimates are reasonable and acceptable for the purposes of the SAMA evaluation.

Evacuation modeling was based on a site-specific evacuation study performed by SNC in 1996 (SNC 1996b). SNC assumed that 95 percent of the population within the evacuation zone (extending out to 16 km [10 mi] from the plant) would start moving 45 minutes after declaration of a General Emergency at a radial speed of 2.5 m/s (8.2 ft/s). SNC also assumed that 5 percent of the population would not evacuate. This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone.

In response to an RAI regarding the validity of the evacuation assumption for future years, SNC noted that risk estimates for the HNP site are relatively insensitive to evacuation assumptions because of its rural siting (the 0-16 km [0-10 mi] population is 2 percent of the 0-80 km [0-50 mi] population). Furthermore, SNC observed that conservative assumptions were selected in its evacuation calculations. For example, the assumed evacuation times corresponded to the speed of the slowest subpopulation (special needs persons under adverse conditions), which is approximately half of the evacuation speed indicated for the general population (under adverse conditions).

Evacuation notification is assumed to take place at the times specified for declaring a General Emergency. In a response to an RAI, SNC provided the times at which a General Emergency would be declared. For Level 2 Sequences 4 and 5, these times are simultaneous to the predicted time for the core to be uncovered. For Sequence 2, a General Emergency is declared as soon as the operators realize that they have a station blackout with no possibility of obtaining offsite or onsite power to restore decay-heat-removal systems. In Sequence 11, an ATWS has occurred, the main steam isolation valves have closed and the standby liquid control system has failed to inject. A General Emergency is declared based on a transient occurring with failure of a core shutdown system and containment failure likely. In Sequence 15, there are no water-injection capabilities available. Core damage and vessel failure are unavoidable. A General Emergency is declared when two of the three fission product boundaries (fuel

cladding, reactor vessel, and containment) have failed and the failure of the third boundary is likely. For these scenarios, the reported times seem reasonable. Hence, the staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Site-specific economic data requiring spatial distributions as input to MACCS2 were prepared by specifying the data for each of the 29 counties within 80 km (50 mi) of the plant. The values used in each of the 160 sectors surrounding the plant corresponded to the county that made up a majority of the land in that sector. When no single county represented a majority of the sector, conglomerate data (weighted by the fraction of each county in the sector) were developed. For the remaining economic data, generic data were provided. Agricultural production information was taken from the 1997 Agricultural Census (USDA 1998) and the Atkinson County [Georgia] Extension Service.

The staff concludes that the methodology used by SNC to estimate the CDF and offsite consequences for HNP provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDF and offsite doses reported by SNC.

5.2.3 Potential Design Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by SNC are discussed in this section.

5.2.3.1 Process for Identifying Potential Design Improvements

SNC's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- reviews of SAMA analyses submitted in support of original licensing and license renewal activities for other operating nuclear power plants and advanced light-water reactor plants
- reviews of other NRC and industry documentation discussing potential plant improvements
- review of the plant-specific insights from the HNP IPE and IPEEE.

Table 6 in Attachment F to the ER lists the 114 candidate improvements extracted from the above reviews.

SNC performed a qualitative screening of the initial list of SAMAs using the following criteria:

- The SAMA is not applicable to HNP due to design differences (not applicable to the BWR/4/Mk I design).
- The SAMA was related to the mitigation of recirculation pump seal failures or an interfacing system loss-of-coolant accident (ISLOCA). These types of events are not significant risk contributors for BWRs. (See NRC Information Notice 92-36 [NRC 1992] and its supplement [NRC 1994b] for information specifically related to ISLOCAs.)
- The SAMA has already been implemented at HNP (or the HNP design meets the intent of the SAMA).

Based on the qualitative screening, only 42 SAMAs were applicable to HNP and were considered of potential value in averting the risk of severe accidents.

5.2.3.2 Staff Evaluation

SNC's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events. The initial list of SAMAs generally addressed the accident categories that are dominant CDF contributors or issues that tend to have a large impact on a number of accident sequences at HNP. The preliminary review of SNC's SAMA identification process raised some concerns that plant-specific risk contributors were not fully considered. The staff requested additional plant-specific risk information (dominant minimal cut sets and importance measures) to determine if any significant SAMAs might have been overlooked. The SNC response to the RAI indicated that the insights from the HNP IPE, and not the newer HNP PSA, were used in the identification process. There are a few differences in the final results between the IPE and the PSA, but the list of SAMA candidates appears to address the major contributors to risk for both the IPE and the PSA. Although SNC did not take full advantage of the HNP PSA and the capabilities of the detailed model, it made a reasonable effort to search for potential SAMA candidates, using the knowledge and experience of its PRA personnel; reviewing insights from the IPE, IPEEE, and other plant-specific studies; and reviewing plant improvements in previous SAMA analyses. It should be noted that insights from the IPE have already led to the implementation of numerous potential SAMAs at HNP.

The list of 114 candidate SAMAs strongly focuses on hardware changes that tend to be expensive to implement (of the 114 SAMAs, only about 25 percent involve something other than hardware changes, and only two non-hardware SAMA candidates made it through all the screening to the final analysis). While hardware changes may often provide the greatest risk reduction, consideration should be given to other options that provide marginally smaller risk

reductions with much smaller implementation costs. This is particularly true when the maximum attainable benefit is relatively small. For example, instead of adding redundant direct current (DC) control power for the plant service water (PSW) pumps, making procedural changes to provide better manual control may gain nearly as much benefit with a significantly smaller implementation cost.

This issue was raised in an RAI. In its response, SNC cited 26 SAMA candidates as examples of where actions other than hardware changes were considered. Of these 26 SAMA candidates, only 3 were eligible for screening; 10 were already implemented at HNP, 8 were associated with recirculation pump seal failures or ISLOCAs (both considered to be too insignificant with respect to BWR risk to pursue), 2 were combined with other SAMAs (hardware changes), and 3 were determined to not be applicable to HNP. Thus, of the 42 SAMA candidates that were applicable to HNP and were of potential value in averting the risk of severe accidents, only 3 (about 7 percent) were not hardware changes.

The NRC notes that the set of SAMAs submitted is not all inclusive, because additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered. On this basis, the NRC concludes that the set of potential SAMA alternatives identified by SNC is acceptable.

5.2.4 Risk-Reduction Potential of Design Improvements

SNC evaluated the risk-reduction potential of the 42 unique SAMA candidates that were applicable to HNP by first applying a bounding technique. Each SAMA was assumed to completely eliminate all risk. If the implementation costs were greater than the maximum benefit ($500,000; see Section 5.2.6), then the SAMA was screened from further consideration. If the SAMA could not be screened based on this analysis, then a more refined look at the costs and benefits was warranted.

Using this approach, all but 16 SAMAs were eliminated because the cost was expected to exceed the maximum potential benefit. For each of the 16 remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed estimated cost. During this analysis, SNC determined that six of the SAMA candidates were adequately covered by existing plant design and procedures. In addition, the detailed estimation revealed that the cost of one of the candidates (SAMA 41) was greater than the $500,000 cost associated with the maximum potential risk benefit. SNC dropped these seven SAMA candidates from further consideration. The nine remaining SAMA candidates are listed in Table 5-5.

Table 5-5. Cost-Benefit Results for Potentially Cost-Effective SAMA Candidates

No.	SAMA	Result of Potential Enhancement	CDF Reduction (percent)	P-Rem Reduction (percent)	Total Benefits	Imple-mentation Costs	Net Benefit
9	Add redundant direct current (DC) power for plant service water (PSW) pumps C & D.	Would increase reliability of PSW by reducing frequency of loss of PSW	0.11	0.07	$500	$97,000	($96,500)
22	Provide reliable power to control building fans.	Would increase availability of control room ventilation upon a loss of power	0.0	0.0	$0	$101,000	($101,000)
25	Add a diesel building switchgear room high-temperature alarm.	Would improve diagnosis of a loss of switchgear room cooling	0.2	1.2	$2492	$100,000	($97,508)
46	Use the fire protection system as a backup source for containment spray.	Would provide redundant containment spray function without the cost of installing a new system	0.0	0.01	$0[a]	$25,000	($25,000)
60	Improve 4.16-kilovolt (kV) bus cross-tie ability.	Would improve alternating current (AC) power reliability	0.0	0.05	$61	$100,000	($99,939)
73	Use fire protection system as a backup source for diesel cooling.	Would provide a redundant and diverse source of cooling for diesel generators	0.17	1.01	$2098	$126,000	($123,902)
78	Provide DC power to the 120/240-V vital AC system from station battery instead of its own battery.	Would increase the reliability of the 120-Vac buses	0.0	0.0	$78	$106,360	($106,282)

(a) Although there would be a non-zero benefit for this SAMA, the value is so low that it is approximately zero.

Table 5-5. (contd)

No.	SAMA	Result of Potential Enhancement	CDF Reduction (percent)	P-Rem Reduction (percent)	Total Benefits	Imple-mentation Costs	Net Benefit
99	Implement internal flood prevention and mitigation enhancements.	Would reduce the consequences of internal flooding	0.03	0.0	$98	$325,000	($324,902)
105	Proceduralize intermittent operation of the high-pressure coolant injection (HPCI) system.	Would allow extended duration of HPCI availability	0.0	0.0	$0	$22,200	($22,200)

Note: All benefits and costs are on a per unit basis.

For each of these SAMAs, a risk-reduction analysis was performed. The specific impacts on the CDF and LERF models were identified, the appropriate model elements were changed to reflect the plant or procedure enhancement, and the models were requantified. Table 5-5 shows the percent reductions in the CDF and person-rem public exposure for each SAMA.

The evaluation of the SAMA risk-reduction potentials did not consider uncertainties. The HNP PSA used in the risk-reduction evaluation does not lend itself to propagating uncertainty; therefore, an uncertainty analysis was not performed. The uncertainties in the PSA, risk-reduction estimates, and costs all contribute to uncertainties in the value-impact analyses for each SAMA. Factors of 3 to 5 are common for the Level 1 PSA alone. Even larger uncertainties are common for the Level 2 and Level 3 analyses. However, the margins between the costs and the benefits for the SAMAs presented in Table 5-5 are so large that even if the risk-reduction benefits were a factor of 10 greater, all of the SAMAs would still be eliminated.

The NRC staff concludes that the risk-impact analyses performed for the final nine SAMA candidates were conducted according to accepted PRA practices and are acceptable and appropriate for the SAMA analysis.

5.2.5 Cost Impacts of Candidate Design Improvements

SNC developed a preliminary cost estimate for each of the 42 unique SAMA candidates as part of a cost-screening analysis. The screening criterion was established at a cost of $500,000 based on the analysis of the maximum potential benefit. Thus, if a SAMA cost more than $500,000, there was no potential for being cost-beneficial, even if it eliminated all risk.

The preliminary cost estimates were developed to determine which SAMA candidates would clearly cost more than $500,000 and could readily be dismissed. The cost estimates were based on the total costs associated with performing engineering, procurement, and construction. The cost history for similar modifications at the plant or at other plants was considered in developing the estimates.

Using the $500,000 screening value, 26 candidate SAMAs were eliminated. For the 16 remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed cost estimate based on the same set of cost elements considered before plus training costs. During the detailed analysis, SNC determined that six of the candidate SAMAs were adequately covered by existing plant design and procedures. SNC found that another candidate SAMA was more expensive than the $500,000 cutoff value. SNC eliminated these seven candidate SAMAs from further consideration. Table 5-5 shows the cost-benefit analysis results for the nine remaining SAMA candidates.

The cost estimates are reasonable and in most cases are probably conservative (low) in that they do not consider the cost of replacement power during extended outages to implement the modifications, and they do not include contingency costs associated with unforeseen implementation obstacles. Where applicable, costs were determined on a dual-unit basis (rather than doubling a single-unit estimate) to give a more accurate overall cost estimate.

The staff concludes that the cost estimates are sufficient and appropriate for use in the SAMA evaluations.

5.2.6 Cost-Benefit Comparison

The staff's evaluation of SNC's cost-benefit analysis is described in the following sections.

5.2.6.1 SNC Evaluation

The methodology used by SNC was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184 (NRC 1997c). The guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) - COE

where APE = present value of averted public exposure ($)
AOC = present value of averted offsite property damage costs ($)
AOE = present value of averted occupational exposure ($)
AOSC = present value of averted onsite costs ($)
COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. The same analytical approach was used by SNC for the initial screening of the SAMAs. However, for the screening process SNC calculated the maximum averted costs assuming that all severe accident costs were eliminated. SNC's derivation of each of the associated costs is summarized below.

Averted Public Exposure (APE)

SNC called this cost the Offsite Exposure Cost. Averted public exposure costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem/ry)
x monetary equivalent of unit dose ($2000 per person-rem)
x present value conversion factor (10.76, based on a 20-year period with a 7 percent discount rate)

As stated in NUREG/BR-0184 (NRC 1997c), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening (severe accident costs eliminated), SNC calculated an APE of $72,565.

Averted Offsite Property Damage Costs (AOC)

SNC called this the Offsite Economic Cost. Averted offsite property damage costs were calculated using the following formula:

AOC = Annual CDF reduction
x offsite economic costs associated with a severe accident (on a per event basis)
x present value conversion factor

For the purposes of initial screening (severe accident costs eliminated), SNC cited an annual offsite economic risk of $9262 based on the Level 3 risk analysis. This results in a discounted value of $99,659.

Averted Occupational Exposure (AOE) Costs

SNC calls this the Onsite Exposure Cost. Averted occupational exposure costs were calculated using the following formula:

AOE = Annual CDF reduction
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor

SNC derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997c). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose

(20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening (severe accident costs eliminated), SNC calculated an AOE of $6237.

Averted Onsite Costs (AOSC)

Averted onsite costs include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. SNC derived the values for AOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997c).

SNC divided this cost element into two parts, the Onsite Cleanup and Decontamination Cost (also commonly referred to as averted cleanup and decontamination costs [ACC]) and the replacement power cost (RPC).

Averted cleanup and decontamination costs are calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $1.1E+9 (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening (severe accident costs eliminated), SNC calculated an ACC of $193,973.

Long-term RPC are calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor

For the purposes of initial screening (severe accident costs eliminated), SNC calculated an RPC of $120,041. The total averted cost for the screening process is $492,476, which SNC rounded up to $500,000.

SNC Results

The cost-benefit results for the individual analysis of the final nine SAMA candidates are presented in Table 5-5. All of the SAMAs have significantly large negative net values. SNC concluded that implementation of any of these SAMAs is not justified because the costs of implementation greatly exceed the benefits. Therefore, SNC has decided not to pursue any of these SAMAs further.

5.2.6.2 Staff Evaluation

The cost-benefit analysis conducted by SNC was based primarily on the NRC's *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997c). No deviations were found. The staff concludes that the cost of implementing any of the nine SAMAs would far exceed the estimated benefit, with a margin of about a factor of 20. Use of a 3-percent discount rate in place of the 7 percent discount rate used in SNC's analysis would increase net values, but would not lead to the identification of any cost-beneficial SAMAs. Similarly, implementing any of the SAMAs in the near term instead of waiting until the start of the license renewal period (thereby extending the period in the value-impact analysis) would not increase the net benefit sufficiently to make any of the SAMA candidates cost-beneficial.

5.2.7 Conclusions

SNC compiled a list of 114 SAMA candidates using as resources SAMA analyses submitted in support of licensing activities for other nuclear power plants, NRC and industry documents discussing potential plant improvements, and the plant-specific insights from the HNP IPE and IPEEE. A qualitative screening removed those SAMA candidates that (1) did not apply to HNP due to design differences, (2) were related to the mitigation of recirculation pump seal failures or ISLOCAs (not significant risk contributors for BWRs), or (3) had already been implemented at HNP. Only 42 SAMA candidates survived this screening process.

Using the HNP PSA and a Level 3 analysis developed specifically for SAMA evaluations, a maximum obtainable benefit of about $500,000 was calculated. This value was used as a second screening that eliminated the SAMA candidates whose cost to implement would exceed the maximum obtainable benefit. This process left only 16 SAMA candidates for further analysis.

For each of these 16 SAMA candidates, a more detailed conceptual design and cost estimate were developed. In doing so, SNC determined that six SAMA candidates were adequately covered by existing plant design and procedures and that another would cost more than

$500,000 to implement. SNC eliminated these seven SAMA candidates from further consideration. The final nine SAMA candidates were processed through a detailed cost-benefit analysis as shown in Table 5-5.

The cost-benefit analyses showed that none of the final nine SAMA candidates were cost-beneficial and the negative net benefit margins were large. SNC concluded that there was no justification to implement any of the SAMA candidates and decided not to pursue any of the SAMA candidates further.

The staff reviewed the SNC analysis and concluded that the methods used and the implementation of those methods were sound. While there is at least one area of weakness in the analysis (a lack of explicit treatment of uncertainties), the conservative treatment of SAMA benefits and costs, the resulting large negative net benefits, and the inherently small baseline risks support the conclusion that the SAMA evaluations performed by SNC are reasonable and sufficient for the license renewal submittal.

Based on its review of SNC's SAMA analyses, it is the staff's conclusion that none of the candidate SAMAs are cost-beneficial. This conclusion is consistent with the low residual level of risk indicated in the HNP PSA and the fact that HNP has already implemented many plant improvements identified by the IPE and IPEEE.

5.3 References

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

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

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

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

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

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

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

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in 10 CFR Part 51, Subpart A, Appendix B, that are applicable to the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear

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

Power Reactor." The GEIS also addresses the impacts from radon-222 and technetium-99. There are no Category 2 issues for the uranium fuel cycle and solid waste management.

6.1 The Uranium Fuel Cycle

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

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

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

Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2000) that it is not aware of any new and significant information associated with the renewal of the HNP operating licenses (OLs). No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL (except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, as discussed below), and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

  The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

  > The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal is calculated to be about 14,800 person rem [148 person Sv], or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are

questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA [National Environmental Policy Act] implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no collective impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

  For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem [1 mSv] per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem [1 mSv] per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem [1 mSv] per year. The lifetime individual risk from 100 millirem [1 mSv] annual dose limit is about is about 3×10^{-3}.

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

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no collective impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Nonradiological impacts of the uranium fuel cycle. Based on information in the GEIS, the Commission found that "The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

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

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

  The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low-level waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

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

  > The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to

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

The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Onsite spent fuel. Based on information in the GEIS, the Commission found that "The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

- Nonradiological waste. Based on information in the GEIS, the Commission found that "No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

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

  The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4—Environmental

Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in §51.52.

HNP meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

6.2 References

10 CFR 51.23, "Temporary storage of spent fuel after cessation of reactor operation—generic determination of no significant environmental impact."

10 CFR 51.51(b), Table S-3, "Uranium fuel cycle environmental data."

10 CFR 51.52(c), Table S-4, "Environmental effects of transportation of fuel and waste to and from one light-water cooled nuclear power reactor."

10 CFR Part 51, Subpart A, Appendix B, "Environmental effect of renewing the operating license of a nuclear power plant."

10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

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

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

Southern Nuclear Operating Company (SNC). 2000. *Application for License Renewal for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. Appendix D, Applicant's Environmental Report–Operating License Renewal Stage, Edwin I. Hatch Nuclear Plant.*

U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS 00046-G, Vols. 1-3, Washington, D.C.

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

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

7.0 Environmental Impacts of Decommissioning

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

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

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

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

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

Category 2 issues are those that do not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required. There are no Category 2 issues related to decommissioning at Edwin I. Hatch Nuclear Plant (HNP).

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to HNP decommissioning following the renewal term are listed in Table 7-1. The Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2000) that it is not aware of any new and significant information associated with the renewal of the HNP operating licenses (OLs). No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

Table 7-1. Category 1 Issues Applicable to the Decommissioning of HNP Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
DECOMMISSIONING	
Radiation Doses	7.3.1; 7.4
Waste Management	7.3.2; 7.4
Air Quality	7.3.3; 7.4
Water Quality	7.3.4; 7.4
Ecological Resources	7.3.5; 7.4
Socioeconomic Impacts	7.3.7; 7.4

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

- Radiation doses. Based on information in the GEIS, the Commission found that "Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem [0.01 person-Sv] caused by buildup of long-lived radionuclides during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation doses associated with decommissioning following license renewal beyond those discussed in the GEIS.

- Waste management. Based on information in the GEIS, the Commission found that "Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Air quality. Based on information in the GEIS, the Commission found that "Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on air quality during decommissioning beyond those discussed in the GEIS.

- Water quality. Based on information in the GEIS, the Commission found that "The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on water quality during decommissioning beyond those discussed in the GEIS.

- Ecological resources. Based on information in the GEIS, the Commission found that "Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on ecological resources during decommissioning beyond those discussed in the GEIS.

- Socioeconomic impacts. Based on information in the GEIS, the Commission found that "Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on the socioeconomic impacts of decommissioning beyond those discussed in the GEIS.

7.1 References

10 CFR Part 51, Subpart A, Appendix B, "Environmental effect of renewing the operating license of a nuclear power plant."

Southern Nuclear Operating Company (SNC). 2000. *Application for License Renewal for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. Appendix D, Applicant's Environmental Report–Operating License Renewal Stage, Edwin I. Hatch Nuclear Plant.*

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

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

8.0 Environmental Impacts of Alternatives to License Renewal

This chapter examines the potential environmental impacts associated with denying a renewed operating license (OL) (i.e., the no-action alternative); the potential environmental impacts from electric generating sources other than renewal of the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2 OLs; the potential impacts from instituting additional conservation measures to reduce the total demand for power; and the potential impacts from power imports. The impacts are evaluated using a three-level standard of significance—SMALL, MODERATE, or LARGE—based on Council on Environmental Quality (CEQ) guidelines. These significance levels are as follows:

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

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

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

8.1 No-Action Alternative

For license renewal, the no-action alternative refers to a scenario in which the U.S. Nuclear Regulatory Commission (NRC) would not renew the HNP OLs, and the applicant would then decommission HNP when plant operations cease. Replacement of HNP electricity generation capacity would be met either by (1) demand-side management and energy conservation (perhaps supplied by an energy service company), (2) imported power, (3) some generating alternative other than HNP, or (4) some combination of these. However, due to the influence of the ongoing deregulation of the retail market, Southern Nuclear Operating Company (SNC) might not be the ultimate power supplier. SNC discussed the environmental impacts of the no-action alternative in its Environmental Report (ER; SNC 2000).

SNC will be required to comply with NRC decommissioning requirements whether or not the OLs are renewed. If the HNP OLs are renewed, decommissioning activities may be postponed for up to an additional 20 years. If the licenses are not renewed, then SNC would begin decommissioning activities when plant operations cease, beginning in 2014 and 2018 for HNP Units 1 and 2, respectively, or perhaps sooner. The impacts of decommissioning would occur concurrently with the impacts of supplying replacement power. The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 (NRC 1996;

1999)[a] and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586 (NRC 1988), describe decommissioning activities.

The environmental impacts associated with decommissioning under the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the GEIS, Chapter 7 of this supplemental environmental impact statement (SEIS), and NUREG-0586 (NRC 1988). The impacts of decommissioning after 60 years of operation generally would not be significantly different from those occurring after 40 years of operation.

- Socioeconomic: When HNP ceases operation, there will be a decrease in employment and tax revenues associated with the closure. These impacts would be concentrated in Appling and Toombs counties and to a lesser degree in Montgomery, Tattnal, and Jeff Davis counties. Most secondary employment impacts and impacts on population would be concentrated in Appling and Toombs counties, with lesser impacts in the other three counties. Table 2-7 shows the current geographic distribution of HNP employees by county.

  Table 2-15 shows the tax contribution of HNP to Appling County, where the plant is located. Most of the tax revenue losses resulting from closure of HNP would occur in Appling County. In 1998, HNP contributed about $8.5 million to Appling County, or 68 percent of all taxes collected by the county. The no-action alternative results in the loss of these taxes and payrolls 20 years earlier than if the licenses are renewed (Table 8-1).

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comment
Socioeconomic	LARGE	Decrease in employment, higher-paying jobs, and tax revenues
Historic and Archaeological Resources	SMALL to LARGE	Sale or transfer of land within plant site leads to changes in land-use pattern
Environmental Justice	MODERATE to LARGE	Loss of employment opportunities and social programs

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

HNP provided approximately 12 million megawatt hours (MWh) of electricity in 1997 to customers in Georgia via the Georgia Power Company (GPC) electric grid that serves approximately 1.7 million customers in a 148,000 km^2 (57,000 mi^2) area of the State. The 12 million MWh represents approximately 12 percent of the electricity generated in the State of Georgia in 1997 (SNC 2000). Under the no-action alternative, energy costs in the area may be higher in a regulated utility environment.

It is clear from the staff's interviews with local real estate agents and appraisers that there would be a significant adverse impact on housing values, the local economy, and employment if HNP were to close. The loss of payrolls, workers, and taxes would be substantial, and would adversely affect Appling and Toombs counties in particular. Schools in Appling County would be impacted severely because a significant percentage of the revenues collected from taxes are used to support the schools in the county. In Toombs County, a number of textile firms left the county in the 1990s, further depressing local employment opportunities for county residents. South-central Georgia, where HNP is located, is a region of the State that is economically disadvantaged when compared to other parts of Georgia, such as Atlanta or Savannah.

SNC employees at HNP currently contribute time and money toward community involvement, including schools, churches, and other civic activities. It is likely that with a reduced presence in the community following decommissioning, SNC's community involvement efforts in the bi-county region would be lessened.

The property of the HNP site totals approximately 910 ha (2240 acres) with approximately 540 ha (1340 acres) in Appling County and the remaining 360 ha (900 acres) in Toombs County. The restricted industrial area of the site, containing the reactors, containment building, switchyard, cooling area, and associated facilities, occupying approximately 120 ha (300 acres), is located in Appling County. Approximately 650 ha (1600 acres) of the site are managed for timber production and wildlife habitat. There are recreational facilities on the site available for use, with permission, by residents of Toombs and Appling counties. These facilities may be lost if the license renewal application is not approved, and the HNP units are decommissioned and the plant site is developed, sold, or used for other purposes.

- Historic and Archaeological Resources: The potential for future adverse impacts to unrecorded historic and archaeological resources at the HNP site following decommissioning will depend on the future use of the site land. Known cultural activities include the current Visitors Center and associated interpretative efforts that are funded and maintained by SNC. Eventual sale or transfer of the land within the plant site could result in adverse impacts on these resources should the land-use pattern change.

- Environmental Justice for No-Action: Current operations at HNP do not have disproportionate impacts on minority and low-income populations of the surrounding counties, and no environmental pathways have been identified that would cause disproportionate impacts. Because closure would result in a significant decrease in employment opportunities and tax revenues in Appling and Toombs counties, it is possible that the counties' ability to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for the minority or low-income populations. Negative and disproportionate impacts on minority or low-income populations from this source under the no-action alternative are possible.

8.2 Alternative Energy Sources

Nuclear power plants are commonly used for base-load generation; the GEIS indicates that coal-fired and gas-fired generation capacity are the feasible alternatives to nuclear-power generation capacity, based on current (and expected) technological and cost factors. The alternatives of coal-fired generation and gas-fired generation are presented (in Sections 8.2.1 and 8.2.2, respectively) as if such plants were constructed at the HNP site. If construction takes place on the existing HNP site, SNC expects to use the existing water-intake and discharge structures, switchyard, and transmission lines. However, construction could take place at an alternate location. Such a location could be either a current industrial site or an undisturbed, pristine site requiring a new generating building and facilities, new switchyard, and at least some new transmission lines. Construction of the coal-fired or gas-fired generation facility at a new site could impact up to approximately 450 ha (1100 acres) (SNC 2000). For purposes of this SEIS, a "greenfield" site is assumed to be an undisturbed, pristine site.

Depending on the location of an alternative site, it might also be necessary to provide a connection to the nearest gas pipeline (in the case of natural gas) or rail connection (in the case of coal). The requirement for these additional facilities likely would also increase the environmental impacts relative to those that would be experienced at the existing HNP site.

The cooling water needs of a fossil-fired plant of equal capacity to HNP would be provided by a closed-loop cooling system using the existing cooling towers at the HNP site. Water-use volume would be approximately 110,000 m^3/d (30 million gpd), which is less than the 216,000 m^3/d (57 million gpd) used by the existing HNP (SNC 2000).

The potential for using imported power is discussed in Section 8.2.3. In 1995, Georgia was a substantial net seller of electricity. During 1995, the net interstate flow of electricity was 15 million MWh, or about 15 percent of all electricity produced in Georgia (SNC 2000). During 1996, SNC facilities in Georgia (including those of subsidiaries Georgia Power and Savannah Electric) generated approximately 90 percent (90 million MWh) of the power in Georgia. HNP

generated approximately 13 million MWh during 1996 (SNC 2000). Even though Georgia is a net exporter of electricity, SNC does not discount the option of importing electric power depending on economic conditions within a deregulated market.

Several other technologies were considered, but were determined not to be reasonable replacements for a nuclear power plant. These options included wind, solar, hydropower, geothermal, wood energy, municipal solid waste, biomass-derived fuels, oil, advanced nuclear, fuel cells, delayed retirement of other generating units, and utility-sponsored conservation as discussed in Section 8.2.4. Some of the alternatives in this section are technically feasible, but could not provide enough power on their own to replace the power from HNP. The final section considers the environmental consequences of a mix of alternatives. These impacts are the same as or larger than the environmental consequences of relicensing.

8.2.1 Coal-Fired Generation

It was assumed that it would take 1800 MW(e) of coal-fired generation capacity to replace the 1690 MW(e) of HNP, Units 1 and 2. The increased size over current HNP capacity would be necessary to offset increased internal electrical usage for auxiliary pollution control, pumping water for cooling, and coal and ash handling (SNC 2000). This alternative could consist of three 600-MW(e) units, each of which would be 60 m (200 ft) tall and could be tangentially fired with dry-bottom boilers.

Construction of the coal-fired alternative would take approximately 5 years. The workforce during the construction period would average 1500, with a peak of 2000, and during operations would average 250.

The assumptions and most numerical values used in the following descriptions were provided in the SNC ER (SNC 2000). The staff reviewed this information and used it in the analysis of environmental impacts.

8.2.1.1 Closed-Cycle Cooling System

Closed-cycle cooling would be the most likely cooling system if the existing HNP site were used. The plant would use the existing HNP intake, discharge structures, and cooling towers as part of a closed-loop cooling system. This alternative would minimize environmental impacts, because minimal construction would be required to adapt the existing system to the coal-fired alternative. It is assumed that the coal-fired alternative would require a water-use volume (including cooling water, wet scrubber sulfur oxides emission controls, and boiler make-up) of approximately 110,000 m^3/d (30 million gpd), which would be less than the existing HNP withdrawal of approximately 216,000 m^3/d (57 million gpd). Based on the design and efficiency

of the existing cooling towers, discharge temperatures would be less than or equal to those currently observed. The overall impacts of this system are discussed in the following sections. The impacts are summarized in Table 8-2.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation—Closed-Cycle Cooling

	HNP Site		Alternative Greenfield Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	MODERATE	Uses approximately 360 ha (900 acres) including land for the plant, coal storage, and ash and scrubber sludge disposal	MODERATE to LARGE	610 ha (1500 acres), including transmission lines and rail line for coal delivery (assuming site is within 16 km (10 mi) of the nearest railway connection
Ecology	MODERATE to LARGE	Uses undeveloped areas in current HNP site plus other nearby land, plus rail corridor	MODERATE to LARGE	Impact will depend on ecology of site
Water Use and Quality				
- Surface Water	SMALL	Uses existing intake and discharge structures Volume 110,000 m^3/d (30 million gpd) and temperature rise less than HNP	SMALL to MODERATE	Impact will depend on volume and other characteristics of receiving water
- Groundwater	SMALL	Little groundwater is currently used at HNP. This practice likely would continue	SMALL to LARGE	Impact will depend on site characteristics and availability of groundwater
Air Quality	MODERATE	Sulfur oxides – 3300 MT/yr (3600 tons/yr) – allowances may be required Nitrogen oxides – 1550 MT/yr (1710 tons/yr) – allowances may be required Particulate – 220 MT/yr (filterable) (240 tons/yr) – 49 MT/yr (un-filterable – PM_{10}) (54 tons/yr) Carbon monoxide – 1060 MT/yr (1170 tons/yr) Trace amounts of mercury, arsenic, chromium, beryllium, selenium	MODERATE	Potentially same impacts as HNP site, although pollution control standards may vary

Table 8-2. (contd)

Impact Category	HNP Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Waste	MODERATE	Total waste volume would be estimated around 1.4 million MT/yr (1.5 million tons/yr) of ash and scrubber sludge; land devoted to waste disposal is approximately 240 ha (600 acres)	MODERATE	Same impacts as HNP site; waste disposal constraints may vary
Human Health	SMALL	Impacts considered minor	SMALL	Same impact as HNP site
Socioeconomics	MODERATE to LARGE	1200 to 2000 additional workers during peak period of the 5-year construction period, followed by reduction from current HNP workforce of 950 to 250; tax base preserved	MODERATE to LARGE	Depends on whether alternate site outside of Appling County. If outside, construction impacts would be relocated. Appling County would experience loss of tax base and employment.
	SMALL	For transportation, the impact is considered SMALL. The area is very rural; 20 train trips per week for coal and lime; 115 cars per train. Plant workforce less, so commuting impacts less than current HNP site situation	SMALL to MODERATE	For transportation, the impact is considered SMALL to MODERATE and will vary depending on plant location
Aesthetics	SMALL to MODERATE	Visual impact of power plant units and stacks that would be visible from offsite; noise impacts minimized by site location	MODERATE to LARGE	Alternate locations could reduce aesthetic impact if siting is in an industrial area; large if siting is largely in undeveloped area
Historic and Archeological Resources	SMALL	Affects previously developed parts of current HNP site; cultural resource inventory should minimize any impacts on undeveloped lands	SMALL	Alternate location would necessitate cultural resource studies
Environmental Justice	MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 700 jobs in a economically depressed county could reduce employment prospects for minority and low-income populations	SMALL to LARGE	Impacts will vary depending on population distribution and makeup

- **Land Use**

The existing facilities and infrastructure at the HNP site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, it is assumed that the alternatives would use the existing intake and discharge structures, switchyard, offices, and transmission line rights-of-way. This is done primarily to minimize the predicted environmental impacts of these alternatives during construction. Using existing intake and discharge structures could also reduce operational impacts because it is reasonable to assume that aquatic communities in the immediate vicinity of the plant have already adapted to HNP patterns of water withdrawal and thermal discharge. Construction of new intake and discharge structures at a new site would necessitate aquatic community adaptations at the new site, adding to the environmental impact of the alternatives.[(a)] By using existing structures such as these, the environmental impact of construction would be reduced.

The coal-fired generation alternative would necessitate converting roughly an additional 360 ha (900 acres) of the HNP site to industrial use (plant, coal storage, and ash and scrubber sludge disposal). Currently, most of this land is forested. These changes would noticeably alter the current HNP site land-use patterns and would have a MODERATE environmental impact. Additional land-use changes would likely occur in an undetermined coal-mining area outside of the HNP site region of influence because of the mining necessary to supply coal for the plant.

Bituminous coal is the most common coal burned in coal-fired units because of its higher heating values. Coal would have a heating value of 13,000 British thermal units (Btus) per pound, an ash content of 10 percent, and a sulfur content of 0.8 percent. A maximum of 14,100 metric tons (MT) (15,500 tons) of coal and 800 MT (880 tons) of lime/limestone per day would be delivered by railcar on the existing rail spur that serves the HNP site.

Coal for the plant would be delivered by rail trains of 115 cars each. Each open-top rail car holds about 90 MT (100 tons) of coal. An additional 65 rail cars per week would be required to deliver the lime for plant operations. In all, approximately 520 trains per year, or an average of 10 trains each week, would deliver the coal and lime for all three units. Because there is an empty train for each full train delivery, a total of 20 train trips per week are expected.

(a) Additionally, it is reasonable to assume that construction and operations at a new site would mean that intake and discharge at the HNP site would stop, necessitating adaptation of the HNP site aquatic communities to the change in their environment.

Approximately 1.4 million MT (1.5 million tons) of coal-combustion by-products per year (ash and scrubber sludge) would be disposed of onsite, requiring approximately 240 ha (600 acres) for a by-product disposal area.[a] Facilities would be constructed to control and treat leachate from coal storage areas and ash and scrubber sludge disposal areas. The existing switchyard and transmission system would be used. It is assumed that coal-fired generation structures and facilities, including coal storage and ash and scrubber sludge disposal areas, would all be located within the current HNP site boundaries.

The impact of a coal-fired generating unit on land use at the existing HNP site is best characterized as MODERATE. The impact would definitely be greater than the license renewal alternative.

Construction of the coal-fired generation alternative at a new site could impact up to 610 ha (1500 acres). In addition to the 360 ha (900 acres) needed for the plant, coal storage, and ash and scrubber sludge disposal areas, an additional 60 ha (150 acres) would be required for offices, roads, parking areas, and a switchyard. Cooling-water intake and discharge structures and mechanical or natural-draft cooling towers would have to be constructed. An additional 120 ha (300 acres) would be needed for transmission lines, assuming the plant is sited 16 km (10 mi) from the nearest substation. Approximately 70 ha (160 acres) would also be needed for a rail line for coal delivery, assuming that the alternative site location is within 16 km (10 mi) of nearest railway connection. Depending particularly on transmission line and rail line routing, this alternative would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating an alternate energy source at the existing HNP site would noticeably alter ecological resources because of the need to convert roughly 360 ha (900 acres) of established forested land to industrial use (plant, coal storage, and ash and scrubber sludge disposal). The use of an existing intake and discharge system, to which the area aquatic communities have become acclimated, would limit operational impacts. Siting at the existing HNP site would have a MODERATE to LARGE ecological impact that would be greater than license renewal.

(a) While only half of these values are directly attributable to the alternative of a 20-year HNP license renewal, the total values are pertinent as a cumulative impact over the estimated 40-year operating life of the plant.

Even at another existing power plant site, adding the HNP coal-fired generation alternative would introduce construction impacts and new incremental operational impacts. At a greenfield site (an undisturbed, pristine area), the impacts would certainly alter the ecology. Impacts would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. These ecological impacts would be MODERATE to LARGE.

- **Water Use and Quality**

Surface water. The coal-fired generation alternative is assumed to use the existing HNP intake and discharge structures as part of a closed-loop cooling system. This alternative would minimize environmental impacts because minimal construction would be required to adapt the system to the coal-fired alternative. It is assumed that the coal-fired alternative would require a water-use volume (including cooling water, wet scrubber sulfur oxides emission controls, and boiler make-up) of approximately 110,000 m^3/d (30 million gpd), which would be less than the existing HNP withdrawal of approximately 216,000 m^3/d (57 million gpd). Based on the design and efficiency of the existing cooling towers, discharge temperatures would be less than or equal to those currently observed. This in turn would comply with the existing HNP National Pollutant Discharge Elimination System (NPDES) permit. The GEIS analysis determined that surface-water quality, hydrology, and use impacts for license renewal would be SMALL. Because the coal-fired generation alternative is assumed to have the same discharge characteristics as the existing HNP, surface-water impacts are expected to remain SMALL; the impacts would be so minor that they would not noticeably alter any important attribute of the resource.

For alternative greenfield sites, the impact on the surface water would depend on the volume associated with the cooling system and characteristics of the receiving body of water. The impacts would be SMALL or MODERATE.

Groundwater. Groundwater use under the coal-fired alternative will not be significantly different than under current operations at HNP. The reduced work force size for the coal-fired alternative (from 950 down to 250) would reduce the groundwater withdrawals for potable water use. Assuming 0.13 m^3/d (35 gpd) per person, maximum groundwater usage would be approximately 33 m^3/d (8750 gpd), or approximately 93 m^3/d (24,500 gpd) less than under the license renewal option.

However, the leachate from ash and scrubber waste disposal areas and the runoff from coal storage areas would have to be controlled to avoid groundwater and surface-water contamination. For this reason, the appropriate characterization of coal-fired generation

groundwater impacts would be SMALL; the impacts would be so minor that they would not noticeably alter any important attribute of the resource.

For alternative greenfield sites, the impact on the groundwater would depend on the site characteristics, including the amount of groundwater available. The impacts would range between SMALL and LARGE.

- **Air Quality**

Currently, Appling County is in attainment with all of the Federal ambient standards for criteria pollutants (particulates, ozone, nitrogen dioxide, lead, sulfur oxides, and carbon monoxide). The air-quality impacts of coal-fired generation vary considerably from those of nuclear power due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, and mercury. Impacts for particular pollutants are described below. The impacts are based on estimates in SNC's ER (SNC 2000), which the staff reviewed.

Sulfur oxides emissions. Using current control technology for sulfur oxides emissions, the total annual stack emissions would include approximately 3300 MT (3600 tons) of SO_x, most of which would be sulfur dioxide (SO_2) (SNC 2000). Additional reductions could become necessary. The acid rain provision of the Clean Air Act (CAA, Sections 403 and 404) set a limit for the nation's SO_2 emissions from power plants. Under the CAA, affected fossil-fired steam units are allocated a number of SO_2 emission allowances. To achieve compliance, each utility must hold enough allowances to cover its SO_2 emissions annually or be subject to certain penalties. If the utility's SO_2 emissions are less than its annually allocated emission allowances, then the utility may bank the surplus allowances for use in future years. An SO_2 allowances market has been established for the buying and selling of allowances.

To build and operate a coal-fired generation alternative beginning in the year 2014 at the HNP site, GPC would have to purchase sufficient SO_2 allowances for the HNP-alternative plant or increase SO_2 removal efficiency such that purchase of SO_2 allowances is not required. Thus, a major new combustion facility would not add to net regional emissions, although it might do so locally. Regardless, SO_x emissions would be greater than the license renewal alternative.

Nitrogen oxides emissions. Using currently available control technology, the total annual NO_x emission of a new coal-fired power plant would be approximately 1550 MT (1710 tons). This level of NO_x emissions would be greater than the OL renewal alternative. Section 407 of the CAA establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A

new coal-fired power plant would be subject to the new source performance standards for such plants as set forth in 40 CFR 60.44a(d)(1).

Particulate emissions. The total estimated annual stack emissions would include 220 MT (240 tons) of filterable particulates and 49 MT (54 tons) of matter having a diameter of 10 microns or less (PM_{10}). In addition, coal-handling equipment would introduce fugitive particulate emissions. These emissions are more than the license renewal alternative.

Carbon monoxide emissions. The total carbon monoxide emissions would be approximately 1060 MT (1170 tons) per year, which is more than the license renewal alternative.

Mercury. Coal-fired boilers account for nearly one-third of mercury emissions in the United States. Technologies available to control mercury emissions have varying degrees of success. In response to growing concerns about mercury, the CAA Amendments of 1990 require EPA to identify mercury emission sources, evaluate the contributions of power plants and municipal incinerators, identify control technologies, and evaluate the toxicological effects from the consumption of mercury-contaminated fish.

On December 20, 2000, the U.S. Environmental Protection Agency (EPA) issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants, including mercury and other toxic pollutants (EPA 2000b, p. 79828). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under section 112(c) of the CAA for which emission standards for hazardous air pollutants will be issued. A new coal-fired power plant would be subject to the new regulations when they are promulgated by EPA.

The EPA studies also found that certain segments of the U.S. population (e.g., developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000b, p. 79830).

There is no subsistence eating of fish among the population of Appling and Toombs counties. Concentrations of mercury are likely to be small and with the forthcoming regulations will be controlled. Therefore, the probable effect of trace mercury emissions on human health from the coal-fired alternative would be SMALL, although larger than the license renewal alternative.

Summary. The GEIS analysis did not quantify coal-fired emissions, but implied that air impacts would be substantial and mentioned global warming and acid rain as potential impacts. Adverse human health effects from coal combustion have led to important Federal legislation in recent years, and public health risks, such as cancer and emphysema, have been associated with the products of coal combustion. Federal legislation and large-scale concerns, such as acid rain and global warming, are indications of concerns about air resources. SO_x emission allowances, NO_x emission offsets, low NO_x burners, overfire air, selective catalytic reduction, fabric filters or electrostatic precipitators, and scrubbers may be required as mitigation measures. As such, the appropriate characterization of coal-fired generation air impacts at the HNP site would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Siting the coal-fired generation elsewhere would not significantly change air quality impacts, although it could result in installing more or less stringent pollution control equipment to meet applicable standards. Therefore, the impacts would be MODERATE.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. Three 600-MW(e) coal-fired plants at the HNP site would generate approximately 1.4 million MT (1.5 million tons) of this waste annually for 40 years. The waste would be disposed of onsite, accounting for 240 ha (600 acres) of land area. While only half of these values are directly attributable to the alternative to a 20-year HNP license renewal, the total values are pertinent as a cumulative impact. This impact could extend well after the 40-year operation life because revegetation management and groundwater monitoring for leachate contaminant impacts could be a permanent requirement.

The GEIS analysis concluded that large amounts of fly ash and scrubber sludge would be produced and would require constant management. Disposal of this waste could noticeably affect land-use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land would be available for other uses, and regulatory requirements would ensure groundwater protection. For these reasons, the appropriate characterization of impacts from waste generated from burning coal would be MODERATE; the impacts would be clearly noticeable, but would not destabilize any important resource.

Siting the facility on an alternate greenfield site would not alter waste generation, although other sites might have more constraints on disposal locations. Therefore, the impacts would be MODERATE.

- **Human Health**

Coal-fired power generation introduces worker risks from fuel and lime/limestone mining, and worker and public risks from fuel and lime/limestone transportation and stack-emissions inhalation. Stack impacts can be very widespread and health risks difficult to quantify. This alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

The GEIS analysis noted that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but did not identify the significance of these impacts. Regulatory agencies, such as the EPA, focus on air emissions and have revised regulatory requirements or proposed statutory changes, based on human health impacts. Such agencies also impose site-specific emission permit limits as needed to protect human health. Thus, human health impacts from inhaling toxins and particulates generated by burning coal would be SMALL.

Using the same logic, siting the facility at an alternate greenfield site would not alter the expected human health effects. Therefore, the impacts would be SMALL.

- **Socioeconomics**

Construction of the coal-fired alternative would take approximately 5 years. It is assumed that construction would take place concurrently while the existing nuclear units continue operation and would be completed at the time HNP would cease operations. Thus, the workforce would be expected to average 1500 with a peak of 2000 additional workers during the 5-year construction period. The surrounding communities would experience demands on housing and public services that could have LARGE impacts. After construction, the communities would be impacted by the loss of jobs; construction workers would leave, the nuclear plant workforce (950) would decline through a decommissioning period to a minimal maintenance size, and the coal-fired plant would introduce only 250 new jobs.

The GEIS analysis of socioeconomic impacts at a rural site such as HNP would be larger than at an urban site because more of the 1500-to-2000 peak construction workforce would need to move to the area to work. Operational impacts could result in moderate socioeconomic benefits in the form of several hundred jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits would be less than those achieved through HNP license renewal.

The size of the construction workforce for a coal-fired plant and plant-related spending during construction would be very noticeable. Operational impacts, once the coal-fired replacement plants are constructed and the nuclear plants decommissioned, would result in

an eventual loss of approximately 700 high-paying jobs (950 for two nuclear units down to 250 for the coal-fired plant), with a commensurate reduction in demand on socioeconomic resources and contribution to the regional economy. The partial replacement of industrial tax base with that from the coal-fired power plant would help stabilize some of the loss of tax base associated with the nuclear units. For these reasons, the appropriate characterization of socioeconomic impacts for a coal-fired plant would be MODERATE to LARGE; the impacts would be clearly noticeable, but would not destabilize any important resource.

Construction at another site would relocate some socioeconomic impacts, but would not eliminate them. The community around HNP would still experience the impact of HNP's operational job loss, and the communities around the new site would have to absorb the impacts of a large, temporary workforce and a moderate, permanent workforce. Therefore, the impacts are MODERATE to LARGE, based on the adverse effects on the employment and the tax base in Appling and Toombs counties.

For transportation related to coal and lime delivery, the impacts are considered SMALL. Approximately 520 trains per year, or an average of 10 trains each week, would deliver the coal and lime for all three units. Because there is an empty train for each full train delivery, a total of 20 train trips is expected per week, or at least 2.6 trips per day. On several days per week, there could be three trains per day using the rail spur to the HNP site. Coal and lime delivery would occur during daylight hours.

The industrial spur rail line serving the HNP site is currently not in use, and the Norfolk Southern rail line is used four times per day. Therefore, the use of rail for coal/lime delivery would not affect other rail use in the vicinity of the site. The rail line spur from the main railroad to HNP crosses U.S. Highway 341 and U.S. Highway 1, in addition to several county roads. Based on the use of a 115-car coal train with three locomotives, and assuming a speed of 32 km/hr (20 mph) through the town of Baxley and approaching the site, the affected at-grade crossing intersections are estimated to be blocked for about 5 minutes per train trip. For two train trips per day, this equates to two separate 5-minute periods for each highway, separated by the time (4.5 hours) necessary to unload the rail cars. HNP is located in a mostly rural area and the roads are lightly traveled. Therefore, two separate 5-minute periods each day are expected to have a SMALL effect on vehicular traffic in the area.

Impacts from relocating the plant to a greenfield site would depend on where the new site is located. If the greenfield site were located in a rural setting, such as the current HNP site, then the impacts would be considered SMALL. If it were located in a more crowded suburban area, they could be considered MODERATE.

For transportation related to commuting by plant operating personnel, the impacts are also considered SMALL. HNP is operated on a continuous basis (i.e., 24 hours per day, every day, except when downtime for maintenance, inspection, etc., is required). The maximum number of plant operating personnel would be approximately 250 (SNC 2000). The current HNP workforce is approximately 950. Therefore, traffic impacts associated with commuting plant personnel would be expected to be SMALL compared to the current impacts from HNP operations. Impacts from relocation at a greenfield site could be SMALL to MODERATE depending on the site location—rural or suburban—and the existing transportation infrastructure at the new location.

- **Aesthetics**

The three power plant units, which could be as much as 60 m (200 ft) tall, would be visible over intervening trees for miles around. The three 180-m (600-ft) stacks could be visible at a distance of approximately 6.5 km (4 mi) during the summer and approximately 16 km (10 mi) in the winter. In contrast, the existing HNP reactor buildings and single main exhaust stack are 60 m (200 ft) and 120 m (393 ft) tall, respectively (SNC 2000). The existing mechanical draft cooling towers are approximately 18 m (60 ft) tall. The addition of three 180-m (600-ft) stacks for the coal-fired alternative would contrast with what is otherwise the natural-appearing rural area, with woods and farming areas, and would be a MODERATE visual aesthetic impact compared to the existing HNP facility; noticeable but not destabilizing.

Coal-fired generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., induced-draft fans and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime delivery, and the commuting of plant employees (SNC 2000). The incremental noise impacts of a coal-fired plant compared to existing HNP operation are considered to be SMALL to MODERATE. Further, because of the location of the facility and the effects of shielding by physical barriers (e.g., coal pile, buildings, intervening trees, or other physical barriers), the impacts of noise offsite would be limited (SNC 2000).

Coal and lime delivery would be expected to result in some noise impacts on residents living in the vicinity of the facility and along the rail route. Normally coal is delivered and unloaded during daylight hours. The existing rail spur has historically had infrequent use, with smaller unit trains being the predominant type of rail use. Delivery of coal and lime would add a new noise source for receptors along the rail corridor. Although noise from passing trains

significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. Therefore, the impacts of noise on residents in the vicinity of the facility and the rail line would be considered SMALL.

Alternative site locations could reduce the aesthetic impact of coal-fired generation if siting were in an area that was already industrialized. In such a case, however, the introduction of such tall stacks and cooling towers would probably still have a MODERATE incremental impact. Locating at other, largely undeveloped sites could show a LARGE impact.

- **Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively SMALL unless important site-specific resources were affected. Under this alternative, cultural resource inventories would be required for any lands that have not been previously disturbed. Other lands that are purchased to support the facility would also require an inventory of field cultural resources, identification and recording of extant historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site. I

Coal-fired generation at HNP would not directly affect cultural resources. Therefore, the impacts would be SMALL.

Construction at another site would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. This would be required for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, or other rights-of-way). These impacts can generally be managed and maintained and as such are considered SMALL.

- **Environmental Justice**

No environmental pathways have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the HNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority and low-income populations. Closure of the HNP units would result in a decrease in employment of 700 employees in Appling and Toombs counties. It is possible that the counties' ability to maintain social services could be reduced at the same time as diminished

economic conditions reduce employment prospects for the minority or low-income populations. Impacts at other sites would depend upon the site chosen. These impacts would be MODERATE.

If the replacement plant was built in Appling County, the county's tax base would be largely maintained, and some potential negative socioeconomic impacts on the minority or low-income populations would be avoided. If the plant was built elsewhere, environmental justice impacts could be SMALL to LARGE, depending on the plant location and nearby population distribution.

8.2.1.2 Once-Through Cooling System

This section discusses the environmental impacts of converting the current HNP closed-cycle cooling system to once-through cooling. Realistically this would not occur at the current HNP site due to the infrastructure currently in place for a closed-cycle system with the existing nuclear units. If SNC switched from closed-cycle to once-through cooling, such a conversion would most likely take place at a greenfield site with sufficient water resources to support the system.

Generally, the impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a coal-fired plant using the close-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling system. Table 8-3 summarizes the incremental differences.

Given that the once-through cooling system would most likely be constructed at a new greenfield site, the differences noted in Table 8-3 should be compared with the Alternative Greenfield Site column in Table 8-2.

8.2.2 Gas-Fired Generation

It was assumed that a replacement natural gas-fired plant would use combined-cycle technology. In the combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery steam generator to generate additional electricity. The size, type, and configuration of gas-fired generation units and plants currently operational in the United States vary and include simple-cycle combustion and combined-cycle units that range in size from 25 MW(e) to 600 MW(e) (EPA 1994). As with coal-fired technology, units may be configured and combined at a location to produce the desired amount of electricity, and construction can be phased to meet electrical power needs.

Section 8.2.2.1 discusses the environmental impacts of converting the current HNP site to a natural gas-fired generation facility with a closed-cycle cooling and building a similar facility on a greenfield site. (The assumptions and numerical values used in the following description were provided in the SNC ER [SNC 2000]. The staff reviewed this information and used it in the analysis of the environmental impacts.)

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation with the Alternate Cooling System—Once-Through Cooling

Impact Category	Change in Impacts from HNP Closed-Cycle Cooling System
Land Use	Reservoir or other sufficient cooling resource required
Ecology	Impact would depend on ecology at the site
Water Use and Quality	
- Surface Water	Increased water withdrawal, thermal load higher
- Groundwater	None
Air Quality	None
Waste	None
Human Health	None
Socioeconomics	None
Aesthetics	Elimination of cooling towers
Historic and Archaeological Resources	None
Environmental Justice	None

8.2.2.1 Closed-Cycle Cooling System

The primary source of information used to describe and scale for size (megawatt and land use) for the gas-fired alternative is the EPA documentation for the Tampa Electric Company Polk Power Station. The Polk facility is typical of current available gas-fired technology being constructed and operated today. In addition, information from the EPA (EPA 1993) and U.S. Department of Energy's (DOE's) Energy Information Administration (EIA) technical publications (DOE 2000) on fuel specifications and best available emission-control technology was used to specify fuel types and emission-control technology that would be used in the gas-fired alternative. In some cases, SNC used referenced data directly; in other cases, SNC appropriately scaled data to fit the size plant needed for an HNP alternative energy source.

For the purposes of this SEIS, it is assumed that it would take 1760-MW(e) of gas-fired generation to replace the existing 1690-MW(e) HNP units. The increase in generating capacity would be necessary to offset increased internal electrical usage for pollution control and pumping water for cooling, but would not be as great as for the coal-fired alternative due to reduced cooling-water flow and pollution-control needs.

The SNC gas-fired generation alternative consists of four 440-MW(e) (International Standards Organization rating) combined-cycle units each consisting of two 155-MW(e) simple-cycle combustion turbines and a 130-MW(e) heat-recovery steam generator. On an average annual basis, these units would generate up to 440 MW(e) each, providing the 1760 MW(e) needed to replace HNP-generated power.

Natural gas, typically having an average heating value of 1000 Btu/ft^3, would be the primary fuel. The gas-fired plant would burn approximately 283,000 m^3 (10 million ft^3) per hour. Low-sulfur No. 2 fuel oil would be the backup fuel. Natural gas would be delivered via an existing pipeline located approximately 7 km (4.5 mi) from the HNP site. Approximately 20 to 50 ha (55 to 121 acres) would be disturbed during pipeline construction. The existing line currently has sufficient reserve capacity to supply the needs of the gas-fired alternative (SNC 2000).

Each unit would be less than 30 m (100 ft) high and would be designed with dry, low NO_x combusters, water injection, and selective catalytic reduction, and would exhaust through a 70-m (230-ft) stack after passing through heat-recovery steam generators. The 70-m (230-ft) height is based on good engineering practice formulas using the tallest proposed onsite facility (i.e., the 28-m [92-ft] turbine building). While modeling would have to be used to justify stack height greater than 70 m (230 ft), the relatively flat terrain and low structures of the area probably mean that modeling would not support a greater stack height.

NO_x emissions from the gas-fired alternative would be 350 MT/yr (386 tons/yr). There would be no solid waste products (i.e., ash) from natural gas fuel burning.

The plant would use the existing HNP intake and discharge and the existing mechanical cooling towers. Cooling requirements would be less; average withdrawal flows would be approximately 57,000 m^3/d (15 million gpd).

Construction of the gas-fired alternative would take approximately 3 years and the workforce during the construction period would average 500, with a peak of 750. The workforce during operations would average 125.

The overall impacts of this system are discussed in the following sections. The impacts are summarized in Table 8-4.

- **Land Use**

  Gas-fired generation at the HNP site would require converting an additional 200 ha (500 acres) of the site to industrial use (SNC 2000). Currently, this land is mostly forested. An additional 20 to 50 ha (55 to 121 acres) would be disturbed during pipeline construction but, because this disturbance would be temporary and would not alter existing land-use patterns (access road right-of-way and cultivation), the land-use impacts from pipeline construction would be SMALL. These changes in aggregate would noticeably alter current HNP land-use patterns and would create MODERATE impacts; the impact would noticeably alter habitat but would not destabilize any important attribute of the resource.

  Construction of the gas-fired generation plant at a new site could impact approximately 240 ha (600 acres). In addition to the 200 ha (500 acres) needed for the power block area and pipeline construction described above, approximately 40 ha (100 acres) would be required for offices, roads, parking areas, and a switchyard. In addition, approximately 120 ha (300 acres) would be needed for transmission lines, assuming the plant is sited 16 km (10 mi) from the nearest substation (SNC 2000). Plants of this type are usually built very close to existing natural gas pipelines. Including the land required for pipeline construction, a greenfield site would require approximately 360 ha (900 acres). The greenfield site alternative could result in MODERATE land-use impacts.

  The GEIS estimated that land-use requirements for a 1000-MW gas-fired plant at a greenfield site would be SMALL (approximately 45 ha [110 acres] for the plant site), and that co-locating with a retired nuclear plant would reduce these impacts. The HNP land-use estimate exceeds the GEIS estimate, even factoring in the fact that the SNC plants are

Table 8-4. Summary of Environmental Impacts of Gas-Fired Generation—Closed-Cycle Cooling

	HNP Site		Alternative Greenfield Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	MODERATE	Additional 200 ha (500 acres) for power block, 20 to 50 ha (55 to 121 acres) disturbed for gas pipeline; land disturbed currently forested and would be in addition to land already disturbed onsite; additional land for backup oil storage tanks	MODERATE	360 ha (900 acres) for power block, offices and transmission lines; additional land for backup oil storage tanks
Ecology	MODERATE to LARGE	Constructed on cleared land adjacent to HNP site on approximately 200 ha (500 acres); habitat loss	MODERATE to LARGE	Impact depends on location and ecology of the site; potential habitat loss and fragmentation; reduced productivity and biological diversity
Water Use and Quality				
- Surface Water	SMALL	75% reduction in water flow compared to existing HNP use	SMALL to MODERATE	Impact depends on volume and characteristics of receiving body of water
- Groundwater	SMALL	Reduced groundwater withdrawals due to reduced workforce	SMALL to LARGE	Groundwater impacts would depend on use and available supply
Air Quality	MODERATE	Primarily NO_x – 350 MT/yr (386 tons/yr) with gas; 265 MT/yr (290 tons/yr) with flue gas-recirculation. – emissions less than coal-fired alternative	MODERATE	Same impacts as for HNP site
Waste	SMALL	Small amount of ash produced	SMALL	Same impacts as for HNP site
Human Health	SMALL	Impacts considered to be minor	SMALL	Same impacts as for HNP site

Table 8-4. (contd)

Impact Category	HNP Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Socioeconomics	MODERATE	500 to 750 additional workers during 3-year construction period; followed by reduction from 950 persons to 125 persons; tax base sustained with new gas-fired plant replacing HNP	MODERATE to LARGE	Construction impacts would be relocated. Appling and Toombs counties would experience workforce reduction, plus loss of tax base if plant locates outside county
	SMALL	Transportation impacts are considered SMALL because there is less commuting workforce than current HNP or coal-fired alternative	SMALL	Transportation impacts would depend on population density and transportation infrastructure, but generally would be SMALL due to workforce size (125)
Aesthetics	SMALL to MODERATE	Visual impact of stacks and equipment would be noticeable, but not as significant as coal option or existing HNP reactor building and stack	SMALL to MODERATE	Alternate locations could reduce the aesthetic impact if siting is in an industrial area
Historic and Archaeological Resources	SMALL	Plant footprint less than coal-fired alternative; site knowledge minimizes possible cultural impacts	SMALL	Alternate location would necessitate cultural resource preservation measures
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Impacts on housing are possible during construction; loss of 825 high-paying jobs might lessen employment opportunities for minority and low-income populations.	SMALL to LARGE	Impacts vary depending on population distribution and makeup; impacts to Appling County could be MODERATE to LARGE if new plant built outside of county

considerably larger. The land-use change would noticeably alter the overall site pattern for natural land use, particularly if such land is wooded and would have to be cleared prior to constructing the plant and associated facilities. The impacts are considered MODERATE, depending on the length and routing of required pipelines and transmission lines.

- **Ecology**

  Roughly 200 ha (500 acres) of established forest land would need to be converted to industrial use if the gas-fired units are sited at the existing HNP site. This is in addition to the cleared land devoted to the nuclear units even though some of the land currently devoted to the nuclear power plant operations may be used in the gas-fired generation scenario. Ecological impacts would also be minimized by using the existing cooling water intake and discharge system.

  The GEIS noted that land-dependent ecological impacts from construction would be SMALL unless site-specific factors indicate a particular sensitivity and that operational impacts would be smaller than for other fossil fuel technologies of equal capacity. The staff has identified the conversion of 200 ha (500 acres) of forested land to industrial use as one of these site-specific impacts. Thus, siting at the existing HNP site would have a MODERATE to LARGE ecological impact and would definitely be more adverse to the environment than the proposed relicensing alternative.

  At a greenfield site, the impacts would certainly alter the ecology and could impact threatened and endangered species. These ecological impacts could be MODERATE to LARGE. Impacts would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity.

- **Water Use and Quality**

  Surface water. The plant would use the existing HNP intake and discharge structures as part the cooling system; however, cooling requirements would be less (75 percent reduction over existing HNP use—approximately 57,000 m^3/d [15 million gpd] would be used for condenser cooling and to meet existing limitations on discharge temperatures [SNC 2000]). Because existing limitations on discharge temperatures would be met, water-quality impacts would continue to be SMALL.

  Water-quality impacts from sedimentation during construction was another land-related impact that the GEIS categorized as SMALL. The GEIS also noted that operational water-quality impacts would be similar to, or less than, those from other centralized generating technologies. The staff has concluded that water-quality impacts from coal-fired generation would be SMALL, and gas-fired alternative water usage would be less than that for coal-fired generation. Surface-water impacts would remain SMALL; the impacts would not be detectable or would be so minor that they would not noticeably alter any important attribute of the resource.

For alternative greenfield sites, the impact on surface water would depend on the volume and other characteristics of the receiving body of water. The impacts would be SMALL to MODERATE.

Groundwater. Groundwater use under the gas-fired alternative will not be significantly different than under current operations at HNP. The reduced workforce size (from 950 to 125) would reduce groundwater withdrawals for potable water use. The groundwater impacts would be very SMALL; i.e., the impacts would be so minor that they would not noticeably alter any important resource.

For alternative greenfield sites, the impact to the groundwater would depend on the site characteristics, including the amount of groundwater available. The impacts would range between SMALL and LARGE.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. NO_x emissions from the gas-fired alternative would be 350 MT/yr (386 tons/yr). By comparison, NO_x emissions, assuming flue gas re-circulation, would be 265 MT/yr (290 tons/yr) (SNC 2000). New CAA provisions might result in SNC having to further reduce NO_x by shutting other sources down or by modifying plants to reduce NO_x formation (e.g., installing over-fired air, low NO_x burners, flue gas re-circulation, and selective non-catalytic and catalytic reduction systems). Precise reduction requirements are speculative at this time (SNC 2000).

The GEIS noted that gas-fired air-quality impacts are less than other fossil technologies because fewer pollutants are emitted, and SO_x is not emitted at all. Emissions from the gas-fired alternative would be less than emissions from the coal-fired alternative. However, the GEIS also noted, as did SNC, that the gas-fired alternative would contribute NO_x emissions to an area that in the future may become a non-attainment area for ozone. Because NO_x contribute to ozone formation, the reduced NO_x emissions are still of future concern, and low NO_x combusters, water injection, and selective catalytic reduction could become regulatory-imposed mitigation measures.

For these reasons, the appropriate characterization of air impacts from a gas-fired plant would be MODERATE; the impacts, primarily NO_x, would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole at this time.

Siting the gas-fired plant elsewhere would not significantly change air-quality impacts because the site could also be located in a greenfield area that was not a serious non-attainment area for ozone. In addition, the location could result in installing more or less stringent pollution control equipment to meet the regulations. Therefore, the impacts would be MODERATE.

- **Waste**

There will be only small amounts of solid-waste products (i.e., ash) from burning natural gas. The GEIS concluded that waste generation from gas-fired technology would be minimal. Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation would be limited to typical office wastes. This impact would be SMALL; waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute.

Siting the facility at an alternate greenfield site would not alter the waste generation; therefore, the impacts would continue to be SMALL.

- **Human Health**

The GEIS analysis mentions potential gas-fired alternative health risks (cancer and emphysema). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. As discussed in Section 8.2.1 for the coal-fired alternative, legislative and regulatory control of the Nation's emissions and air quality are protective of human health. The impacts of the gas-fired alternative on human health would be SMALL; that is, human health effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

Siting of the facility at an alternate greenfield site would not alter the human health effects that would be expected. Therefore, the impacts would be SMALL.

- **Socioeconomics**

The GEIS concluded that socioeconomic impacts from constructing a gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts (local purchases and taxes) of any nonrenewable technology. Compared to the coal-fired alternative, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would all reduce some of the socioeconomic impacts. For these reasons, gas-fired generation

socioeconomic impacts themselves would be SMALL to MODERATE; that is, depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize any important attribute of the resource.

For HNP, it is assumed that construction of new gas-fired generating facilities would take place while HNP continues operation, with completion at the time that the nuclear units would halt operations. Therefore, for the 3-year construction period, the site would have between 500 and 750 additional workers. During this time, the surrounding communities would experience demands on housing and public services that could have large impacts. After construction, the communities would be impacted by the loss of jobs; construction workers would leave, the nuclear plant workforce (of 950 workers) would decline through a decommissioning period to a minimal maintenance size, and the gas-fired plant would introduce a replacement tax base and only 125 new jobs. Socioeconomic impacts from start of construction through nuclear plant decommissioning would be MODERATE because of the loss of jobs from HNP.

Construction at another site would relocate some socioeconomic impacts, but would not eliminate them. The community around the HNP site would still experience the impact of the loss of HNP operational jobs and the tax base. The communities around the new site would have to absorb the impacts of a moderate, temporary workforce and a small, permanent workforce. Therefore, the impacts would be MODERATE to LARGE, based on net job and tax-base losses.

With respect to transportation, the HNP workforce (of 950 workers) would decline and the gas-fired plant would introduce only 125 new jobs. Therefore, traffic impacts associated with commuting plant personnel would be expected to be less than the current impacts from HNP operations and would be SMALL. The impact of relocating the plant to a new greenfield site would also be considered SMALL because of the small workforce size associated with the gas-fired plant.

- **Aesthetics**

The combustion turbines and heat-recovery boilers would be relatively low structures, less than 30 m (100 ft) tall, and would be screened from most offsite vantage points by intervening woodlands. The steam turbine building would be taller, approximately 46 m (150 ft) in height, and, together with the exhaust stacks (70 m [230 ft] in height), would be visible offsite. The use of these facilities along with the existing mechanical-draft cooling towers and associated facilities, would have less visual impact than the existing HNP reactor building and stack, which are considerably taller (60 m [200 ft] and 120 m [393 ft] tall, respectively) (SNC 2000).

The GEIS analysis noted that land-related impacts, such as aesthetic impacts, would be small unless site-specific factors indicate a particular sensitivity. As in the case of the coal-fired alternative, aesthetic impacts from the gas-fired alternative would be noticeable. However, because the gas-fired structures are shorter than the coal-fired structures and more amenable to screening by vegetation, the staff concluded that the aesthetic resources would not be destabilized by the gas-fired alternative. For these reasons, the appropriate characterization of aesthetic impacts from a gas-fired plant would be SMALL to MODERATE; the impacts would be clearly noticeable, but would not destabilize this important resource.

Alternative locations could reduce the aesthetic impact of gas-fired generation if siting were in an area that was already industrialized. In such a case, however, the introduction of the steam generator building, stacks, and cooling-tower plumes would probably still have a SMALL to MODERATE incremental impact.

- **Historic and Archaeological**

Gas-fired generation at HNP would not directly affect cultural resources (SNC 2000). The GEIS analysis noted that cultural resource impacts associated with the gas-fired alternative would be small unless important site-specific resources were affected. Gas-fired alternative construction at the HNP site would affect a smaller area within the footprint of the coal-fired alternative. As discussed in Section 8.2.1, site knowledge minimizes the possibility of cultural resource impacts. Impacts on cultural resources would be SMALL; that is, the effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

Construction at another, alternative site could necessitate instituting cultural resource preservation measures (power block area or transmission line right-of-way), but impacts to cultural resources could generally be managed and kept SMALL. Cultural resource studies would be required for the pipeline construction and any other areas of ground disturbance associated with this alternative.

- **Environmental Justice**

No environmental pathways have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement gas-fired plant was built at the HNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority or low-income populations. The impacts would be SMALL to MODERATE. Impacts at other sites would depend upon the site chosen. If the replacement plant was built in Appling

County, the county's tax base would be largely maintained, and some potential negative socioeconomic impacts on the minority or low-income populations would be avoided. If the plant was built elsewhere, outside of Appling County, then the environmental justice impacts of losing the plant would be LARGE. The impacts to the other areas would be SMALL to LARGE, depending on the population distribution.

8.2.2.2 Once-Through Cooling System

This section discusses the environmental impacts of converting the current HNP closed-cycle cooling system to once-through cooling. Realistically, this would not occur at the current HNP site due to the infrastructure currently in place for a closed-cycle system with the existing nuclear units. If SNC switched from closed-cycle to once-through cooling, such a conversion would most likely take place at a greenfield site with sufficient water resources to support the system.

The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a gas-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences. Given that the once-through cooling system would most likely be constructed at a new greenfield site, the differences noted in Table 8-5 should be compared with the Alternative Greenfield Site column in Table 8-4.

8.2.3 Imported Electrical Power

SNC adopts by reference, as representative of the environmental impacts of the imported electrical power alternative to HNP license renewal, the GEIS discussion of environmental impacts from generic alternatives.

"Imported power" means power purchased and transmitted from electric power-generation plants that the applicant does not own and that are located elsewhere within the region, United States, or Canada. Georgia is a net exporter of electric power (SNC 2000). However, SNC cannot discard imported power as a feasible alternative to HNP license renewal. Market conditions, particularly the anticipated free market created by deregulation, could result in a company finding it advantageous to import power to replace a retired Georgia plant while exporting other power generated in the State (SNC 2000). SNC assumes that if it did import power to replace HNP-generated capacity, the power would be generated elsewhere using one or more of the technologies that NRC discusses in GEIS, Chapter 8. SNC has no basis for estimating which generation technology, or which mix of technologies, would be used other than to point to the currently available mix of technologies. Thus, importing (purchasing) additional power is a feasible alternative to SNC license renewal.

Table 8-5. Summary of Environmental Impacts of Gas-Fired Generation With the Alternate Cooling System—Once-Through Cooling

Impact Category	Change in Impacts from HNP Closed-Cycle Cooling System
Land Use	Reservoir or other sufficient cooling resource required
Ecology	Impact would depend on ecology at the site
Water Use and Quality	
- Surface Water	Increased water withdrawal, thermal load higher
- Groundwater	None
Air Quality	None
Waste	None
Human Health	None
Socioeconomics	None
Aesthetics	Elimination of cooling towers
Historic and Archaeological Resources	None
Environmental Justice	None

According to the DOE EIA's International Energy Outlook 1998 (DOE 1997),

> Hydro Quebec has targeted the U.S. market for future sales growth. Hydro Quebec currently owns Vermont Gas and has signed a deal with Enron to market electricity in the Northeast while selling Enron's gas in Quebec. In April 1997, Hydro Quebec petitioned the FERC (Federal Energy Regulatory Commission) to sell electricity in the United States. In return, it would allow U.S. competitors to wheel electricity into Quebec. In November 1997, Hydro Quebec received FERC approval to sell power in the United States at market-based rates.

Depending on transmission availability, relative power costs, whether Canadian environmental and aboriginal rights controversies over the hydroelectric James Bay Project in Northern Quebec can be solved, and whether appropriate transmission agreements and facilities could be put in place, Hydro Quebec could be a future source of imported power. However, there could be significant environmental impacts in Northern Quebec.

Regardless of the technology used to generate imported power, the generating technology would be one of those described in this SEIS and in the GEIS (probably coal, natural gas, nuclear, or Canadian hydroelectric). The description of the environmental impacts of other technologies in GEIS, Chapter 8 is representative of the imported electrical power alternative to HNP license renewal. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or Canada.

8.2.4 Other Alternatives

Other commonly known generation technologies considered by NRC are listed in the following sections. However, these sources have been eliminated as "reasonable alternatives" to the proposed action because the generation of 1690 MW(e) of electricity as a base-load supply using these technologies is not technologically feasible (NRC 1996).

8.2.4.1 Wind

Wind speeds in central and eastern Georgia (Macon and Savannah data) average 12 km/hr (7.8 mph) (SNC 2000), whereas average wind speeds of more than 21 km/hr (13 mph) are required for wind turbines to generate electricity. Regions with wind speeds of this magnitude include the Great Plains, the West, coastal areas, and parts of the Appalachians, including a small area of northeast Georgia (SNC 2000). The staff concludes that locating a wind-energy facility on or near the HNP site would not be feasible given the current state of the technology.

Based on the GEIS land-use estimate for wind power,[(a)] replacement of HNP generating capacity, even assuming ideal wind conditions, would require the dedication of almost 109,000 ha (270,000 acres) or 1090 km^2 (422 mi^2). The current HNP site is about 910 ha (2240 acres), and Appling County, in which the facility is located, is about 1330 km^2 (514 mi^2) (SNC 2000). The size of the site needed eliminates the possibility of co-locating a wind facility at the HNP site even if such technology were technological feasible. Locating the technology at an alternative greenfield site could be undertaken, but the required land-use resources would be large and potentially ecologically disruptive. Thus, based on the lack of adequate wind speeds and the amount of land that would be required for wind-powered generating facilities,

(a) GEIS Section 8.3.1 estimates 150,000 acres per 1000 MW(e) for wind power.

the staff has concluded that the wind alternative is not feasible at a greenfield site. A wind power alternative would require a large greenfield site, resulting in a LARGE environmental impact.

8.2.4.2 Solar

Solar power technologies, photovoltaic and thermal, cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity (DOE 2000). The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent. Energy storage requirements prevent the use of solar energy systems as base load.

Second, there also are substantial impacts to natural resources (wildlife habitat, land use, and aesthetic impacts) from construction of these facilities. According to the GEIS, land requirements are high—14,000 ha (35,000 acres) per 1000 MW(e) for photovoltaic and approximately 6000 ha (14,000 acres) per 1000 MW(e) for solar thermal systems. Neither type of solar electric system would fit at the HNP site, and either would have large environmental impacts at a greenfield site.

Third, in addition to the dedicated land-use requirements, the HNP site receives less than 3.9 kWh of solar radiation per square meter per day, compared to 5 to 7.2 kWh of solar radiation per square meter per day in areas of the West, such as California, which are most promising for solar technologies (GEIS, Sections 8.3.2 and 8.3.3). Because of the natural resource impacts (land and ecological), the area's low rate of solar radiation and high technology costs, the staff views the role of solar electric power in Georgia as limited to niche applications and not a feasible base-load alternative to HNP license renewal. Some solar power may substitute for electric power in roof-top and building applications. But any attempt to implement solar technology on a scale to replace the power output from HNP would result in LARGE environmental impacts.

8.2.4.3 Hydropower

Approximately 15 percent, or 3412 MW(e), of Georgia's generating capacity is hydroelectric (SNC 2000). As GEIS, Section 8.3.4 points out, hydropower's percentage of the country's generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. Based on the GEIS, land-use estimates for hydroelectric power require approximately 400,000 ha (1 million acres) per 1000 MW(e). Replacement of HNP generating capacity would require flooding more than 7300 km^2 (2800 mi^2) (SNC 2000). Due to the large land-use and related environmental and ecological resource impacts associated with siting a

hydroelectric facility large enough to replace HNP, the staff concludes that local hydropower is not a feasible alternative to HNP license renewal on its own. Any attempts to site hydroelectric facilities large enough to replace HNP would result in LARGE environmental impacts.

8.2.4.4 Geothermal

Geothermal has an average capacity factor of 90 percent and can be used for base-load power where available. However, as illustrated by GEIS, Figure 8.4, geothermal plants might be located in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. But there is no feasible location for 1690 MW(e) of geothermal capacity to serve as an alternative to HNP license renewal.

The technology is not widely used as base-load generation due to the limited geographical availability of the resource and immature status of the technology (NRC 1996). Although small-scale applications such as geothermal heat pumps may be viable, the technology is not applicable to the region when the replacement of 1690 MW(e) is needed. The staff concludes that geothermal is not a feasible alternative to HNP license renewal.

8.2.4.5 Wood Energy

A wood-burning facility can provide base-load power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (GEIS, Section 8.3.6). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered fuel cost and high construction cost per equivalent generating capacity with nuclear. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

In Georgia, the pulp, paper, and paperboard industries, which consume large quantities of electricity, are the largest consumers of wood and wood waste for energy, benefitting from the use of waste materials that could otherwise represent a disposal problem. In 1995, processing of wood products in Georgia generated 13.5 million m^3 (478 million ft^3) of wood and bark residues. Approximately 48 percent, or 6.5 million m^3 (230 million ft^3), of the residue was used as industrial fuel (SNC 2000). The 90 trillion Btu of energy estimated to be available annually from Georgia forests would only produce the amount of electricity that HNP produces in 7 hours (SNC 2000).

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has concluded that wood waste is not a feasible alternative to renewing the HNP license.

8.2.4.6 Municipal Solid Waste

The initial capital costs for municipal solid waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and handling equipment for municipal solid waste. The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining in "real" terms (DOE 2000). Therefore, municipal solid waste would not be a feasible alternative to HNP license renewal, particularly at the scale required.

8.2.4.7 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive for automotive fuel), and gasifying energy crops (including wood waste). The GEIS points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as HNP. For these reasons, such fuels do not offer a feasible alternative to HNP license renewal. In addition, these systems have LARGE impacts on land use.

8.2.4.8 Oil

Oil is not considered a stand-alone fuel because it is not cost-competitive when natural gas is available. The cost of oil-fired operation is as high as eight times as expensive as nuclear and coal-fired operation. More specifically, GPC has six oil-fired units. It has been GPC's experience that the cost of oil-fired operation is about six times that of nuclear operation and two times that of coal-fired operation (SNC 2000). Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation (DOE 1996). For these reasons, oil-fired generation is not a feasible alternative to HNP license renewal, nor is it likely to be included in a mix with other resources, except as a backup fuel.

8.2.4.9 Advanced Nuclear Power

Work on advanced reactor designs has continued and nuclear plant construction continues overseas. However, the cost of building a new nuclear plant and the political uncertainties that have historically surrounded many nuclear plant construction projects are among the factors that have led energy forecasters (such as the EIA) to predict no new domestic nuclear power plant orders for the duration of current forecasts; i.e., through the year 2020 (DOE 1996). For these reasons, the staff does not consider new nuclear plant construction as a feasible alternative to HNP license renewal.

8.2.4.10 Fuel Cells

Phosphoric acid fuel cells are the most mature fuel cell technology, but they are only in the initial stages of commercialization. Two-hundred turnkey plants have been installed in the United States, Europe, and Japan. Recent estimates suggest that a company would have to produce about 100 MW of fuel-cell stacks annually to achieve a price of $1000 to $1500/kW (DOE 1999). However, the current production capacity of all fuel-cell manufacturers only totals about 60 MW/yr. The use of fuel cells for base-load capacity requires very large energy storage devices that are not feasible for storage of sufficient electricity to meet the base-load generating requirements. This is a very expensive source of generation, which prevents it from being competitive. This technology also has a high land-use impact, which, like wind technology, results in a large impact on the natural environment. It is estimated that 14,000 ha (35,000 acres) of land would be required to generate 1000 MW(e) of electricity (NRC 1996). Therefore, the staff considers fuel cells not to be a feasible alternative to license renewal at this time.

8.2.4.11 Delayed Retirement

HNP provides approximately 12 million MWh of GPC's generating capacity and approximately 14 percent of its energy requirements (SNC 2000). As a subsidiary of SNC, GPC supplies electrical power to the SNC regional electric grid (which includes Savannah Electric, Alabama Power, Gulf Power, and Mississippi Power). SNC expects the demand on its regional grid to increase approximately two percent (700 MW/yr), including reserve capacity, through the year 2018. In its planning, SNC considered the delayed retirement of older, less-efficient base-load plants. However, the cost of refurbishing these plants to make them more efficient and meet future emission limits would exceed the cost of building new plants (SNC 2000). For

these reasons, delayed retirement of other SNC generating units would not be a feasible alternative to HNP license renewal.[a]

8.2.4.12 Utility-Sponsored Conservation

GPC has developed residential, commercial, and industrial programs to reduce both peak demands and daily energy consumption (demand-side management). GPC program components include the following:

- Peak-clipping programs – This includes energy saver switches for air conditioners, heat pumps, and water heaters and allows GPC to interrupt electrical service to reduce load during periods of peak demand. It includes dispersed generation, giving GPC dispatch control over customer backup generation resources; and curtailable service, allowing GPC to reduce customers' load during periods of peak demand.

- Load-shifting programs – These programs use time-of-use rates to encourage shifting loads from on-peak to off-peak periods. Use of computerized real-time displays allow the customer to monitor power usage and to keep power usage below peak thresholds levels while maintaining optimal product production.

- Conservation programs – These promote the use of high-efficiency heating, ventilating, and air conditioning systems; encourage the construction of energy-efficient homes and commercial buildings; improve energy efficiency in existing homes; and provide incentives for use of energy-efficient lighting, motors, and compressors.

The GPC demand-side management program currently produces an estimated annual peak demand generation reduction of about 885 MW(e). The GPC load growth projection anticipates a demand-side management savings of about 1120 MW(e) in 2016. Because these savings are part of the long-range plan for meeting projected demand, SNC does not view these savings as available "offsets" for HNP. Nor does SNC foresee the availability of another 1690 MW(e) (HNP capacity) (SNC 2000). Therefore, the conservation option is not considered a reasonable replacement for the license renewal alternative.

(a) An exception to this statement might occur if the new plants were constructed at a greenfield site. Adding the economic costs of new construction to the ecological damages that could occur with development at the virgin site, plus associated permitting costs and delays with plant and site development, the refurbishment of the existing plants might become economically attractive.

8.2.4.13 Combination of Alternatives

Even though individual alternatives to HNP might not be sufficient on their own to replace HNP due to the small size of the resource (hydro) or lack of cost-effective opportunities (e.g., for conservation), it is conceivable that a mix of alternatives might be cost-effective. For example, if some additional cost-effective conservation opportunities, combined with limited wind, small-scale solar, and geothermal, could be found and combined with a smaller imported power or natural gas-fired alternative, it might be possible to reduce some of the key environmental impacts of alternatives. However, it is unlikely that the environmental impact of all aspects of such a hypothetical mix could be reduced to SMALL (see Table 8-6). In comparison, the impacts of renewing the HNP licenses are SMALL on all dimensions.

Table 8-6 provides a summary of the environmental impacts of one assumed combination. The impacts are based on the gas-fired generation impact assumptions discussed in Section 8.2.2 of this report, adjusted for the reduced power generation—1690 MW(e) versus 1200 MW(e)—plus 500 MW(e) obtained through additional conservation measures. While conservation measures would have very little or no negative environmental effects, the gas-fired generation option would increase emissions and environmental impacts. Based on the estimated environmental impacts of the assumed combination, the staff concludes that it is unlikely that the environmental impacts of such a hypothetical mix could be reduced to SMALL.

Table 8-6. Summary of Environmental Impacts of 500-MW(e) Demand-Side Measures, Plus 1200-MW(e) Gas-Fired Generation—Closed-Cycle Cooling

Impact Category	HNP Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Land Use	MODERATE	Additional 200 ha (500 acres) for power block, 20 to 50 ha (55 to 121 acres) disturbed for gas pipeline; land disturbed currently forested and would be in addition to land already disturbed onsite; additional land for backup oil storage tanks	MODERATE	360 ha (900 acres) for power block, offices and transmission lines; additional land for backup oil storage tanks
Ecology	MODERATE to LARGE	Constructed on cleared land adjacent to HNP site; habitat loss due to pipeline construction	MODERATE to LARGE	Impact depends on location and ecology of the site
Water Use and Quality				
- Surface Water	SMALL	>75% reduction in water flow compared to existing HNP use	SMALL to MODERATE	Impact depends on volume and characteristics of receiving body of water
- Groundwater	SMALL	Reduced groundwater withdrawals due to reduced workforce	SMALL to MODERATE	Groundwater impacts would depend on uses and available supply
Air Quality	SMALL to MODERATE	Primarily NO_x for gas-fired plant	SMALL to MODERATE	Same impacts as for HNP site
Waste	SMALL	Minor waste generation with gas (oil not evaluated)	SMALL	Same impacts as for HNP site
Human Health	SMALL	Impacts considered to be minor (see discussion of gas-fired alternative)	SMALL	Same impacts as for HNP site

Table 8-6. (contd)

Impact Category	HNP Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Socioeconomics	MODERATE	500 to 750 additional workers during 3-year construction period; followed by a reduction in employment from 950 persons at HNP to 125 persons; tax base sustained with new gas-fired plant replacing HNP	MODERATE to LARGE	Construction impacts would be relocated. Appling and Toombs counties would experience workforce reduction plus loss of tax base if plant were located elsewhere. Other community gains 125 workers
	SMALL	Transportation impacts would be SMALL due to less commuting workforce than HNP or coal-fired alternatives	SMALL	Transportation impacts would most likely be SMALL; actual impacts depend on population, transportation systems
Aesthetics	SMALL to MODERATE	Visual impact of stacks would be noticeable, but not as significant as coal-fired option or existing HNP reactor building and stack	SMALL to MODERATE	Alternate locations could reduce aesthetic impact if siting is in an industrial area
Archaeological and Historic Resources	SMALL	Plant footprint less than coal-fired alternative; HNP site knowledge minimizes possible cultural resource impacts	SMALL	Alternate location would necessitate cultural resource preservation measures
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Impacts on housing are possible during construction; loss of 825 high-paying jobs might lessen employment opportunities for minority and low-income populations.	SMALL to LARGE	Impacts vary depending on population distribution and makeup; impacts to Appling County could be MODERATE to LARGE if new plant built outside county

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