Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 18

Regarding
Joseph M. Farley Nuclear Plant, Units 1 and 2

Final Report

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

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Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
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Abstract

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

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

Regarding the 69 issues for which the GEIS reached generic conclusions, neither SNC nor the staff has identified information that is both new and significant for any issue that applies to Farley Units 1 and 2. In addition, the staff determined that information provided during the scoping process and the draft SEIS comment process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the Farley OLs will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the staff's conclusion in the GEIS is that the impact is of SMALL significance[a] (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to Farley Units 1 and 2 are addressed in this SEIS. With the exception of chronic effects of electromagnetic fields (for which the magnitude of impact is “uncertain”), the staff concludes that the significance of the potential environmental impacts of renewal of the OLs for each applicable issue is SMALL. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment.

The NRC staff's recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Farley Units 1 and 2 are not so great that

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

preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on the following: (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by SNC; (3) consultation with Federal, State, Tribal, 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 September 12, 2003, the Southern Nuclear Operating Company (SNC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for the Joseph M. Farley Nuclear Plant Units 1 and 2 (Farley), for an additional 20-year period. If the OLs are renewed, State regulatory agencies and SNC will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration dates of the current OLs, which are June 25, 2017, for Unit 1, and March 31, 2021, for Unit 2.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4321) in 10 CFR Part 51. In 10 CFR 51.20(b)(2), the Commission requires preparation of an environmental impact statement (EIS) or a supplement to an EIS for renewal of a reactor OL. In addition, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[a]

Upon acceptance of the SNC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a notice of intent to prepare an EIS and conduct scoping. The staff visited the Farley site in January 2004 and held public scoping meetings on January 8, 2004, in Dothan, Alabama. In the preparation of this supplemental environmental impact statement (SEIS) for Farley Units 1 and 2, the staff reviewed the SNC Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part I, of this SEIS.

The draft SEIS was published in August 2004. In September 2004, the staff held two public meetings in Dothan, Alabama, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this SEIS. When the comment period ended, the staff considered and dispositioned all of the comments received. These comments are addressed in Appendix A, Part II, of this SEIS.

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,

(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.

and mitigation measures for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

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

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

The 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 an existing nuclear power plant continues to operate beyond the period of the current OLs.

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ("Temporary storage of spent fuel after cessation of reactor operation—generic determination of no significant environmental impact") and in accordance with § 51.23(b).

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

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

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

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

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

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

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

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

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

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

This SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for Farley Units 1 and 2) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration, gas- and coal-fired generation appear to be the most likely power generation alternatives if the power from Farley Units 1 and 2 is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Farley site or some other unspecified location.

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 information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither SNC, the scoping process, nor the staff has identified any new issue applicable to Farley Units 1 and 2 that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Farley Units 1 and 2.

SNC's license renewal application presents an analysis of the Category 2 issues plus environmental justice. The staff has reviewed the SNC analysis for each issue and has conducted an independent review of each issue. Five Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at Farley. Four Category 2 issues are not discussed in this SEIS, because they are specifically related to refurbishment. 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 as necessary to support the continued operation of Farley Units 1 and 2, for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1974 *Final Environmental Statement Related to Operation of Farley*.

Twelve Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this SEIS in relation to operation during the renewal term. For all 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 determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Farley Units 1 and 2, and the plant improvements already made, the staff concludes that three of the candidate SAMAs are potentially cost-beneficial. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they do not need to be implemented as part of license renewal pursuant to 10 CFR Part 54.

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

If the Farley operating licenses are not renewed and the units cease operation on or before the expiration of their current operating licenses, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Farley Units 1 and 2. The impacts may, in fact, be greater in some areas.

The recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Farley 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 the following: (1) the analysis and findings in the GEIS; (2) the ER submitted by SNC; (3) consultation with other Federal, State, Tribal, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

Abbreviations/Acronyms

°	degree
ACHP	Advisory Council on Historic Preservation
ac	acre(s)
ACF	Apalachicola-Chattahoochee-Flint
ADECA	Alabama Department of Economic and Community Affairs
ADEM	Alabama Department of Environmental Management
ADOT	Alabama Department of Transportation
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AFW	auxiliary feedwater
AL	Alabama
ALARA	as low as reasonably achievable
AOC	present value of averted offsite property damage costs
AOE	present value of averted occupational exposure
AOSC	present value of averted onsite costs
APC	Alabama Power Company
APE	present value of averted public exposure
AQCR	air quality control region
ASME	American Society of Mechanical Engineers
ATWS	anticipated transient without scram
BA	biological assessment
BMP	best management practices
Bq	becquerel(s)
Btu	British thermal unit(s)
Btu/ft^3	British thermal unit(s) per cubic foot
Btu/kWh	British thermal unit(s) per kilowatt-hour
C	Celsius
CAA	Clean Air Act
CCDP	conditional core damage probability
CCF	common-cause failures
CCW	component cooling water
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second

Ci	curie(s)
cm	centimeter(s)
CO_2	carbon dioxide
COE	cost of enhancement
CWA	Clean Water Act
DBA	design-basis accident
dbh	diameter at breast height
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSM	demand-side management
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency electromagnetic field
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ESA	Endangered Species Act
ESRP	Environmental Standard Review Plan, NUREG-1555, Supplement 1, Operating License Renewal
F	Fahrenheit
FAA	Federal Aviation Administration
FES	Final Environmental Statement
FL	Florida
FNAI	Florida Natural Areas Inventory
FR	Federal Register
FRAIG	Fire Risk Analysis Implementation Guide
FSAR	Final Safety Analysis Report
ft	foot/feet
ft^3	cubic foot/feet
ft^3/s	cubic foot/feet per second
ft^3/yr	cubic foot/feet per year
FWS	U.S. Fish and Wildlife Service
GA	Georgia
GADNR	Georgia Department of Natural Resources
gal	gallon
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437

GPC	Georgia Power Company
gpd	gallons per day
gpm	gallons per minute
GWPS	gaseous waste processing system
ha	hectare(s)
HEPA	high-efficiency particulate air
HLW	high-level waste
HMTA	Hazardous Materials Transportation Act
hr	hour(s)
HRA	human reliability analysis
HVAC	Heating ventilation air conditioning
Hz	Hertz
IEEE	Institute of Electrical and Electronic Engineers
in.	inch(es)
ILRT	integrated leak rate test
IPA	integrated plant assessment
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISLOCA	interfacing systems loss-of-coolant accident
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kV/m	kilovolt per meter
kWh	kilowatt hour(s)
kWh(e)	kilowatt hour(s) electric
L	liter(s)
L/day	liter(s) per day
L/min	liter(s) per minute
lb	pound
LLW	low-level waste
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LRT	leak rate test
LWPS	liquid waste processing system
M	million
m	meter(s)
m/s	meter(s) per second

m^3	cubic meters
m^3/d	cubic meters per day
m^3/s	cubic meter(s) per second
m^3/yr	cubic meter(s) per year
mA	milliampere(s)
MAB	maximum attainable benefit
MACCS2	MELCOR Accident Consequence Code System 2
mi	mile(s)
mg/L	milligram(s) per liter
mGy	milligray(s)
mL	milliliter(s)
MOA	Memorandum of Agreement
mph	miles per hour
mrad	millirad(s)
mrem	millirem(s)
mrem/yr	millirem(s) per year
mSv	millisievert(s)
mSv	millisievert(s) per year
MT	metric ton(s) (or tonne[s])
MTHM	metric tons of heavy metal (a conventional unit for high-level nuclear waste)
MTU	metric ton(s) uranium
MT/yr	metric tons of heavy metal per year
MW	megawatt(s)
MWd/MTU	megawatt-day(s) per metric ton uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
N/A	not applicable
NAS	National Academy of Sciences
NAWQA	national water quality assessment
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
ng/J	nanogram per joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NMP	Navigation Maintenance Plan
NOAA	U.S. National Atmospheric and Oceanic Administration
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission

NRHP	National Register of Historic Places
NSSS	nuclear steam supply system
NWPPC	Northwest Power Planning Council
ODCM	Offsite Dose Calculation Manual
OL	operating license
PM_{10}	particulate matter, 10 microns or less in diameter
ppt	parts per thousand
PRA	probabilistic risk assessment
PSD	prevention of significant deterioration
PWR	pressurized water reactor
RAI	request for additional information
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act
rem	special unit of dose equivalent, equal to 0.01 sievert
REMP	radiological environmental monitoring program
ROW	right(s)-of-way
RPC	replacement power costs
RRW	risk reduction worth
s	second(s)
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SBO	station blackout
SCE & G	South Carolina Electric and Gas Company
SEARP & DC	Southeast Alabama Regional Planning and Development Commission
SEIS	supplemental environmental impact statement
SER	Safety Evaluation Report
SERI	System Energy Resources, Inc.
SGTR	steam generator tube rupture
SHPO	State Historic Preservation Officer
SMA	seismic margins assessment
SMITTR	surveillance, monitoring, inspections, testing, trending, and record keeping
SNC	Southern Nuclear Operating Company
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SSD	safe shutdown
Sv	Seivert(s) (special unit of dose equivalent)
TBq	terabecquerel(s)

TN	Tennessee
TRO	total residual oxidant
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Service
VOC	volatile organic compound
WINGS	Wildlife Incentives for Non-Game and Game Species
WOG	Westinghouse owners group
yr	year

1.0 Introduction

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

The Southern Nuclear Operating Company (SNC) operates Joseph M. Farley Nuclear Plant (Farley) Units 1 and 2 in southeastern Alabama under OLs NPF-2 and NPF-8, which were issued by the NRC. These OLs will expire in June 2017 for Unit 1 and March 2021 for Unit 2. By letter dated September 12, 2003, SNC submitted an application to the NRC to renew the Farley Units 1 and 2 OLs for an additional 20 years under 10 CFR Part 54. SNC is a licensee for the purpose of its current OLs and an applicant for the renewal of the OLs. Farley is owned by Alabama Power Company (APC) and operated by SNC. APC and SNC are the facility's licensees. SNC has exclusive responsibility for and control over the physical construction, operations, and maintenance of the facility. Pursuant to 10 CFR 54.23 and 51.53(c), SNC submitted an Environmental Report (ER; SNC 2003) in which SNC analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

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

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

1.1 Report Contents

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

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

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

- The preparers of the supplement
- The chronology of NRC staff's environmental review correspondence related to this SEIS
- The organizations contacted during the development of this SEIS
- SNC's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process)
- GEIS environmental issues that are not applicable to Farley Units 1 and 2
- Severe accident mitigation alternatives (SAMAs).

1.2 Background

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

1.2.1 Generic Environmental Impact Statement

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

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

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

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

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

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

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

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

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

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

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

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues (environmental justice and chronic effects of electromagnetic fields) were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation 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 in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

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

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

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

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

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

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

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

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

- Contain an analysis of any Category 1 issue unless there is significant new information on a specific issue—this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

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

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

The NRC staff also has a process for identifying new and significant information. That process is described in detail in NUREG-1555, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (ESRP), (NRC 2000). The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues 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.

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

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the SNC license renewal application began with publication of a notice of acceptance for docketing in the *Federal Register* (FR); 68 FR 61835 [NRC 2003a]) on October 30, 2003, and a notice of an opportunity for a hearing was published in the *Federal Register* (68 FR 62640 [NRC 2003b]) on November 5, 2003. The staff published a notice of intent to prepare an EIS and conduct scoping (68 FR 68125 [NRC 2003c]) on December 5, 2003. Two public scoping meetings were held on January 8, 2004, in Dothan, Alabama. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report—Joseph M. Farley Nuclear Plant Units 1 and 2, Alabama* (NRC 2004a) dated March 30, 2004. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in the ESRP (NRC 2000). The staff and contractors retained to assist the staff visited the Farley site on January 7, 2004, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to Farley Units 1 and 2 were reviewed and are referenced in this report.

On August 12, 2004, the NRC published a Notice of Availability of the draft SEIS in 69 FR 49916 (NRC 2004b). A 75-day comment period began on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the results of the NRC staff's review. During this comment period, two public meetings were held in Dothan, Alabama, in September 2004. During these meetings, the staff described the preliminary results of the NRC's environmental review and answered questions to provide members of the public with information to assist them in formulating their comments. The comment period for the Farley draft SEIS ended on November 5, 2004. Comments made during the 75-day comment period, including those made at the two public meetings, are presented in Part II of Appendix A of this SEIS. The NRC responses to those comments are also provided.

This SEIS presents the staff's analysis that considers and weighs the environmental effects of the proposed renewal of the OLs for Farley Units 1 and 2, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental effects. Chapter 9 provides the NRC staff's recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for Farley Units 1 and 2. The Farley Nuclear Plant is located in Houston County in southeastern Alabama on the west bank of the Chattahoochee River approximately 8 km (5 mi) north of Gordon, Alabama, 27 km (17 mi) east of Dothan, Alabama, 161 km (100 mi) southeast of Montgomery, Alabama, and 290 km (180 mi) south-southwest of Atlanta, Georgia. The plant has two Westinghouse-designed pressurized water reactors, each originally with a design power level of 2660 megawatts thermal (MW[t]) and a gross electrical output of 861 megawatts electric (MW[e]). In 1997, an uprate license amendment was submitted, and subsequently approved by NRC on April 29, 1998 (SNC 2003). The current rated thermal power level for each unit is 2775 MW(t). The uprated gross electrical output for each unit is approximately 910 MW(e). Unit 1 has a net electrical output of 847 MW(e), and Unit 2 has a net electrical output of 852 MW(e). Plant cooling is provided by a closed-cycle system utilizing six 14-cell mechanical draft cooling towers that dissipate heat primarily to the air. As part of the plant's normal operating and maintenance activities, Farley is constructing new mechanical draft cooling towers to replace the current towers for both units. Construction commenced in January 2003 and is to be completed by May 2005, resulting in the six towers being replaced by four 18-cell and two 16-cell towers. The current OL for Unit 1 expires on June 25, 2017, and for Unit 2 on March 31, 2021. By letter dated September 12, 2003, SNC submitted an application to NRC (SNC 2003) to renew these OLs for an additional 20 years of operation (until June 25, 2037, for Unit 1 and March 31, 2041, for Unit 2).

1.4 The Purpose and Need for the Proposed Action

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

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

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

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

1.5 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. In its ER, SNC provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with Farley Units 1 and 2 license renewal. Authorizations and consultations relevant to the proposed renewal action are included in Appendix E.

The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that SNC is in compliance with applicable environmental standards and requirements for Farley Units 1 and 2. The staff has not identified any environmental issues that are both new and significant.

1.6 References

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

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

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

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

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

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

U.S. Atomic Energy Commission (AEC). 1974. *Final Environmental Statement Related to Operation of Joseph M. Farley Nuclear Plant Units 1 and 2*, Alabama Power Company. Dockets No. 50-348 and 50-364. December 1974.

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

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

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

U.S. Nuclear Regulatory Commission (NRC). 2003a. "Notice of Acceptance for Docketing of the Application Regarding Renewal of License Nos. NPF-2 and NPF-8 for an Additional Twenty-Year Period." *Federal Register*, Vol. 68, No. 210, pp. 61835-61836. Washington, D.C. October 30, 2003.

U.S. Nuclear Regulatory Commission (NRC). 2003b. "Notice of Opportunity for a Hearing Regarding Renewal of License Nos. NPF-2 and NPF-8 for an Additional Twenty-Year Period." *Federal Register*, Vol. 68, No. 214, pp. 62640-62641. Washington, D.C. November 5, 2003.

U.S. Nuclear Regulatory Commission (NRC). 2003c. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 68, No. 234, pp. 68125-68126. Washington, D.C. December 5, 2003.

U.S. Nuclear Regulatory Commission (NRC). 2004a. *Environmental Impact Statement Scoping Process: Summary Report—Farley Units 1 and 2, Dothan, Alabama*. Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004b. "Notice of Availability" *Federal Register*, Vol. 69, p. 49916. Washington, D.C. August 12, 2004.

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

The Joseph M. Farley Nuclear Plant (Farley) is located in Houston County in southeastern Alabama on the west bank of the Chattahoochee River. The plant consists of two units. Each nuclear reactor is a pressurized water reactor with steam generators producing steam that turns turbines to generate electricity. Plant cooling is provided by a closed-cycle system utilizing mechanical draft cooling towers that dissipate heat primarily to the air. As part of the plant's normal operating and maintenance activities, Farley is constructing new mechanical draft cooling towers to replace the current towers for both units. Construction commenced in January 2003 and is to be completed by May 2005, resulting in the six towers being replaced by four 18-cell and two 16-cell towers. The plant and its environs are described 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

The Farley nuclear plant is located in southeastern Alabama approximately 8 km (5 mi) north of Gordon, Alabama, 27 km (17 mi) east of Dothan, Alabama, 161 km (100 mi) southeast of Montgomery, Alabama, and 290 km (180 mi) south-southwest of Atlanta, Georgia. The region surrounding Farley is a sparsely populated, largely rural area, with forests and small farms as the dominant land use. The Farley site is approximately 749 ha (1850 ac) with approximately 202 ha (500 ac) used for generation and maintenance facilities, laydown areas, parking lots, and roads. A 44-ha (108-ac) pond for use as the ultimate heat sink for the safe shutdown of both units is also located on the site. The Farley site or "Owner Controlled Area" is owned by Alabama Power Company (APC) and operated by Southern Nuclear Operating Company (SNC) (SNC 2003a). Figures 2-1 and 2-2 show the site location and features within 80 km (50 mi) and 10 km (6 mi), respectively.

The region surrounding Farley was identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] as being located in a medium population area. Farley employs a workforce of about 900 permanent employees and about 375 contract and matrixed employees. SNC refuels Farley Units 1 and 2 at nominal 18-month intervals. During refueling outages, site employment increases by as many as 800 workers for temporary duty (typically, 30 to 40 days).

(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.

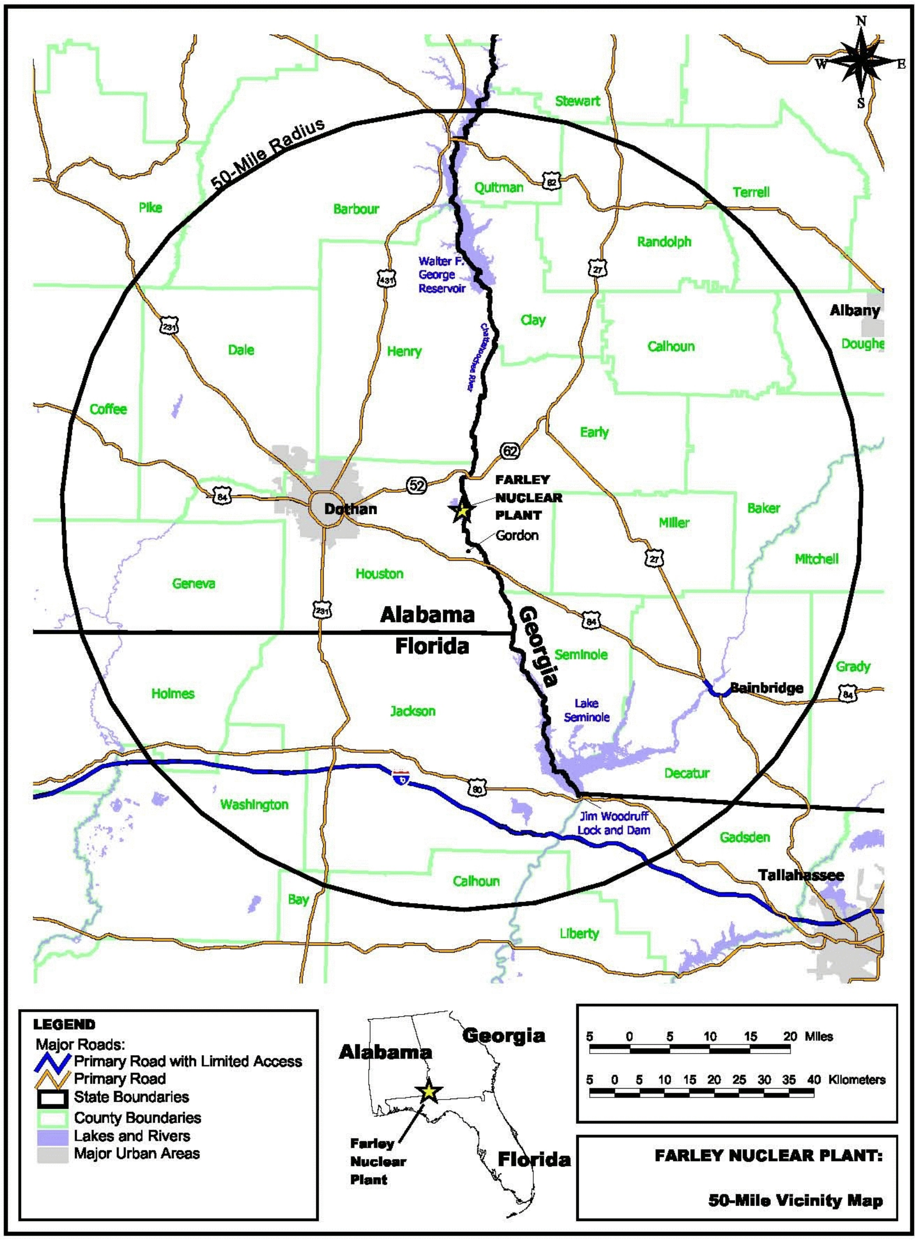

Figure 2-1. Location of Farley Units 1 and 2, 80-km (50-mi) Region

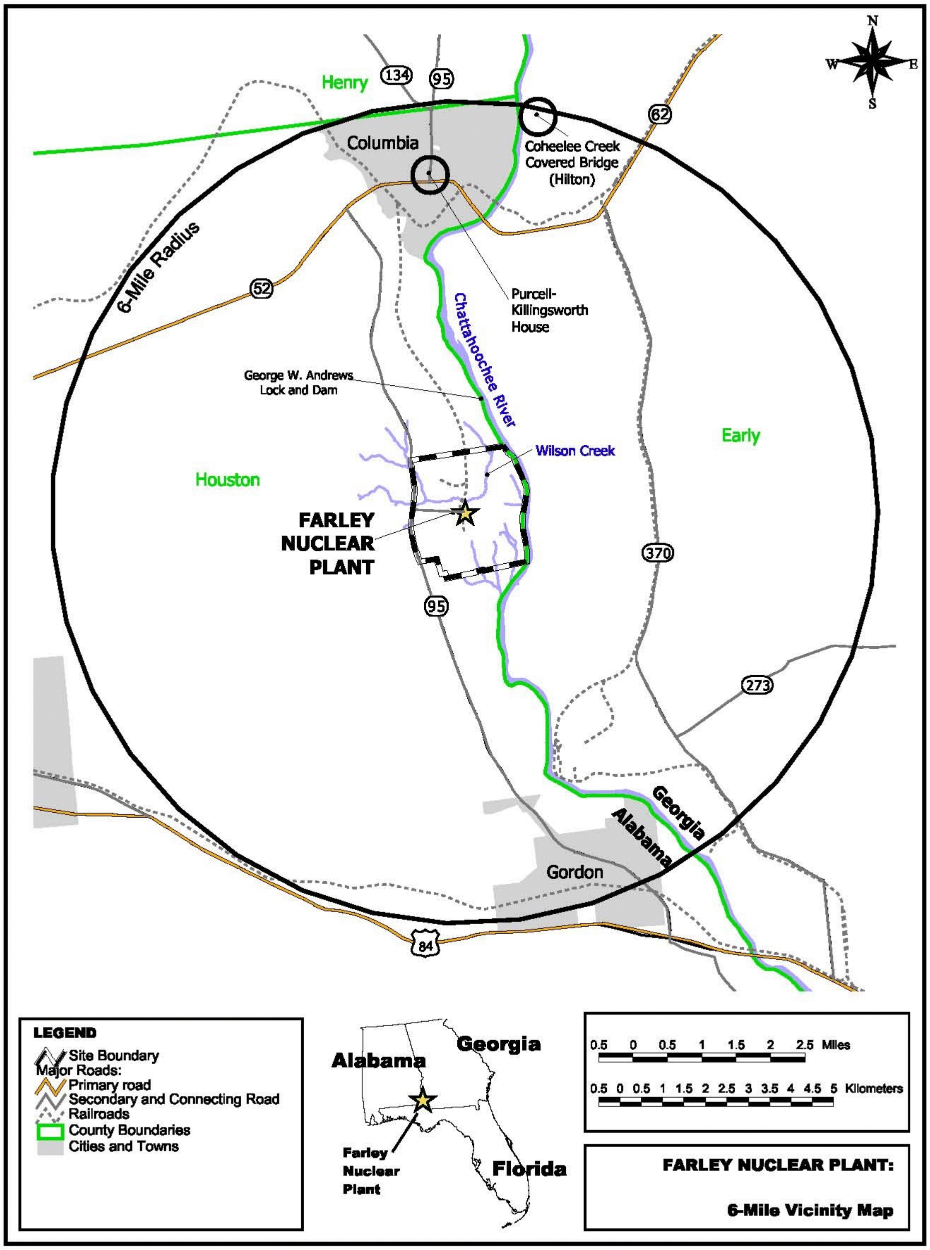

Figure 2-2. Location of Farley Units 1 and 2, 10-km (6-mi) Region

2.1.1 External Appearance and Setting

Located in Houston County, Alabama, the Farley site consists of approximately 749 ha (1850 ac) on the west bank of the Chattahoochee River. The developed areas of the plant are primarily located on a plateau approximately 1 km (0.6 mi) west of the river, with the area adjacent to the river mostly undeveloped. There are two topographical features at the site: (1) gently rolling upland west of the Chattahoochee River Valley, and (2) the river terraces and floodplain of the Chattahoochee River. The Chattahoochee River flows in a northwest-to-southeast direction, forming the eastern border for the site and serving as the boundary between Houston County, Alabama and Early County, Georgia (SNC 2003a).

2.1.2 Reactor Systems

Farley is a two-unit electric generating plant (see Figure 2-3). Each unit is equipped with a nuclear steam supply system (NSSS) that uses a pressurized water reactor. Westinghouse Electric Corporation designed and supplied the NSSS and the turbine generators. As originally designed and operated, Farley Units 1 and 2 each had core thermal ratings of 2660 megawatts thermal (MW[t]) and a gross electrical output of 861 megawatts electric (MW[e]). In 1997, an uprate license amendment was submitted, and subsequently approved by the Nuclear Regulatory Commission (NRC) on April 29, 1998 (SNC 2003a). The current rated thermal power level for each unit is 2775 MW(t). The uprated gross electrical output for each unit is approximately 910 MW(e). Unit 1 has a net electrical output of 847 MW(e), and Unit 2 has a net electrical output of 852 MW(e) (SNC 2003a).

The reactor containment structures are steel-lined, reinforced concrete cylinders with semi-hemispherical domes and flat reinforced concrete foundation mats. The containment for each unit is designed to withstand an internal pressure of 54 pounds per square inch above atmospheric pressure. With these engineered safety features, the containment structures (reactor buildings) are designed to withstand severe weather (e.g., tornadoes and hurricanes) and provide radiation protection during operations and postulated accidents. Farley uses fuel that is slightly enriched uranium dioxide, with a 5-percent enrichment limit (enriched in the isotope uranium-235). The highest enrichment to date is 4.6 percent. SNC operates the reactors below the Updated Final Safety Analysis Report-mandated burnup rate limit of 60,000 megawatt-days per metric ton uranium (SNC 2003a).

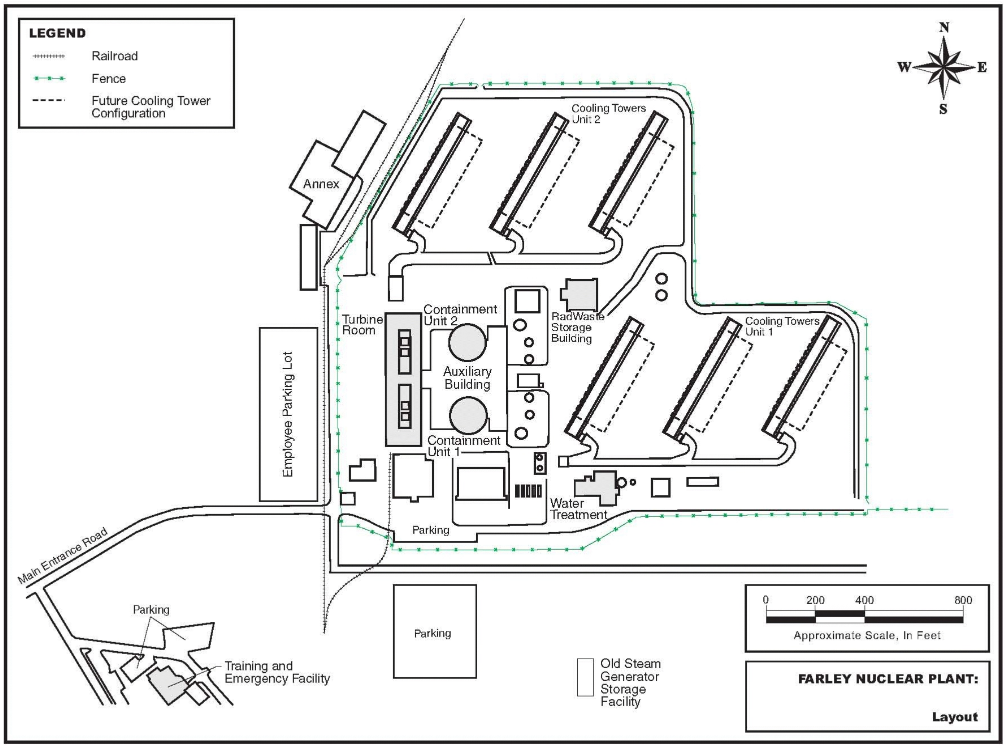

Figure 2-3. Farley Site Layout

2.1.3 Cooling and Auxiliary Water Systems

The Farley cooling system is operated as a closed-cycle system using six mechanical draft cooling towers for main condenser cooling (NRC 1996). Each of the two units currently uses three 14-cell cooling towers to dissipate heat. However, as described in Section 1.3, Farley is constructing new mechanical draft towers that will consist of four 18-cell and two 16-cell towers. Surface water from the Chattahoochee River is diverted to a 44-ha (108-ac) service water storage pond onsite, which provides service water, makeup water for the circulating water system, and dilution water that may be discharged to the river during periods of low flow, when releases to the river would exceed permit limits. A small portion of the circulating water flow is returned to the Chattahoochee River. This surface water diversion is authorized under a Certificate of Use issued by the Alabama Department of Economic and Community Affairs (ADECA).

Water is drawn from the Chattahoochee River through the Farley intake structure, which consists of three bays, each with 0.95-cm (0.37-in.) mesh vertical traveling screens to prevent small fish and debris from being entrained. Accumulated debris is washed from the screens into a trough and collected for disposal. Ten pumps behind the intake bays then move the water through a 61-m (200-ft) canal to the service water storage pond at a rate of about 292,000 L/min (77,000 gpm). During normal operations, the service water storage pond stores river water to provide the ultimate heat sink for the safe shutdown of both units.

From the service water storage pond, water is moved into the Farley service water systems at a combined rate of approximately 288,000 L/min (76,000 gpm) for both units (see Figure 2-4). It is assumed that 3800 L/min (1000 gpm) seeps to the ground and returns to the river. The service water intake structure has three pump bays, each with two entrances. Each entrance is 4 m (13 ft) wide and 7.8 m (25.5 ft) high. These entrance bays also are equipped with trash racks and vertical traveling screens (SNC 2004a)

Excess heat produced by Farley's two nuclear units is dissipated by circulating water through the mechanical draft cooling towers. Each cooling tower circuit is designed to transfer approximately 6.3 x 10^9 Btu/h of heat to the atmosphere. Farley is currently in the process of constructing new fiberglass cooling towers to replace the existing 25-year-old wooden towers. The new towers are being constructed adjacent to current tower locations. Construction commenced in January 2003 and is planned to be completed by May 2005.

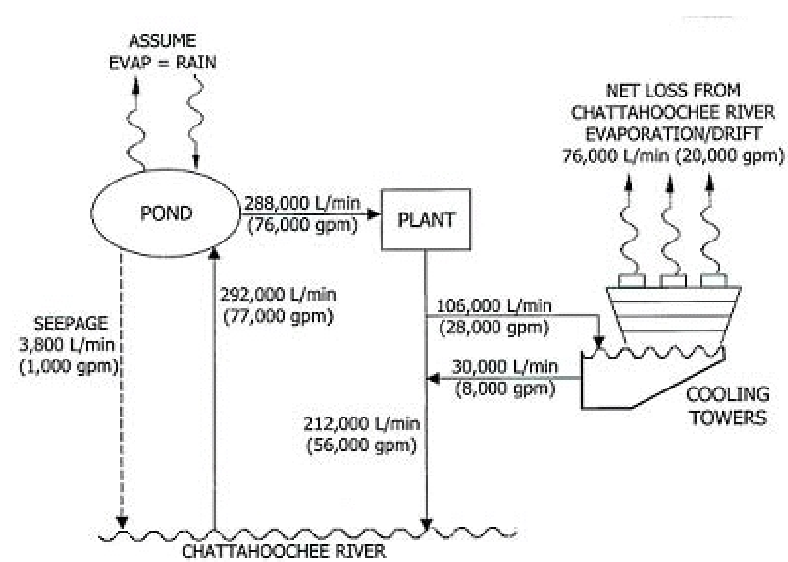

Figure 2-4. Surface Water Use at Farley

Water discharged from both units' service water and circulating water systems is combined and carried through a single 1.5-m (60-in.) pipe to a discharge structure located on the shore of the Chattahoochee River approximately 529 m (1740 ft) downstream of the intake. The pipe and discharge are directed downstream at a 45 degree angle. At this location, the river is approximately 114 m (375 ft) wide with an average depth of 3.6 m (12 ft) (McCracken 1990). Discharge water normally contains residual heat and small amounts of oxidizing biocides. During outages, small amounts of hydrazine may also be present.

Oxidizing biocides (typically sodium hypochlorite) are added to the service water system at the service water intake structure at concentrations adequate to control Asiatic clams (*Corbicula fluminea*) and microfouling organisms, while maintaining total residual oxidant (TRO) concentrations within National Pollutant Discharge Elimination System (NPDES) permit limits. Biocides and other treatment chemicals are also added to the circulating water system. Farley's permit authorizes discharges of oxidizing biocide residuals (TRO) with limits applicable to cooling tower blowdown and the final discharge. A dechlorination system is utilized to neutralize discharge from cooling tower blowdown. Approximately 2 x 10^8 Btu/h of heat is also released to the river from each unit. SNC monitors the discharge to ensure Farley's compliance with its NPDES permit limits for both thermal loading and water quality.

Approximately 500 L/min (130 gpm) of groundwater is used at Farley for domestic purposes and for makeup to the fire protection system, as authorized under a Certificate of Use issued by ADECA. Three onsite wells currently supply the plant. Production Well No. 2, located north of the plant facilities, supplies the majority of Farley Plant groundwater, with a five-year average daily use of 443 L/min (117 gpm) (SNC 1997, 1998, 1999, 2000a, 2001). This well is located approximately 304 m (1000 ft) north of the plant and is 236 m (775 ft) deep, drawing from the deep major aquifer. Construction Wells No. 1 and 2 are located at the northern edge of the plant facilities. They have a combined average daily use of 45 L/min (12 gpm) and draw from the major shallow aquifer, at depths of 73 m (240 ft) and 117 m (385 ft), respectively. The site elevation at all three wells is approximately 56 m (183 ft) above mean sea level.

In the past, the site has used additional wells. Production Well No. 1 was removed from use and capped in 1996. Production Well No. 3, located south of the plant facilities, draws from the major shallow aquifer and is used as needed to provide water to Farley.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

SNC uses liquid, gaseous, and solid radioactive waste management systems to collect and treat the radioactive materials that are produced as a by-product of the Farley site operations. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to maintain levels as low as reasonably achievable (ALARA) before they are released to the environment. The Farley site waste processing systems meet the design objectives of Title 10 of the Code of Federal Regulations (CFR) Part 50, Appendix I ("Numerical Guides for Design Objective, 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”). 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 from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination.

Nonfuel solid waste results from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid waste also consists of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. Solid waste is shipped to a waste processor for volume reduction before disposal or sent directly to the licensed disposal facility. Spent resins and filters are dewatered and packaged for shipment to licensed offsite processing or disposal facilities (SNC 2003b). Currently, solid waste is shipped to Barnwell, South Carolina and Clive, Utah.

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. Farley Units 1 and 2 currently operate on a staggered 18-month refueling cycle, resulting in at least one refueling every year and two refuelings every third year. The spent fuel assemblies are currently stored onsite in two spent fuel pools (one for each unit) in the spent fuel storage building, which is an integral part of the auxiliary building. Spent fuel has been stored on the Farley site since 1979, with anticipated storage capacity being available until 2006 and 2010 for Units 1 and 2, respectively. A new independent spent fuel storage installation is expected to be constructed before capacity in both spent fuel pools is exhausted.

The Offsite Dose Calculation Manual (ODCM) for the Farley site describes the methods used for calculating concentration of radioactive material in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from Farley Units 1 and 2 (SNC 2000b). The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with NRC regulations (NRC 1991).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

Farley Units 1 and 2 are served by separate liquid waste processing systems (LWPS). However, both units share a common demineralizer bed system for processing certain liquids (SNC 2000b). Each LWPS on the Farley site collects and processes potentially radioactive liquid waste for either recycling or for release to the environment (SNC 2002a). Liquid waste is sampled and analyzed before it is recycled or discharged. Based on a laboratory analysis of the radionuclide content, this waste is either released under controlled conditions via the cooling water system or retained for further processing. The LWPS may be divided into two streams which include (1) a reactor-grade, recyclable stream and (2) a non-recyclable stream (SNC 2004a).

Stream 1 processes reactor-grade water that enters the LWPS via equipment leaks and drains, valve and pump seal leakoffs, tank overflows, and other tritiated and aerated water sources. De-aerated tritiated water inside the reactor building from sources such as valve leakoff, which is collected in the reactor coolant drain tank, may be routed directly to the boron recycle waste holdup tanks for processing and reuse. Administratively controlled equipment drains are the major contributors of water to this subsystem. Valve and pump leakoffs outside the reactor building are also collected in the waste holdup tank for processing and recycle. Abnormal liquid sources include leaks that may develop in the reactor coolant and auxiliary systems.

The basic composition of the liquid collected in the waste holdup tank is boric acid and water with some radioactive contamination. Liquid collected in this tank is normally treated by evaporation to remove radioisotopes, boron, and air from the water so that it may be reused in the reactor coolant system. The condensate leaving the LWPS waste evaporator may pass through the waste evaporator condensate demineralizer and then enter the waste evaporator condensate tank. When a sufficient quantity of water has collected in the waste evaporator condensate tank, it is normally transferred to the reactor makeup water storage tank for reuse. If the condensate requires further processing, it may be passed through the waste evaporator condensate demineralizer again or, if necessary, returned to the waste holdup tank for additional evaporation. Liquid in the waste holdup tank can also be sent directly to a demineralizer and then to a waste monitoring tank where it is stored prior to discharge.

Stream 2 collects and processes nonreactor-grade liquid waste from floor drains, equipment drains containing nonreactor-grade water, laundry and hot shower drains, and other nonreactor-grade sources. Equipment in this subsystem includes a floor drain tank and filter, laundry and hot shower tank and filter (Unit 1 only), chemical drain tank, waste monitor tank demineralizer and filter, disposable demineralizer system, and two waste monitor tanks. Non-recyclable reactor coolant leakage enters the waste holdup tank from system leaks inside the reactor building via the containment sump, from system leaks in the auxiliary building via the floor drains, and from various other floor drain tanks. Laundry and hot shower drains are the largest volume source of liquid waste and normally need no treatment for removal of radioactive material. This water is transferred to a waste monitor tank via the laundry and hot shower filter, and discharged if the activity level is below acceptable limits.

Releases from the waste monitoring tanks are routed to the service water discharge line (which provides dilution prior to release to the unrestricted area), and thence to the Chattahoochee River. The service water discharge line also receives input from the cooling tower blowdown, the turbine building sump, and the steam generator blowdown systems. Liquid waste discharges from the waste monitor tanks and from the steam generator blowdown system for each unit are interlocked with two process radiation detection monitors that automatically secure the discharge if the concentration of radioactive materials in the liquid discharge exceeds a preset limit.

The spent resin sluice portion of the LWPS consists of two spent resin storage tanks, a spent resin sluice pump, and a spent resin sluice filter. The system is designed to transport spent resin to the spent resin storage tank for treatment. Following treatment, the sluice water is available for subsequent resin sluicing operations or disposal.

The ODCM prescribes the alarm/trip setpoints for the liquid-effluent radiation detection monitors, which are derived from 10 times the effluent concentration limits provided in 10 CFR Part 20, Appendix B, Table 2, Column 2 (Carr 2000). There are two liquid-effluent radiation monitors for the primary radioactive liquid waste discharge pathway for Farley Units 1 and 2. The alarm/trip setpoint for each liquid-effluent monitor is based on the concentration of radioactive material in either a batch of liquid to be released or in the continuous liquid discharge (Carr 2000).

During 2002, Unit 1 had 276 batch releases and Unit 2 had 254 batch releases of liquid effluents with a total volume for the Farley site of 1.11×10^8 L (2.93×10^7 gal) of liquid waste released prior to dilution (SNC 2003b). In this liquid waste, there was a total fission and activation product activity of 0.0048 TBq (0.129 Ci) and total tritium activity of 60.79 TBq (1623 Ci). These volumes and activities are typical of past years. Each drain stream uses one 3.8×10^4 L (10,000 gal) liquid waste-holdup tank. The actual liquid waste generated is reported in the *Joseph M. Farley Nuclear Plant, Revision to Annual Radioactive Effluent Release Report for 2002* (SNC 2003b). See Section 2.2.7 for a discussion of the calculated doses to the maximally exposed individual as a result of these releases.

SNC does not anticipate any increase in liquid waste releases during the renewal period.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The gaseous waste processing system (GWPS) is the primary gaseous waste handling system for Farley Units 1 and 2. Discharges for each unit are handled separately. The GWPS was originally designed to remove fission product gases from the reactor coolant and store them indefinitely. However, operating experiences demonstrate that periodic releases must be made due to nitrogen buildup (SNC 2004a). The system is also designed to collect gases from the boron recycle evaporator and reactor coolant drain tank. The GWPS consists mainly of a closed-loop system composed of two waste gas compressors, two catalytic hydrogen recombiners, and eight gas decay tanks to accumulate the fission product gases. The catalytic hydrogen recombiners are no longer used. The principal source or input to the GWPS during normal operation is taken from the gas space in the volume control tank.

During normal power operation, the volume control tank requires purging only on an intermittent or as-needed basis. Without the continuous input of hydrogen with trace fission gases from the volume control tank, there is no need to continuously operate the GWPS. When the GWPS is required, the compressors and gas decay tanks are used in a compressed storage mode of operation. In this mode a waste gas compressor takes the suction on a waste gas decay tank. The discharge of the waste gas compressor is routed to bypass the recombiners and return back to the gas decay tank, completing the loop.

The auxiliary building supports both Units 1 and 2. This building continuously exhausts air drawn from building areas with the potential for radioactive contamination. The supply and exhaust ducts are arranged so that air flow is always in the direction of progressively greater potential contamination. Exhaust air from these areas is continuously drawn through the roughing/high-efficiency particulate air (HEPA)/charcoal filter plenums and is routed to the main exhaust fans and plant vent stacks for both units.

The reactor building for each unit can also release radioactive gases intermittently. Radioactive gases are released inside the reactor building when primary system components are opened or if leakage from the primary system occurs. The gaseous activity inside the reactor building may be purged through the auxiliary building and ultimately through the plant vent stack for each unit. The reactor containment structure can be exhausted to the outside atmosphere through an integrated leak rate test (ILRT) vent for each unit.

The turbine building for each unit is also a source of radioactive gas emissions. Turbine building steam leakage may release radioactive gas if primary to secondary leakage occurs. Turbine building ventilation system exhausts are not treated prior to release and are released through a vent on each building.

At the Farley plant, there are six designated points (three for each unit) where radioactivity may be released to the atmosphere in gaseous discharges: the plant vent stacks, the turbine building vents, and the ILRT vents. For each unit, reactor containment purge and waste gas decay tank effluents are discharged through their respective plant vents. Of these six, only four are routine release pathways, since ILRT vent releases are performed only infrequently. These release points or their source streams are routinely monitored or sampled for noble gases, radioiodines, particulates, and tritium, as appropriate, prior to release (SNC 2003b).

The ODCM prescribes alarm/trip setpoints for effluent monitors and control instrumentation to ensure that the alarm/trip will occur before exceeding the limits of 10 CFR Part 20 for gaseous effluents (Carr 2000). These control or release points are continuously or intermittently monitored and provide alarms with automatic valve closure when radiation levels exceed a preset level, thus terminating release or discharge (Carr 2000).

During 2002, Farley Units 1 and 2 released to the environment a total fission and activation gas activity of 4.71 TBq (127.4 Ci), iodine activity of 2.85×10^{-7} TBq (7.71×10^{-6} Ci), a total particulate activity of 1.27×10^{-6} TBq (3.42×10^{-5} Ci), and a total tritium activity of 4.35×10^{-1} TBq (11.75 Ci) (SNC 2003b). These releases are typical of past years. The actual gaseous waste generated is reported in the *Joseph M. Farley Nuclear Plant Revision to Annual Radioactive Effluent Release Report for 2002* (SNC 2003b). See Section 2.2.7 for a discussion of the calculated doses to the maximally exposed individual as a result of these releases.

SNC does not anticipate any increase in gaseous releases during the renewal period.

2.1.4.3 Solid Waste Processing

The solid waste system on the Farley site is designed to encapsulate, package, and/or solidify spent resins, evaporator concentrates, and chemical tank effluents, and to compress most radioactive solid waste for shipment to an approved offsite burial facility. This system is located next to Unit 1 and has adequate capacity to serve both units. Inputs to the solid waste system come from the spent resin storage tanks, waste evaporator, concentrated waste tank, and chemical drain tank. Solid, compressible waste is generated by routine plant operation and maintenance activities.

Solid waste processing is performed in the solidification and dewatering facility. This facility contains shielded pits and process lines and is located east of the Unit 1 auxiliary building. Spent resin, evaporator concentrates, and chemical drain tank effluents may be encapsulated in containers, while most solid waste is compressed directly into drums. In the case of metals, wood, etc., the material will be loaded into an appropriate sized container to facilitate shipment and burial.

A portable cement solidification system is used to provide more efficient waste solidification and to reduce waste volumes. The portable system is operated in the solidification and dewatering facility and is capable of solidifying wastes from both units. The system also serves as a solidification system for the disposable demineralizer system, should solidification be required prior to shipment. Solidification via the portable system is accomplished with the liner inside a shipping cask or a shielded enclosure that provides the necessary personnel shielding.

A separate system is available to compact dry active waste such as paper, disposable clothing, rags, towels, floor coverings, shoe covers, plastics, cloth smears, and respirator filters. Shielding is designed to limit general area radiation levels in the drumming rooms, drum storage rooms, and the low-level radwaste building.

During normal work activities, tools, scrap, and other miscellaneous equipment and materials may become radioactively contaminated. The solidification and dewatering facility can also be used as a decontamination area for these items when needed.

The solid waste system is normally operated on a batch basis. Radioactive waste is generally stored in the shielded areas of the radwaste area located to the east of the auxiliary building (SNC 2002a). Solid waste is either shipped directly to an offsite licensed disposal facility (e.g., spent resins) or consigned to a licensed processing facility for volume-reduction and decontamination activities (e.g., compactible trash). The material that remains after volume reduction is transported by the processing facility to a final disposal facility, depending on the radioactive limits. Solid waste is disposed of at licensed facilities such as those in Barnwell, South Carolina, or Envirocare in Utah (SNC 2003b).

Disposal and transportation of solid waste are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There is no release to the environment from radioactive solid waste generated at the Farley plant.

In 2002, Farley Units 1 and 2 made 20 highway shipments and 39 rail shipments of solid waste to Envirocare (Clive, Utah) and 10 highway shipments of solid wastes to Barnwell, South Carolina, with a total volume of 34.87 m^3 (1,232.8 ft^3) and a total activity of 47.92 TBq (1,295.11 Ci) (SNC 2003b). These shipments are representative of the shipments made in the past several years and are not expected to change substantively during the license renewal period. The actual amount of solid waste generated is reported in the *Joseph M. Farley Nuclear Plant Revision to Annual Radioactive Effluent Release Report for 2002* (SNC 2003b).

2.1.5 Nonradioactive Waste Systems

Various nonradioactive wastewater and solid waste management activities are conducted as part of normal operation and maintenance activities at the Farley plant. They include collection, treatment, and offsite disposal of the following non-radioactive waste streams:

- Solid waste
- Hazardous and mixed waste
- Liquid waste
- Sludges

Non-radioactive solid waste generated at Farley falls into five categories: recycleables, sanitary solid waste, construction and demolition waste, industrial waste, and hazardous waste. The first choice for managing solid waste at Farley is recycling. Programs are currently in place for paper, cardboard, plastic, wood, aluminum, scrap metal, used oil, and lead acid batteries. Sanitary solid waste that cannot be recycled consists primarily of food waste from the cafeteria and eating areas and office waste. It is collected in dumpsters and sent to the Dothan municipal landfill for disposal. Construction and demolition waste consists primarily of bricks, concrete, wood, and plastic resulting from demolition of onsite structures and waste from onsite construction projects. This waste is recycled, where feasible, and otherwise is disposed in an unlined, onsite solid waste landfill permitted by the Alabama Department of Environmental Management (ADEM) (see Table E-2). Industrial waste, such as sand blast waste and treated wood, is sent off-site to a lined solid-waste disposal facility.

Farley generates a small amount of hazardous waste each year and minimal amounts of mixed waste. Hazardous waste generation results primarily from painting operations. An active waste minimization program is in place to limit hazardous/mixed waste generation. Farley has a Resource Conservation and Recovery Act (RCRA) identification number as a Small Quantity Generator (see Table E-2), and periodically sends these wastes to permitted offsite facilities for treatment and disposal.

Liquid waste is generated by site processes such as water treatment, sewage treatment, analytical laboratory activities, and maintenance. Water-based liquid waste is managed under the site's NPDES permit. After the appropriate treatment processes, wastewater streams are discharged to the Chattahoochee River and monitored and regulated according to NPDES permit requirements (SNC 2004a). Other liquids, such as oils, are managed via recycling or as solid waste.

Sludges are generated by processes such as water treatment, sewage treatment, and sump cleanouts. These materials are managed on a case-by-case basis depending on the material that created the sludge. Sewage sludge is sent offsite to a municipal treatment plant for treatment and disposal.

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. Maintenance activities conducted at Farley Units 1 and 2 include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating, while others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. SNC refuels Farley Units 1 and 2 at nominal 18-month intervals. During refueling outages, site employment increases by as many as 800 workers for temporary duty (typically, 30 to 40 days).

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 aging management program is described in Appendix B of the Farley Units 1 and 2 license renewal application (SNC 2003a). The IPA identified 21 programs and inspections as managing aging effects at Farley. SNC has performed some major modifications at Farley in the past (e.g., replacement of steam generators in 2000 and 2001) and will perform others in the near future (e.g., cooling tower replacement). However, the IPA that SNC conducted has not identified the need to undertake any refurbishment or replacement activities. SNC expects to conduct the activities related to the management of aging effects during plant operation or normal refueling and other outages, but does not anticipate any additional full-time staff (non-outage workers) at the plant during the period of the renewed license (SNC 2003a).

2.1.7 Power Transmission System

APC originally built five transmission lines specifically to connect Farley to the transmission system. Construction on a sixth transmission line (Farley-Sinai Cemetery) was recently completed. The transmission system that connects Farley to the transmission grid has changed from the original final environmental statement (FES) (see Figure 2-5). New substations and lines have been constructed. The SNC Environmental Report (ER) describes and evaluates all lines from Farley to the first substation that connects Farley to the transmission grid (SNC 2003a).

The Farley-Raccoon Creek line, originally built to connect Farley to the grid, was extended to Tifton. Therefore, the section of transmission line from Raccoon Creek to Tifton (approximately 51 km [32 miles]) is within scope of the environmental review for license renewal. SNC submitted supplemental information including the Raccoon-to-Tifton section (SNC 2004a).

For the specific purpose of connecting Farley to the transmission system, approximately 524 km (326 mi) of transmission lines were constructed, and occupy approximately 2403 ha (5938 ac) of rights-of-way (ROWs). The transmission line ROWs pass through land that is primarily rolling hills covered in forests or farmland. The areas are mostly remote, with low population densities. The longer lines cross numerous State and U.S. highways, including U.S. 231 and U.S. 431. Transmission line ROWs that pass through farmlands generally continue to be used in this fashion. SNC plans to maintain these transmission lines indefinitely, as they are integral to the larger transmission system. A discussion of the features of the transmission lines, including, voltage, ROW width and length, and presence of other lines in the ROW follows. Table 2-1 summarizes the approximate distance of the transmission lines and the widths of the transmission line ROWs (SNC 2003a).

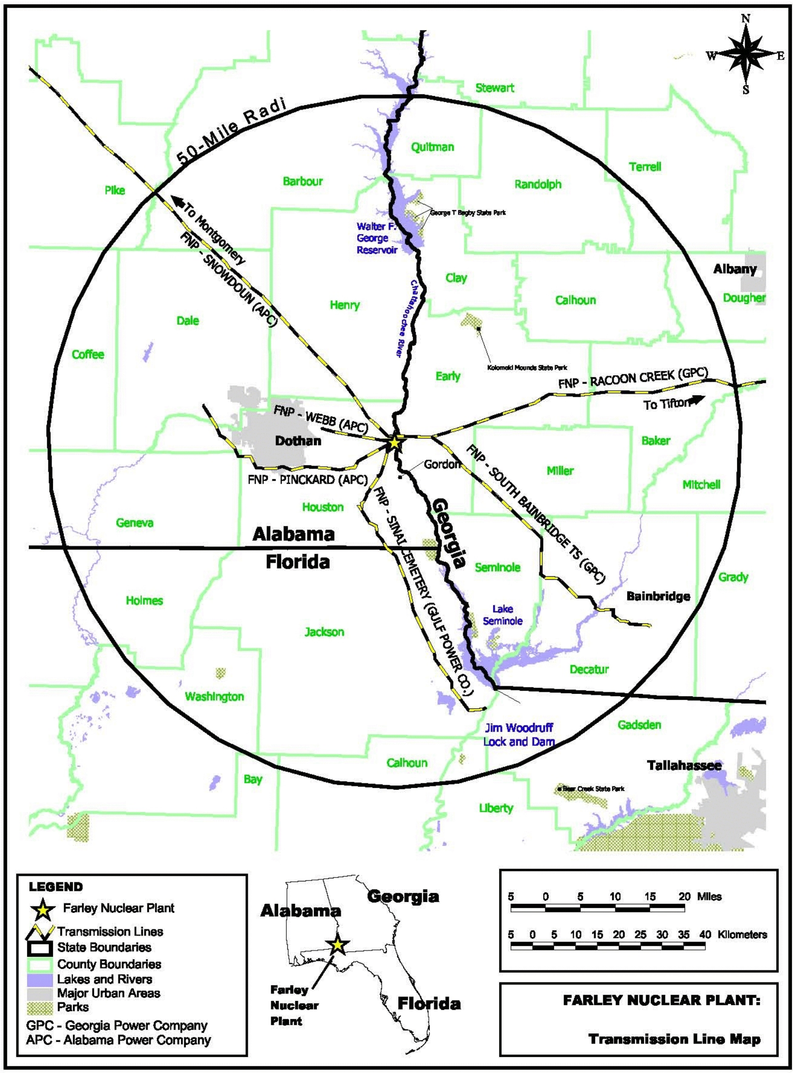

Figure 2-5. Farley Transmission Lines

Table 2-1. Farley Transmission Line Corridors

Substation	No. of Lines	kV	Approximate Distance km	(mi)	ROW	ROW Width m	(ft)	ROW Area hectares	acres
Webb	1	230	17	11	Farley-Webb	38	125	64	159
Pinckard	1	230	50	31	Farley-Pinckard	38	125	190	470
Bainbridge[(a)]	1	230	74	46	Farley-Bainbridge	38	125	282	697[(a)]
Raccoon Creek-Tifton	1	500	151	94	Farley-Raccoon Creek-Tifton	46	150	692	1709
Snowdoun	1	500	155	96	Farley-Snowdoun	61	200	939	2321
Sinai Cemetery	1	230	77	48	Farley-Sinai Cemetery	38	125	236	582
Totals[(b)]	6	N/A	524	326		N/A	N/A	2403	5938

Source: SNC 2003a

(a) The shared right-of-way is included in the Farley-Raccoon Creek-Tifton right-of-way total.

(b) Column totals may reflect rounding.

The list below identifies the transmission lines by the name of the substation at which each line connects to the transmission system.

- Farley-Webb—This 230-kilovolt (kV) line provides power to and from the Webb Substation located approximately 3.2 km (2 mi) east of Dothan, Alabama. The line is 17 km (11 mi) long with a ROW width of 38 m (125 ft), and occupies 64 ha (159 ac).

- Farley-Pinckard—This 230-kV line provides power to and from the Pinckard Substation approximately 8 km (5 mi) west of Dothan. The line is 50 km (31mi) long with a ROW width of 38 m (125 ft), and occupies 190 ha (470 ac).

- Farley-S. Bainbridge—This 230-kV line provides power to and from the S. Bainbridge Substation 0.8 km (0.5 mi) southwest of Bainbridge, Georgia. The line shares the ROW with the Farley-Raccoon Creek-Tifton line for approximately the first 11 km (7 mi) of the ROW from the Farley site. The line is 74 km (46 mi) long with a ROW width 38 m (125 ft), and occupies 282 ha (697 ac). The shared ROW is included in the Farley-Raccoon Creek-Tifton ROW total.

- Farley-Raccoon Creek-Tifton—This 500-kV line to the Tifton Substation shares the ROW with the Farley-S. Bainbridge line for approximately the first 11 km (7 mi) of the ROW from the Farley site. The line is 151 km (94 mi) long with a ROW width of 46 m (150 ft), and occupies 692 ha (1709 ac).

- Farley-Snowdoun—This 500-kV line provides power to and from Snowdoun Substation, approximately 6.4 km (4 mi) south of Montgomery, Alabama. The line is 155 km (96 mi) long with a ROW width of 61 m (200 ft), and occupies 939 ha (2321 ac).

- Farley-Sinai Cemetery—This 230-kV line has been newly constructed in an existing ROW that was originally dedicated to a 115-kV line that was dismantled. The line terminates at a new substation near the Gulf Power Company Sholtz Electric Generating Plant. The line is approximately 77 km (48 mi) long with a ROW width of 38 m (125 ft), and occupies 236 ha (582 ac).

All Farley transmission lines have been designed and constructed in accordance with the National Electrical Safety Code (NESC) and industry guidance that was current when the lines were built. Ongoing ROW surveillance and maintenance of transmission facilities ensure continued conformance to design standards.

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Farley. 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 associated with other Federal project activities.

2.2.1 Land Use

Farley is located in Houston County in southeastern Alabama, on the west bank of the Chattahoochee River. It is located approximately 8 km (5 mi) north of Gordon, Alabama, 27 km (17 mi) east of Dothan, Alabama, 161 km (100 mi) southeast of Montgomery, Alabama, and 290 km (180 mi) south-southwest of Atlanta, Georgia. The site is in a sparsely populated, largely rural area, with forests and small farms as the dominant land use. The Chattahoochee River flows in a northwest-to-southeast direction, forming the eastern border of the site and serving as the boundary between Houston County, Alabama (to the west) and Early County, Georgia (to the east). Water is diverted to Farley from the Chattahoochee River and is stored in a 44-ha (108-ac) pond. The Farley property, which is approximately 749 ha (1850 ac), is owned by APC and operated by SNC. The "Owner-Controlled Area" is posted and access to the area is controlled (SNC 2003a).

2.2.2 Water Use

Farley is located on the west (Alabama) bank of the lower Chattahoochee River at approximately River Mile (RM) 44. The Chattahoochee River is the primary water source for Farley. It is the surface water system of concern and the only significant surface water source in the vicinity of Farley. The Chattahoochee River rises in the Blue Ridge Mountains of northeast Georgia, and flows south along the entire length of the state for approximately 692 km (430 mi) before it merges with the Flint River. The two rivers merge at Lake Seminole to form the Apalachicola River. From Lake Seminole, the Apalachicola River flows south for 171 km (106 mi) across the Florida Panhandle and ultimately empties into Apalachicola Bay, which is part of the Gulf of Mexico.

Over its length, the Chattahoochee moves through three major physiographic provinces (Blue Ridge, Piedmont, and Coastal Plain) and falls about 912 m (3000 ft) in elevation (USGS 2000a). It drains an area of 22,700 km^2 (8770 mi^2) and, according to the U.S. Geological Survey (USGS), is "the most heavily used water resource in Georgia" (USGS 2000a). At Cornelia, Georgia, upriver of Lake Lanier, the Chattahoochee River is free-flowing; however, for the rest of its length, including the portion of the river immediately above and below Farley (i.e., between George Andrews Lock and Dam upstream and the Jim Woodruff Dam downstream), river flows and water levels behave hydrodynamically like reservoirs. The USGS (2000b) notes that river flows in the vicinity of Farley both up- and down-stream of the plant are controlled by releases from five upstream reservoirs built in the 1950s for flow regulation, hydroelectric power generation, and improved navigation, and by activities (such as dredging) intended to keep the river navigable. These are key elements of the Apalachicola-Chattahoochee-Flint (ACF) Project, managed by the U.S. Army Corps of Engineers (USACE) Mobile District (Bradley 2004; Jangula 2004; Vaughan 2004).

Navigation along the ACF river system has been Federally managed since the early 1800s. Recreational uses at the lakes were authorized by the Flood Control Act of 1944, and passage of the 1945 River and Harbors Act authorized a 3-m (9-ft) deep and 30-m (100-ft) wide channel to be constructed on the Apalachicola River, the Chattahoochee River segment to Columbus, Georgia, and the Flint River segment to Bainbridge, Georgia, and maintained by the USACE. In 1953, Congress authorized the development of the ACF Project for navigation, power generation and stream flow regulation. The ACF reservoirs, locks, and dams have been operational since 1963 (USACE 2004a).

The dam immediately upstream of the Farley plant is the George W. Andrews Lock and Dam (RM 47), 5 km (3 mi) upstream of Farley, which forms Lake Andrews. Lake Andrews is a long (47 km [29 mi]), narrow impoundment with a surface area of only 623 ha (1540 ac). The lock and dam were built to regulate downstream flow and improve navigation, and are not used for hydroelectric power generation. The flows, circulation patterns, and retention times in this reservoir are more characteristic of a river than a reservoir. For water years 1976 to 1999, annual mean flow at the George W. Andrews gaging station ranged between 9.7 million L/min and 27.2 million L/min (5718 cfs and 16,000 cfs), and averaged 18.7 million L/min (11,000 cfs) (USGS 2000b). Flows in this portion of the Chattahoochee River are highest in winter and early spring (January to April) and lowest in late summer and fall (August to October), a pattern observed throughout the river system. The Farley plant withdraws water from the river at an average rate of approximately 292,000 L/min (77,000 gpm), which represents approximately 3.0 percent of the river's annual mean flow.

The dam immediately downstream of the Farley plant is the Jim Woodruff Lock and Dam, 71 km (44 mi) downstream, and south of the Florida-Georgia border. It was completed in 1957 and forms Lake Seminole at the confluence of the Chattahoochee and Flint Rivers. Lake Seminole is a relatively shallow, 15,200-ha (37,500-ac) impoundment and is a popular destination for boaters, fishermen, and waterfowl hunters in the region.

ACF river system flows and discharges are managed year-round to meet multiple resource uses, in accordance with the USACE's draft ACF Water Control Plan (USACE 1989). The USACE holds weekly staff meetings to discuss the various use areas for which the ACF river/impoundment systems are managed—hydropower, recreation, navigation, fish and wildlife, flood control, and water supply—to exchange information and make water management decisions for the upcoming week. Weekly basin reports summarize the conditions in each of the river basins. Operation of the lakes on the ACF system are also guided by use of action zones. The action zones provide guidelines on meeting the project purposes for each lake (USACE 2004b). For example, during spawning seasons, the USACE maintains minimum lake levels and instantaneous releases at major locks and dams in the system to support fish and invertebrate reproduction in near-shore zones. At other times of the year, other management objectives may control flows and water levels at all points in the ACF system, including the reach of the river on the Farley site, which is considered to be the uppermost portion of Lake Seminole (Bradley 2004; Jangula 2004; Vaughan 2004).

Historically, the lower Chattahoochee River was subject to extreme seasonal fluctuations in flow and was navigable only at certain times of the year. After the three locks and dams were completed, it was possible for large vessels (including tugboats and barges) to move from the Gulf of Mexico to Columbus, Georgia (approximately 121 km [75 mi] north of Farley) via the navigation channel.

Demand for Chattahoochee River water from upstream users has increased dramatically in recent years. The increased demand in the ACF river basin has created water use conflicts between Alabama, Georgia, and Florida. The largest user of the Chattahoochee River is metropolitan Atlanta, Georgia. This area expects to increase its consumptive use of the river, which would reduce the amount of water available for downstream users.

Increased upstream water withdrawal also decreases the navigability of the river below Columbus, Georgia. In the early 1980s, a Memorandum of Agreement (MOA) was signed by the USACE (Mobile District), and the States of Alabama, Florida, and Georgia. This MOA directed the development of a Navigational Maintenance Plan (NMP) for the ACF. The plan was developed in 1986 with the intention of forecasting the maintenance needs of the system over the next 25 years, and was to be reviewed every five years and revised as necessary to address changes in either the characteristics of the river system, maintenance requirements, or environmental concerns. The initial NMP has not been revised (SNC 2004a).

The ACF Compact was created in 1997 and included the States of Florida, Georgia, and Alabama as well as 12 Federal agencies, including the USACE. The Compact directed formation of the ACF Basin Commission, whose purpose is to develop an allocation formula for the resource, and monitor use of the resource (University of Florida 2000; JSU 2000). To evaluate the environmental and socioeconomic impacts of the proposed allocation formula, the USACE, in cooperation with 10 other Federal agencies, developed the *Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida and Georgia Draft EIS* (USACE 1998). Negotiations are still ongoing among some of the affected parties; however, the ACF Compact expired on August 31, 2003. The States' next step may be litigation before the U.S. Supreme Court for an equitable allocation of the disputed waters (Clemons 2003).

The maximum groundwater usage at Farley is 3.35 million L/day (885,600 gallons per day). Groundwater supplies 227 L/min (60 gpm) to the sanitary water system, and no more than 227 L/min (60 gpm) to maintain the level in the fire protection storage tank. Groundwater also provides a back-up supply to the filtered water storage tank. The plant water treatment system uses the service water system as its primary water source. Groundwater is not used for emergency cooling.

Groundwater used at Farley is typically supplied by three onsite wells, which are discussed in Section 2.1.3. Production Well No. 2 has a 5-year average daily use of 443 L/min (117 gpm). Construction Wells No. 1 and 2 have a combined 5-year average daily use of 45 L/min (12 gpm). In the past, the site has used additional wells, as discussed in Section 2.1.3.

The Farley groundwater well system is capable of supplying 2330 L/min (615 gpm). The system capacity meets the normal system demand of 454 L/min (120 gpm), leaving almost 1900 L/min (500 gpm) capacity available to supplement the water treatment system supply during low river flow conditions.

There are no well users in the vicinity of Farley that use significantly large amounts of groundwater. Localized cones of depression occur where groundwater is pumped from a limited area for municipal and industrial purposes, such as Dothan, Alabama, 27 km (17 mi) west of the plant. Well surveys have shown that municipalities and industries near the site do not require or use large amounts of groundwater (SNC 1996). As a result, no significant cones of depression exist in the area surrounding the site. Dewatering activities for plant construction temporarily modified groundwater levels in the unconfined and confined sections of the major shallow aquifer. They returned to pre-construction water levels after dewatering at the plant was stopped.

2.2.3 Water Quality

Potential environmental issues associated with water quality at the Farley plant include surface water in the Chattahoochee River and groundwater.

Information on the water quality and biotic resources of the Chattahoochee River is contained in a series of reports prepared in support of a Clean Water Act Section 316(a) demonstration for the Farley plant (APC 1983). Surface-water quality data have also been collected in the ACF River basin as part of the USGS National Water Quality Assessment (NAWQA) program (Garrett et al. 2000). Physical, chemical, and biological data were collected at 132 stream sites and at 15 locations within 6 reservoirs, and were analyzed for nutrients, carbon, pesticides, major ions, and field parameters. In addition, ADEM and the U.S. Environmental Protection Agency (EPA) have water quality data sets for the study area.

The 2002 ADEM Clean Water Act Section 305(b) report notes that water quality in the Chattahoochee River is suitable for a range of aquatic life, but is experiencing a significantly increasing trend in total phosphorous concentrations from upstream (agricultural and municipal) sources (ADEM 2003). In addition, fecal coliform bacteria levels are occasionally elevated in portions of the ACF system (USACE 1998). Chemical analyses of river water samples taken at the Farley intake in support of its most recent NPDES permit reapplication (Carr 2000) showed no detected levels of volatile and semivolatile organic compounds, polychlorinated biphenyls or pesticides; low levels of several metals (indicative of regional soil chemistry); a pH of 7.06 at a temperature of 21°C (69.8°F); 0.52 mg/L of nitrogen as nitrates; and biological and chemical oxygen demand of 1 and 3 mg/L, respectively.

Temperatures and dissolved oxygen (DO) levels in the Chattahoochee River were measured as part of Farley's Clean Water Act Section 316(a) demonstration (APC 1983). Temperatures measured at the plant intake and a location approximately 2.4 km (1.5 river miles) upstream ranged from 9.0°C in January to 29.87°C in August (mean of 18 monthly samples taken from August 1981 through January 1983). Temperatures were elevated slightly at sampling stations located at and downstream of the plant discharge (APC 1983), as discussed further in Section 4.1. A thermal mixing study was conducted in February 1991 as part of Farley's NPDES compliance program (APC 1991), in which it was shown that during wintertime conditions (1.39 million L/min or 820 cfs), water temperatures did not remain elevated more than 2.8°C (5°F) above intake temperatures beyond the immediate wastewater discharge area (i.e., no more than 7.6 m [25 feet] from the discharge structure), and were within 0.67°C (1.2°F) of ambient river temperatures 454 m (1500 feet) downstream of the discharge structure in a September 1990 low-flow study.

Temperature and DO levels vary seasonally and tend to show an inverse relationship in the ACF system, with high temperatures associated with relatively low DO levels and low temperatures associated with relatively high DO levels (USACE 1998). DO concentrations measured at the plant intake and a location approximately 2.4 km (1.5 river miles) upstream ranged from 6.63 mg/L in September to 12.80 mg/L in January, and tended to be slightly (but not significantly) higher at the downstream stations (APC 1983).

Visibility is a measure of turbidity in water, which can indicate sediment and/or phytoplankton density. Visibility in the Chattahoochee River was measured by Secchi disk as part of Farley's Clean Water Act Section 316(a) demonstration (APC 1983). Mean readings of 80.8 and 80.1 cm (31.5 and 31.2 in., respectively) were measured at the plant intake and a location approximately 2.4 km (1.5 river miles) upstream, respectively (mean of 18 monthly samples). APC attributed these levels to sediment resuspension and turbulence associated with upstream dam releases, as well as elevated phytoplankton populations associated with the upstream reservoirs. Visibility did not change significantly at sampling stations located at and downstream of the plant discharge (APC 1983).

Storm water and industrial wastewater discharges to the Chattahoochee River and Wilson Creek are regulated and monitored under Farley's NPDES permit administered by the ADEM, as discussed previously. The range of parameters monitored includes TRO, pH, temperature, hydrazine, total chromium, acute and chronic toxicity, zinc, biochemical oxygen demand, total suspended solids, fecal coliform, and oil and grease. These permit conditions are based on a series of detailed studies conducted by SNC in the 1990s to evaluate mixing zones for thermal, hydrazine, and chlorine discharges to the Chattahoochee River.

The Farley plant does not discharge directly to groundwater, although there is some seepage to groundwater from the service water pond. Groundwater quality data have also been collected in the ACF River basin as part of the USGS NAWQA program (Garrett et al. 2000). Physical, chemical, and biological data were collected at 132 stream sites and at 161 groundwater sites, including wells, springs, drains, and seeps. Groundwater samples were collected at varying frequencies and analyzed for nutrients, carbon, pesticides, and major ions; field measurements included specific conductance, temperature, pH, dissolved oxygen, and alkalinity. Groundwater samples also were analyzed for volatile organic compounds, trace metals, radionuclides and stable isotopes.

Groundwater in the vicinity of the site tends to be somewhat mineralized due to prolonged contact with, and dissolution of, rock minerals. It may be locally higher than nearby surface waters in hardness, dissolved solids, and conductivity.

2.2.4 Air Quality

The climate on the Farley site is humid and subtropical, with continental influences, especially in winter. Recent nearby climate summaries are available from Fort Rucker 70 km (42 mi) west-northwest (NCDC 1992). The applicant provided local climatological information (AEC 1974) based on historic meteorological observations from Dothan, Alabama, 27 km (16 mi) to the west, and at Blakely, 25 km (15 mi) northeast. Additional recent meteorological observation data are available for Dothan and Fort Rucker (NOAA 2003). Other weather stations, Montgomery, Alabama, located 160 km (95 mi) to the northwest, Mobile, Alabama, located 300 km (180 mi) to the southwest, and Tallahassee, Florida, located 115 km (70 mi) to the southeast, define the regional climate (NOAA 2002). The historic data from the stations near the Farley site are comparable to the regional climate pattern, which demonstrates a moderating climate influence for stations nearer the Gulf of Mexico.

The summers in the region are long, hot, and humid, with little day-to-day temperature change, and the winters are mild. Normal daily maximum and minimum temperatures in July are on the order of 33°C (91°F) and 22°C (72°F), respectively. In winter there are frequent shifts between warm moist air from the Gulf of Mexico and dry, cool continental air. Severely cold weather seldom occurs, but freezing morning temperatures are quite common in winter. Regional normal daily maximum and minimum temperatures in January are on the order of 14.4°C (58°F) and 3.3°C (38°F), respectively. The relative humidity is high at Dothan and throughout the surrounding region with all season averages on the order of 90 to 95 percent and 90 percent for 6 AM and 7 PM, respectively (SNC 2003a).

The fastest monthly average winds occur in winter and spring, with a maximum speed of 17 km/h (10 mph) in March; the slowest monthly average winds occur in summer, with speeds of about 10 km/h (6 mph), based on the historical records at the Dothan Airport station. The winds on the Farley site show the same trends as the nearby Dothan airport, with the winds exhibiting predominant ENE/NE components (SNC 2004a). The regional climatological records for extreme wind speeds show the regional maximum winds in the period of record though 2002 to be on the order of 100 to 108 km/hr (60 to 65 mph) (NOAA 2003).

Precipitation occurs almost entirely as rain. In summer nearly all precipitation is due to thunderstorms, which occur mainly in the afternoon. From August through early October widespread heavy rain falls, with an occasional tropical disturbance or hurricane moving inland from the Gulf. Winter rain is due mainly to extratropical weather systems. The regional average annual precipitation is about 132 cm (52 in.), with peak monthly values in March and July. Based on statistics for the 30 years from 1954 through 1983, the probability of a tornado striking the site is expected to be about 3×10^{-4} per year (Ramsdell and Andrews 1986).

The Farley site is located in Houston County, Alabama, which is part of the Southeast Alabama Intrastate Air Quality Control Region (AQCR) (40 CFR 81.267). The AQCR is designated as being unclassified or in attainment for all criteria pollutants (40 CFR 81.301). As of

January 6, 2004, the nearest nonattainment areas, designated as marginal for ozone, are Jefferson and Shelby counties (Birmingham), Alabama, approximately 320 km (200 mi) northwest of Farley and Fulton County (Atlanta), Georgia (designated as severe for ozone), approximately 300 km (185 mi) northeast of Farley (SNC 2003a; EPA 2004). ADEM, under authority delegated to them under the Clean Air Act, has determined that the air emissions from operations on the Farley site are small enough so as not to be of regulatory concern (ADEM 1997).

2.2.5 Aquatic Resources

Farley Units 1 and 2 are located near the west bank of the lower Chattahoochee River at approximately RM 44. The plant lies between the George W. Andrews Lock and Dam, located 5 km (3 mi) upstream of the Farley site, and the Jim Woodruff Lock and Dam, located 71 km (44 mi) downstream (SNC 2003a); this reach is approximately 76 km (47 mi) long. At the location of the plant's discharge structure, the Chattahoochee River is approximately 114 m (375 ft) wide, with an average depth of 3.6 m (12 ft) and average velocity of 0.9 m/s (3 f/s) (APC 1991). Downstream portions of the river range up to 132 m (435 ft) in width and 7.3 m (24 ft) in depth (APC 1991). The Chattahoochee River flows in a northwest-to-southeast direction (SNC 2003a) and it hosts a multitude of uses including navigation, hydroelectric power generation, and recreation (Brim Box 2000).

The principal aquatic resources in the vicinity of the Farley site are associated with the Chattahoochee River. Other important aquatic habitats include the 44-ha (108-ac) service and makeup water pond (on the Farley site), and habitats associated with multiple river and creek crossings, wetlands, swamps, marshes, and ponds through which transmission line ROWs traverse (Tetra Tech 2002a). These crossings also include important habitats within Elmodel and Lake Seminole Wildlife Management Areas in Georgia (SNC 2003a). The transmission lines associated with Farley Units 1 and 2 traverse three states (Alabama, Georgia, and Florida) and maintenance activities occurring near aquatic resources are currently carried out by subcontractors to Alabama Power Company, Georgia Power Company, and Gulf Power Company under uniform guidance provided by SNC.

Transmission line ROW maintenance activities in the vicinity of aquatic crossings employ best management practices (BMPs) to minimize shoreline disturbance, erosive activities, and herbicide use (SNC 2003a, 2004b). Mowing cycles for vegetation management of ROWs vary between transmission lines, with cycles ranging from three to six years. Herbicide application occurs on a two-year cycle in Alabama (APC 2004). In Georgia, herbicides are used on an as-needed basis between their five-year mowing cycle (GPC 2004). In Florida, vegetation management recently shifted from mowing to herbicide application, which provides a lengthened maintenance cycle (four to six years) (Gulf Power Company 2004). When used for vegetation management along any of the transmission line ROWs associated with Farley Units 1 and 2, herbicides are applied during the growing season (generally May to October) and typically by using backpack sprayers, although some sensitive areas receive manual removal of vegetation. However, when necessary, aerial application (helicopter spraying) is also used (SNC 2004b; APC 2004). Herbicide application is performed according to label specifications by certified applicators. The Raccoon Creek-Tifton transmission line ROW that crosses into Elmodel Wildlife Management Area (structures 163 to 166) is managed by the Georgia Department of Natural Resources (Kandler 2004). The South Bainbridge transmission line ROW passes through Lake Seminole Wildlife Management Area (structures 179 to 181) and is maintained by GPC contractors (GPC 2004; Kandler 2004).

Although the topography of the Farley site is generally flat to gently rolling, along streams some slopes approach 12 percent. Many of the flatland areas adjacent to the Chattahoochee River periodically flood (Farley Nuclear Plant 2000). Habitats at the site that may provide refuge for aquatic species include floodplain forests, ravine forests, non-floodplain wetlands (Tetra Tech 2002a), and riparian areas.

Several non-floodplain wetlands occur on the Farley site. Most of these are generally weedy marsh areas with scattered red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), black willow (*Salix nigra*), and buttonbush (*Cephalanthus occidentalis*) woody species. Plume grass (*Erianthus* sp.), woolgrass bulrush (*Scirpus cyperinus*), needlerushes (*Juncus* spp.), and other emergent, non-woody species are also found in these wetlands. One wetland has a broad expanse of open water dominated by water lilies (*Nuphar lutea* and *Nymphaea odorata*), water shield (*Brasenia screberi*), and non-woody marsh grasses such as woolgrass bulrush and common needlerush (*Juncus effusus*) (Tetra Tech 2002a).

The hardwood bottoms in the vicinity of the river include species such as the water oak (*Quercus nigra*), cherrybark oak (*Q. pagoda*), white oak (*Q. alba*), and tulip poplar (*Liriodendron tulipfera*). The hardwood areas and mixed pine-hardwood areas along the streams and in the upland areas consists of various oaks, sweetgum, and tulip poplar (Farley Nuclear Plant 2000).

The aquatic communities of the lower Chattahoochee River in the vicinity of the Farley site have not been the subject of recent scientific study. The most comprehensive source of information on the local aquatic communities is the Cooling Water Intake Study 316(b) Demonstration for Farley Units 1 and 2, which contains detailed information on phytoplankton, zooplankton, and fish populations (APC 1983). An extensive survey on the distribution, abundance, and conservation status of unionid mussels of the Apalachicola Basin (including the lower Chattahoochee River) was recently conducted (Brim Box 2000). Information on the habitat preferences and life histories of the Chattahoochee River fishes, as well as species distribution maps and collections by county, may be found in Fishes of Alabama (Mettee et al. 1996).

The fish community of the Chattahoochee River in the vicinity of the Farley site is diverse, composed of a mix of common southeastern stream species (many of which adapt well to reservoir conditions), species typically found in swamps and backwaters of rivers, and a small number of migratory and semi-migratory species (SNC 2003a). Approximately 92 known fish species occur in the Chattahoochee River system (Mettee et al. 1996) and perhaps two-thirds of these species are found in the lower Chattahoochee (SNC 2003a).

Stream fishes commonly observed and occasionally collected in the lower Chattahoochee River near the Farley site include longnose gar (*Lepisosteus osseus*), redfin pickerel (*Esox americanus*), river redhorse (*Moxostoma carinatum*), greater jumprock (*M. lachneri*), green sunfish (*Lepomis cyanellus*), redbreast sunfish (*L. auritus*), channel catfish (*Ictalurus punctatus*), and several common minnow species (e.g., longnose shiner [*N. longirostris*] and weed shiner [*N. texanus*]) as well as bowfin (*Amia calva*), spotted sucker (*Minytrema melanops*), chain pickerel (*Esox niger*), and flier (*Centrarchus macropterus*). A number of other fish species found in the Chattahoochee River in the vicinity of the Farley site are adapted to a range of environmental conditions and are abundant in rivers, lakes, reservoirs, and swamps across the Southeast. These include the gizzard shad (*Dorosoma cepedianum*), common carp (*Cyprinus carpio*), blacktail shiner (*Cyprinella venusta*), bluegill (*L. machrochirus*), and largemouth bass (*Micropterus salmoides*) (SNC 2003a).

Three Morone species (striped bass [*M. saxatilis*], white bass [*M. chrysops*], and hybrid bass [e.g., palmetto bass, *M. chrysops x saxatilis*]) are found in the lower Chattahoochee River and are sought by anglers in the spring of the year near George W. Andrews Lock and Dam. In addition to these, anadromous (e.g., striped bass) and semi-anadromous (e.g., white bass and hybrid bass) populations, small numbers of catadromous American eels (*Anguilla rostrata*) are also found in the lower Chattahoochee. The size and timing of this seasonal movement of eels are not well understood. Small numbers of eels are found year-round in the Chattahoochee River in the vicinity of the Farley site (SNC 2003a).

Benthic macroinvertebrate populations inhabiting the Chattahoochee River in the vicinity of the Farley site have not been systematically surveyed (SNC 2003a). Rapidly shifting bottom sands were noted to prevent the establishment of a diverse benthic community in this area (AEC 1974). Detailed information on the historic and current distribution of 22 unionid mussels in the Apalachicola, Chattahoochee, and Flint Rivers, which together compose the Apalachicola Basin, have been extensively studied (Brim Box 2000). Species diversity and abundance of freshwater mussels declined in the Chattahoochee River since the early part of the 20th century, with dramatic declines over the past decades. This decline has been attributed to erosion and sedimentation (from land clearing and intensive farming in the river basin); dredging, snag removal, and channel modifications (for navigation); the development of impoundments for flood control and hydropower; runoff of agricultural chemicals and animal wastes (chiefly poultry); mining activities in tributary streams; and discharges from wastewater treatment facilities. In addition, the prolific Asiatic clam (*Corbicula fluminea*) invaded the Chattahoochee River system, competing with native mussels for habitat and resources. At present, it appears that the once rich and abundant Chattahoochee River mussel fauna have been reduced to remnant and isolated populations in small headwater streams and monospecific populations of common species (e.g., *Utterbackia imbecilis*) in impoundments on the river (Brim Box 2000).

The installation of a series of locks and dams within the Chattahoochee River occurred in the 1950s and these influence the river flow rates downstream of each dam. The highest flow rates generally occur in winter and early spring (January to April) and the lowest in late summer and fall (August to October). Daily mean flow rates have varied significantly from a low of 0.00 m^3/s (0.00 cfs) to a high of 5522 m^3/s (195,000 cfs). Assuming a discharge flow of 212,000 L/min (56,000 gpm) from water use data, the net loss to the Chattahoochee River is 76,000 L/min (20,000 gpm or 45 cfs) or 0.8 percent of the river's lowest annual mean flow between 1996 and 2000, 2 percent of the 7Q10[a] flow, and 0.6 percent of the Most Probable Flow (SNC 2004a).

The blowdown from the cooling towers is discharged into the Chattahoochee River (AEC 1974) and a portion of the service water flow is returned to the river (SNC 2003a). A study of the thermal plume (defined as water with a 2.8˚C [5˚F] or more temperature rise above ambient river temperature) associated with the discharge of service and cooling water from Farley Units 1 and 2 back to the Chattahoochee River found that this thermal plume extended less than 7.6 m (25 ft) downstream of the discharge structure. The discharge plume declined in temperature to 1.1˚C (2˚F), or less, above ambient river temperature approximately 122 m (400 ft) downstream of the discharge structure. Temperatures of this discharge plume, were within 0.7˚C (1.2˚F) of ambient river temperature less than 456 m (1500 ft) from the discharge structure. This study was conducted during a low flow event (23 m^3/s [820 cfs]) during September of 1990 (APC 1991). A total residual chlorine (TRC) study concluded that the mixing zone for TRC does not produce an exposure-duration relationship that is toxic to aquatic organisms normally present in the Chattahoochee River. This study was also performed during a low flow event (APC 1991).

Table 2-2 presents aquatic species that are listed, proposed for listing, or candidates for listing by the Federal government or the States of Georgia, Alabama, or Florida that could occur in the vicinity of the Farley site, or within aquatic habitats traversed by associated transmission lines. Seven of these species are Federally protected under the Endangered Species Act (ESA) and the remainder are State listed or candidates for listing. The Federally listed species are the Gulf sturgeon (*Acipenser oxyrinchus desotoi*; Federally threatened), the fat threeridge (*Amblema neislerii*; Federally and State endangered), Chipola slabshell *(Elliptio chipolaensis*; Federally threatened), purple bankclimber (*Elliptoideus sloatianus*; Federally threatened), shinyrayed pocketbook (*Lampsilis [Villosa] subangulata*; Federally endangered), Gulf moccasinshell (*Medionidus penicillatus*; Federally endangered), and the oval pigtoe (*Pleurobema pyriforme*; Federally endangered). No designated critical habitat exists for any of the listed species on or in the vicinity of the Farley site or within the ROWs of associated transmission lines. No aquatic species in the area are proposed for Federal listing, although one species (the Alabama shad [*Alosa alabamae*]) is a candidate for State listing.

(a) 7Q10 is defined as the lowest stream flow for seven consecutive days that would be expected to occur once in ten years.

Table 2-2. Federally Listed and Georgia, Alabama, and Florida State-Listed Aquatic Species Potentially Occurring in Baker, Coffee, Decatur, Early, Miller, Mitchell, Seminole, Tift, and Worth Counties (Georgia), Barbour, Dale, Geneva, Henry, Houston, Montgomery, and Pike Counties (Alabama), and Jackson County (Florida)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)] GA	AL	FL
		FISH			
Acipenser oxyrinchus desotoi	Gulf sturgeon	T	—	—	SSC
Micropterus cataractae	shoal bass	—	—	—	SSC
Notropis harperi	redeye chub	—	R	—	—
Pteronotropis welaka	bluenose shiner	—	R	—	—
Crystallaria asprella	crystal darter	—	—	SP	—
Cyprinella callitaenia	bluestripe shiner	—	T	—	—
Notropis hypsilepis	highscale shiner	—	T	—	—
Alosa alabamae	Alabama shad	—	C	—	—
Ameiurus serracanthus	spotted bullhead	—	R	—	—
		REPTILES AND AMPHIBIANS			
Graptemys barbouri	Barbour's map turtle	—	T	SP	SSC
Graptemys pulchra	Alabama map turtle	—	R	SP	—
Macroclemys temminckii	alligator snapping turtle	—	T	SP	SSC
Pseudemys concinna suwanniensis	Suwanee cooter	—	SSC	—	SSC
Haideotriton wallacei	Georgia blind salamander	—	T	—	SSC
Amphiuma pholeter	one-toed amphiuma	—	R	—	—
		INVERTEBRATES			
Amblema neislerii	fat threeridge	E	E	—	—
Elliptio chipolaensis	Chipola slabshell	T	—	SP	—
Elliptoideus sloatianus	purple bankclimber	T	T	—	—
Ptchobranchus jonesi	southern kidneyshell	—	—	SP	—
Lampsilis australis	southern sandshell	—	—	SP	—
Lampsilis (Villosa) subangulata	shinyrayed pocketbook	E	E	SP	—
Medionidus penicillatus	Gulf moccasinshell	E	E	—	—
Pleurobema pyriforme	oval pigtoe	E	E	SP	—

(a) E = endangered, T = threatened, C = candidate for Federal listing, R = Georgia rare species, SP = Alabama State protected species, SSC = Florida species of special concern, — = no listing

Source: SNC 2003a; FWS 2003j; Goldman 2004

2.2.5.1 Federally Listed Aquatic Species

The Gulf sturgeon was listed as a Federally threatened species on September 30, 1991 ([56 FR 49653] FWS 1991b); it is also a species of special concern in Florida. Historically, this fish occurred in most major rivers from the Mississippi River to the Suwannee River; currently, its population levels in these rivers are unknown (with the exception of the Suwannee and the Apalachicola Rivers) but are considered reduced from historic levels. This is an anadromous fish, migrating from marine habitats (the marine waters of the central and eastern Gulf of Mexico to Florida Bay) into large coastal rivers. Both immature and mature fish migrate into freshwater rivers, spending eight to nine months each year in the rivers and three to four of the coolest months in the estuaries and Gulf waters. Gulf sturgeon less than two years old remain in riverine and estuary habitats all year. Barriers (e.g., dams) to its spawning habitats, loss of habitat, poor water quality, and overfishing are considered threats that negatively impacted this species (FWS 2003h).

Gulf sturgeon migrated 322 km (200 mi) upstream into the ACF river system before the construction of the Jim Woodruff Lock and Dam in 1957, with numerous anecdotal reports of this fish in the Flint and Chattahoochee Rivers. No evidence exists that the Gulf sturgeon passes through this lock system. A recovery plan for the Gulf sturgeon was issued in September 1995 by the FWS (1995b). Critical habitat was designated for the Gulf sturgeon on March 19, 2003 ([68 FR 13370] FWS 2003i), but includes no critical habitat units for the Chattahoochee River or in the areas traversed by transmission lines associated with Farley Units 1 and 2 (FWS 2003i). It is not expected that the Gulf sturgeon will occur in the lower Chattahoochee River in the vicinity of the Farley site nor immediately downstream of Farley, due to the lock and dam located downstream that impedes upstream migration into the area. The Recovery Plan for the Gulf sturgeon does not note any known recent occurrences in this area (FWS 1995b).

The fat threeridge was listed as a Federally endangered species on March 16, 1998 (63 FR 12664 [FWS 1998]), throughout its entire range; within this range it is known to occur in Florida (FWS 2003a). This mussel is also State-listed as endangered in Georgia. It is endemic to the ACF river system and historically occurred in the Apalachicola, Flint, and Chipola Rivers (FWS 2003g). It has never been reported from the Chattahoochee River drainage (Brim Box 2000). It is currently considered extirpated from the Flint River (which constituted the majority of its historic range) and is known to occur at 15 sites of unknown viability in the Apalachicola and lower Chipola Rivers. The fat threeridge inhabits main channels of small to large rivers with slow to moderate currents. It uses substrates that vary from gravel to cobble to a mixture of sand and sandy mud, in moderate currents (FWS 2003g; Brim Box 2000). Five potential host fish have been identified for the fat threeridge; the weed shiner, bluegill, redear sunfish (*Lepomis microlophus*), largemouth bass, and blackbanded darter *(Percina nigrofasciata*) (FWS 2003g). This species historically occurred in a tributary of the lower Chattahoochee River, but is not expected to currently occur in the lower Chattahoochee River, in the vicinity of the Farley site.

The Chipola slabshell was listed as a Federally threatened species on March 16, 1998 (63 FR 12664 [FWS 1998]), throughout its entire range; within this range it is known to occur in Alabama and Florida (FWS 2003b). This mussel is also a State protected species in Alabama. Prior to its decline, it occurred in the Chipola River system and one site in the Chattahoochee River system; its range includes one tributary of the Chattahoochee River, Mill Creek in Houston County, Alabama (Brim Box 2000). It is currently known sporadically from the middle portion of the Chipola River system. The Chipola slabshell inhabits large creeks and the Chipola River's main channel in slow to moderate currents and in substrates of silty sand. It is typically found in sloping bank habitats. The historic extent of occurrence for this species in the lower Chattahoochee River is 6 river miles, with a current extent of 0 river miles and no known subpopulations (FWS 2003g). Only one specimen of the Chipola slabshell was found in Mill Creek in 1991 to 1992 and this is the only known record of this species from outside of the Chipola River drainage (Brim Box 2000). This species historically did not occur, nor is it expected to currently occur, in the lower Chattahoochee River in the vicinity of the Farley site.

The purple bankclimber was listed as a Federally threatened species on March 16, 1998 (63 FR 12664 [FWS 1998]), throughout its entire range; within this range it is known to occur in Georgia and Florida (FWS 2003c). This mussel is also State-listed as threatened in Alabama. Although it once occurred in larger streams throughout the ACF and Ochlockonee River systems, it is now known to sporadically occur in the Apalachicola, Flint, and Ochlockonee Rivers, and to occur at single sites in the Chattahoochee River and a Flint River tributary (FWS 2003g). Populations of the purple bankclimber were found in a 1991 to 1992 study, immediately below the Jim Woodruff Lock and Dam in the Appalachichola River. A total of 30 sites with the purple bankclimber were found in the Appalachichola and Flint Rivers. It is the second largest freshwater mussel in the ACF Basin, with the largest specimens now found in the Apalachicola River below this dam (Brim Box 2000). The purple bankclimber inhabits small to large river channels with slow to moderate currents and with sand, sand mixed with mud, or gravel substrates. It uses the eastern mosquitofish (*Gambusia holbrooki*), blackbanded darter, guppy (*Poecilia reticulata*), and greater jumprock as host fish. The historic extent of occurrence for this species in the lower Chattahoochee River is 75 river miles, with a current extent of 0 river miles and no known subpopulations (FWS 2003g). It is not expected that this species currently occurs in the lower Chattahoochee River in the vicinity of the Farley site. The last record of this species in the Chattahoochee River was in the early 1800s, with the exception of two live individuals recently noted in 2000 in Lee County, Alabama, and Harris County, Georgia, respectively (FWS 2003g; Brim Box 2000).

The shinyrayed pocketbook was listed as a Federally endangered species on March 16, 1998 (63 FR 12664 [FWS 1998]), throughout its entire range; within this range it is known to occur in Alabama, Georgia, and Florida (FWS 2003d). This mussel is also State-listed as endangered in Georgia and is a State protected species in Alabama. It is historically endemic to the main channels and tributaries of the ACF Basin Rivers (including the Chattahoochee River) and Ochlockonee River system. It currently occurs in scattered areas in tributaries of the ACF Basin and in the Ochlockonee River and is considered extirpated from the main stems of these rivers, with the exception of the Flint River (FWS 2003g; Brim Box 2000). The shinyrayed pocketbook inhabits small to medium creeks and rivers. It prefers clean or silty sand substrates in slow to moderate currents. They are often found at the interface of stream channels and sloping bank habitats (in areas in which transitional sediment particle size and current strength exist). Brim Box (2000) found that 45 percent of these mussels inhabited sand/rock substrate and 38 percent used a substrate that was predominantly sand/clay or sandy (FWS 2003g). The host fish for this mussel are the largemouth bass and spotted bass (*Micropterus punctatus*) (Brim Box 2000). The historic extent of occurrence in the lower Chattahoochee River is 58 river miles, with a current extent of 9 river miles and two known subpopulations (FWS 2003g). In the 1991 to 1992 survey, the shinyrayed pocketbook was found in two tributaries of the Chattahoochee River and, in 1994, this species was found in the Sawhatchee Creek (a creek outside the area of the Farley site and its associated transmission lines), another tributary of the river (Brim Box 2000).

The Gulf moccasinshell was listed as a Federally endangered species on March 16, 1998 (63 FR 12664 [FWS 1998]), throughout its entire range; within this range it is known to occur in Georgia and Florida (FWS 2003e). This mussel is also State-listed as endangered in Georgia. Historically, it occurred in the main channels and tributaries of the ACF Basin Rivers and Econfina Creek. It is currently considered extirpated from the main stems of the Chattahoochee, Apalachicola, and Suwannee Rivers, with known occurrences in the Econfina Creek, the Flint and Chipola Rivers, and various tributaries throughout its range (FWS 2003g). In a 1991 to 1992 survey, one specimen was found in a Chattahoochee River tributary. Populations of this species in Alabama are considered to be extirpated from their historic range (Brim Box 2000). The Gulf moccasinshell is found within the channels of small- to medium-sized creeks to large rivers with slow to moderate currents with sand and gravel or silty sand substrates. Fish hosts for this mussel include the blackbanded darter and the brown darter (*Etheostoma edwini*) (Brim Box 2000). The historic extent of occurrence for this species in the lower Chattahoochee River is 84 river miles, with a current extent of 9 river miles and approximately 2 known subpopulations (FWS 2003g). It is not expected that this species currently occurs in the lower Chattahoochee River in the vicinity of the Farley site.

The oval pigtoe was listed as a Federally endangered species on March 16, 1998 (63 FR 12664 [FWS 1998]) throughout its entire range; within this range it is known to occur in Georgia and Florida (FWS 2003f). This mussel is also State-listed as endangered in Georgia, and is a State protected species in Alabama. Its historic range includes the Suwannee drainage west to the Econfina Creek drainage (Brim Box 2000). The oval pigtoe occurs in small- to medium-sized creeks to small rivers and it uses silty sand to sand and gravel substrates, typically with slow to moderate currents. Stream channels provide the best habitat for this species. Glochidia use the sailfin shiner (*Pteronotropis hpselopterus*), eastern mosquitofish, and the guppy to host their transformation to juveniles (FWS 2003g). The historic extent of occurrence for this species in the lower Chattahoochee River is 84 river miles, with a current extent of 9 river miles, and one known subpopulation (FWS 2003g). No live specimens or shells were found in the Chattahoochee River mainstem during the 1991 to 1992 survey, although two shells were found in a tributary of this river (the Sawhatchee Creek). In 1994, additional live individuals were found in this tributary. This species is considered extirpated from its historic localities in the Chattahoochee River with the exception of the Sawhatchee Creek, located in southwestern Georgia (Brim Box 2000), and outside the area of the Farley site and its associated transmission lines. This species is not expected to currently occur in the lower Chattahoochee River in the vicinity of the Farley site.

These six mussels have dramatically declined and have been extirpated from the majority of their historic range by the impacts of human activities. These activities included the construction of impoundments, channelization, pollution, sedimentation, and other factors. Current threats to the remaining populations include habitat fragmentation or destruction by erosive land practices, construction of new impoundments, water withdrawals, and invasive species. Such activities result in mussel habitats impacted by sedimentation, turbidity changes, increased suspended solids, and pesticides. In particular, mussel species with low population levels and restricted ranges (especially the fat threeridge, Gulf moccasinshell, oval pigtoe, and purple bankclimber) are particularly vulnerable to toxic chemical spills and other catastrophic events, and further genetic isolation (FWS 2003g). However, the FWS recovery plan is addressing these remaining threats by applying knowledge of current freshwater mussel distributions and habitat needs in conjunction with the reduction or prevention of threats (through regulatory mechanisms, habitat restoration programs, and partnerships with various stakeholders) (FWS 2003g).

These mussel species are all highly restricted in distribution and typically occur in small subpopulations. Little evidence exists that these species will recover from their historic habitat losses without significant human intervention (FWS 2003g). As mentioned previously, no critical habitat has been designated for these six mussel species (FWS 2003a–f). A recovery plan was issued by the FWS in September 2003 that covers these species (FWS 2003g).

2.2.5.2 State-Listed Aquatic Species

Three State-listed fish may occur in counties within which the Farley site and its associated transmission lines are located: the bluestripe shiner (*Cyprinella callitaenia*), highscale shiner (*Notropis hypsilepsis*), and the Alabama shad. The bluestripe shiner is a State-threatened species in Georgia. It inhabits rivers, reservoirs, and large tributaries with slow to moderate currents over sand and gravel substrates. Its diet has not been studied, but is presumed to consist of drifting insects (Mettee et al. 1996). The highscale shiner is also a State-threatened species in Georgia. It inhabits small- to medium-sized streams in upland areas, with flows that occur over bedrock and sand substrates. It often occurs near the mouths of small tributaries, but its diet is unknown (Mettee et al. 1996). The Alabama shad is a candidate species in Georgia (FWS 2003j). SNC has not reported any occurrences of the bluestripe shiner, highscale shiner or Alabama shad within the vicinity of the Farley site or in aquatic habitats along the associated transmission lines, although aquatic species surveys have not been recently carried out by SNC (2003a).

Two State-listed reptiles and one State-listed amphibian may occur in counties within which the Farley site and its associated transmission lines are located: the Barbour's map turtle (*Graptemys barbour*), the alligator snapping turtle (*Macroclemys temminckii*), and the Georgia blind salamander (*Haideotriton wallacei*). Barbour's map turtle is State-listed as threatened in Georgia, State-protected in Alabama, and is a species of special concern in Florida. The species is confined to the Apalachicola drainage system, which includes the Flint River (Georgia), the Chattahoochee River, and streams that enter these two rivers. Rivers are the preferred habitat, especially those portions with strong current and areas of exposed limestone. Barbour's map turtles have been recorded in Houston County, Alabama (Lewis 2002); Jackson County, Florida (FNAI 2002b); and Baker, Decatur, Mitchell, Seminole, and Worth Counties, in Georgia (Krackow 2002). Barbour's map turtle has been recorded at Spring Creek less than 0.16 km (0.1 mi) from the South Bainbridge transmission line ROW in Decatur County, and at several locations on the Flint River within 5 km (3 mi) of the transmission line ROWs in Georgia (Krackow 2002). Therefore this species could occur on the Farley site along the Chattahoochee River, and where the Chattahoochee and Flint Rivers, and their tributaries, cross the transmission line ROWs. The Sinai Cemetery transmission line ROW does not cross any habitat preferred by these turtles. Therefore, the species is probably absent from the Sinai Cemetery ROW (Tetra Tech 2002b).

The alligator snapping turtle is State-listed as threatened in Georgia, as State-protected in Alabama, and as a species of special concern in Florida. It inhabits rivers, oxbows, and sloughs, and is also found in lakes and swamps near rivers. The alligator snapper rarely leaves the water, and is almost never found in isolated ponds and lakes (Shealey 1992a). It is the world's largest freshwater turtle, with recorded weights of over 220 pounds. Alligator snapping turtles have been recorded in Jackson County, Florida (Carmody 2002), and Baker, Decatur, Early, Miller, Mitchell, Seminole, and Worth Counties in Georgia (FWS 2002b). The species could occur along the Farley-associated transmission line ROWs where they cross water bodies. Alligator snapping turtles are probably absent from the Sinai Cemetery ROW, because the ROW does not pass over deep water bodies that are connected to rivers. No recent aquatic species surveys have been carried out by SNC, although this species has not been incidentally observed by SNC nor reported to SNC from its vegetation management contractors (SNC 2003a).

The Georgia blind salamander is State-listed as threatened in Georgia, and as a species of special concern in Florida. It is confined to subterranean waters in limestone sediments. Although it has been found mostly in caves, it may also occur in recharge areas around sinkholes. The Georgia blind salamander has not been recorded in Alabama. It is found in Jackson County, Florida, and in southwestern Georgia in Baker, Decatur, Miller, Mitchell, and Seminole Counties (FNAI 2002b; USGS 2003). It probably does not occur on Farley-associated transmission line ROWs in Georgia. It has not been recorded near the Sinai transmission line ROW in Florida (FNAI 2002a). The probability of Georgia blind salamanders along the Sinai ROW is unclear, because the species is entirely subterranean. The Sinai ROW does cross a few sinkholes in Jackson County, and thus the salamander might occur in some underground portions of the Sinai Cemetery ROW (Tetra Tech 2002b).

2.2.5.3 State Special-Status Aquatic Species

Table 2-2 lists a number of aquatic species that are not Federally or State-listed as threatened or endangered, but have been designated as either an Alabama State protected species, a Georgia rare species, or a Florida species of special concern. These include five fish species, two reptiles, one amphibian, and two freshwater mussels. The shoal bass *(Micropterus cataractae*) inhabits shoals and riffles of small to moderately fast-flowing streams, and are thought to avoid reservoirs (Mettee et al. 1996). The redeye chub (*Notropis harperi*) almost exclusively uses springs and spring runs for its habitat (Mettee et al. 1996). The bluenose shiner *(Pteronotropis welaka*) uses calm backwaters and vegetated streams and river pools with mud or sand bottoms (Mettee et al. 1996). The crystal darter (*Crystallaria asprella*) inhabits large flowing rivers and streams with sand and gravel bars (Mettee et al. 1996). The spotted bullhead (*Ameiurus serracanthus*) inhabits large streams and rivers, in slow to moderate currents over sand and rock substrates (Mettee et al. 1996). The Alabama map turtle (*Graptemys pulchra*) is listed as State-protected in Alabama and as rare in Georgia. It inhabits streams ranging from medium-sized creeks to large rivers. Sand bars and sandy beaches are required as nesting sites (Shealey 1992b). The Alabama map turtle does not inhabit the Chattahoochee River drainage and is not known to occur in Georgia counties crossed by the Farley-associated transmission line ROWs. It has been recorded in Montgomery County, Alabama, and its range also includes the Escambia River drainage in Pike County, Alabama. Thus, it could occur along the northern portion of the Snowdoun ROW, but does not occur on the Farley site or along other Farley-associated transmission line ROWs (Tetra Tech 2002a). The decline of the Suwannee cooter is largely due to human activities such as human predation, automobile strikes, and habitat contamination (Tetra Tech 2002a). The one-toed amphiuma *(Amphiuma pholeter)* inhabits swamps, marshes, drainage ditches, and streams (Miller 2003). The southern kidneyshell (*Ptchobranchus jonesi*) and southern sandshell (*Lampsilis australis*) use riverine warm-water association habitats with fine sediment bottoms or, more generally, rivers within the ACF Basin (Medlin 1999).

2.2.6 Terrestrial Resources

The Farley site is near the boundary of the Dougherty Plain and Southern Red Hills physiographic regions of the East Gulf Coastal Plain. There are two major topographical features at the site: (1) gently rolling upland west of the Chattahoochee River Valley, and (2) the river terraces and floodplain of the Chattahoochee River. This contributes to a diverse distribution of plant species, habitats, and communities. Habitats on the Farley site consist of river bluff forest, ravine forest, floodplain forest, pine-mixed hardwood forest, pine forest, non-floodplain wetlands, and mowed grassy areas (Tetra Tech 2002a). Historic descriptions of the site can be found in the *Final Environmental Statement Related to Construction of Joseph M. Farley Nuclear Plant Units 1 and 2* (AEC 1974).

The Chattahoochee River in the vicinity of Farley is bordered by a mature floodplain forest. Most of the floodplain forests of the Farley site are dominated by high floodplain or ridge floodplain species. On the highest ridges and in high floodplains, willow oak *(Quercus phellos*), Shumard oak (*Q. shumardii*), bitternut hickory (*Carya cordiformis*), sweet gum, swamp chestnut oak (*Q. michauxii*), and cherrybark oak are present. Sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), and black willow dominate early successional areas along the river. Bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), red maple, and laurel oak (*Q. laurifolia*) are commonly found in sloughs, backwaters, and poorly drained areas (Tetra Tech 2002a).

Steep, forested river bluffs occur along the Chattahoochee River within the Farley site, consisting of a mixed hardwood community of white ash (*Fraxinus americana*), southern magnolia (*Magnolia grandiflora*), black walnut (*Juglans nigra*), water oak, cherrybark oak, box elder (*Acer negundo*), and willow oak. The understory contains dwarf palmetto (*Sabal minor*), silverbell (*Halesia* sp.), American holly (*Ilex opaca*), black cherry (*Prunus serotina*), and buckthorn (*Rhamnus caroliniana*). The herbaceous layer is dominated by rich-soil floodplain species such as green dragon (*Arisaema dracontium*), Canada moonseed (*Menispermum canadense*), and southern pipevine (*Aristolochia tomentosa*) (Tetra Tech 2002a).

In areas where Wilson Creek has eroded deeply into the local limestone (marl), several botanically interesting ravines have formed. The largest ravine forest is on the northeastern edge of the Farley site, but ravine forests are also found on the western and southern margins of the site. The canopies of these ravine forests are dominated by beech (*Fagus grandifolia*), sweet gum, water oak, southern magnolia, tulip poplar, Florida maple (*Acer barbatum*), white oak, and white ash. Some of the beeches and maples are over 0.6 m (2 ft) in diameter. Florida maple, eastern hophornbeam (*Ostrya virginiana*), and blue beech (*Carpinus caroliniana*) dominate the understory of these forests. Large colonies of Venus/southern maidenhair fern (*Adiantum capillus-veneris*) and ovate maiden fern *(Thelypteris ovata*) occur on moist limestone bluffs in the ravines (Tetra Tech 2002a).

The pine-mixed hardwood forests found on the Farley site are primarily successional and recovering from past logging. The dominant pine in most areas is loblolly pine (*Pinus taeda*). Hardwood species usually encountered include red maple, sweet gum, water oak, hickories (*Carya* spp.), and other upland oaks (*Quercus* spp.) (Tetra Tech 2002a). These forests are managed for timber production as well as wildlife habitat, and periodic thinning occurs where necessary (SNC 2002b).

APC maintains approximately 526 ha (1300 ac) of the Farley site as a wildlife preserve. The Farley Wildlife Management Plan strategies include managing vegetation to promote and protect diverse habitats, periodic thinning or logging of pine timber stands, mowing grassy areas, and installing nest boxes. Nest boxes have been installed for wood ducks (*Aix sponsa*), eastern bluebirds (*Sialia sialis*), purple martins (*Progne subis*), kestrels (*Falco sparverius*), and barred owls (*Strix varia*), and a nest platform has been erected for ospreys (*Pandion haliaetus*)

(SNC 2002b). Additionally, SNC and APC perform construction and maintenance activities in accordance with APC's "Guidelines for Performing Power Line Construction and Maintenance in Areas of Gopher Tortoise Habitat" (APC 1995). The Wildlife Habitat Council has recognized Farley as a certified corporate wildlife habitat for its wildlife and land management efforts since 1992 (SNC 2003a).

Terrestrial wildlife species that occur in the forested portions of the Farley site are those typically found in similar habitats in South Alabama. Common mammals at the site include the opossum (*Didelphis virginiana*), armadillo (*Dasypus novemcinctus*), eastern cottontail (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Wading birds (egrets and herons) occur in wetlands and along the edges of ponds and the Chattahoochee River. Numerous bird species (e.g., eastern bluebirds, purple martins, common bobwhite [*Colinus virginianus*], blue jay [*Cyanocitta cristata*], and various warblers), as well as several reptile and amphibian species, including the Alabama State protected gopher tortoise (*Gopherus polyphemus*), occur at the site (SNC 2003a).

Six high-voltage (230 and 500 kilovolt [kV]) transmission lines originate at Farley and connect to six sub-stations (see Figure 2-5). Approximately 524 km (326 mi) of transmission line ROWs are associated with Farley. The standard width of the 500-kV transmission line ROWs is 45 m (150 feet), while the 230-kV transmission line ROWs are 38 m (125 feet) wide. Alabama counties crossed by the transmission line ROWs include Barbour, Dale, Geneva, Henry, Houston, Montgomery, and Pike. Georgia counties crossed by the transmission line ROWs include Baker, Decatur, Early, Miller, Mitchell, Seminole, Tift, and Worth Counties. Jackson County is the only county crossed by Farley-associated transmission lines in Florida.

The transmission line ROWs are located primarily within the East Gulf Coastal Plain physiographic province. The region is characterized by sandy soils and flat to gently rolling terrain. The slope, aspect, and underlying substrate of the soils play a significant role in determining the assemblage of plants and animals that occur in a given area. Because of the substantial length of the transmission line ROWs and the different directions they take from Farley, they transect a wide array of geophysical conditions that occur in the East Gulf Coastal Plain. Swamps, marshes, and river and creek crossings along transmission line ROWs provide habitats that appear suitable for several Federally listed and State-listed plant and animal species. Numerous marshes and beaver ponds were observed within the transmission line ROWs. These areas provide excellent foraging habitat for many wildlife species, some of which are listed species (Tetra Tech 2002a,b). Many animal species are highly mobile and use more than one habitat type. The transmission line ROWs provide an open canopy and offer an abundance of herbaceous ground cover. Thus, they can be natural avenues for movement and foraging by some animals, especially those that prefer open habitats (Tetra Tech 2002a).

The 230-kV line connecting Farley to the Webb substation near Dothan, Alabama, is about 17 km (11 mi) long and covers about 64 ha (159 ac). Land use in the vicinity of Webb transmission line ROW is largely agricultural and residential. Numerous homes are adjacent to the ROW, with hayfields, pastures, and row crops within or adjacent to the ROW. A few portions of the Webb ROW traverse small isolated wetlands and forested areas.

A 230-kV line carries power west from Farley to the Pinckard substation 50 km (31 mi) from Farley, covering approximately 190 ha (470 ac). The Pinckard transmission line ROW traverses land that is primarily agricultural and residential, but also crosses several streams, creeks, and wetlands, some of which are forested.

The 500-kV line ROW connecting Farley to the Snowdoun substation near Montgomery, Alabama, is about 155 km (96 mi) long and covers approximately 939 ha (2321 ac). Undulating hills and broad, shallow valleys are found in the northern portion of the Snowdoun ROW. Land use along the Snowdoun transmission line ROW is dominated by row crops and pine plantations. However, the ROW crosses several streams, creeks, and small rivers on its route to Montgomery.

The Farley to the Raccoon Creek-Tifton (Georgia) 500-kV line ROW is 151 km (94 mi) long, covering 692 ha (1709 ac). The Raccoon Creek-Tifton ROW traverses numerous pine plantations and agricultural tracts, but also crosses large expanses of natural habitats such as pine flatwoods, cypress ponds, swamps, wetland sinks, and pond cypress savannahs.

The Farley to South Bainbridge (Georgia) 230-kV line is 74 km (46 mi) long and covers 282 ha (697 ac) (AEC 1974). The Raccoon Creek-Tifton and South Bainbridge ROWs overlap for the first 11 km (7 mi) east of Farley. Land use in the vicinity of the South Bainbridge transmission line ROW is largely agricultural and rural, with large tracts of corn and hayfields. The ROW also traverses some moderately large areas of pine flatwoods (Tetra Tech 2002a).

The Farley to Sinai Cemetery (Florida) 230-kV transmission line ROW is approximately 77 km (48 mi) long, and covers approximately 236 ha (582 ac) (Tetra Tech 2002b). The Farley-to-Sinai Cemetery ROW primarily crosses agricultural lands, with soybeans, cotton, peanuts, and hay being the most common crops. At two locations in Alabama, the ROW crosses rolling hills drained by deeply cut creeks that flow into the Chattahoochee River. The banks, bluffs, and ravines of these creeks harbor a rich flora dominated by southern magnolia, American beech, Florida maple, and various species of ferns and herbaceous plant species that grow on calcium-rich soils. Along the Alabama-Florida boundary and southward into Jackson County, Florida, the landscape is dominated by large and small ponds and sinks. Many of these sinks are shallow and have been incorporated into agricultural usage as cattle ponds or simply wet spots in the fields. Other sinks, however, appear to provide potential habitat for State- and Federally listed plant species. However, the extensive withdrawal of groundwater by central-pivot irrigation and drought has dramatically reduced the water level in most of the sinks. The most common wetland species found in these sinks include pond cypress, black willow, buttonbush, woolgrass bulrush, plume grass, and needlerushes (Tetra Tech 2002b).

Transmission line ROWs are managed in Alabama by APC, in Georgia by Georgia Power Company (GPC), and in Florida by Gulf Power Company. APC, GPC, and Gulf Power use several methods to control vegetation in Farley transmission line rights-of-way. Dry upland areas (particularly those that are not subject to erosion) are generally periodically mowed, while steep slopes and margins of wetlands and streams are sprayed with approved (non-restricted) herbicides when necessary. Herbicides are applied by backpack sprayer to ensure that chemicals are used sparingly and applied directly to the brushy or woody vegetation. Some ecologically sensitive areas are hand-cleared. This integrated approach to vegetation management is intended to minimize soil loss and protect wetlands and streams from sedimentation. Mowing generally occurs on a three-year cycle in Alabama, a five-year cycle in Georgia, and a four- to six-year cycle in Florida, during the growing season (May to October, with the majority occurring in May and June).

Herbicide application occurs on a two-year cycle in Alabama, and may occur any time during the five-year mowing cycle in Georgia, generally once or twice during the five-year mowing cycle. Herbicide application occurs on a four- to six-year cycle in Florida. Danger trees (those located too near power lines and that may disrupt power) are removed as needed along transmission lines, with inspections occurring every 12 to 18 months. Some portions of the transmission line ROWs are cultivated by local farmers and, therefore, require no additional vegetation maintenance. Private interests that have agreed to handle vegetation maintenance are also maintaining other portions of the transmission line ROWs for wildlife enhancement.

APC participates with the U.S. Department of Agriculture Natural Resources Conservation Service and local soil and water conservation districts in a pilot project to enhance wildlife habitats along transmission line ROWs (Heitschmidt 2000). GPC participates in a wildlife management program with the Georgia Department of Natural Resources (GADNR) on Farley transmission line rights-of-way. The Wildlife Incentives for Non-Game and Game Species (WINGS) program is designed to help land users convert Georgia Power transmission line ROWs into productive habitat for wildlife. WINGS offers grant money and land management expertise to landowners, hunting clubs, and conservation organizations who commit to participating in the program for three years. GPC is one of two utilities funding the WINGS program in Georgia (SNC 2003a). GPC is also working with the Georgia Natural Heritage Program at GADNR to survey for sensitive species along transmission line rights-of-way. Contractors who perform work along the transmission line ROWs in Georgia are given a report that details work to be completed and delineates areas that have species of concern that need special treatment (e.g., hand clearing near wetlands and avoidance of gopher tortoise burrows). SNC and APC perform transmission line maintenance activities in accordance with APC's "Guidelines for Performing Power Line Construction and Maintenance in Areas of Gopher Tortoise Habitat" (APC 1995).

Table 2-3 presents terrestrial species that are listed, proposed for listing, or candidates for listing by the Federal government or the States of Alabama, Georgia, or Florida that could occur in the vicinity of Farley or its associated transmission line ROWs.

Table 2-3. Federally Listed and Georgia, Alabama, and Florida State-Listed Terrestrial Species Potentially Occurring in Baker, Coffee, Decatur, Early, Miller, Mitchell, Seminole, Tift, and Worth Counties (Georgia), Barbour, Dale, Geneva, Henry, Houston, Montgomery, and Pike Counties (Alabama), and Jackson County (Florida)[ab]

Scientific Name	Common Name	Federal Status	State Status AL	State Status FL	State Status GA
		AMPHIBIANS			
Ambystoma (Phaeognathus) cingulatum	flatwoods salamander	T	SP	SSC	T
Desmognathus monticola	seal salamander	—	SP	—	—
Hyla andersonii	pine barrens treefrog	—	SP	SSC	—
Notophthalmus perstriatus	striped newt	—	—	—	R
Rana capito	gopher frog	—	SP	SSC	—
		REPTILES			
Alligator mississippiensis	American alligator	T (S/A)	—	SSC	—
Drymarchon corais couperi	Eastern indigo snake	T	SP	T	T
Gopherus polyphemus	gopher tortoise	—	SP	SSC	T
Heterodon simus	southern hognose snake	—	SP	—	—
Masticophis flagellum flagellum	eastern coachwhip snake	—	SP	—	—
Pituophis melanoleucus mugitus	Florida pine snake	—	SP	SSC	—
		BIRDS			
Aimophila aestivalis	Bachman's sparrow	—	—	—	R
Aramus guarauna	limpkin	—	—	SSC	—
Egretta caerulea	little blue heron	—	—	SSC	—
Egretta thula	snowy egret	—	—	SSC	—
Egretta tricolor	tricolored heron	—	—	SSC	—
Elanoides forficatus	American swallow-tailed kite	—	—	—	R
Eudocimus albus	white ibis	—	—	SSC	—

(a) Species included in this table meet at least one of the following criteria:
– Species has been recorded to occur (or is likely to occur) on the Farley site or in at least one county traversed by Farley transmission lines.
– Species has been recorded within 5 km (3 mi) of the South Bainbridge or Raccoon Creek-Tifton transmission lines.
– Species was observed during SNC-commissioned field surveys conducted in 2001 to 2002 (Tetra Tech 2002a,b).
– Species was listed in correspondence between State and Federal agencies and SNC as potentially occurring on the Farley site or in counties crossed by transmission lines (SNC 2003a).

(b) E = endangered, T = threatened, C = candidate for Federal listing, R = Georgia rare species, SP = Alabama State protected species, SSC = Florida species of special concern, U = an unusual species, T(S/A) = threatened due to similarity of appearance, — = no listing

Scientific Name	Common Name	Federal Status	State Status AL	FL	GA
Falco sparverius paulus	southeastern American kestrel	—	—	T	—
Falco peregrinus tundrius	Arctic peregrine falcon	—	SP	E	E
Haliaeetus leucocephalus	bald eagle	T	SP	T	E
Mycteria americana	wood stork	E	SP	E	E
Pandion haliaetus	osprey	—	SP	—	—
Picoides borealis	red-cockaded woodpecker	E	SP	T	E
Rynchops niger	black skimmer	—	—	SSC	—
MAMMALS					
Corynorhinus (Plecotus) rafinesquii	Rafinesque's big-eared bat	—	SP	—	R
Geomys pinetis	southeastern pocket gopher	—	SP	—	—
Mustela frenata	long-tailed weasel	—	SP		—
Myotis austroriparius	southeastern bat	—	SP	—	—
Myotis grisescens	gray bat	E	SP	E	E
Myotis sodalis	Indiana bat	E	SP	E	E
Sciurus niger shermani	Sherman's fox squirrel	—	—	SSC	—
PLANTS					
Aquilegia georgiana var. australis	Marianna columbine	—	—	E	—
Arabis canadensis	sicklepod	—	—	E	—
Arnoglossum diversifolium (syn. *Cacalia diversifolia*)	variable-leaved Indian plantain	—	—	E	T
Asplenium heteroresiliens	Wagner spleenwort	—	—	—	T
Asplenium monanthes	single-sorus spleenwort, San Felasco spleenwort	—	—	E	—
Balduina atropurpurea	purple honeycomb head	—	—	—	R
Baptisia megacarpa	Apalachicola wild indigo	—	—	E	—
Brickellia cordifolia	Flyr's brickell-bush	—	—	E	—
Callirhoe papaver	poppy mallow	—	—	E	—
Calycanthus floridus	sweet shrub	—	—	E	—
Calystegia catesbeiana	Catesby's bindweed	—	—	E	—
Carex baltzellii	Baltzell sedge	—	—	T	E
Carex dasycarpa	velvet sedge	—	—	—	R
Croomia pauciflora	few-flowered croomia	—	—	E	T
Cryptotaenia canadensis	Canada honewort	—	—	E	—
Elliottia racemosa	Georgia plume	—	—	—	T
Epidendrum conopseum	green fly orchid	—	—	—	R
Evolvulus sericeus sericeus	creeping morning-glory, silver dwarf morning-glory	—	—	—	E
Fimbristylis perpusilla	Harper fimbry	—	—	—	E

Scientific Name	Common Name	Federal Status	State Status AL	FL	GA
Forestiera godfreyi	Godfrey's privet	—	—	E	—
Fothergilla gardenii	dwarf witch-alder	—	—	—	T
Hepatica nobilis	liverleaf	—	—	E	—
Hexastylis shuttleworthii var. harperi	Harper heartleaf	—	—	—	U
Illicium floridanum	Florida anise tree	—	—	T	E
Kalmia latifolia	mountain laurel	—	—	T	—
Lilium catesbaei	southern red lily	—	—	T	—
Lindera melissifolia	pondberry	E	—	—	E
Linum westii	West's flax	—	—	E	—
Litsea aestivalis	pondspice	—	—	E	T
Lythrum curtissii	Curtiss' loosestrife	—	—	E	T
Macranthera flammea	hummingbird flower	—	—	E	—
Magnolia ashei	Ashe's magnolia	—	—	E	—
Magnolia pyramidata	pyramid magnolia	—	—	E	—
Malaxis unifolia	green adders'-mouth	—	—	E	—
Marshallia obovata	Barbara's buttons	—	—	E	—
Marshallia ramosa	southern Barbara's buttons, pineland marshallia	—	—	E	R
Matelea alabamensis	Alabama milkvine	—	—	E	T
Matelea baldwyniana	Baldwyn's spiny-pod	—	—	E	—
Matelea floridana	Florida spiny-pod	—	—	E	—
Melanthium (Veratrum) woodii	Ozark bunchflower, Woods' false hellebore	—	—	E	R
Myriophyllum laxum	lax water-milfoil	—	—	—	T
Pachysandra procumbens	Allegheny spurge	—	—	E	—
Panicum (Dicanthelium) hirstii	Hirst's panic grass	C	—	—	E
Paronychia chartacea minima	Crystal Lake nailwort	T	—-	E	—
Pellaea atropurpurea	purple cliff brake	—	—	E	—
Penstemon dissectus	grit beardtongue	—	—	—	R
Physocarpus opulifolius	eastern ninebark	—	—	E	—
Physostegia leptophylla	narrowleaf obedient plant, narrowleaf dragon head	—	—	—	T
Pinckneya bracteata	hairy fever tree	—	—	T	—
Pinguicula planifolia	Chapman's butterwort	—	—-	T	—
Pinguicula primuliflora	clearwater butterwort	—	—	E	T
Platanthera ciliaris	yellow fringed orchid	—	—	T	—
Platanthera integra	yellow fringeless orchid	—	—	E	—
Platanthera nivea	snowy orchid	—	—	T	—
Ptilimnium nodosum	harperella	E	—	—	E

Scientific Name	Common Name	Federal Status	State Status AL	FL	GA
Rhododendron austrinum	orange azalea	—	—	E	—
Rhododendron prunifolium	plumleaf azalea	—	—	—	T
Ruellia noctiflora	white-flowered wild petunia	—	—	E	—
Sageretia minutiflora	climbing buckthorn (tiny-leaf buckthorn)	—	—	—	T
Salix eriocephala	heart-leaved willow	—	—	E	—
Salix floridana	Florida willow	—	—	E	E
Salvia urticifolia	nettle-leaved sage	—	—	E	—
Sarracenia flava	yellow pitcher plant	—	—	—	U
Sarracenia leucophylla	white trumpet, white-top pitcherplant	—	—	E	E
Sarracenia minor	hooded pitcherplant	—	—	T	U
Sarracenia psittacina	parrot pitcherplant	—	—	T	T
Sarracenia purpurea	decumbent pitcherplant, purple pitcherplant	—	—	T	E
Sarracenia rubra	sweet pitcherplant	—	—	T	E
Schisandra coccinea	scarlet magnoliavine	—	—	E	—
Schisandra glabra	bay star-vine	—	—	—	T
Schwalbea americana	American chaffseed	E	—	E	E
Sideroxylon (Bumelia) lycioides	silky buckthorn, gopherwood buckthorn	—	—	E	—
Sideroxylon (Bumelia) thornei	Thorne's (swamp) buckthorn	—	—	E	E
Silene polypetala	fringed campion	E	—	E	E
Silene regia	royal catchfly	—	—	—	R
Spigelia gentianoides	gentian pinkroot	E	—	E	—
Stewartia malacodendron	silky camellia	—	—	E	R
Stylisma pickeringii var. pickeringii	Pickering morning-glory	—	—	—	T
Thalictrum cooleyi	Cooley meadowrue	E	—	E	E
Torreya taxifolia	Florida torreya	E	—	E	E
Trillium lancifolium	narrow-leaved trillium	—	—	E	—
Trillium reliquum	relict trillium	E	—	—	E
Uvularia floridana	Florida merrybells, Florida bellwort	—	—	E	—
Xyris scabrifolia	Harper's yellow-eyed grass	—	—	T	—
Zanthoxylum americanum	northern prickly ash	—	—	E	—

Source: SNC 2003a; Tetra Tech 2002a,b

SNC commissioned field surveys in 2001 and 2002 of State- and Federally listed terrestrial plant and animal species on the Farley site and its transmission line ROWs. These surveys, described in reports entitled *Threatened and Endangered Species Surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Rights-of-Way, 2001–2002* (Tetra Tech 2002a) and *Threatened and Endangered Species Survey: Sinai Cemetery Transmission Line Right-of-Way* (Tetra Tech 2002b) were intended to: (1) identify listed species on the Farley site and associated transmission line ROWs, and (2) provide a basis for the assessment of potential impacts to these species from operations over the license renewal term. Although few listed species were observed along the transmission line ROWs, many animal species are mobile and secretive. Thus, the absence of a species during a few surveys is not necessarily evidence that the species does not use the area in question (Tetra Tech 2002a,b). Therefore, listed species that are thought to occur in counties crossed by the transmission line ROWs are also discussed.

2.2.6.1 Federally Listed Terrestrial Species

No areas designated by the U.S. Fish and Wildlife Service (FWS) as critical habitat for Federally listed threatened or endangered species exist on the Farley site or adjacent to associated transmission lines. The Raccoon Creek-Tifton transmission line ROW crosses the 2 km (1 mi) wide Elmodel Wildlife Management Area in western Georgia, approximately 61 km (38 mi) east-northeast of Farley. The South Bainbridge ROW crosses the Lake Seminole Wildlife Management Area in southwestern Georgia, approximately 58 km (36 mi) southeast of Farley. Otherwise, the transmission line ROWs do not cross any State or Federal parks, wildlife refuges, or wildlife management areas.

No Federally listed or proposed-for-listing plants were found during the 2001 to 2002 surveys of the Farley site and associated transmission line rights-of-way. Nine Federally listed terrestrial plant species and one Federal candidate are thought to occur in counties crossed by the transmission line ROWs but were not observed during plant surveys in 2001 or 2002 (Tetra Tech 2002a,b). These Federally listed species mainly occur either in Florida or Georgia. Although these species were specifically surveyed for in the transmission line ROWs and at Farley, they were not found in any of the survey sites (Tetra Tech 2002a,b).

Pondberry (*Lindera melissifolia*) is Federally listed as endangered, and State-listed as endangered in Georgia. It is thought to occur in Baker, Decatur, Tift, and Worth Counties, Georgia. Pondberry is a deciduous shrub, reaching heights of 0.5 to 2 m (1.6 to 6.5 ft), that often grows in thickets in shallow pools and along margins of cypress ponds and in seasonally wet low areas in bottomland hardwoods (Patrick et al. 1995). It is extremely rare and is primarily known from a few populations in Baker and Wheeler Counties in Georgia (FWS 1993). It is considered extirpated from Alabama and Florida (FWS 1993). Potential pondberry habitat occurs along the South Bainbridge and Raccoon Creek-Tifton transmission line rights-of-way, although pondberry was not observed there during site surveys (Tetra Tech 2002a). This species could be affected by transmission line ROW maintenance activities such as mowing and herbicide use that occurs near wetlands. However, because it is a shrub that would not respond well to ongoing mowing and herbicide application, and because of its extreme rarity (FWS 1993), this species is most likely absent from the transmission line rights-of-way.

Crystal Lake nailwort (*Paronychia chartacea minima*) is Federally listed as threatened and is State-listed in Florida as endangered. Crystal Lake nailwort is a short-lived (annual) mat-forming herb that is found along the margins of karst lakes in the Florida panhandle (FWS 1999). It is unlikely to be found along the Sinai Cemetery transmission line right-of-way, as the ROW does not pass close to any lakeshores. In addition, this species was not observed during ROW surveys (Tetra Tech 2002b). It is not expected to be found on the Farley site. The Crystal Lake nailwort apparently favors mild disturbance, prefers open habitats, and thrives in fire lanes and along sand roads (FWS 1999). Flowering occurs in late summer and fruits mature in September and October (FWS 1999). Therefore this species (if present) would benefit from ongoing mowing regimes in transmission line ROWs, because enough time passes between mowing events to allow for plants to mature and set seed.

Harperella (*Ptilimnium nodosum*) is Federally listed as endangered, and State-listed as endangered in Georgia. Harperella is an annual herb, reaching 10 to 40 cm (4 to 16 in.) tall, that is found in wet savannas, peaty fringes of pineland pools and cypress ponds in Alabama and Georgia (Patrick et al. 1995). It is also found on granite outcrops in Georgia (FWS 1990a). Harperella is not known to occur in Alabama at Farley or in counties crossed by the transmission line ROWs, but could potentially occur along the South Bainbridge transmission line ROW in Decatur County, Georgia (Krackow 2002). However, it was not observed there in site surveys (Tetra Tech 2002a). In addition, it has not been recorded within 5 km (3 mi) of the transmission line ROWs in Georgia (Krackow 2002). Therefore it is unlikely that this species is present along the transmission line ROWs. The primary threat to Harperella is lowering of the water table (FWS 1990a). As SNC does not manipulate water levels along transmission line rights-of-way, it is unlikely that maintenance of the ROWs would have a large effect on this species, if it were present. Mowing of stream banks/wetlands or application of herbicides might negatively affect this species, if it were to occur along the transmission line ROWs.

American chaffseed (*Schwalbea americana*) is Federally listed as endangered and State-listed as endangered in Florida and Georgia. American chaffseed is a perennial herb, reaching 50 to 70 cm (20 to 27 in.) height, which grows in fire-maintained wet savannas and in grassy openings and swales in longleaf pine woods (Patrick et al. 1995). It is thought to occur in Baker, Decatur, Early, Miller, Tift, and Worth counties in Georgia (Krackow 2002), and thus may potentially occur in appropriate habitats along the Raccoon Creek-Tifton and South Bainbridge transmission line rights-of-way, although it was not observed there during site surveys (Tetra Tech 2002a). This species is shade-intolerant and adapted to open conditions. In South Carolina, it is often found in powerline ROWs that experience frequent mowing (FWS 1995a). Thus, it appears that this species, if present, would benefit from ongoing transmission line ROW maintenance activities.

Fringed campion (*Silene polypetala*) is Federally listed as endangered and State-listed as endangered in Florida and Georgia. Fringed campion is a perennial, mat-forming herb that spreads by sending out long runners, which terminate in rosettes (Patrick et al. 1995). Each rosette produces one to several flowering shoots up to 40 cm (16 in.) tall (FWS 1992a). It occupies mature hardwood and hardwood-pine forests on river bluffs, stream terraces, moist slopes, and well shaded ridge crests (Patrick et al. 1995). Development and logging are the main cause for its decline (Krackow 2002). Fringed campion is thought to be present in Jackson County in Florida and Decatur County in Georgia, and thus may be present in appropriate habitats along the Sinai Cemetery and South Bainbridge transmission line rights-of-way. Because it is shade-tolerant and is negatively affected by activities that disturb the litter layer (Patrick et al. 1995), it is unlikely to be found along portions of the transmission line ROW that are regularly mowed or treated with herbicides. Thus, the fringed campion is unlikely to be affected by ongoing transmission ROW maintenance activities. However, it may potentially occur adjacent to transmission line ROWs in untreated areas, where it would be unaffected by transmission line maintenance activities.

Gentian pinkroot (*Spigelia gentianoides*) is Federally listed as endangered and State-listed as endangered in Florida. Gentian pinkroot is an extremely rare perennial herb with a single stem reaching 10 to 30 cm (4 to 12 in.) in height. It occupies mixed pine-hardwood forests and longleaf-wiregrass woods (FWS 1992b). Gentian pinkroot is present in Jackson County, Florida (Carmody 2002), and may occur in appropriate habitat along the Sinai Cemetery transmission line right-of-way, although it was not observed there during site surveys (Tetra Tech 2002b). As it is normally found in woodlands and forests, it is unlikely to occur in transmission line ROWs where ongoing maintenance activities such as mowing occur.

Cooley’s meadowrue (*Thalictrum colleyi*) is Federally listed as endangered and State-listed as endangered in Florida and Georgia. Cooley's meadowrue is a tall (1 m, or 3 ft) perennial herb that occurs in fine sandy loam in periodically disturbed open, seasonally wet pine-hardwood stands and in adjacent wet savannas (Patrick et al. 1995, FWS 1994). It may now be mainly limited to roadsides and power line ROWs in Georgia (Patrick et al. 1995). Cooley's meadowrue is thought to occur in Decatur, Tift, and Worth Counties in Georgia (Krackow 2002). Because it is known to reside in other power-line rights-of-way, it is possible that Cooley's meadowrue is present in appropriate habitats along portions of the Raccoon Creek-Tifton and South Bainbridge transmission line rights-of-way, although it was not seen there during the 2001 to 2002 plant surveys (Tetra Tech 2002a). As it prefers open, periodically disturbed habitats (FWS 1994), it is likely that ongoing transmission line ROW maintenance activities (mowing) would benefit this species, if it were present.

Florida torreya (*Torreya taxifolia*) is Federally listed as endangered and State-listed as endangered in Florida and Georgia. Florida torreya is a relatively small, conical, needle-bearing evergreen tree, reaching up to 14 m (45 ft) tall (Patrick et al. 1995; FWS 1991c). It occurs in beech-magnolia forests and in mixed hardwoods on middle slopes of steep ravines with nearly permanent seepage (steepheads) and on lower ravine slopes and adjacent floodplains (Patrick et al. 1995). This species is critically endangered due to a blight possibly associated with fire suppression (Esser 1993). Most mature trees in the wild have been killed by fungus and other infections, leaving only root sprouts that mostly grow to less than 3 m (10 ft) in height before becoming infected by the fungus (FWS 1991c). However, treatment with the commercial fungicide Maneb can successfully treat the fungus (Esser 1993). Florida torreya is thought to occur in Jackson County, Florida, and Decatur County, Georgia. Thus it could potentially occur on appropriate habitat along the Sinai Cemetery and South Bainbridge transmission line rights-of-way, although it was not seen there during the 2001 to 2002 plant surveys (Tetra Tech 2002a,b). This species is unlikely to occur on transmission line ROWs where mowing or herbicide application occurs (because most trees and large shrubs were removed when the ROWs were created), and therefore is unlikely to be affected by ongoing ROW maintenance activities.

Relict trillium (*Trillium reliquum*) is Federally listed as endangered and State-listed as endangered in Georgia. Relict trillium is a small perennial herb with three strongly mottled leaves on the end of a 5 to 25-cm long (2 to 10-in.) stem. It is mainly found in undisturbed hardwood forests in Alabama, Georgia and South Carolina (Patrick et al. 1995; FWS 1990b). Relict trillium is thought to occur in Henry County in Alabama (Lewis 2002) and Decatur, Early, and Tift Counties in Georgia (Krackow 2002), and thus may potentially occur along or near the Snowdoun, Raccoon Creek-Tifton, and South Bainbridge transmission line rights-of-way. However, as this species does not respond well to disturbance (FWS 1990b), it is unlikely to be found in the transmission line ROWs. Therefore it is unlikely to be significantly affected by ongoing ROW maintenance activities. In addition, mowing and herbicide use are unlikely to occur in the habitats occupied by this species.

Hirst's panic grass (*Panicum [Dicanthelium] hirstii*) is Federally listed as a candidate species and is State-listed as endangered in Georgia. Hirst's panic grass is a purplish-green grass reaching heights of 0.6 to 1.2 m tall (23 to 47 in.). It is found in small, seasonally wet ponds (Patrick et al. 1995). Hirst's panic grass has been recorded as occurring in Miller County, Georgia (USDA 2002), although it may be extirpated from Georgia (FWS 2002a). It may be present in appropriate habitat along the South Bainbridge transmission line right-of-way. The main cause for decline of Hirst's panic grass is drainage of wetlands and encroachment by woody vegetation (FWS 2002a). As water levels are not altered as part of transmission line ROW management activities and woody vegetation is controlled in transmission rights-of-way, this species (if present) is likely to be positively affected by ongoing ROW maintenance activities.

Eight Federally listed animal species are thought to occur in counties crossed by the transmission line ROWs. Two Federally listed animal species, the bald eagle (*Haliaeetus leucocephalus*), and the American alligator (*Alligator mississippiensis*) were observed during the special-status species surveys conducted in 2001 to 2002 (Tetra Tech 2002a,b).

Bald eagles are Federally listed as threatened, State-listed as endangered in Georgia, State-listed as threatened in Florida, and are State-protected in Alabama. Bald eagles occur in a wide variety of habitats, but proximity to water is important. Preferred habitat includes a high amount of water-to-land edge where prey is concentrated. Thus, bald eagles are generally restricted to coastal areas, lakes, and rivers. A bald eagle was observed on the eastern shoreline of the Chattahoochee River adjacent to Farley in Early County Georgia (Tetra Tech 2002a). Bald eagles are thought to occur in all counties of Alabama, Florida, and Georgia crossed by the transmission line ROWs (ADCNR 2003; FNAI 2002b; Krackow 2002). It is likely that bald eagles will be present on the Farley site and along associated transmission line ROWs, at least occasionally, especially in areas with river crossings or lakes.

The American alligator is State-listed in Florida as a species of special concern, and Federally listed as threatened due to its similarity in appearance to the endangered American crocodile (*Crocodylus acutus*). Alligator tracks were observed at the entrance to an alligator den on the Farley-Sinai Cemetery transmission line ROW in Jackson County, Florida, during the 2002 surveys (Tetra Tech 2002b). Alligators have also been observed on the Farley site in the service water pond (Causey 1993). Alligators can be found in appropriate habitat in Alabama, Florida, and southern Georgia (including the counties crossed by the transmission line ROWs) and undoubtedly occur in suitable habitat on Farley transmission line ROW lines (Tetra Tech 2002a,b; GMNH 2000a). Female alligators lay eggs in a nest constructed of leaves and other vegetation. These nests are fairly easy to recognize as they can reach 2.1 m (7 ft) in diameter and 1 m (3 ft) in height (GMNH 2000a).

No other Federally listed wildlife species were observed on the transmission line ROWs or Farley site during the 2001 to 2002 surveys.

Two Federally threatened and four Federally endangered terrestrial animal species are thought to potentially occur in counties occupied by Farley and its associated transmission line rights-of-way, but have not been observed there. The Federally threatened species are flatwoods salamander *(Ambystoma [Phaeognathus] cingulatum*) and Eastern indigo snake (*Drymarchon corais couperi*); the four Federally endangered species are wood stork (*Mycteria americana*), red-cockaded woodpecker *(Picoides borealis*), gray bat (*Myotis grisescens*), and Indiana bat (*Myotis sodalis*).

The flatwoods salamander is Federally listed as threatened, State-listed as threatened in Georgia, and State-protected in Alabama. This salamander inhabits pine-flatwoods-wiregrass communities that adjoin cypress heads or ponds without large predatory fish. Because of the absence of this habitat type on the Farley site, flatwoods salamanders are not expected to occur there. Flatwoods salamanders have been confirmed in Houston County, Alabama (Lewis 2002), Jackson County, Florida (FNAI 2002b), and Baker, Early, Miller, Tift and Worth Counties in Georgia (FWS 2002b). The flatwoods salamander has not been observed on the Farley site or associated transmission line ROWs. However, it is extremely cryptic and may be difficult to observe without extensive pit trapping (Tetra Tech 2002a,b). The flatwoods salamander is unlikely to occur along the transmission line ROWs, as they do not pass through habitat suitable for this species. There is a moderate possibility that it could occur in some areas adjacent to the ROWs (Tetra Tech 2002a,b).

The Eastern indigo snake is Federally listed as threatened, State-listed as threatened in Georgia, and is State-protected in Alabama. It typically inhabits dry areas that are bordered by water. Indigo snakes are found in southern Alabama, Georgia, and Florida, and typically spend the winter in gopher tortoise burrows (FWS 1991a). Indigo snakes are known to occur in Barbour, Dale, Geneva, Henry, Houston, Montgomery, and Pike Counties in Alabama (Lewis 2002); Jackson County in Florida (FNAI 2002b); and Baker, Decatur, Miller, Mitchell, Seminole, Tift, and Worth Counties in Georgia (FWS 2002b). The Eastern indigo snake has not been observed on the Farley site or along the associated transmission line ROWs. However, snakes are often difficult to detect, and therefore its presence cannot be ruled out on the Farley site and along the associated transmission line ROWs. Because of available habitat, Eastern indigo snakes could occur on the Farley site and along portions of the associated transmission line ROWs in Alabama, Georgia, and Florida (Tetra Tech 2002b).

The wood stork is Federally listed as endangered, State-listed as endangered in Georgia and Florida, and is State-protected in Alabama. Wood stork habitats include cypress/gum ponds, river swamps, marshes, and bays. They usually forage in shallow water (10 to 50 cm, or 6 to 20 in.), and are a highly gregarious species. Wood storks are thought to occur in Barbour and Montgomery Counties, Alabama; Jackson County, Florida; and Baker, Decatur, Early, Miller, Mitchell, Seminole, Tift, and Worth Counties in Georgia. Wood storks have not been observed on the Farley site or along the associated transmission line ROWs. There are no known stork rookeries in the vicinity of the Farley site or the associated transmission line ROWs in Alabama or Georgia (Tetra Tech 2002a). Florida natural Areas Inventory (FNAI) records (FNAI 2002a) indicate a possible wood stork rookery approximately 2 km (1 mi) southwest of the transmission line ROW in Jackson County, Florida, near Ocheesee Pond. Wood storks might forage, at least occasionally, in suitable wetlands in or near the transmission line ROWs (Tetra Tech 2002a,b).

The red-cockaded woodpecker is Federally listed as endangered, State-listed as endangered in Georgia and Florida, and is State-protected in Alabama. The red-cockaded woodpecker lives in groups and excavates cavities in living pines in open, mature pine stands with sparse midstory vegetation. Cavities are rarely found in trees as young as 30 to 40 years old, and most cavity trees are at least 80 years old. Ideal foraging habitat consists of pine stands with trees greater than 23 cm (9 in.) diameter at breast height (dbh), although they also forage in pine stands of 10 to 23 cm (4 to 9 in.) dbh, and sometimes in pines scattered through hardwood stands. Preferred habitat for this species does not exist on the Farley site (Tetra Tech 2002a). Some portions of the Raccoon Creek-Tifton ROW traverse what appears to be suitable red-cockaded woodpecker habitat. These areas were searched during the 2001 survey, but no red-cockaded woodpeckers or cavity trees were observed (Tetra Tech 2002a,b). Red-cockaded woodpeckers are thought to occur where suitable habitat exists in Barbour, Dale, Geneva, Henry, Houston, Montgomery and Pike Counties in Alabama (ADCNR 2003); Jackson County in Florida (Carmody 2002); and Baker, Decatur, Early, Miller, Mitchell, Seminole, Tift and Worth Counties in Georgia (FWS 2002b). Red-cockaded woodpeckers have not been observed on the Farley site or along the associated transmission line ROWs (Tetra Tech 2000a,b). The probability of this species occurring on the Farley site or along the associated transmission line ROWs is very low, due to the absence of suitable habitat on the Farley site and the absence of cavity trees in the limited suitable habitat along the associated transmission line ROWs.

The gray bat is Federally listed as endangered, State-listed as endangered in Florida and Georgia, and is State-protected in Alabama. It is thought to occur in Jackson County, Florida (Carmody 2002). It inhabits moist caves in limestone strata and forage primarily over water, up to 40 km (25 mi) from their cave roost. Gray bats have not been observed on the Farley site or along the associated transmission line ROWs in Alabama and Georgia, and they are not likely to occur in these regions due to the absence of caves. Jackson County has one of the highest concentrations of caves in Florida (Gore 1987). Large colonies of gray bats occur in Florida Caverns State Park, approximately 16 km (10 mi) from the Sinai Cemetery transmission line ROW. The FNAI (2002a) database did not contain any records of this species in the vicinity of the transmission line ROW. Because of the scarcity of open water bodies along the ROW, gray bats probably do not forage within the ROW (Tetra Tech 2002b). However, they might cross the ROW while traveling to and from foraging areas.

The Indiana bat is Federally listed as endangered, State-listed as endangered in Florida and Georgia, and is State-protected in Alabama. The Indiana bat is a migratory species, traveling as far as 483 km (300 mi) between winter and summer habitats (Humphrey 1992a). The species is apparently absent south of Tennessee during the summer (FWS 1991e). The Indiana bat has not been observed on the Farley site or its associated transmission line ROWs. There are no recorded occurrences of this species in Georgia or Alabama counties crossed by the transmission line ROWs. Because no hibernation caves are known to occur within the area encompassed by the Farley site and associated transmission line ROWs, the potential for occurrence of this species on the Farley site and along the ROWs is negligible. FNAI (2002b) data indicate that Indiana bats have been confirmed in Jackson County, but the FNAI (2002a) database did not contain any records of this species in the vicinity of the transmission line ROW, and no hibernation caves are known to occur in the vicinity of the transmission line ROW. Therefore, the potential for Indiana bats along the Sinai Cemetery transmission line ROW is low.

2.2.6.2 State-Listed Terrestrial Species

Two State-listed plant species (Thorne's [swamp] buckthorn [*Sideroxylon thornei*] and Florida willow [*Salix floridana]*), and two plant species listed as unusual by GADNR (yellow pitcher plant (*[Sarracenia flava*] and hooded pitcher plants (*[Sarracenia minor]*) were found in plant surveys in 2001 to 2002 (Tetra Tech 2002a,b). The pitcher plants were found on the Farley-Raccoon

Creek-Tifton transmission line; no other State-listed plant species were observed on the transmission line ROWs during the surveys (Tetra Tech 2002a,b).

Thorne's buckthorn (*Sideroxylon thornei*) [*Brumelia*] is State-listed as endangered in Florida and Georgia. Thorne's buckthorn is found in oak flatwoods where the soil is saturated for long periods, such as calcareous swamps and woods bordering cypress ponds (Patrick et al. 1995). During the 2001 to 2002 plant surveys it was found on the Farley-Raccoon Creek-Tifton transmission line ROW in Early County, Georgia. It is also found in Houston County, Alabama; Jackson County, Florida; and Baker, Decatur, Miller, Seminole, Tift, and Worth Counties in Georgia. Thus there is a possibility this species may be found in appropriate habitat on the Farley site and on the Sinai Cemetery, South Bainbridge, and Raccoon Creek-Tifton transmission line rights-of-way.

Florida willow (*Salix floridania*) is State-listed as endangered by Florida and Georgia. Florida willow is found along marshy shores of spring-fed woodland streams or in openings of boggy woods (Patrick et al. 1995). In 2001 to 2002 it was observed along the edge of the Raccoon Creek-Tifton and South Bainbridge ROWs where they overlap east of Farley in Early County, Georgia (Tetra Tech 2002a,b). Florida willow is also thought to occur in Jackson County, Florida, and Decatur County, Georgia. Thus it may potentially occur in appropriate habitat along the Sinai Cemetery transmission line ROW.

State-listed animal species observed on the Farley site and related transmission line ROWs during recent surveys include the gopher tortoise (*Gopherus polyphemus*), eastern coachwhip snake (*Masticophis flagellum flagellum*), dusky gopher frog (*Rana capito*), osprey (*Pandion haliaetus*), and southeastern pocket gopher (*Geomys pinetis*). In addition, Bachman's sparrow *(Aimophila aestivalis*), listed as rare in Georgia, and little blue heron (*Egretta caerulea*) listed as a species of special concern in Florida, have been observed on Farley transmission line rights-of-way. Bachman's sparrows were heard singing at two locations on the Farley-South Bainbridge ROW. The little blue heron was observed foraging in a marsh on the Farley-Sinai Cemetery ROW.

The gopher tortoise is State-listed as protected in Alabama, threatened in Georgia, and as a species of special concern in Florida. It is also Federally listed as threatened, but only west of Mobile and Tombigbee Rivers in Alabama, which is outside of the range of the Farley properties. Gopher tortoises occur in well-drained sandy soils in transitional (forest and grassy) areas. It is commonly associated with a pine overstory and an open understory with a grass and forb groundcover and sunny areas for nesting (FWS 1991d). Active gopher tortoise burrows were observed on the Farley site and within all six Farley-associated transmission line ROWs. The activities required for vegetation maintenance in transmission line ROWs can actually provide habitat more favorable to the gopher tortoise than in areas outside the ROWs. Specifically, the ROWs often provide this State-listed species with food in the form of abundant herbaceous vegetation and open sunlit sites for nesting. In some areas, these conditions occur infrequently in habitat beyond the transmission line ROW edges, especially in the prolonged absence of fire (Tetra Tech 2002a,b).

Ospreys are State-listed as protected in Alabama. Ospreys are primarily found near water, where they hunt for fish and other aquatic vertebrates. They nest in trees, snags, telephone poles, and other manmade structures (GMNH 2000b). Adult and nestling ospreys were observed on the Farley site on a nesting platform erected for this species between the Chattahoochee River and the power production facilities. An osprey was also seen flying over the South Bainbridge ROW at the Lake Seminole (Flint River) crossing in Georgia. Ospreys are thought to occur in Montgomery County in Alabama, so may occur along the Snowdoun transmission line ROW. They are also thought to occur in Jackson County in Florida, and Tift County in Georgia. However, they are not State-listed in Florida or Georgia.

Gopher frogs are State-listed as protected in Alabama and as a species of special concern in Florida. The dusky gopher frog is found in pine scrub and sandhills, near ponds (GMNH 2000c). They are known to occur in Barbour County, Alabama; Jackson County, Florida; and Baker, Seminole, and Tift Counties in Georgia. They also are likely to occur in other counties in Georgia crossed by transmission line ROWs (GMNH 2000c). Three dusky gopher frogs were observed in a gopher tortoise burrow on the South Bainbridge ROW in Seminole County, Georgia (Tetra Tech 2002a,b). Gopher frogs could occur in appropriate habitat found along the Snowdoun, Raccoon Creek-Tifton, South Bainbridge, and Sinai Cemetery transmission line rights-of-way.

Eastern coachwhip snakes are listed as State-protected in Alabama. They occur in pine and palmetto flatwoods, sandhills, scrub, and along beach dunes (FMNH 2000). Eastern coachwhip snakes were observed near the Flint River on the Raccoon Creek-Tifton ROW and on the Sinai transmission line ROW in Jackson County, Florida. Eastern coachwhips are not State-listed in Georgia or Florida where they were observed. Eastern coachwhip snakes are thought to occur in Barbour County, Alabama (Lewis 2002), and thus may occur in or near the Snowdoun transmission line ROW.

Southeastern pocket gophers are listed as State-protected in Alabama. They occur in upland areas with dry sandy soils or well-drained fine-grained gravelly soils (GMNH 2000d). Southeastern pocket gophers were observed on transmission lines in Florida; this species is not State-listed in Florida (Tetra Tech 2002a,b). They are known to occur in Dale and Houston Counties in Alabama (Lewis 2002), so they may potentially occur on the Farley site and associated transmission line ROWs that cross those counties. They are also found in all counties crossed by transmission line ROWs in Florida and Georgia, but are not State-listed in these areas.

There are nine species of State-listed or State-protected animal species that were not observed during the surveys but may occur, at least occasionally, within or adjacent to the Farley site and transmission line rights-of-way. These are discussed below.

The southeastern American kestrel (*Falco sparverius paulus*) is State-listed as threatened in Florida. It is one of two subspecies of the American kestrel that occur in Alabama, Florida, and Georgia. The northern subspecies *(F. s. sparverius*) is a winter resident only, and is not Federally or State-listed in Alabama, Georgia, or Florida. The southeastern subspecies is a year-round resident. Southeastern kestrels are found in open pine habitats, woodland edges, prairies, and pastures. Nest sites are tall dead trees or utility poles generally with an unobstructed view of surroundings, and woodpecker cavities. Sandhill habitats seem to be preferred, but kestrels may also occur in flatwoods settings. Open patches of grass or bare ground are needed in flatwoods settings, because thick palmettos prevent detection of prey (FNAI 2001b). The southeastern American kestrel occurs in Jackson County (Carmody 2002), and probably forages along some portions of the Sinai Cemetery transmission line ROW. It is also present in south and central Alabama and Georgia (NatureServe 2003), and may be found along transmission line ROWs in those states.

The peregrine falcon (*Falco peregrinus*) is State-listed as endangered in Florida and Georgia and as State-protected in Alabama. FWS formerly listed the American peregrine falcon *(F. p. anatum*) as endangered. Because of the similar appearance among subspecies, FWS also listed the general species (*Falco peregrinus*) as endangered. The peregrine falcon (including all subspecies) was removed from the Federal list on August 25, 1999. Peregrine falcons formerly nested throughout most of the U.S., but there have been no reports of nesting in the southeastern U.S. in many years. Wintering peregrine falcons are sometimes observed in the southeastern U.S., usually in coastal areas. Typical winter habitats consist of coastal shorelines, as well as lake and river margins, ponds, sloughs, and marshes near the coast. Because there have been no reports of nesting in the southeastern United States in many years, and since wintering falcons are essentially coastal, the possibility of peregrine falcons nesting or foraging along the transmission line ROW is very low (Tetra Tech 2002b).

The pine barrens tree frog (*Hyla andersonii*) is listed as State-protected in Alabama and as a species of special concern in Florida. They inhabit hillside seepage bogs. Adults forage in evergreen bog shrubbery and tadpoles develop in small pools of clear seepage water in the bogs (Means 1992a). This species is found along the Florida-Alabama border, and is not known to occur in Georgia. Within Alabama it is known only from Escambia, Covington, and Geneva counties (Means 1992a; Lewis 2002). Approximately 2 km (1 mi) of the Pinckard transmission line ROW traverses Geneva County, but there is no seepage bog habitat in that portion of the ROW, or in other nearby Farley-associated transmission line ROWs (Tetra Tech 2002a). Within Florida the pine barrens tree frog is found in Santa Rosa, Okaloosa, Walton, and Holmes Counties, which lie west of the Sinai Cemetery transmission line ROW (Means 1992a). No seepage bog habitat was observed on the Sinai ROW. Thus, the probability of the pine barrens tree frog occurring along the ROWs or on the Farley site is negligible (Tetra Tech 2002a,b).

Seal salamanders (*Desmognathus monticola*) are State-protected in Alabama. Seal salamanders are associated with rocky, small streams and creeks, usually in hardwood ravines

(Means 1992b). Seal salamanders are primarily Appalachian but can be found in scattered populations throughout Alabama, northwestern Florida, and northwestern Georgia (USGS 2002). Seal salamanders are known to occur in Henry County (Lewis 2002). Most seal salamander populations are to the north or west of Farley and the associated transmission line ROWs (Means 1992b, Tetra Tech 2002a,b). Seal salamander habitat occurs along Wilson Creek on the Farley site and in portions of the Snowdoun ROW. Thus, its existence is possible, but probably unlikely, on the Farley site and on the Snowdoun ROW. It is not likely to occur on the other transmission line ROWs, due to the lack of appropriate habitat and to the species' restricted geographic range (Tetra Tech 2002a).

The Florida pine snake (*Pituophis melanoleucus mugitus*) is listed as State-protected in Alabama and as a species of special concern in Florida. It occupies habitats with relatively open canopies and dry soils, such as sand pine scrub, sandhills, pine flatwoods on well-drained soils, and old fields on former sandhill habitats (FNAI 2001a). It is extremely fossorial, and seeks out burrows of rodents and gopher tortoises (Franz 1992). This snake is restricted to Florida and Coastal Plain areas of Alabama, Georgia, and South Carolina. Florida pine snakes have been recorded in Jackson County, Florida (Carmody 2002), and Baker and Tift Counties in Georgia (GADNR 2003). Florida pine snakes are not likely to occur on the Farley site due to the absence of xeric habitats, but the species might occur in portions of the Webb, Pinckard, and South Bainbridge transmission line ROWs (Tetra Tech 2002a). Suitable habitats for this species are rare on the Raccoon Creek-Tifton and Snowdoun ROWs, and most of the Snowdoun ROW is outside the species' known geographic range (Tetra Tech 2002a). Florida pine snakes might also occur within the Sinai Cemetery transmission line ROW where the ROW crosses suitable habitats (Tetra Tech 2002b).

The Southern hognose snake (*Heterodon simus*) is listed as State-protected in Alabama. It is found primarily in dry sandy habitats such as sandhills, pine/turkey oak woodlands, and scrub. It is semi-fossorial and its diet consists almost exclusively of frogs and toads (Mount 1975; Tennent 1997). It is has been recorded in Dale County, Alabama (Tuberville 2002); Jackson County, Florida (FNAI 2002b); and Baker, Decatur, Early, Miller, Mitchell, and Tift Counties in Georgia (GADNR 2003). The Southern hognose snake may occur along portions of the transmission line ROWs, but is less likely to occur on the Farley site due to the absence of its preferred habitat. The Southern hognose snake might occur, at least occasionally, along portions of the Sinai transmission line ROW.

Rafinesque's big-eared bat (*Corynorhinus [Plecotus] rafinesquii*) is listed as State-protected in Alabama and rare in Georgia. This bat is found in forested areas and swamps, especially in pine flatwoods and pine-oak woodlands. It roosts in hollow trees, under bark, in old cabins and barns, and in wells and culverts (GMNH 2000e). Because of its large geographic range (the entire southeastern United States), Rafinesque's big-eared bat might occur along the transmission line ROWs and on the Farley site (Tetra Tech 2002a).

The southeastern bat (*Myotis austroriparius*) is listed as State-protected in Alabama. It inhabits caves, hollow trees, attics and crevices of buildings, concrete storm sewers, and other dark cavities. The species is found in southern Alabama, southern Georgia, and in the northern two-thirds of Florida. Tens of thousands of southeastern bats have been recorded in Jackson County caves (Gore 1987). They appear to prefer foraging over water (Humphrey 1992b). Southeastern bats have been recorded in Barbour County, Alabama (Lewis 2002), Jackson County, Florida (FNAI 2002b), and Decatur and Miller Counties, Georgia (GADNR 2003). Southeastern bats might be present along the transmission line ROWs and could occur on the Farley site (Tetra Tech 2002b).

The long-tailed weasel (*Mustela frenata*) is listed as State-protected in Alabama. It is found in forested and open habitats and occupies a wide variety of terrestrial communities. It inhabits shallow ground burrows, or in crevices of logs or stumps (NatureServe 2003). Because of their wide geographic range (throughout the United States) and unrestricted habitat preferences, they may occur on the Farley site and along all associated transmission line ROWs (Tetra Tech 2002a,b).

2.2.7 Radiological Impacts

SNC conducts an annual radiological environmental monitoring program (REMP) in and around the Farley plant. This program was initiated in 1975 before Unit 1 operation began in 1977 (SNC 2003b). Through this program, radiological impacts to workers, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are to

- Determine the levels of radiation and the concentrations of radioactivity in the environment and;

- Assess the radiological impact to the environment due to the operation of the Joseph M. Farley Nuclear Plant.

Radiological releases are summarized in two annual reports: *Joseph M. Farley Nuclear Plant Annual Radiological Environmental Operating Report* (SNC 2003c) and *Joseph M. Farley Nuclear Plant Revision to Annual Radioactive Effluent Release Report* (SNC 2003b). The limits for all radiological releases are specified in the Farley Plant ODCM (Carr 2000). These limits are designed to meet Federal standards and requirements. The REMP details the sample types to be collected and the analyses to be performed in order to monitor the airborne, direct radiation, waterborne, and ingestion pathways, and also delineates the collection and analysis frequencies. In addition, the REMP describes the locations of the indicator, community, and control stations that are monitored on an annual basis.

SNC's review of historic data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of Farley were a small fraction of the limits specified in the SNC ODCM (Carr 2000) to meet EPA radiation standards in 40 CFR Part 190 as required by 10 CFR 20.1301(d). The most recent environmental radiation monitoring and surveillance program reports issued by the States of Georgia (GADNR 2000) and Alabama (ADPH 2003) also confirmed that the Farley plant had a negligible radiological impact on the states' environment.

For 2002 (the most recent year that data were available), dose estimates were calculated based on actual liquid and gaseous effluent release data (SNC 2003b). Dose estimates were performed by SNC using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM. An assessment of doses to the maximally exposed individual from gaseous and liquid effluents was performed by SNC for locations representing the maximum dose. In all cases, doses were well below the technical specification limits as defined in the ODCM (SNC 2003b). A breakdown of the maximum dose to an individual located at the Farley plant boundary from liquid and gaseous effluents released during 2002 are summarized as follows:

- Total body dose from liquid effluents at the site discharge was 2.96×10^{-4} mSv (2.96×10^{-2} mrem), which is about 0.49 percent of the 0.06 mSv (6 mrem) dose limit specified in 10 CFR Part 50, Appendix I. The critical organ dose due to the liquid effluents at the site discharge was 8.06×10^{-4} mSv (8.06×10^{-2} mrem). This dose was about 0.05 percent of the 0.20 mSv (20 mrem) dose limit (SNC 2003b).

- The air dose due to noble gases in gaseous effluents was 4.04×10^{-4} mSv (4.04×10^{-2} mrad) gamma (0.20 percent of the 0.20 mGy [20 mrad] gamma dose limit), and 1.43×10^{-4} mGy (1.43×10^{-2} mrad) beta (0.04 percent of the 0.40 mGy [40 mrad] beta dose limit) (SNC 2003b).

- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days was 1.79×10^{-5} mSv (1.79×10^{-3} mrem), which is 0.006 percent of the 0.30 mSv (30 mrem) dose limit (SNC 2003b).

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Farley plant 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 following: applicant's ER (SNC 2003a); supplemental information submitted on November 3, 2003, by SNC (Beasley 2003); and information obtained from county and city staff, businesses, and community groups from January 6 to January 9, 2004. The following information describes the economy, population, and communities near the Farley site.

2.2.8.1 Housing

Approximately 900 permanent employees and 375 contract and matrixed employees work at Farley. Approximately 77 percent of these employees live in Houston County, Alabama. The remaining 23 percent are distributed across 22 counties in Alabama, Georgia, and Florida, with numbers ranging from 1 to 76 employees per county. Given the predominance of SNC employees living in Houston County and the absence of the likelihood of significant socioeconomic effects in other locations, the focus of the analyses undertaken in this supplemental Environmental Impact Statement (SEIS) is on this county.

SNC refuels Farley Units 1 and 2 on an 18-month cycle. During refueling outages, site employment increases by as many as 800 temporary workers for 30 to 40 days. Many of these workers are assumed to be temporarily located in the same geographic areas as the permanent staff.

Table 2-4 provides the number of housing unit vacancies for Houston County for 1990 and 2000, the latest year for which information is available. Most of the new housing has been developed around the Dothan Metropolitan Area in conjunction with the retail and medical industries.

Table 2-4. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Percentage Change
Housing Units	30,844	39,571	+28
Occupied Units	28,492	35,834	+26
Vacant Units	2,352	3,737	+59

Sources: USCB Table DP 1, General Population and Housing Characteristics, 1990; Geographic Area Houston County, Alabama, and USCB Table DP 1, Profile of General Demographic Characteristics, 2000, Geographic Area Houston County, Alabama.

2.2.8.2 Public Services

- **Water Supply**

This discussion of public water systems focuses on Houston County because approximately 77 percent of the Farley employees reside in this county. Local municipalities provide public potable water service to residents who do not have individual onsite wells. These providers are subject to regulation under the Federal Safe Drinking Water Act, as implemented by the Alabama Department of Health.

Water related resource problems were identified as potential barriers to future development in Houston County due to both residential and industrial demand. Over the past 20 years, groundwater overdraft areas have developed within the region. The potentiometric surface in the vicinity of Dothan, Fort Rucker (Dale County), and Enterprise (approximately 40 km [25 mi] west of Dothan and 50 km [31 mi] from Farley) have experienced significant declines in the Nanafalia-Clayton aquifer, which is the major water supply in the area. The city of Dothan has reported a decline of 30 m (100 ft) in the depth of the aquifer, and a recommendation has been made by the U.S. Department of Agriculture (USDA), the U.S. Natural Resources Conservation Service, and the U.S. Forest Service that all water systems in the area develop a 10 to 20-year plan for additional water supplies (SEARP & DC 1998). The city of Dothan, the nearest urban area to Farley, is serviced by Dothan Utilities, the largest potable water supplier in Houston County. Water is pumped from various shallow and deep groundwater wells located throughout the Dothan area. As the city grows and new development occurs, water mains are constructed and extended to meet the increased demand (City of Dothan 2001). Dothan likely will need additional water sources and conservation measures by as early as 2020. One of the options the city is considering is constructing, by 2011, a 38 million L/day (10 million gallon per day [gpd]) surface water treatment plant on the Chattahoochee River upstream of Farley between Columbia and Farley. This treatment plant would be expandable to 76 million L/day (20 million gpd). The plant would connect to the city via a 91-cm (36-in.) pipe. The city should make a decision on constructing this plant by 2006 (SNC 2003a). Table 2-5 provides the details of Houston County's respective water suppliers and capacities.

Table 2-5. Major Public Water Supply Systems in Houston County

Water System	Maximum Daily Capacity m^3/s (ft^3/s)	Average Daily Capacity m^3/s (ft^3/s)
Avon Water Supply	N/A	0.0023 (.08)
Columbia Water Works	0.022 (0.78)	0.005 (0.18)
Cottonwood Water Works	0.038 (1.34)	0.011 (0.37)
Cowarts Water System	0.038 (1.34)	0.011 (0.40)
Gordon Water Works	0.016 (0.56)	0.002 (0.07)
Houston County Water Authority	0.025 (0.89)	0.008 (0.30)
Kinsey Water System	0.037 (1.30)	0.008 (0.28)
Taylor Water System	0.07 (2.40)	0.020 (0.71)
Webb Water System	0.013 (0.45)	0.006 (0.21)
Dothan Utilities	1.40 (49.51)	0.606 (21.39)

Source: Chapman 2001

- **Education**

In 2002, 14,855 students attended Houston County mainstream public schools. Although the region's two school districts do not keep track of the number of Farley employees' children attending district schools, it is likely that they are served by these schools because approximately 77 percent of the employees live in Houston County.

- **Transportation**

Road access to Farley is via State Road 95, a two-lane paved road with a north to south orientation. State Road 95 passes through the towns of Columbia and Gordon. Employees traveling from Dothan use either U.S. 84 or State Road 52. U.S. 84 is a four-lane highway that intersects with State Road 95 near Gordon, and State Road 52 crosses State Road 95 southwest of Columbia. The Alabama Department of Transportation maintains level-of-service designations for roadways in the state. Traffic counts determining the average number of vehicles per day are available for selected state-maintained routes. Table 2-6 lists roadways in the vicinity of Farley and the average number of vehicles per day, as determined by the Alabama Department of Transportation (ADOT 1998).

Table 2-6. Traffic Counts for Roads in the Vicinity of Farley

Roadway and Location	Annual Average Daily Traffic
State Road 95, near Farley	710
State Road 95, near Columbia	1,010
State Road 95, near Gordon	640
State Road 52, Dothan	8,280
State Road 52, approximate midpoint between Dothan and Columbia	4,990
State Road 52, near Columbia	4,720
U.S. 84, Dothan	14,610
U.S. 84, approximate midpoint between Dothan and Gordon	8,820
U.S. 84, near Gordon	6,060

Source: ADOT 1998

2.2.8.3 Offsite Land Use

Houston County occupies roughly 150,320 ha (371,456 ac) of land area (SNC 2003a). As shown in Table 2-7, major county-wide land use categories include the following: residential (2.9 percent), commercial (0.3 percent), industrial (0.3 percent), transportation (4.3 percent), public and semi-public (1.8 percent), agricultural (43.4 percent), forest (33.7 percent) and other (13.3 percent). Most land in the county is rural in nature, either vacant, forested, or in agricultural production. Approximately 115,897 ha (286,428 ac) or 77 percent of the county, is forested or used as farmland (SEARP & DC 1998). This rural agricultural character is found throughout the county, with the exception of the city of Dothan. Roadways and residential development are the largest non-agricultural uses of land in Houston County.

The majority of employees (77 percent) live in Houston County, and Farley pays property taxes to Houston County. This county has experienced growth over the last several decades and land use planning, such as zoning, have guided growth and development. Regional and local planning officials share the goals of encouraging growth and development in areas where public infrastructure, such as water and sewer systems, are planned, and discouraging strip development and incompatible land use mixes in contiguous areas. As demonstrated below, there is no specific land use plan for Houston County. However, a regional economic planning agency, the Southeast Alabama Regional Planning and Development Commission (SEARP & DC 1998), provides regional comprehensive land use planning services that guide development for the seven-county region known as the Southeast Alabama Regional Economic Development District. The region includes Barbour, Coffee, Covington, Dale, Geneva, Henry, and Houston counties. Additionally, the city of Dothan has developed a land use plan that is used for planning efforts within city limits. No plans within this region contain growth control measures that limit housing development (SEARP & DC 1998).

Table 2-7. Land Use in Houston County, 1999

Land Use	Hectares	Acres	Percent of Total
Residential	4,359	10,772	2.9
Commercial	451	1,114	0.3
Industrial	451	1,114	0.3
Forest	50,658	125,181	33.7
Recreation	2,706	6,686	1.8
Transportation and utilities	6,464	15,973	4.3
Agriculture	65,239	161,212	43.4
Other	19,993	49,404	13.3
Total	150,321	371,456	100.0

Source: SNC 2003a

The city of Dothan, 27 km (17 mi) west of Farley, is the largest urban area in Houston County. Land use in the city may be categorized as follows: agricultural and non-urban (58 percent), residential (23 percent), commercial (8 percent), industrial (5 percent), recreational (3 percent), public and semi-public (2 percent), and other (1 percent). Most land (58 percent) identified as forest, agricultural, and other (non-urban) is located outside of the city proper. Residential and commercial uses are the two largest urban categories.

Most development in Dothan centers around the existing infrastructure, notably the transportation and sanitary sewer networks. Dothan has completed a program to build three new fire stations, construct new wells, and install approximately 12,192 m (40,000 ft) of sanitary sewer collection and interceptor lines. In addition, much of the city's development over the last 25 years has occurred in the northwestern and western portions of the city, which are generally well served by arterial and collector streets, as well as the Beaver Creek and Little Choctawhatchee Wastewater Treatment Plants. Outside of the Ross Clark Circle, development has historically been less intense. The overall effect has been to create an unbalanced pattern of development. The portion of the city located within Ross Clark Circle, where sanitary sewer service is generally available and where most of the property has access to major transportation arteries, is almost fully developed.

Commercial land uses account for approximately eight percent of the land in Dothan. To a great extent, commercial development has "shadowed" residential development over the past two decades. A significant portion of the commercial development has taken place along major thoroughfares in the northwestern and western areas of the city. The character of commercial development throughout the city varies, depending on its relative proximity to other land uses and the characteristics of the roads on which the development is located. The past decade has seen a reversal of the decline of the city's core central business district, with growth in traditional retail activity including a number of restaurants, clubs, and specialty shops.

Industrial uses occupy approximately five percent of the land, and most of the county's major employers are located in or near the city of Dothan. Industrial activity is widely scattered throughout Dothan because industrial facilities often need to be located near major transportation arteries. There is a considerable amount of undeveloped land, which has been zoned for industrial use, outside of the Ross Clark Circle.

2.2.8.4 Visual Aesthetics and Noise

Farley is situated on the west bank of the Chattahoochee River. The local terrain is level to gently undulating. The area around Farley is largely rural, characterized by farmland, forest, and small residential communities. Each unit has three 14-cell cooling towers. The Farley site is visible from the highway passing in front of its entrance, but not from the local communities. Noise has not been considered a problem due to the plant's distance from other communities.

2.2.8.5 Demography

SNC used 2000 census data from the U.S. Census Bureau (USCB) website (USCB 2000a) and geographic information system software (ArcView) to determine demographic characteristics in the Farley vicinity. NRC guidance calls for the use of the most recent USCB decennial census data, which, in the case of publication of the Farley ER (SNC 2003a), was the 2000 Census. Population was estimated from the Farley site out to 80 km (50 mi).

As derived from 2000 USCB information, approximately 93,120 people live within 32 km (20 mi) of Farley. Applying the GEIS sparseness measures, Farley has a population density of 28 persons/km^2 (74 persons/mi^2) within 32 km (20 mi) of the plant, and therefore falls into Category 3.[a] The city of Dothan has a population of 57,737 persons (USCB 2000b). As estimated from 2000 USCB information, approximately 393,639 people live within 80 km (50 mi) of Farley. This equates to a population density of 19 persons/km^2 (50 persons/mi^2) within 80 km (50 mi), and falls into Category 2.[b]

According to the GEIS sparseness and proximity matrix, the ranking (sparseness Category 3 and proximity Category 2), indicates that Farley is located in a medium population area. All or parts of 28 counties and the city of Dothan are located within 80 km (50 mi) of the plant. The Dothan Metropolitan Statistical Area, composed of Dale and Houston Counties, Alabama, is a varied mixture of rural and a few metropolitan areas, with a current total population of approximately 137,916 (USCB 2000b). Houston County is growing at a faster rate than the State of Alabama as a whole. From 1970 to 2000, Alabama's average annual population growth rate was 1.0 percent, while Houston County increased by 1.9 percent (USCB 1995, 2000b).

In 1995, Alabama reported a population count of 4.3 million people, or 1.6 percent of the U.S. population, ranking twenty-second in population among the 50 states and the District of Columbia. By the year 2025, Alabama is projected to have 5.2 million residents and remain the twenty-second most populous state (USCB 1996). Between the years 2000 and 2040, Houston County is projected to grow at an average annual rate of 1.1 percent (Tetra Tech 2001).

Table 2-8 shows estimated populations and annual growth rates (1980 to 2040) for Houston County, Alabama, the county with the greatest potential to be socioeconomically affected by license renewal activities at Farley. The table is based on USCB data for 1980, 1990, and 2000; data from the University of Alabama for 2010; and Tetra Tech projections to 2040. The Tetra Tech estimates are based on standard linear regression techniques.

(a) Category 3 is defined as having 23 to 46 persons/km^2 (60 to 120/persons/mi^2), or having fewer than 23 persons/km^2 (60 persons/mi^2) with at least one community with 25,000 or more persons within 32 km (20 mi).

(b) Category 2 is defined as having no city with 100,000 or more persons, and having between 19 and 73 persons/km^2 (50 and 190 persons/mi^2) within 50 miles.

Table 2-8. Estimated Populations and Average Annual Growth Rates in Houston County from 1970 to 2040

Year	Population	Percent
1970	56,574	—
1980	74,632	3.2
1990	81,331	0.9
2000	88,787	0.9
2010	98,766	1.1
2020	109,580	1.1
2030	119,434	0.9
2040	129,288	0.8

Source: SNC 2003a

- **Transient Population**

The transient population in the vicinity of Farley can be identified as daily or seasonal. Daily transients are associated with places where a large number of people gather regularly, such as local businesses, industrial facilities, and schools. There is little seasonal transient population within 16 km (10 mi) of the Farley site.

- **Migrant Farm Labor**

Production of agricultural crops within 80 km (50 mi) of the site was estimated based on those counties within this radius. Production in those counties which lie partially outside of this area was multiplied by the fraction of the county within the area of interest. Non-food crops (cotton and tobacco) were harvested from 24 percent of the croplands within 80 km (50 mi) of the site. Of the food crops, legumes make up 26 percent of total cropland, consisting mainly of peanuts and soybeans. Grain makes up 18 percent, consisting mainly of corn and wheat. The total food and commercial harvest consumed approximately 75 percent of the croplands within 80 km (50 mi) of the site; pasture made up another 15 percent of this land. Almost all of the laborers on farms in the area are believed to be residents in the area. Migrant labor plays little or no role.[a]

(a) Personal interview with Bob Lisec, Agricultural Extension, January 8, 2004.

2.2.8.6 Economy

The economy within a 80-km (50-mi) radius of Farley is dominated by the city of Dothan metropolitan area. The regional medical center for parts of Florida, Georgia and southeastern Alabama is in Dothan. The local economy has made the transition from low-wage textiles in the 1960s to 1970s to a major retail center. Dothan was number two in the state for per capita retail sales ($10,028), just behind Birmingham ($10,268). The Dothan metropolitan area, which includes Dale County, has an economic employment profile led by services (22 percent), manufacturing (19 percent), retail trade (18 percent), government (17 percent), construction (7 percent), transportation and public utilities (6 percent), and agriculture, wholesale trade and finance, insurance and real estate (each with 4 percent). While agriculture has not changed significantly, the addition of retail and medical centers has helped diversify the local economy (see Table 2-9).

Table 2-9. Major Employment Facilities Within 16 km (10 mi) of the Farley Site

Employer	Number of Employees
Southeast Alabama Medical Center	2200
Dothan City and Houston County School System	1800
Flowers Hospital	1200
City of Dothan	1160
Perdue Farms, Inc.	1150
Michelin Tire Corporation	650
Sony Magnetic Products of North America	650
Pemco World Air Services	610

Source: Personal communication, Dothan Area Chamber of Commerce, January 8, 2004

The annualized unemployment rate for the state of Alabama in August 2003 was 5.7 percent. In August 2003, Houston County had an unemployment rate of 4.5 percent (University of Alabama 2003). The estimated median household income in Alabama in 2002 was $34,770. Houston County and the city of Dothan had estimated median household incomes of $34,547 and $36,035, respectively (Dothan Chamber of Commerce 2002).

There are over 80,198 ha (198,215 ac) of farmland in Houston County. Within Houston County, cash receipts for farm and forestry (including government payments) were $76,086,000 in 2002 (Alabama Department of Agriculture 2003). Major crops consisted of cotton (21,700 bales); corn (286,000 bushels); soybeans (88,000 bushels); peanuts (74.6 million pounds); wheat (49,000 bushels); hay (21,000 tons); and pecans (40,000 pounds). The number of hectares planted in 1997 was 80,198 (198,215 ac), with an average farm size of 116 ha (287 ac).

Farley paid between $5.0 million and $5.4 million in property taxes each year between 1995 and 1999, which accounted for approximately one-third of the property tax revenues collected over this period (see Table 2-10). The County Revenue Commission reported property tax revenues in 2002 and 2003 or $7.6 million and $8.1 million, respectively.

Table 2-10. Property Taxes Paid to Houston County from 1995 to 1999; Farley Nuclear Plant Contribution to County Property Tax Revenues

Year	Total Houston County Property Tax Revenues ($)	Property Tax Paid to Houston County by Farley ($)	Percent of Total Property Taxes
1995	19,436,494	7,515,813	39
1996	19,856,091	7,832,915	37
1997	19,997,678	7,032,407	35
1998	20,720,238	7,004,786	34
1999	23,317,790	7,540,540	32
2000	23,634,860	7,611,279	32
2001	23,987,565	7,637,005	32
2002	24,345,336	7,646,683	31

Source: Alice Moss, Chief Revenue Clerk, Houston County Revenue Commission

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at Farley and in the surrounding area. This section draws on information contained in the Environmental Report (ER) prepared by SNC (2003a), from archives and records stored at the University of Alabama Office of Archaeological Research Alabama State Site Files at Moundville Archaeological Park, as well as published literature that address the archaeology and history of Alabama.

2.2.9.1 Cultural Background

Farley is located in Houston County, Alabama, at the extreme southeastern corner of the state, immediately adjacent to Georgia to the east and the Florida panhandle to the south. This location is part of the Gulf Coastal Plain physiographic province, an emerged portion of the continental shelf consisting of mixed layers of sand, gravel, and clay that have been moved and reshaped by water (Walthall 1980; Bense 1994). This broad coastal margin averages some 241 to 322 km (150 to 200 mi) in width, and gradually rises in elevation from sea level to around 91 m (300 ft) at the edge of the Piedmont physiographic province. The Piedmont physiographic province is a large, highly dissected plateau between the coastal plain and the foothills of the Appalachian Mountains. The boundary between the Coastal Plain and the Piedmont is referred to as the Fall Line due to its numerous waterfalls. Farley is located about halfway between the Florida coastline (Apalachicola Bay) and the Fall Line.

The topography of the Coastal Plain is dominated by rolling hills and shallow valleys. Vegetation is that of the southern mixed forest, containing a mixture of broadleaf deciduous and evergreen species, including several pines. An intermittent zone of the Coastal Plain just below the Fall Line, averaging about 32 km (20 mi) in width, contains unusually rich soils and an equally rich and diverse forest including several species of oak, hickory and walnut. This zone, sometimes referred to as the Black Belt due to its dark, rich soils, supported a high population density during prehistoric and early historic times. Suitable sources for stone tools typically are rare in the Coastal Plain, and thus required long-distance procurement and trade from the southwestern corner of the state and from various areas within the Piedmont zone. However, suitable outcrops of chert are present along the Chattahoochee river in and around the vicinity of Farley, which show evidence of having been quarried. Chattahoochee is a Creek Indian name that means “stream with pictured rocks” (Read 1984; Ethridge 2003), arguably referring to the appearance of waterworn boulders and cobbles of banded chert in the waters and alluvial floodplain of the river.

Farley is situated at an elevation of about 55 m (180 feet) above mean sea level. It is located along the western bank of the Chattahoochee River, in a sparsely populated largely rural area, with forests and small farms as the dominant land use (SNC 2003a). The lengthy Chattahoochee River is the dominant natural resource in the area, and would have served as a major transportation corridor and settlement area for prehistoric populations. Approximately 40 km (25 mi) south of the intersection between Alabama, Florida, and Georgia, the Chattahoochee River joins with the Flint River, and together they become the Apalachicola River.

The nearest established cultural or historic park to Farley is Kolomoki Mounds Historic Park approximately 35 km (22 mi) to the northeast, which is part of the Georgia State Parks system. Due to the widespread historic displacement of Native American Indian tribes in Alabama and Georgia, the reservation land of the nearest Federally recognized tribe is that of the Poarch Band of Creek Indians, approximately 209 km (130 mi) to the west of Farley. In addition to the Poarch, other closely culturally affiliated Federally recognized tribes are located in central Florida and Oklahoma. There are also three State-recognized tribes within approximately 80 km (50 mi) of Farley, two in southeastern Alabama, and one in southern Georgia.

In those portions of southeastern Alabama still largely undisturbed by historic and modern agriculture and development, a rich heritage is present in terms of surviving prehistoric and early historic Native American resources, and likewise in terms of historic Euroamerican resources (DeJarnette 1975; Walthall 1980; Stepp and Stepp 1984; Wright 1986; Bense 1994; Sassaman and Anderson 1996; Martin 1998; Sheldon 2001; White 2002). The Coastal Plain has an archaeological sequence that extends back at least 12,000 years. The cultural history can be divided into five major periods: Paleoindian (10,000 B.C., and perhaps as early as 13,000 B.C., to around 8000 B.C.), Archaic (8000 to 1000 B.C.), Woodland (1000 B.C. to around A.D. 1000), Mississippian (A.D. 1000 to around 1500), and Historic (A.D. 1500 to the present). The end of the Mississippian period and early portion of the Historic period is sometimes referred to as the Protohistoric period.

During the Paleoindian period, the native peoples seemingly were organized into small mobile bands with an economy based on hunting and fishing. Animals hunted included megafauna such as the now extinct mammoth. Later during the Paleoindian period, the economy began to diversify, with a greater emphasis on foraging and the hunting of smaller animals. The environment of the Paleoindian period was significantly different from the present. This was at the end of the last ice age, in which the climate was cooler than at present and glaciers covered much of the northern portion of North America. The presence of this ice also meant that ocean levels were much lower than at present, perhaps 23 to 30 m (75 to 100 feet) lower. Thus, many of the archaeological sites in the Coastal Plain dating from this time period would today be underwater or would be situated in and around wetlands. The Paleoindian period occupation is represented by a scattering of temporally diagnostic projectile points, used in conjunction with spears and atlatls (dart throwers). The general area around Farley was included in the Suwannee and Simpson diagnostic point style.

The transition between the Paleoindian and Archaic periods was accompanied by substantial environmental change. As glaciers began to melt, sea level began to rise. These changing environmental conditions led to the disappearance of the megafauna along with a greater dependance on river systems and the beginnings of the use of domesticated plants. The Archaic period is typically divided into three components: Early, Middle, and Late Archaic. The greatest change came about during the Middle Archaic when ocean levels reached or even slightly exceeded current levels. Archaic sites on the Coastal Plain east of the Mississippi River are generally rare, and at least some Middle Holocene sites are now submerged, such as reported for Appalachee Bay. Middle and Late Archaic archaeological sites typically exhibit greater evidence of sedentary economies, such as the presence of storage pits, extensive refuse middens, and large quantities of fire-cracked rock. Archaic period habitation sites appear to have been divided into base camps used during the spring, summer, and winter months, and smaller upland sites used during the fall for deer hunting and nut gathering. As with the earlier Paleoindian period, Archaic period occupation is represented by a number of temporally and regionally diagnostic projectile points.

In the Woodland period, Native American cultures reached their modern configurations as noted at the time of initial European contact in the sixteenth and seventeenth centuries. The middle of the Woodland period witnessed the establishment of large sedentary base camps in river valleys, with associated smaller resource gathering sites being established in surrounding areas. The increasing dependence on agriculture resulted in the development of increasingly complex trade networks and political systems. The Woodland period is also characterized by three major technological adaptions. The first is the increased manufacture and use of ceramic containers. The second is the development of the bow and arrow, which resulted in the use of very small, triangular projectile points that are quite distinct from those of earlier cultural periods. The third is the expanded use of formally constructed earthen mounds at archaeological habitation sites.

Woodland period archaeological sites are much more numerous throughout southeastern Alabama than are the earlier Archaic period sites. An example of a sizeable late Woodland settlement is that of the previously mentioned Kolomoki mounds across the Chattahoochee River and east of Farley. This settlement, constructed and used during the period of 250 to 950 A.D. by the Woodland period Swift Creek and Weeden Island cultures, is nearly 121 ha (300 ac) in extent, and included a great temple mound, two burial mounds, and four ceremonial mounds.

Toward the end of the Woodland period and during the subsequent Mississippian period, Native American villages throughout the Midwest and much of the Southeast apparently were organized into redistributive chiefdom-level societies (Bense 1994). The use of long-houses, palisades, earth lodges, mounds and other earthen works, and designated ossuaries for the burial of human remains are hallmarks of the Mississippian period. The Mississippian period also witnessed the development and fluorescence of the Southeastern Ceremonial Complex which emphasized ancestor worship, warfare, and fertility.

The Woodland and Mississippian periods are divided by archaeologists into a number of chronological and regional phases that reflect minor but distinctive differences in material culture. Those Woodland period phases specific to archaeological sites at Farley include Cataco Creek (circa 1300 to 1000 B.C.), Deptford (circa 200 B.C. to A.D. 100), Swift Creek (circa A.D. 100 to 500), and Weeden Island (circa A.D. 500 to 1000). A single Mississippian period phase is represented, Wakulla (circa A.D. 800 to 1100). Creek Indian phases include the Protohistoric Bull Creek (circa A.D. 1400 to 1600), and Historic Creek (after 1600).

The historic period for the Gulf Coastal Plain can be roughly divided into eight subperiods: Contact (1500 to 1600); Catholic Mission System (1600 to 1700); Colonial (1700 to 1821); Antebellum (1821 to 1860); Civil War (1861 to 1865); Reconstruction and Growth (1865 to 1917); World War I to World War II (1917 to 1945); and Modern (1945 to present).

At the time of historic European contact, the ancestors of the modern Creek Indians lived in a number of small distinct Mississippian-related societies in southern and central Alabama and Georgia (Walthall 1980; Read 1984; Wright 1986; Bense 1994; Cumming 1998; De Vorsey 1998; Perdue and Green 2001; White 2002; Ethridge 2003). The dominant group, sharing a common language or dialects thereof, was the Muskogee. The Muskogee consisted of 12 bands including the Kasihta, Coweta, Coosa, Abihka, Wakokai, Eufaula, Hilibi, Atasi, Kolomi, Tukabahchee, Pakana, and the Okchai. The bands situated to the north along the Coosa, Tallapoosa, and Alabama Rivers became known as the Upper Creek, while those along the Chattahoochee and Flint Rivers collectively became known as the Lower Creek.

The historic period begins in the early 1500s with the first incursions of European explorers in and around the Gulf Coastal Plain (Bense 1994; Cumming 1998; De Vorsey 1998; Ethridge 2003). The best known early expedition into the interior Southeast was that by Hernando de Soto in 1539 to 1542. It traversed across the Flint River, but then skirted virtually all of the Chattahoochee River, striking west through the Piedmont until reaching the Mississippi River (Bense 1994). The chronicles of the de Soto expedition provide a wealth of information on the late Mississippian culture in general. However, the de Soto expedition also cruelly slaughtered a number of the native peoples, ransacked a number of villages it encountered, and introduced diseases for which the native populations had no immunity. This marked the beginning of 300 years of population dislocation and cultural extirpation in the Southeast, ultimately resulting in amalgamations of native peoples previously distinct from one another and distributions that reflected the nature of European encroachment and economic systems rather than the traditional patterns of the native populations.

The following Indian villages in Alabama represent locations that are depicted on historic maps dating to the late 1600s through the early 1800s in and around the present location of Houston County (Wright 2003): In 1675, two villages named “Sawolki” (Sabolaca), one large (or old) and one small (or young) are noted along the lower portion of the Chattahoochee River-Sawolki is later identified in Houston County and by 1798 the location is placed in Barbour County, suggesting a gradual relocation through time of the village upstream. “Cactaw Hatchee” (1761) is probably located in Geneva or Dale County just west of Houston County. “Chiskataloosa” (1757) is depicted in Houston County along the west bank of the Chattahoochee River several kilometers north of the Florida border. However, from this date (1757) until 1797, various maps indicate that the location of this village shifts gradually north through Houston and Henry Counties into Barbour County. “Tamatle” (Tamali) apparently moved downriver along the Chattahoochee from Barbour County to a point south of Houston County during the period of 1675 to 1820. “Wioopke” is depicted on maps dating from 1757 to 1776 as on the west bank of the Chattahoochee River just above its junction with the Flint River—later maps from 1778 to 1808 depict the village in Houston County and finally in Henry County. In 1822, “Wekivas” was depicted as in Houston County on the west bank of the Chattahoochee River, about 3 km (2 mi) below “Emussas” and 6 km (4 mi) above “Cheskitaloma.” “Ecunchate” (Red Ground) is variously located on maps, including a 1822 map depicting it on the west bank of the Chattahoochee River in Houston County several kilometers above the Florida state line. And finally, “Amassi” (Yamassee) was occupied on the west bank of the Chattahoochee River in 1822, after moving from several different locations in South Carolina and Alabama after their defeat in the Yamassee War of 1715.

During the late 1600s and the 1700s, the Spanish periodically attempted to establish a series of Catholic missions in Florida and Georgia that met with varying degrees of success and disaster. Maps dating to 1760 and 1774 (Bense 1996; De Vorsey 1998) depict a mission at the junction of the Chattahoochee and Flint Rivers (La Encarnación a la Santa Cruz de Sabacola), while earlier documents indicate that a mission and Spanish fort of this name (Sabacola) existed at this location from 1682 to 1690. The 1774 map also depicts a mission (San Nicholás) seemingly in the general vicinity of Dothan and Farley, and another to the north on the Georgia side of the Chattahoochee River (San Carlos). Also during this period, the French expanded their trading in the Southeast, including with the Creek and Cherokee tribes in central Alabama.

The Catholic Mission system and French trading networks collapsed in the late 1700s due to the loss of "La Florida" to England after the Seven Years' War in Europe, and due to the increased numbers of American settlers streaming into Florida, Georgia (one of the original 13 colonies), and the Alabama territory. However, what really drew the American settlers was the combination of (1) the defeat of the British by Andrew Jackson in the War of 1812 and subsequent withdrawal of British troops from the Gulf Coast; (2) the defeat of the Upper Creeks during the First Creek War of 1813 to 1815; and (3) the First Seminole War of 1818 in which the Apalachicola River was expunged of Native American settlements. The onrush of American settlers resulted in Alabama officially becoming a state in 1819.

In the early 1800s, a sizeable population (about 25,000) of Creek Indians and other groups (such as the Yamassee) was still present along the Flint River and most of the Chattahoochee River, including and north of Henry County (which then included Houston County). However, in 1830 the American Congress passed the Indian Removal Act. This and subsequent treaties encouraged the American residents of Alabama and Georgia to take matters into their own hands and to forcibly carry out the terms of the Indian Removal Act. This in turn led to a general uprising by the Native Americans from 1835 to 1837 in which American settlers located along and between the Chattahoochee and Flint Rivers were vigorously attacked. The majority of this action took place north and east of Henry (and Houston) County, and in central Florida. This in turn led to the American military action of the Second Seminole War, in which hostilities ceased around 1843. Within a couple of years from this date, virtually the entire expanse of the Chattahoochee, Flint, and Apalachicola Rivers were devoid of Indian settlements.

The eventual town of Dothan was first settled in the 1820s by a homesteader in the vicinity of a fresh water spring at an intersection of Indian trails (Stepp and Stepp 1984; Martin 1998). The Antebellum period prior to the Civil War saw the development of plantations (primarily using African slaves for manpower), independent farms, and small towns throughout much of the Southeast, in which agriculture dominated local economies. This was facilitated by the invention of the cotton gin in 1793, which allowed short-fiber cotton to be grown virtually anywhere in the region, becoming the single most important cash crop. In the 1830s, a military fort was established about 19 km (12 mi) east of the spring on the Barber Plantation to defend the local American settlers from Indian hostilities after the passage of the Indian Removal Act. The fort was abandoned in the 1840s after the relocation of the Indian peoples. By 1858, nine families were living around the spring, and applied for a post office under the name Poplar Head, due to a thick stand of these trees near the spring. Because "Poplar Head" was already in use by another nearby town, the name Dothan was instead provided by Washington.

There were no actual Civil War battles in what became Houston County, but the area nevertheless was largely abandoned at this time. The overall physical effects of the Civil War and the abolishment of slavery led to fundamental changes in the economic basis of the Southeast between 1865 and 1917 (Bense 1994). While plantations were typically returned to their former owners, plantation operations became dependant on voluntary contracts or tenant farming with their labor force. Over time, plantations became smaller, averaging less than 40 ha (100 ac) by 1920. The expansion of the railroads, the rebuilding of basic infrastructure, and the Industrial Revolution all led to major changes.

The city of Dothan was incorporated in 1885. Houston County, the last of the modern Alabama counties to be formally constituted, was created in 1903 from Henry County, and Dothan became the county seat. The period between World War I and World War II saw the continued growth of small towns, and the continuation of the use of small plantations and independent farms. The successful development of the peanut industry in the general vicinity of Dothan has led to this area currently supplying nearly a quarter of the commercial peanut crop in the United States.

Construction began in the early 1970s at Farley, and in 1977 and 1981, respectively, Farley Units 1 and 2 were put into operation.

2.2.9.2 Historic and Archaeological Resources at and Near Farley

An archaeological records search was conducted at the Alabama State Site Files in Moundville, to determine what specific historic properties may be present at and around Farley.

These record searches revealed that between 1947 and 1982, 14 archaeological sites were recorded on lands within the boundaries of Farley, as part of three separate surveys of varying levels of intensity. The 1947 work, conducted by archaeologists from the University of Alabama (DeJarnette 1975) resulted in the documenting of five sites, including one re-recorded in 1975 and inadvertently provided a new number. This site, a Late Woodland and early Mississippian period village with an earthen burial mound, was originally partially excavated in 1905 by pioneering Southeastern archaeologist, Clarence Bloomfield Moore (Sheldon 2001). Surveys in 1975, also by the University of Alabama, documented six sites, including the site earlier excavated by Moore. Surveys conducted in 1982 by archaeologists from the Cleveland Museum of Natural History documented four sites. In addition, a previously unrecorded archaeological site, a small chert quarry, was inadvertently discovered in 2004 by archaeologists during NRC field checks in support of the present document.

In chronological order, from earliest to most recent, these 15 archaeological sites include the following: a Paleoindian chipped stone scatter; a Woodland Cataco Creek possible village location; a Woodland Deptford village location; a Woodland Deptford through Mississippian Wakulla village location (excavated by Moore in 1905); another Woodland Deptford through Mississipian Wakulla possible village location; a Mississippian Wakulla possible village location; two Mississippian Wakulla artifact scatters; a Protohistoric Creek village; a Historic Creek artifact scatter; four chipped stone scatters of unknown age; and the previously mentioned chert quarry site, also of unknown age.

These archeological sites have not been evaluated for potential eligibility to the National Register of Historic Places (NRHP). However, it is noted that several of these sites were heavily impacted by historic agriculture, and two possibly by early construction activities connected with Farley. These sites may lack integrity for inclusion in the NRHP.

As of 2001, seven properties in Houston County were listed in the NRHP, along with two properties in Henry County and four properties in Early County, Georgia (SNC 2003a). Of these 13 historic properties, two are within a 10-km (6-mi) radius of Farley. These include the Purcell-Killingsworth House in Houston County, a Victorian mansion completed in 1890, and the Coheelee Creek Bridge in Early County, the southernmost-surviving covered bridge in Georgia, which was constructed in 1891.

While there are no structures or buildings at Farley itself that are 50 years in age or older, there is a small historic cemetery containing approximately 25 graves, with associated grave markers ranging in date from 1917 to 1969. The cemetery is still occasionally visited by family members, and Farley personnel conduct yearly maintenance at the location.

As previously mentioned, the reservation land of the Poarch Band of the Creek Tribe in southwestern Alabama, 209 km (130 mi) to the west, represents the physically closest Federally recognized culturally affiliated tribe to Farley. Other culturally affiliated Federally recognized tribes include the Muskogee Creek tribe in Oklahoma, and the Seminole tribes of Florida. State-recognized tribes in the vicinity of Farley include the Cherokees of Southeast Alabama, the MaChis Lower Creek Tribe (Alabama), and in Georgia the Lower Muskogee Creek (Perdue and Green 2001).

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating licenses for Farley. 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.

As stated in the Farley application (SNC 2003a), 71 km (44 mi) downstream of Farley lies Lake Seminole, a 15,175-ha (37,500-ac) impoundment created by the Jim Woodruff Lock and Dam. The Lake Seminole project, originally authorized as the Jim Woodruff Lock & Dam Project by the River and Harbor Act of 1946, was the first of three locks and dams constructed for navigation, hydropower, recreation, and related use purposes on the Apalachicola, Chattahoochee, and Flint River systems. The dams were constructed to provide a 3-m (9-ft) deep channel from the Gulf Intercoastal Waterway to Columbus, Georgia. The channel traverses the Apalachicola, the Chattahoochee River and the Flint River to Bainbridge, Georgia. Construction of this multi-purpose project began in 1947 and was completed in 1957 at a cost of $46.5 million. Lake Seminole is operated at a relatively constant level at elevation 24 m (78 ft) above mean sea level. Although there is some fluctuation for power production, no storage for flood control is provided. The powerhouse has the capacity to generate 45 MW of electricity (SNC 2003a).

The other two lock and dam projects, the Walter F. George Lock and Dam and the George W. Andrews Lock and Dam, both lie upstream of Farley. They form the Walter F. George Reservoir and Lake Andrews, respectively. The powerhouse at Walter F. George Lock and Dam has the capacity to generate 150 MW of electricity. Staffed 24 hours a day, the powerhouse control room regulates water flows and power generation for the lower end of the Chattahoochee River. The George W. Andrews Lock and Dam is not a hydropower facility.

Georgia Power is relicensing three hydroelectric facilities near Columbus, Georgia as the Middle Chattahoochee River Hydroelectric Project. The three dams involved are the Goat Rock Dam, Oliver Dam, and North Highlands Dam. Together they have 129.3 MW of installed electric capacity and produce approximately 524,000 MWh annually (SNC 2003a).

NRC is required under Section 102(c) of the National Environmental Policy Act (NEPA) of 1969 to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. NRC consulted with the FWS. Consultation correspondence is included in Appendix E.

2.3 References

10 CFR 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.”

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

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

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

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

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

40 CFR 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.”

Alabama Department of Agriculture. 2003. "Agricultural Statistics Bulletin 45."

Alabama Department of Conservation and Natural Resources (ADCNR). 2003. *County by County Listing of Alabama Species on Federal List for Threatened and Endangered Species or Whose Status is a Concern*. Available online at: http://www.dcnr.state.al.us/agfd/fish/endangeredco.html.

Alabama Department of Environmental Management (ADEM). 1997. Letter to Mr. Wayne Carr, Manager, Environmental Services, SNC, Birmingham, Alabama. No Subject. (January 14, 1997)

Alabama Department of Environmental Management (ADEM). 2003. *2002 Report to Congress,305(b) Report*. Accessed at: http://www.adem.state.al.us/WaterDivision/WQuality/305b/WQ305bReport.htm on February 10, 2004.

Alabama Department of Public Health (ADPH). 2003. *Alabama 2002 Annual Report—Environmental Radiation in Alabama*. Montgomery Alabama, April 30, 2002.

Alabama Department of Transportation, Bureau of Transportation Planning (ADOT). 1998. *1998 Alabama Traffic Flow*.

Alabama Power Company (APC). 1983. Cooling Water Intake Study 316(b) Demonstration, 2-Unit Operation.

Alabama Power Company (APC). 1991. *Final Report: Evaluation of Mixing Zones for Temperature, Hydrazine, and Total Chlorine in the Chattahoochee River Related to the Farley Nuclear Power Plant Main Combined Facility Discharge*. Birmingham, Alabama. March, 1991.

Alabama Power Company (APC). 1995. *Guidelines for Performing Power Line Construction and Maintenance in Areas of Gopher Tortoise Habitat.*

Alabama Power Company (APC). 2004. Alabama Power Company, Vegetation Management, Electric Line Maintenance, Substation Ground Maintenance, Herbicide Applications, and Wood Residue Recycling. Asplundh Tree Expert Company and Personal Touch Company.

Anderson, D.G. 1996. "Approaches to Modeling Regional Settlement in the Archaic Period Southeast." In *Archaeology of the Mid-Holocene Southeast*, edited by K.E. Sassaman and D.G. Anderson, pp. 157–176. University Press of Florida, Gainesville.

Beasley, J.B. 2003. Letter from Vice President, SNC, to U.S. NRC. Subject: *Joseph M. Farley Nuclear Plant NRC Environmental Scouting Trip Requested Additional Information in Support of NRC TAC nos. MC0768, MC0769*. (November 3, 2003)

Bense, J.A. 1994. *Archaeology of the Southeastern United States*. Academic Press, New York.

Bradley, K.P., Chief, Navigation Section, U.S. Army Corps of Engineers (USACE), Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 23, 2004).

Brim Box, J., and J.D. Williams. 2000. "Unionid Mollusks of the Apalachicola Basin in Alabama, Florida, and Georgia." Bulletin 21, Alabama Museum of Natural History, April 2, 2000.

Carmody, G.A. 2002. Letter from U.S. Fish and Wildlife Service Field Office, Balboa, Florida, to C.R. Pierce, License Renewal Services Manager, SNC. No subject. (June 13, 2002)

Carr, W.C. 2000. Letter from SNC to J. Warr, ADEM. Subject: "NPDES Permit Renewal Application for Farley Nuclear Plant. ENV-00-0115." (May 3, 2000)

Causey, K. 1993. *Land Management Options and Recommendations for the Farley Nuclear Plant, Houston County, Alabama*. Report submitted to Farley Nuclear Plant. February 4, 1993.

Chapman, M. 2001. Facsimile transmission to E.N. Hill (Tetra Tech NUS). *Permitted Drinking Water Sources in Houston County.*

City of Dothan. 2001. *Dothan Utilities Water Production and Distribution.*

Clemons, J. 2003. *Water-Sharing Compact Dissolves.* Water Log 23(3), Mississippi–Alabama Sea Grant Legal Program, University, MS. Accessed at: http://www.olemiss.edu/orgs/SGLC on February 22, 2004.

Cumming, W.P. 1998. *The Southeast in Early Maps*, Third Edition. University of North Carolina Press, Chapel Hill, North Carolina.

De Vorsey, L., Jr. 1998. "American Indians and the Early Mapping of the Southeast." In *The Southeast in Early Maps, Third Edition*, by W.P. Cumming, pp. 65–98. University of North Carolina Press, Chapel Hill, North Carolina.

DeJarnette, David L. 1975. *Archaeological Salvage in the Walter F. George Basin of the Chattahoochee River in Alabama*. The University of Alabama Press, Tuscaloosa.

Dothan Chamber of Commerce. 2002. "Demographic Profile." June 2002.

Elliott, D.L., C.G. Holladay, W.R. Barchet, H.P. Foote, and W.F. Sandusky. 1986. *Wind Energy Resource Atlas of the United States*. DOE/CH 10093-4, U.S. Department of Energy, Washington, D.C.

Endangered Species Act (ESA). 16 USC 1531, et seq.

Esser, L.L. 1993. *Torreya taxifolia.* In: *Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory* (Producer). Available online at: http://www.fs.fed.us/database/feis/plants/tree/tortax/all.html.

Ethridge, Robbie. 2003. *Creek Country: The Creek Indians and Their World.* The University of North Carolina Press, Chapel Hill.

Farley Nuclear Plant. 2000. *Farley Nuclear Plant Environmental Procedure FNP-0-ENV-23, Land and Wildlife Management Program*. August 9, 2000.

Florida Museum of Natural History (FMNH). 2000. *Eastern Coachwhip Snake*. Accessed at: http://www.flmnh.ufl.edu/natsci/herpetology/flguide/masticophisflagellum.htm on December 10, 2003.

Florida Natural Areas Inventory (FNAI). 2001a. “Florida Pine Snake.” In: *Field Guide to the Rare Animals of Florida*. Accessed at: http://www.fnai.org/FieldGuide/pdf/pituophis_melanoleucus_mugitus.pdf on December 10, 2003.

Florida Natural Areas Inventory (FNAI). 2001b. “Southeastern American Kestrel.” In: *Field Guide to the Rare Animals of Florida*. Accessed at: http://www.fnai.org/FieldGuide/pdf/Falco_sparverius_paulus.pdf on December 10, 2003.

Florida Natural Areas Inventory (FNAI). 2002a. Data Report: *FNAI Element Occurrence Records On or Near Sites, Electrical Transmission Corridor*. July 26, 2002.

Florida Natural Areas Inventory (FNAI). 2002b. *Species and Natural Community Summary for Jackson County*. Accessed at: http://www.fnai.org/cntylist.htm on December 5, 2003.

Franz, R. 1992. “Florida Pine Snake.” In: *Rare and Endangered Biota of Florida. Vol. 3. Amphibians and Reptiles*. Moler, P.E. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Press of Florida.

Garrett, J.W., H.A. Perlman, and J.D. Scholz.. 2000. *Water-Quality Assessment of the Apalachicola-Chattahoochee-Flint River Basin, Georgia, Florida, and Alabama: Physical, Chemical, and Biological Data, 1992–1995*. Accessed at: http://ga.water.usgs.gov/nawqa/data.abstract.html on March 23, 2004.

Georgia Department of Natural Resources (GADNR). 2000. *1997–1999 Environmental Radiation Surveillance Report*. Atlanta, Georgia.

Georgia Department of Natural Resources (GADNR), Wildlife Resources Division, Georgia Natural Heritage Program. 2003. *Georgia Rare Species Information*. Accessed at: http://www.georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=9&txtPage=6 on November 7, 2003.

Georgia Museum of Natural History (GMNH). 2000a. *American Alligator, Alligator mississippiensis. Georgia Wildlife Web*. Accessed at: http://museum.nhm.uga.edu/gawildlife/reptiles/crocodilia/amississippiensis.html on December 5, 2003.

Georgia Museum of Natural History (GMNH). 2000b. *Osprey, Pandion haliaetus. Georgia Wildlife Web*. Accessed at: http://www.museum.nhm.uga.edu.gawildlife/birds/falconiformes/phaliaetus.html on December 9, 2003.

Georgia Museum of Natural History (GMNH). 2000c. *Gopher Frog, Rana capito. Georgia Wildlife Web.* Accessed at: http://www.museum.nhm.uga.edu.gawildlife/amphibians/anura/ranidae/rcapito.html on December 9, 2003.

Georgia Museum of Natural History (GMNH). 2000d. *Southeastern Pocket Gopher, Geomys pinetis. Georgia Wildlife Web*. Accessed at: http://www.museum.nhm.uga.edu.gawildlife/mammals/Rodentia/Geomyidae/gpinetis.html on December 10, 2003.

Georgia Museum of Natural History (GMNH). 2000e. *Rafinesque's Big-Eared Bat, Corynorhinus rafinesquii. Georgia Wildlife Web*. Accessed at: http://www.museum.nhm.uga.edu.gawildlife/mammals/chiroptera/verpertilionidae/prafinesquii.html

Georgia Power Company (GPC). 2004. *Georgia Power Company's Forestry and Right-of-Way Services Agreement*.

Goldman, L.E. 2004. Letter from U.S. Fish and Wildlife Service, Daphne, Alabama, to P.T. Kuo, NRC, Washington, D.C. No Subject. (February 6, 2004)

Gore, J.A. 1987. *Bat Colonies in Jackson County Caves: Survey of Caves*. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Final Performance Report, Tallahassee, Florida.

Gulf Power Company. 2004. Memo from SNC for Gulf Power Company. Subject: “Gulf Power Company ROW Contractors, Maintenance Activities, and Contract Information.”

Heitschmidt, D. 2000. Letter to District Conservationist, U.S. Department of Agriculture Natural Resources Conservation Service. No Subject. (December 15, 2000)

Humphrey, S.R. 1992a. “Indiana bat.” In: *Rare and Endangered Biota of Florida. Vol. 1, Mammals*. S.R. Humphrey (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida.

Humphrey, S.R. 1992b. “Southeastern Brown Bat.” In: *Rare and Endangered Biota of Florida—Mammals*. Humphrey, S.R. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Press of Florida.

Jacksonville State University Environmental Policy and Information Center (JSU). 2000. *ACT/ACF Tri-State Water Basin Compacts*. Accessed at: http://www.jsu.edu/depart/epic/ACT.htm on July 27, 2001 and March 23, 2004.

Jangula, T., USACE, Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 23, 2004).

Kandler, J. 2004. Facsimile from Jim Kandler, Georgia Power Company, Environmental Laboratory, to Jim Davis, SNC. Subject: “Transmission Right-of-Way Brush Survey for Lake Seminole and Elmodel Wildlife Management Areas.” (January 26, 2004)

Krakow, G. 2002. Letter from Database Manager, Georgia Department of Natural Resources, Wildlife Resources Division, Georgia Natural Heritage Program, to C.R. Pierce, SNC. (June 13, 2002)

Lewis, J. 2002. Letter from Alabama Department of Conservation and Natural Resources (ADCNR), State Lands Division, Natural Heritage Section, Montgomery, Alabama, to C.R. Pierce, License Renewal Services Manager, SNC. Subject: “Response to Sensitive Species Information Request.” (May 21, 2002)

Martin, Annamarie Saliba. 1998. *A Place of Our Own: The Stories of Dothan, Houston County*. Community Communications, Montgomery, Alabama.

McCracken, K.W. 1990. Letter to J.D. Grogan, APC, Birmingham. Alabama. Subject: “Evaluation of Mixing Zones for Temperature and Total Residual Chlorine in the Chattahoochee River Related to the Farley Nuclear Plant Main Combined Facility Discharge.” (November 12, 1990)

Means, D.B. 1992a. "Pine Barrens Tree Frog." In: *Rare and Endangered Biota of Florida. Vol.3, Amphibians and Reptiles.* Moler, P.E. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida.

Means, D.B. 1992b. "Seal Salamander." In: *Rare and Endangered Biota of Florida. Vol.3, Amphibians and Reptiles.* Moler, P.E. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida.

Medlin, S. 1999. *Warmwater Habitat Association*. Accessed at: http://216.239.57.104/search?q=cache:4NORud1V6c8J:www.southernregion.fs.fed.us/planning/sap_library/terrestrial%2520team%27/HA_warmwater_7_99.aw.pdf+southern+sandshell+habitat&hl=en&ie=UTF-8 on February 20, 2004.

Mettee, M.F., P.E. O'Neil, and J.M. Pierson. 1996. *Fishes of Alabama and the Mobile Basin. A Cooperative Effort of the Geological Survey of Alabama, Game and Fish Division of the Alabama Department of Conservation and Natural Resources, and the Region 4 Office of the U.S. Fish and Wildlife Service*. Oxmoor House, Birmingham, Alabama.

Miller, Jessica and Livingunderworld.org. 2003. *Amphiumidae*. Accessed at: http://www.livingunderworld.org/caudata/database/amphiumidae/ on December 10, 2003.

Mount, R.E. 1975. *The Reptiles and Amphibians of Florida*. Auburn University, Auburn, Alabama.

National Climatic Data Center (NCDC). 1992. *International Station Meteorological Climate Summary, Version 2.0*. Naval Oceanography Command Detachment Asheville, USAFETAC OL-A, National Climatic Data Center, Asheville, North Carolina.

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

NatureServe. 2003. *NatureServe Explorer: An online encyclopedia of life (web application)*, Version 1.8. NatureServe, Arlington, Virginia. Accessed at: http://www.natureserve.org/explorer on December 10, 2003.

Patrick, T.S., J.R. Allison, and G.A. Krakow. 1995. *Protected Plants of Georgia, An Information Manual on Plants Designated by the State of Georgia as Endangered, Threatened, Rare or Unusual*. Georgia Department of Natural Resources, Wildlife Resources Division, Georgia Natural Heritage Program. Accessed at: http://www.georgiawildlife.com/content/displaycontent.asp?txtDocument=89&txtpage=9 on November 5, 2003.

Perdue, T. and M.D. Green. 2001. *The Columbia Guide to American Indians of the Southeast*. Columbia University Press, New York.

Ramsdell, J.V. and G.L. Andrews. 1986. *Tornado Climatography of the Contiguous United States*. NUREG/CR-4461, NRC, Washington, D.C.

Read, W.A. 1984. *Indian Place Names in Alabama*, revised edition. The University of Alabama Press, Tuscaloosa.

Sassaman, K.E., and D.G. Anderson (eds.). 1996. *Archaeology of the Mid-Holocene Southeast*. University Press of Florida, Gainesville.

Shealey, R.M. 1992a. "Alligator Snapping Turtle." In: *Rare and Endangered Biota of Florida. Vol.3, Amphibians and Reptiles.* Moler, P.E. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida.

Shealey, R.M. 1992b. "Alabama Map Turtle." In: *Rare and Endangered Biota of Florida. Vol.3, Amphibians and Reptiles.* Moler, P.E. (Ed.). Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida.

Sheldon, C.T., Jr. (ed.). 2001. *The Southern and Central Alabama Expeditions of Clarence Bloomfield Moore*. The University of Alabama Press, Tuscaloosa.

Southeast Alabama Regional Planning and Development Commission (SEARP & DC). 1998. *Overall Economic Development Plan.*

Southern Nuclear Operating Company (SNC). 1996. *Joseph M. Farley Nuclear Plant Units 1 and 2—Final Safety Analysis Report (FSAR)*. Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 1997. *Farley Nuclear Plant Annual Water Use Report for 1996.* ENV-97-059. Birmingham, Alabama. March 27, 1997.

Southern Nuclear Operating Company (SNC). 1998. *Farley Nuclear Plant Annual Water Use Report for 1997.* ENV-98-028. Birmingham, Alabama. February 12, 1998.

Southern Nuclear Operating Company (SNC). 1999. *Farley Nuclear Plant Annual Water Use Report for 1998.* ENV-99-070. Birmingham, Alabama. March 30, 1999.

Southern Nuclear Operating Company (SNC). 2000a. *Farley Nuclear Plant Annual Water Use Report for 1999.* ENV-00-076. Birmingham, Alabama. March 21, 2000.

Southern Nuclear Operating Company (SNC). 2000b. *Offsite Dose Calculation Manual (ODCM) for Southern Nuclear Operating Company Joseph M. Farley Nuclear Plant*. Revision 20. Birmingham, Alabama. February 7, 2000.

Southern Nuclear Operating Company (SNC). 2001. *Farley Nuclear Plant Annual Water Use Report for 2000, Surface Water Withdrawal Report*. Alabama Water Use Reporting System. Certificate Number 0063.

Southern Nuclear Operating Company (SNC). 2002b. *Final Safety Analysis Report*. Chapter 11. FSAR Revision 17. Birmingham, Alabama. May 2002.

Southern Nuclear Operating Company (SNC). 2002c. *Wildlife Habitat Council 2002 Recertification Application for Farley Nuclear Plant.*

Southern Nuclear Operating Company (SNC). 2003a. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 2003b. *Joseph M. Farley Nuclear Plant Revision to Annual Radioactive Effluent Release Report for 2002.* August 1, 2003.

Southern Nuclear Operating Company (SNC). 2003c. *Joseph M. Farley Nuclear Plant Annual Radiological Environmental Operating Report for 2002.* April 2002.

Southern Nuclear Operating Company (SNC). 2004a. *Joseph M. Farley Nuclear Plant Environmental Audit Follow-Up Documents*. SNC Letter NL-04-0172, Enclosure 2. (February 4, 2004)

Southern Nuclear Operating Company (SNC). 2004b. *Southern Nuclear Operating Company Vegetation Management Policy.*

Stepp, W.H., and P.A. Stepp. 1984. *Dothan: A Pictorial History*. The Donning Company, Norfolk, Virginia.

Tennent, A. 1997. *A Field Guide to the Snakes of Florida*. Gulf Publishing Company, Houston, Texas.

Tetra Tech NUS, Inc. 2001. *Population Projections for the FNP Region*. Aiken, South Carolina.

Tetra Tech NUS, Inc. 2002a. *Final Report, Threatened and Endangered Species Surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Corridors (2001–2002)*. Prepared for SNC. June 21, 2002.

Tetra Tech NUS, Inc. 2002b. *Threatened and Endangered Species Survey: Sinai Cemetery Transmission Line Corridor, 2002*. Prepared for SNC. October 25, 2002.

Tuberville, T. 2002. *Upland Snake Species Profile: Southern Hognose Snake.* The Gopher Tortoise Council. Accessed at: http://www.gophertortoisecouncil.org/simus.pdf on December 10, 2003.

U.S. Army Corps of Engineers (USACE), Mobile District. 1989. *ACF Water Control Plan.* Copy furnished electronically by Vaughan, M., Jr., Chief, Water Management Section,USACE, Mobile District, via email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 4, 2004).

U.S. Army Corps of Engineers (USACE), Mobile District. 1998. *Draft Environmental Impact Statement, Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia*. Mobile, Alabama. September, 1998.

U.S. Army Corps of Engineers (USACE), Mobile District. 2004a. *Apalachicola-Chattahoochee-Flint River System History*. Accessed at: http://www.sam.usace.army.mil/op/rec/acf/history.htm on March 3 and 23, 2004.

U.S. Army Corps of Engineers (USACE), Mobile District. 2004b. *How the River Systems are Managed*. Accessed at: http://water.sam.usace.army.mil/narrativ.htm on March 3, 2004.

U.S. Atomic Energy Commission (AEC). 1974. *Final Environmental Statement Related to Operation of Joseph M. Farley Nuclear Plant Units 1 and 2*, Alabama Power Company. Dockets No. 50-348 and 50-364. December 1974.

U.S. Census Bureau (USCB). 1995. *Alabama Population of Counties by Decennial Census: 1900 to 1990.* Available online at: http://www.census.gov/population/cencounts/al190090.txt.

U.S. Census Bureau (USCB). 1996. *State Population Rankings Summary—Alabama's Population Projections: 1995–2025.* Available online at: http://wwwcensus.gov/population/projections/state/9525rank/alprsrel.txt.

U.S. Census Bureau (USCB). 2000a. Summary File 1: Census 2000. Available online at: http://www.census.gov/PressRelease/www/2001/sumfile1.html.

U.S. Census Bureau (USCB). 2000b. *American Factfinder. Census 2000 Redistricting Data (Public Law 94-171) Summary File. Alabama-County*. Available online at: http://factfinder.census.gov/.

U.S. Department of Agriculture (USDA). 2002. *Dicanthelium hirstii (Plant Profile)*. The PLANTS Database, Version 3.5. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. Available online at http://plants.usda.gov.

U.S. Environmental Protection Agency (EPA). 2004. *Currently Designated Nonattainment Areas for All Criteria Pollutants As of August 27, 2003.* Accessed at: http://www.epa.gov/oar/oaqps/greenbk/ancl3.html on April 9, 2004.

U.S. Fish and Wildlife Service (FWS). 1990a. *Harperella (Ptilimnium nodosum [Rose] Mathias) Recovery Plan*. U.S. Fish and Wildlife Service, Northeast Region, Newton Corner, MA.

U.S. Fish and Wildlife Service (FWS). 1990b. *Relict Trillium Recovery Plan*. U.S. Fish and Wildlife Service, Northeast Region, Atlanta, GA.

U.S. Fish and Wildlife Service (FWS). 1991a. "Eastern Indigo Snake." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book).* FWS Region 4. Accessed at: http://endangered.fws.gov/i/a/saa08.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1991b. "Endangered and Threatened Wildlife and Plants; Threatened Status for the Gulf Sturgeon." *Federal Register*, Vol. 56, No. 189, pp. 49653-49658. Washington, D.C. September 30, 1991.

U.S. Fish and Wildlife Service (FWS). 1991c. "Florida Torreya (*Torreya taxifolia*)." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book).* FWS Region 4. Accessed at: http://endangered.fws.gov/i/r/sar03.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1991d. "Gopher Tortoise." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book).* FWS Region 4. Accessed at: http://endangered.fws.gov/i/a/saa08.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1991e. "Indiana Bat." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book).* FWS Region 4. Accessed at: http://endangered.fws.gov/i/a/saa08.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1992a. "Fringed Campion (*Silene polypetala*)." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book)*. FWS Region 4. Accessed at: http://endangered.fws.gov/i/q/saq6l.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1992b. "Gentian Pinkroot, (*Spigelia gentianoides*)." In: *Endangered and Threatened Species of the Southeastern United States (The Red Book)*. FWS Region 4. Accessed at: http://endangered.fws.gov/i/q/saq6f.html on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 1993. *Recovery Plan for Pondberry (Lindera melissifolia [Walt.] Blume)*. U.S. Fish and Wildlife Service Southeast Region, Atlanta, GA.

U.S. Fish and Wildlife Service (FWS). 1994. *Cooley's Meadowrue Recovery Plan*. U.S. Fish and Wildlife Service Southeast Region, Atlanta, GA.

U.S. Fish and Wildlife Service (FWS). 1995a. *American Chaffseed (Schwalbea americana) Recovery Plan*. U.S. Fish and Wildlife Northeast Region, Hadley, Massachusetts.

U.S. Fish and Wildlife Service (FWS). 1995b. *Gulf Sturgeon Recovery Plan*. Atlanta, Georgia.

U.S. Fish and Wildlife Service (FWS). 1998. "Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Five Freshwater Mussels and Threatened Status for Two Freshwater Mussels From the Eastern Gulf Slope Drainages of Alabama, Florida, and Georgia." *Federal Register*, Vol. 63, No. 50, pp. 2664–12687. Washington, D.C. March 16, 1998.

U.S. Fish and Wildlife Service (FWS). 1999. "Papery Whitlow-wort." In: *Multi-Species Recovery Plan for South Florida*. U.S. Fish and Wildlife Service Southeast Region. Accessed at: http://southeast.fws.gov/vbpdfs/species/plants/pach.pdf on December 8, 2003.

U.S. Fish and Wildlife Service (FWS). 2002a. *Candidate And Listing Priority Assignment Form, Panicum hirstii*. Accessed at: https://ecos.fws.gov/docs/candforms_pdf/r5/panhir.pdf on December 12, 2003.

U.S. Fish and Wildlife Service (FWS). 2002b. *Listed Endangered Species in Georgia by County*. Accessed at: http://www.athens.fws.gov/endangered/counties_endangered.html on November 5, 2003.

U.S. Fish and Wildlife Service (FWS). 2003a. *Species Profile: Fat Three Ridge (mussel), Amblema neislerii.* Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F032 on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003b. *Species Profile: Chipola Slabshell (clam), Elliptio chipolaensis*. Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F03O on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003c. *Species Profile: Purple Bankclimber (mussel), Elliptoideus sloatianus.* Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F02E on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003d. *Species Profile: Shinyrayed pocketbook (clam), Lampsilis (Villosis) subangulata.* Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F02Y on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003e. *Species Profile: Gulf Moccasinshell (clam), Medionidus penicillatus.* Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F03M on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003f. *Species Profile: Oval Pigtoe (clam), Pleurobema pyriforme*. Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F02S on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003g. *Recovery Plan for Endangered Fat Threeridge (Amblema neislerii), Shinyrayed Pocketbook (Lampsilis subangulata), Gulf Moccasinshell (Medionidus pencillatus), Ochlockonee Moccasinshell (Medionidus simpsonianus), and Oval Pigtoe (Pleurobema pyriforme); and Threatened Chipola Slabshell (Elliptio chipolaensis), and Purple Bankclimber (Elliptoideus sloatianus).* Atlanta, Georgia.

U.S. Fish and Wildlife Service (FWS). 2003h. *Species Profile: Gulf Sturgeon, Acipenser oxyrinchus desotoi.* Accessed at: https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=E04W on December 6, 2003.

U.S. Fish and Wildlife Service (FWS). 2003i. "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon; Final Rule." *Federal Register*, Vol. 68, No. 53, pp. 13370-13418. Washington, D.C. March 19, 2003.

U.S. Fish and Wildlife Service (FWS). 2003j. *Listed Endangered Species in Georgia by County*. Georgia Ecological Services. Accessed at: http://athens.fws.gov/endangered/counties_endangered.html on December 10, 2003.

U.S. Geological Survey (USGS). 2000a. *Description of the ACF Basin Study Area, Apalachicola-Chattahoochee-Flint River Basin NAWQA Study*. Accessed at: http://ga.water.usgs.gov/nawqa/ basin2.html on July 2, 2001 and January 5, 2004.

U.S. Geological Survey (USGS). 2000b. *Surface-Water Data, Georgia, Water Year 1999.* Water-Data Report GA-99-1.

U.S. Geological Service (USGS), Northern Prairie Wildlife Research Center. 2002. "Seal Salamander, *Desmongnathus monticola*." In: *Checklist of Amphibian Species and Identification Guide: An Online Guide for the Identification of Amphibians in North America north of Mexico.* Available online at: http://www.npwrc.usgs.gov/narcam/idguide/dmontico.htm.

U.S. Geological Service (USGS), Pauxent Wildlife Research Center. 2003. "Georgia Blind Salamander." In: *ARMI National Atlas for Amphibian Distributions*. Prepared by L. Blackburn, P. Nanjappa, and M.J. Lannoo. Accessed at: http://www.mp2-pwrc.usgs.gov/armiatlas/species.cfm?recordID=17317 on December 10, 2003.

U.S. National Atmospheric and Oceanic Administration (NOAA). 2002. *Climatology of the United States No. 81, Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971–2000, Alabama, Florida (revision date February 2002)*. National Climatic Center, Asheville, North Carolina.

U.S. National Atmospheric and Oceanic Administration (NOAA). 2003. *Comparative Climatic Data Publication, Data Tables, Wind—Maximum Speed (MPH)*. Accessed at: http://nndc.noaa.gov/?http://ols.nndc.noaa.gov:80/plolstore/plsql/olstore.prodspecific?prodnum=C00095-PUB-A0001 on April 9, 2004.

U.S. Nuclear Regulatory Commission (NRC). 1991. *Offsite Dose Calculations Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors*. NUREG-1301, Washington, D.C.

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

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

University of Alabama. 2003. Center for Business and Economic Research. November 20, 2003.

University of Florida. 2000. *Water Wars: Water Allocation Law and the Apalachicola-Chattahoochee-Flint River Basin.* Accessed at: http://edis.ifas.ufl.edu/pdffiles/FE/FE20800.pdf on July 26, 2001 and March 23, 2004.

Vaughan, M., Jr., Chief, Water Management Section, USACE, Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 4 and 23, 2004).

Walthall, John A. 1980. *Prehistoric Indians of the Southeast: Archaeology of Alabama and the Middle South*. University of Alabama Press, University, Alabama.

Water Resources Development Act of 1999. Public Law 106-53, 113 Stat. 269.

White, Max E. 2002. *The Archaeology and History of the Native Georgia Tribes*. University Press of Florida, Gainesville.

Wright, Amos J., Jr. 2003. *Historic Indian Towns in Alabama, 1540–1838*. University of Alabama Press, Tuscaloosa.

Wright, J. Leitch, Jr. 1986. *Creeks and Seminoles: The Destruction and Regeneration of the Muscogule People*. University of Nebraska Press, Lincoln.

3.0 Environmental Impacts of Refurbishment

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

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

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

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

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

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

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

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

Category 1 and Category 2 issues related to refurbishment that are not applicable to Farley because they are related to plant design features or site characteristics not found at Farley 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	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. 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 Farley Units 1 and 2 during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities and are described in the Environmental Report (ER; SNC 2003).

SNC's 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 Farley Units 1 and 2 beyond the end of the existing operating licenses. Therefore, refurbishment is not considered in this supplemental environmental impact statement.

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph
Terrestrial Resources		
Refurbishment impacts	3.6	E
Threatened or Endangered Species (for all plants)		
Threatened or endangered species	3.9	E
Air Quality		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
Socioeconomics		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services: transportation	3.7.4.2	J
Historic and archeological resources	3.7.7	K
Environmental Justice		
Environmental justice	not addressed[a]	not addressed[a]

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

3.1 References

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

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

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

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

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

4.0 Environmental Impacts of Operation

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

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site 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 for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B and are applicable to the Farley plant. Section 4.1 addresses issues applicable to the Farley cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to Farley because they

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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.

are related to plant design features or site characteristics not found on the Farley site are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to Farley Units 1 and 2 (Farley) cooling system operation during the renewal term are listed in Table 4-1. Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2003a) that it is not aware of any new and significant information associated with the renewal of the Farley operating licenses (OLs). The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

Table 4-1. Category 1 Issues Applicable to the Operation of the Farley Units 1 and 2 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; 4.4.3
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.3
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.3
Eutrophication	4.2.1.2.3; 4.4.3
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2; 4.4.3
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2; 4.4.3
Discharge of other metals in wastewater	4.2.1.2.4; 4.4.2.2
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.2.2; 4.4.1.2; 4.4.3; 4.6.1.1
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.2.2.1.10; 4.2.2.2; 4.4.3
Cold shock	4.2.2.1.5; 4.2.2.1.10; 4.2.2.2; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.2.2.2; 4.4.3

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
Distribution of aquatic organisms	4.2.2.1.6; 4.2.2.2; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.2.2.2; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.2.2.2; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.2.2.2; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.2.2.2; 4.4.3
Stimulation of nuisance organisms (e.g., shipworms)	4.2.2.1.11; 4.2.2.2; 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	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

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

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

The staff has not identified any new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of altered current patterns at intake and discharge structures 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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.

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

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

The staff has not identified any new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of scouring caused by discharged cooling water 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information (including plant monitoring data, technical reports, including those supporting the Apalachicola-Chattahoochee-Flint (ACF) Draft Environmental Impact Statement (EIS) (USACE 1998), and discussions with the U.S. Army Corps of Engineers (USACE) operators of ACF reservoirs including Lake Seminole, the potentially affected reservoir), and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts at intake and discharge structures 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information including the National Pollutant Discharge

Elimination System (NPDES) permit for Farley (ADEM 2001), and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information including the NPDES permit for Farley (ADEM 2001), and public comments on the draft SEIS. 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 wastewater. Based on information in the GEIS, the Commission found that

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

The staff has not identified any new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information including the NPDES permit for Farley (ADEM 2001), and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of discharges of other metals in wastewater 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of thermal plume barriers to migrating fish 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of entrainment of fish and shellfish in early life stages for cooling tower based systems during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish (cooling tower based 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of impingement of fish and shellfish for cooling tower based systems during the renewal term beyond those discussed in the GEIS.

- Heat shock (cooling tower based 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of heat shock for cooling tower based systems 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 renewal term.

The staff has not identified any new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS.

Therefore, the staff concludes that there are no impacts on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on native 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no cooling tower impacts on native vegetation 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 have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during the staff's independent review of the Joseph M. Farley ER (SNC 2003a), the scoping process, the staff's site visit, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

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

Table 4-2. Category 2 Issues Applicable to the Operation of the Farley Units 1 and 2 Cooling System 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[a]
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 a low flow)	4.3.2.1; 4.4.2.1	A	4.1.1
HUMAN HEALTH			
Microbiological organisms (public health)(plants using lakes or canals or cooling towers that discharge into a small river)	4.3.6	G	4.1.2
(a) Supplemental Environmental Impact Statement			

4.1.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with a Low Flow)

NRC specifies in 10 CFR 51.53(c)(3)(ii)(A) that “if the applicant’s plant uses cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 9×10^{10} m^3/yr (3.15×10^{12} ft^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided.” For water use conflicts, the NRC further states in 10 CFR part 51, Subpart A, Appendix B, Table B-1, “The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations.” This issue is applicable to Farley because the plant uses cooling towers and the Chattahoochee River is categorized as a small river with a low flow.

The impact of consumptive loss on the downstream riparian communities is associated with the small difference it causes in the river surface elevation. The Alabama Department of

Environmental Management (ADEM) uses a 7Q10[a] of 58 m^3/s (2050 cfs) and a Most Probable flow of 224 m^3/s (8000 cfs) for NPDES purposes. Assuming a discharge flow of 212,000 L/min (56,000 gpm) from water use data, the net loss to the Chattahoochee River is 75,700 L/min (20,000 gpm, or 45 cfs), or 0.8 percent of the river's lowest annual mean flow between 1996 and 2000, 2 percent of the 7Q10 flow, and 0.6 percent of the Most Probable flow.

Section 2.2.5 describes the habitats along the shoreline of the Chattahoochee river in the vicinity of the Farley site and immediately downstream. The consumptive loss incurred by plant operations has the greatest potential effect on surface elevation during low-flow periods. The duration of low-flow conditions is approximately three months during late summer and early fall (August to October) (USGS 2002). 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 could have the greatest impact on in-stream 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 generally occurs in late winter through early summer, the period of highest flows in the Chattahoochee river; a few species of fish will spawn during late summer as flows begin to decrease (Mettee et al. 1996). Consumptive loss from plant operations is not expected to have any impact on in-stream communities, because the lowest average daily flow for a one-month period occurs in September, and the highest average daily flow for a one-month period occurs in March (SNC 2003a). Most riverine species have evolved under seasonally fluctuating water level conditions and are unaffected by small fluctuations in water level.

Severe drought conditions were experienced in the region throughout the last three summers (2001, 2002, and 2003), and even through these conditions, operations on the Farley site were not curtailed due to any USACE-mandated flow restrictions on the river in the plant vicinity. The known or planned activities on the ACF river system that could potentially produce additional water conflicts during the renewal period (e.g., the possibility of increased upstream withdrawals by the city of Atlanta, GA, or other major water users within the next 10 years) are neither due to nor impacted by the operations of Farley, who has no plans to modify its river water withdrawal rates during the renewal period. No situations were encountered where makeup water withdrawals for losses due to Farley operations affected the flow conditions in the Chattahoochee River so as to impinge upon the USACE's activities to maintain flows and reservoir levels in the ACF system, or that changes in water levels downstream of Farley due to

(a) 7Q10 is defined as the lowest stream flow for seven consecutive days that would be expected to occur once in ten years.

its water consumption could even be measured or distinguished relative to flow and water level changes due to USACE water management operations in the ACF system (Bradley 2004; Jangula 2004; Vaughan 2004).

Delivery of large equipment components would be by barge up the Chattahoochee River. As described in Section 2.2.2, flows in the Chattahoochee River are managed by the USACE. Barge navigation is not possible during low flow and drought conditions. To allow barge navigation during these periods, the USACE releases water from upstream reservoirs in two-week "navigation windows." Prior to releases, the USACE coordinates with the U.S. Fish and Wildlife Service (FWS) and appropriate State and local agencies to minimize impacts to riparian habitats and species, and to upstream users. It is assumed that coordination between the licensee, the USACE and responsible agencies would occur prior to releases for plant equipment transport by barge, and that these releases would be managed in a way that minimizes significant habitat loss or fragmentation, or would avoid interrupting the reproductive cycles of aquatic species. Therefore, the impact of water use would be SMALL and no mitigation measures are warranted.

4.1.2 Microbiological Organisms (Public Health)

For plants discharging cooling water to cooling ponds, lakes, canals, or small rivers with annual average flow rates less than 9×10^{10} m^3/yr (3.15×10^{12} ft^3/yr), the effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal. This issue is applicable to Farley because the plant discharges to the Chattahoochee River which has an average annual flow rate of 9.9×10^9 m^3/yr (3.5×10^{11} ft^3/yr) and is categorized as a small river in the GEIS (NRC 1996).

The Category 2 designation is based on the potential for public health impacts associated with the enhancement of thermophilic organisms. Thermophilic organisms of concern include the pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic actinomycetes (fungi), the many species of *Legionella* bacteria, and the pathogenic strains of the free-living amoebae of the genera *Naegleria* and *Acanthamoeba*. The NRC noted that 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 these microorganisms, and impact to public health. Thermophilic bacteria generally occur at temperatures of 25°C to 80°C (77°F to 176°F), with maximum growth at 50°C to 60°C (122°F to 140°F) (SNC 2003b).

SNC monitors water temperatures monthly as part of the site's water quality monitoring program. Maximum temperatures for monitoring years 1998 through 2000 at the Main Combined Facility Discharge were highest from June through September, ranging from 31.1°C to 36.0°C (88.0°F to 96.8°F). The highest temperature recorded was 36.0°C (96.8°F) in

July 2000 (SNC 2003b). Maximum temperatures recorded in the Chattahoochee River thermal discharge are below the optimal temperature range for growth and reproduction of thermophilic microorganisms. These temperatures could support limited survival of thermophilic microorganisms in the summer months, although temperatures are below the range most conducive to the growth of thermophilic microorganisms.

Another factor controlling the survival and growth of thermophilic microorganisms in the Chattahoochee River is the disinfection of Farley sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the river from sewage plant discharge. The NPDES permit for Farley plant requires monitoring of fecal coliforms in sewage treatment plant effluent (after discharge from the chlorine contact chamber and prior to mixing with other waste streams). From 1998 to 2000, no fecal coliform limits were exceeded.

There is public access to the Chattahoochee River, including recreational fishing, boating, and swimming. Public use of the river downstream of the plant creates the potential for human exposure to thermophilic organisms. However, given the thermal characteristics of Chattahoochee River in the vicinity of the discharge outfall and the disinfection of sewage effluents, these organisms would not be expected to pose a threat to recreational users of the river or other downstream users.

SNC wrote to the Watershed Planning and Monitoring Program in the Environmental Protection Division of ADEM, the Alabama Department of Public Health, and the Water Protection Branch of the Environmental Protection Division of the Georgia Department of Natural Resources requesting information on any studies that might have conducted concerning thermophilic microorganisms in the Chattahoochee River and any concerns the agencies might have relative to these organisms (SNC 2003b). The agencies contacted did not identify any studies or concerns dealing with thermophilic microorganisms in the Chattahoochee River.

Based on its review of the above information, the staff concludes that the potential impacts to public health from microbiological organisms resulting from operation of Farley's cooling water and sewage effluent discharge systems to the aquatic environment on or in the vicinity of the site area are SMALL, and additional mitigation is not warranted.

4.2 Transmission Lines

Alabama Power Company (APC) initially built five transmission lines for the specific purpose of connecting Farley Nuclear Plants Units 1 and 2 to the transmission system. One additional transmission line, Farley-Sinai Cemetery, was recently built by APC to connect Farley to the regional grid. In total, for the specific purpose of connecting Farley to the transmission system, APC has constructed approximately 524 km (326 mi) of rights-of-way (ROWs) that occupy approximately 2403 ha (5938 ac). The transmission lines pass through land that is primarily rolling hills covered in forests or farmland. The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways, including U.S. 231 and U.S. 431 (SNC 2003a).

APC, Georgia Power Company (GPC), and Gulf Power Company conduct surveillance and maintenance activities to ensure that design ground clearances will not change. These procedures include routine aerial inspections of all ROWs on a regular basis, which include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organization(s) for corrective action.

APC, GPC, and Gulf Power Company use several methods to control vegetation in the Farley transmission. As a general rule, dry upland areas (particularly those not subject to erosion) are periodically mowed, while steep slopes and margins of wetlands and streams are sprayed with approved (non-restricted) herbicides when necessary. Mowing generally occurs on a three-year cycle in Alabama, a five-year cycle in Georgia, and a four to six-year cycle in Florida, during the growing season (May to October, with the majority occurring in May and June). Herbicides are applied by backpack sprayer to ensure that chemicals are used sparingly and applied directly to the brushy or woody vegetation. Herbicide application occurs on a two-year cycle in Alabama, and may occur any time during the five-year mowing cycle in Georgia, generally once or twice during the five-year mowing cycle. Some ecologically sensitive areas are hand-cleared. This integrated approach to vegetation management is intended to minimize soil loss and protect wetlands and streams from sedimentation. Some portions of the transmission are cultivated by local farmers and, therefore, require no additional vegetation maintenance. Private interests that have agreed to handle vegetation maintenance are also maintaining other portions of the transmission for wildlife enhancement. APC participates with the U.S. Department of Agriculture Natural Resources Conservation Service and local soil and water conservation districts in a pilot project to enhance wildlife habitats along transmission line ROWs (SNC 2003a). During 2000, 24 applicants (representing 341 ha [212 ac] of Farley transmission line) participated in this program to enhance wildlife habitats (SNC 2003a). GPC participates in a wildlife management program with Georgia Department of Natural Resources on Farley transmission line ROWs. The Wildlife Incentives for Non-Game and Game Species (WINGS) program is designed to help land users convert GPC transmission line ROWs into productive habitat for wildlife. WINGS offers grant money and land management expertise to landowners, hunting clubs, and conservation organizations who commit to participating in the program for three years. GPC is one of two utilities funding the WINGS program in Georgia.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to transmission lines from Farley are listed in Table 4-3. The applicant stated in its ER (SNC 2003a) that it is not aware of any new and significant information associated with the renewal of the Farley operating license. The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted. A brief description of the staff's review and GEIS conclusions, as codified in Table B-1, for each of these issues follows.

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

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
TERRESTRIAL RESOURCES	
Power line rights-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 wetlands on power line rights-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 rights-of-way	4.5.3

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

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

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, consultation with the FWS, ADEM, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power line 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 are expected to be of small significance at all sites.

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, consultation with the FWS, ADEM, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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.

- Flood plains and wetlands on power line rights-of-way. Based on information in the GEIS, the Commission found that

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

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, consultation with the FWS, ADEM, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power line on flood plains and wetlands during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no onsite land use impacts during the renewal term beyond those discussed in the GEIS.

- Power line rights-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 new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a), the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of power line on land use 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 are discussed in Sections 4.2.1 and 4.2.2.

Table 4-4. Category 2 and Uncategorized Issues Applicable to the Farley 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	N/A	4.2.2

4.2.1 Electromagnetic Fields—Acute Effects

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

APC originally built five transmission lines specifically to connect Farley plant to the transmission system (SNC 2003a). Construction of a sixth transmission line has recently been completed. A total of six transmission lines currently connect Farley plant to the transmission system. The six lines total approximately 524 km (326 mi) in length and occupy approximately 2403 ha (5938 ac) of corridor. All Farley plant transmission lines have been designed and constructed in accordance with the NESC and industry guidance that was current when the lines were built (SNC 2003a). Only the most recently constructed sixth line was designed and built specifically to meet the most current NESC criteria.

SNC performed an analysis to demonstrate that the original five transmission lines at Farley plant are in compliance with the NESC 5-mA, electric-field-induced current limit (SNC 2003a). A computer-model-based analysis was conducted that evaluated the conformance of the transmission lines at Farley plant with the NESC requirement that transmission lines be designed to limit the induced current due to electrostatic effects to 5 mA if the largest anticipated vehicle parked under the lines were short-circuited to ground. SNC calculated electric field strength and induced current using a computer code called AC/DCLINE, produced by the Electric Power Research Institute (EPRI 1991). The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included the limiting case configuration for each line, that line sag be determined at 48.9°C (120°F) conductor temperature, and the maximum vehicle size expected under the lines. For cases where paved roads exist, the vehicle was assumed to be a tractor-trailer. For cases without paved roads, a combine (agricultural tractor) was used in the model.

The initial analysis (SNC 2003a) determined that all but one of the transmission lines are in conformance with the 5-mA NESC limit. One line (Farley-Snowdon) indicated a 5.1 mA induced current. An additional analysis (SNC 2004) using site-specific information resulted in a reduced current value of 3.7 mA. Therefore, the Farley plant transmission line designs conform to the NESC provisions for preventing electric shock from induced current.

The staff has reviewed the available information, including that provided by the applicant, the staff's site visit, the scoping process, and other public sources. Using this information, the staff evaluated the potential for impacts from electric shock resulting from the operation of Farley plant and its associated transmission lines. The staff considered the cumulative impacts of past, current, and foreseeable future actions at the site regardless of what agency (Federal or non-Federal) or person undertakes such other actions. It is the staff's conclusion that the potential for impacts from electric shock during the renewal term is SMALL.

During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Farley Units 1 and 2. Based on the assessment to date, the staff expects that the measures in place at Farley (e.g., transmission lines are in compliance with the NESC) provide mitigation for all impacts related to acute effects of electromagnetic fields, and no new mitigation measures are warranted.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of 60-Hz electromagnetic fields from power lines were not designated as either Category 1 or Category 2, and will not be 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 uncertain 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) contains the following conclusion:

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

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The staff considers the GEIS conclusion that the chronic effects are "uncertain" is 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 Farley in regard to radiological impacts are listed in Table 4-5. SNC stated in its ER (SNC 2003a) that it is not aware of any new and significant information associated with the renewal of the Farley OLs. The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

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

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

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

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

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal 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 2003a) that it is not aware of any new and significant information associated with the renewal of Farley. The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). 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 new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the Joseph M. Farley ER, the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

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

Table 4-7. Environmental Justice and Category 2 Issues Applicable to Socioeconomics 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: public transportation	4.7.3.2	J	4.4.4
Historic and archeological resources	4.7.7	K	4.4.5
Environmental justice	not addressed[(a)]	not addressed[(a)]	4.4.6

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

4.4.1 Housing Impacts During Operations

In 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 [NRC 1996]). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS Table C.1), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

According to the U.S. Census Bureau (USCB) 2000 information, the population living within 32 km (20 mi) of the Farley site was estimated to be approximately 93,120 (SNC 2003a). This translates to about 28 persons/km^2 (72 persons/mi^2) living on the land area present within a 32-km (20-mi) radius of the Farley site.

This concentration falls into GEIS sparseness Category 3.[a] The city of Dothan has a population of 57,737 persons (USCB 2000c). As estimated from 2000 USCB information, approximately

(a) Category 3 is defined as having 23 to 46 persons/km^2 (60 to 120/persons/mi^2), or having fewer than 23 persons/km^2 (60 persons/mi^2) with at least one community with 25,000 or more persons within 32 km (20 mi).

393,639 people live within 80 km (50 mi) of Farley. This equates to a population density of 19 persons/km^2 (50 persons/mi^2) within 80 km (50 mi). According to the GEIS proximity measures (NRC 1996), Farley is therefore classified as Category 2.[a] Applying the GEIS sparseness and proximity matrix (sparseness Category 3 and proximity Category 2) results in the conclusion that Farley is located in a medium population area.

SMALL impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion is required to meet new demand (NRC 1996). The GEIS assumes that no more than a total additional staff of 60 permanent workers might be needed during the license renewal period to perform routine maintenance and other activities. Although SNC expects to perform these routine activities during scheduled outages, they assumed they would not add employees to their permanent staff during license renewal (SNC 2003a). The number of vacant housing units in Houston County is approximately 9.4 percent or 3,737 housing units (USCB 2000a). Therefore, the addition of 60 workers during license renewal could be comfortably absorbed without significant impact to the housing market. With the increase in retail business in the Dothan metropolitan area, there has been a corresponding increase in hotels and motels.[b] SNC stated that temporary workers are likely to use these establishments. However, to provide a bounding analysis, SNC submitted additional information on November 3, 2003, that analyzed the impact of an additional 60 employees and the estimated 114 indirect jobs generated by those additional employees (Beasley 2003). This additional analysis did not change the staff's conclusion related to impacts.

Farley is not projecting new employment due to license renewal activities. As a result, SNC indicated that the impacts would be SMALL and mitigation measures would not be necessary (SNC 2003a).

The staff reviewed the available information relative to housing impacts and SNC's conclusions. Based on this review, the staff concludes that the impact on housing during the license renewal period would be SMALL, and additional mitigation measures are 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

(a) Category 2 is defined as having no city with 100,000 or more persons, and having between 19 and 73 persons/km^2 (50 and 190 persons/mi^2) within 80 km (50 mi).

(b) Personal communication, Dothan Chamber of Commerce, January 8, 2004.

meet ongoing demands for services. The GEIS indicates that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies (NRC 1996).

Analysis of impacts on the public water supply system considered both plant demand and plant-related population growth. Section 2.2.2 describes the Farley permitted withdrawal rate and actual use of water. There are no plans for refurbishment at Farley, so plant demand would not change (SNC 2003a).

Farley assumed no new employment due to license renewal activity. However, to provide a bounding analysis, SNC submitted additional information on November 3, 2003, that analyzed the impact of an additional 60 employees (Beasley 2003). This additional analysis did not change the staff's conclusion related to impacts. Therefore, no increase in water use due to license renewal activity is expected. The staff finds that the impact of increased water use on area water systems is SMALL, and that no further mitigation measures are warranted.

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—Little new development and minimal changes to an area's land use pattern.
>
> MODERATE—Considerable new development and some changes to the land use pattern.
>
> LARGE—Large-scale new development and major changes in the land use pattern.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. Section 4.7.2.1 of the

GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdictions revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land use changes would be MODERATE. If the plant’s tax payments are projected to be a dominant source of the community’s total revenue, new tax-driven land use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development (NRC 1996).

Table 2-10 compares total tax payments made by Farley to Houston County and the county’s annual property tax revenues (SNC 2003a). For the five-year period from 1995 through 1999, Farley’s tax payments to Houston County represented 32 to 38 percent of the county’s total annual property tax revenues. Using the NRC’s criteria, Farley’s tax payments therefore have a LARGE and beneficial impact on Houston County. For the reasons presented below, however, SNC does not anticipate large land use changes as a result of these tax revenues.

SNC does not anticipate major refurbishment or construction during the license renewal period and, therefore, does not anticipate any increase in the assessed value of Farley due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land use and development patterns (SNC 2003a). Farley will continue to be a significant source of tax revenue for Houston County. However, despite having this income source since plant construction in the early 1970s, Houston County has not experienced large land use changes. The Farley environs have remained largely rural, and county population growth rates after Farley’s construction have been minimal. The county planners are not projecting large land use changes (SNC 2003a). SNC believes continued operation of Farley would be important to maintaining the current level of development and public services, and does not anticipate plant-induced changes to local land use and development patterns as a result of license renewal.

If the operating licenses for Farley were not renewed and the station was decommissioned, the impacts to the tax base of the surrounding communities and their economic structures could be significant, as discussed in Section 8.4.7 of the GEIS (NRC 1996). However, based on the information presented above, the staff concludes that tax related land use impacts related to renewing the operating license for Farley are likely to be SMALL.

Because SNC does not anticipate refurbishment activities, the population growth related to the license renewal of Farley is expected to be relatively small, and there would be no new tax impacts on local county land use, the staff concludes that the renewal of Farley’s licenses would have a SMALL overall impact on the local counties and the surrounding region, and would not warrant mitigation.

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. The issue is treated as such in this SEIS.

Expected population growth in the area around Farley is not due to changes in employment at Farley, but due to the successful recruitment of retail, manufacturing and medical related employment increases (Dothan Chamber of Commerce 2004). Current employment associated with Farley is approximately 900 permanent employees, and 375 contract and matrixed employees (Beasley 2003). Farley refuels on an 18-month cycle. During refueling outages, site employment increases by as many as 800 temporary workers for 30 to 40 days. During surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR), Farley believes that these tasks can be performed within this schedule and employment level. Therefore, Farley has no plans to add outage employees for license renewal term outages. However, to provide a bounding analysis, SNC submitted additional information on November 3, 2003, that analyzed the impact of an additional 60 employees (Beasley 2003). This additional analysis did not change the staff's conclusion related to impacts.

The staff reviewed Farley's assumptions and resulting analyses. The staff concludes that any impact of Farley employees on transportation service degradation is likely to be SMALL and no further mitigation measures are warranted.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. The historic preservation review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation (ACHP) at 36 CFR Part 800. Renewal of an OL is an undertaking that could potentially affect historic properties. Therefore, according to the NHPA, the NRC is to make a reasonable effort to identify historic properties in the areas of potential effects. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Officer (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

SNC initiated communication with the Alabama, Georgia, and Florida SHPOs on May 7, 2002 (Pierce 2002a,b,c). The letters express SNC's desire to assess the effects of license renewal on historic properties, as required by the NRC of applicants for operating license renewal (Pierce 2002a,b,c). The letters specifically include the purview of the proposed undertaking for the Farley site itself and the five related transmission lines built to connect Farley to the regional transmission system. SNC also included a sixth line which was under construction (within an existing transmission corridor), the Farley to Sinai Cemetary transmission line, that runs south to the Florida panhandle. SNC notes in its letters that it does not expect the operation of

Farley, including the maintenance of the identified transmission lines, through the license renewal term to adversely affect cultural or historical resources in the area. SNC further states, “No expansion of existing facilities is planned, and no major structural modifications have been identified for the purpose of supporting license renewal. No land-disturbing activities are anticipated beyond those required for routine maintenance and repair.” Finally, a request was made in the letters for State concurrence with a determination that the operation of Farley Units 1 and 2 during the period of license renewal would have “...no effect on any historic or archaeological properties in Alabama.”

In response to SNC dated June 11, 2002, the Alabama SHPO stated that the extension of the operating license would not have an effect on historic properties; thus no further compliance with Section 106 was required (Brown 2002). Similar letters were exchanged with the Georgia SHPO (Bellew 2002) and with the Florida SHPO (Matthews 2002). However, the response from all three SHPOs stressed the need to restrict activities to existing developed areas, and indicated that any new use of previously undeveloped areas within Farley would require evaluation and new consultation. On November 26, 2003, the NRC forwarded letters to the Alabama and Georgia SHPOs (Kuo 2003a,b) notifying them of the proposed undertaking, and the NRC’s intent to prepare an environmental impact statement in accordance with 36 CFR 800.8. Additionally, the NRC corresponded with the ACHP on December 18, 2003 (Kuo 2003c). By letters dated August 26, 2004 and September 2, 2004, the Georgia and Alabama SHPOs, respectively, concurred with the staff’s determination (Bellew 2004; Brown 2004).

It is unlikely that significant historic resources are present in the previously developed portions of the Farley site. However, provisions for dealing with the inadvertent discovery of significant subsurface archaeological deposits and human remains are part of the administrative control procedures in place at Farley in the unlikely event such deposits and remains are encountered during routine operations and maintenance. Major refurbishment of Farley is not required during the license renewal period, and it is anticipated that there will be no need to use the currently undeveloped portions of Farley for operations during the renewal period. Farley management is aware of the known cultural resources at Farley, and is committed to taking them into account during the license renewal period. Continued operation of Farley would have a beneficial effect on these or any potential unknown or undiscovered historic or archaeological resources in undisturbed areas for the duration of the license renewal period by protecting the natural landscape and vegetation and by the restricted access to the plant.

Based on the staff’s cultural resources analysis, the finding that SNC did not identify any major refurbishment activities related to the renewal of the Farley OLs, and that operation will continue within the bounds of plant operations as evaluated in the final environmental statement (FES) (AEC 1974), 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 that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its actions on minority[a] or low-income populations. The memorandum accompanying Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice. Although the Executive Order is not mandatory for independent agencies, the NRC has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the commission published a Final Policy Statement in the *Federal Register* on the treatment of environmental justice matters in NRC regulatory and licensing actions (NRC 2004c). The Final Policy Statement reaffirms that the Commission is committed to full compliance with the requirements of NEPA. Specific guidance is provided in NRC Office of Nuclear Reactor Regulation Office Instruction LIC-203, Revision 1, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues* (NRC 2004a).

The scope of the review as defined in NRC guidance (NRC 2004a) includes identification of impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on these populations, and any additional information pertaining to mitigation. It also includes an evaluation of whether these impacts are likely to be disproportionately high and adverse.

The staff looks for minority and low-income populations within the 80-km (50-mi) radius of the site. For the staff's review, a minority population exists in a census block group[b] if the percentage of each minority and aggregated minority category within the census block group exceeds the corresponding percentage of minorities in the state of which it is a part by 20 percent, or the corresponding percentage of minorities within the census block group is at least 50 percent. A low-income population exists if the percentage of low-income population within a census block groups exceeds the corresponding percentage of low-income population in the state of which it is a part by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent.

(a) The NRC guidance for performing environmental justice reviews defines "minority" as American Indian or Alaskan native; Asian, Native Hawaiian or other Pacific Islander; or Black races; or Hispanic ethnicity. "Other" races and multiracial individuals may be considered a separate minority category (NRC 2004a).

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

For the SNC review, the staff examined the geographic distribution of minority and low-income populations within 80 km (50 mi) of the site, employing the 2000 census (USCB 2000a) for low-income populations and minority populations. The analysis was supplemented by staff's field inquiries to the planning department and social service agencies in Houston County. Supplemental information was requested and received from SNC. The supplemental information included SNC's analysis of unique or significant impacts on minority or low-income populations (SNC 2004).

SNC conducted its analysis for minority and low-income populations using the convention of including a census tract or block group if any part of its area lay within 80 km (50 mi) of Farley. SNC used USCB 2000 census data to determine the minority and low-income characteristics on a block-group level. Using this convention, the 80-km (50-mi) radius included 371 census blocks and 131 census tracts (USCB 2000b). SNC included in the analysis all census blocks or tracts, if any part of a census block or tract fell within 80 km (50 mi) of Farley. Because the tracts making up the significant area are located in Alabama, Florida, and Georgia, SNC defined the geographic area to be Alabama, Florida, and Georgia. Each census tract or block was evaluated against the appropriate state to determine the presence of minority or low-income populations. The NRC staff has since determined by independent analysis that 362 census block groups exist within the 80-km (50-mi) radius, rather than 371 as reported by the USCB. However, this change did not affect the impacts. The criterion of "more than 20 percentage points" was used to determine whether a census tract or block group should be counted as containing a minority or low-income population. Figures 4-1 and 4-2 show the distribution of census blocks for the minority and low-income populations, respectively (shaded areas).

Based on the NRC criterion, the staff determined that Black minority populations exist in 99 block groups. American Indian, Alaskan Native, Asian, Hispanic and all other single minorities, as well as multi-racial minorities and aggregates of minority races exist in 0 block groups. Figure 4-1 shows the location of census block groups with minority populations. By the NRC criteria, 33 census blocks contained areas of low-income populations, as shown in Figure 4-2.

With the locations of minority and low-income populations identified, the staff evaluated whether any of the environmental impacts of the proposed action could affect these populations in a disproportionately high and adverse manner. Based on staff guidance (NRC 2004a), air, land, and water resources within 80 km (50 mi) of the Farley site were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population.

The pathways through which the environmental impacts associated with Farley license renewal can affect human populations are discussed in each associated section. The staff evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts

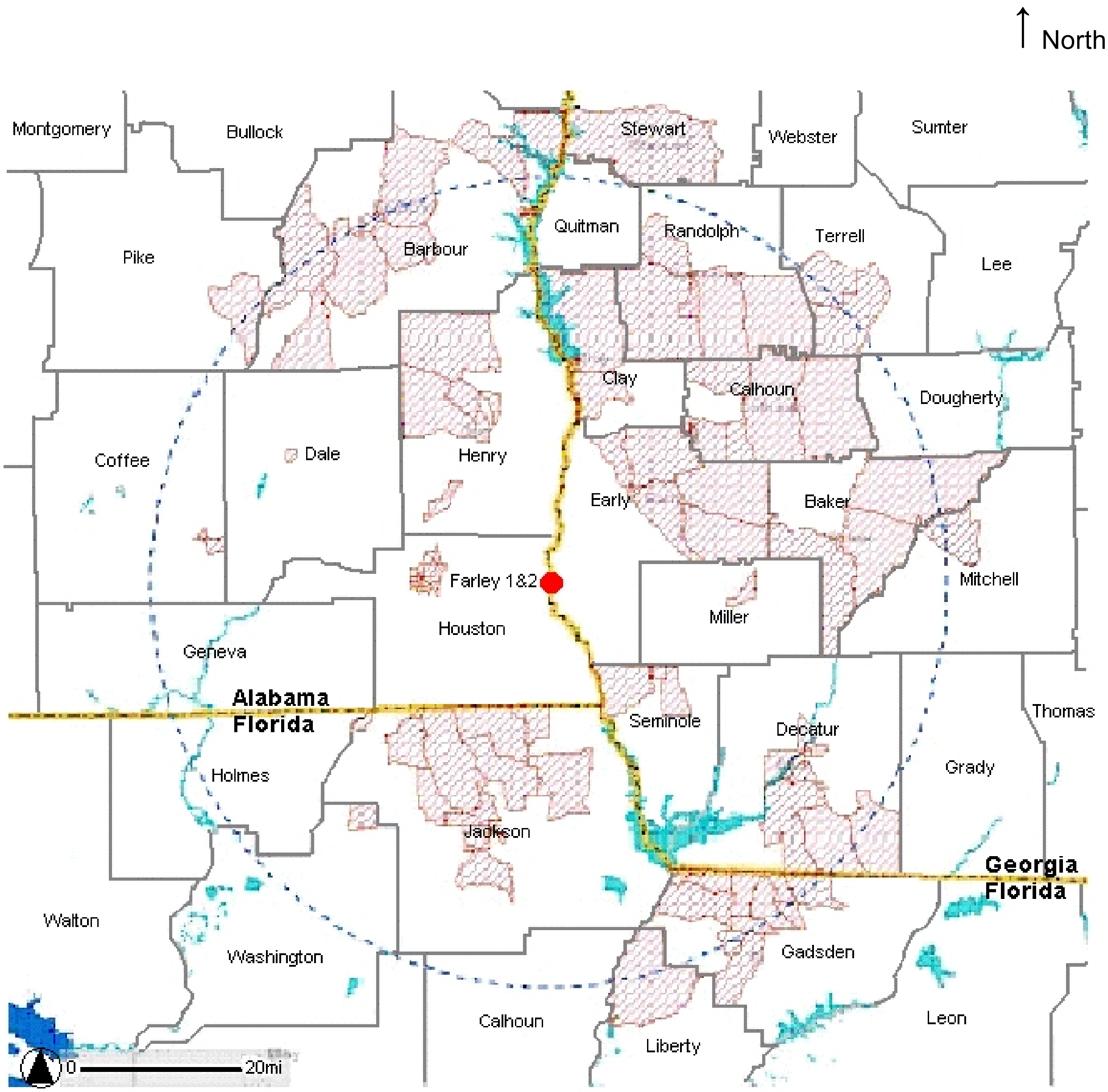

Figure 4-1. Geographic Distribution of Minority Populations (Shown in Shaded Areas) Within 80 km (50 mi) of Farley Units 1 and 2 Based on Census Block Group Data[a]

(a) Note: Some of the census block groups extend into open water.

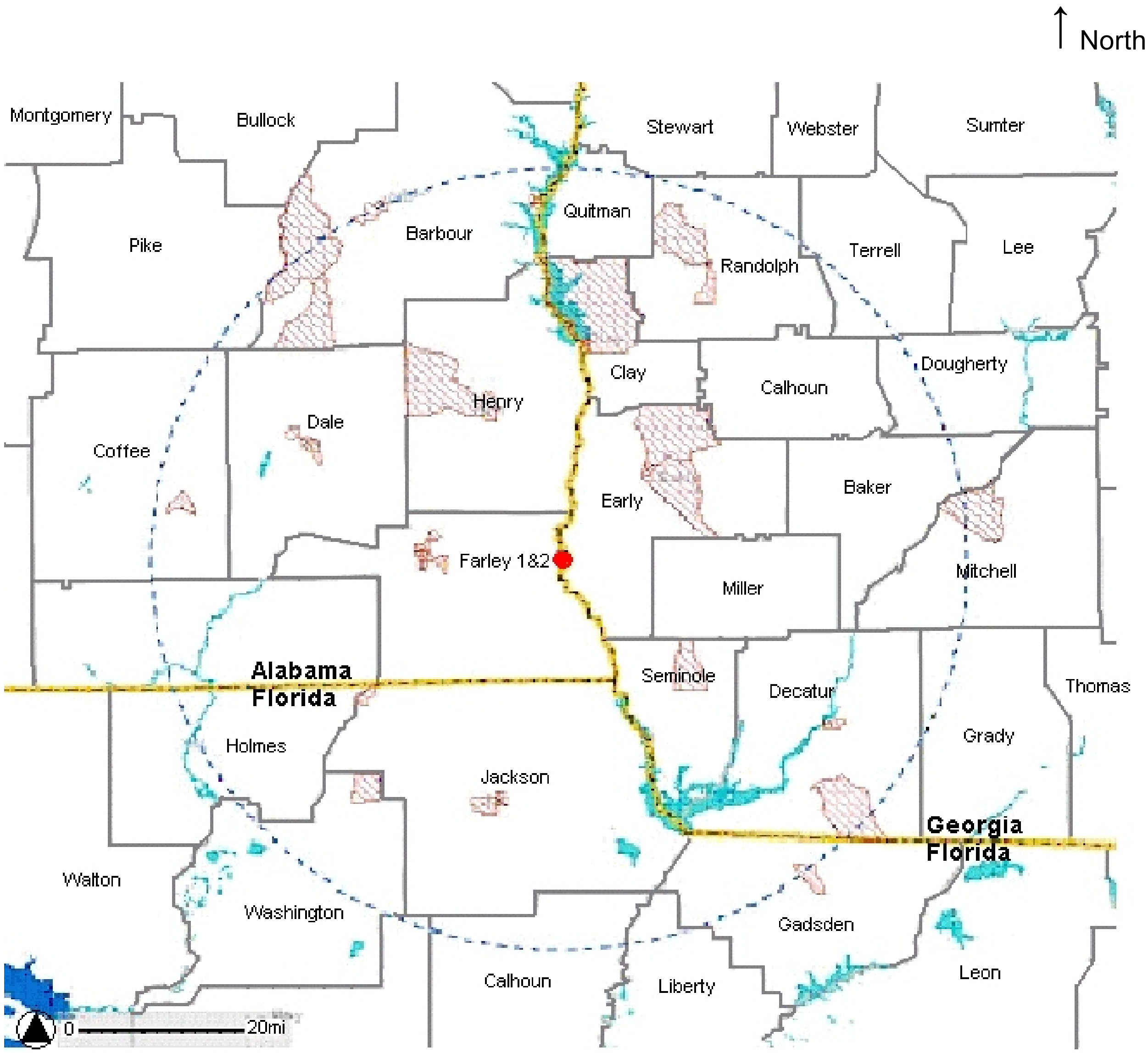

Figure 4-2. Geographic Distribution of Low-Income Populations (Shown in Shaded Areas) Within 80 km (50 mi) of Farley Units 1 and 2 Based on Census Block Group Data[a]

(a) Note: Some of the census block groups extend into open water.

affecting these minority and low-income populations. The staff concludes that offsite impacts from Farley to minority and low-income populations would be SMALL, and no special mitigation actions are warranted.

4.5 Groundwater Use and Quality

No Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 are potentially applicable to Farley Plant groundwater use and quality during the renewal term. SNC submitted, separately from its ER (SNC 2003a), its assessment of issues that may constitute new and significant information associated with the renewal of the Farley plant operating license (SNC 2003b).

The staff has not identified any new and significant information during its independent review of the Joseph M. Farley ER (SNC 2003a) the staff's site visit, the scoping process, staff evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues that are beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation is not likely to be sufficiently beneficial to be warranted.

Category 2 issues related to groundwater use and quality during the renewal term that are applicable to Farley are discussed in the sections that follow. These issues, which require plant-specific analysis, are listed in Table 4-8.

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, and dewatering; plants that use > 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

4.5.1 Groundwater Use Conflicts (Potable and Service Water; Plants That Use > 100 gpm)

As discussed in Section 2.1.3, approximately 500 L/min (130 gpm) is used at Farley for domestic purposes. Groundwater used at Farley is typically supplied by three onsite wells, one having a five-year average daily use of 443 L/min (117 gpm), and the other two having a five-year combined average daily use of 45 L/min (12 gpm). Groundwater is used at Farley to supply the sanitary water system, maintain the level in the fire protection storage tank, and provide a back-up supply to the filtered water storage tank. The plant's water treatment system, main cooling system and emergency cooling system use the service water system as their primary water source; groundwater is not used for these purposes.

Over 27.6 million L (7.3 million gal) of groundwater are withdrawn daily in Houston County (SNC 1996). Data for public water systems are shown in Table 2-5. To determine the general groundwater use surrounding the site, a survey of water users within a 5-km (3-mi) radius of the plant was conducted. The results of the survey were presented in the Final Safety Analysis Report (FSAR) (SNC 1996). Of the 43 wells surveyed, all but two are served in shallow zones, and two are screened in the major deep aquifer. There are no wells that produce from the Chattahoochee River alluvium. The primary use of the groundwater is for domestic needs, with a small percentage for stock watering and irrigation. A pipe-fabricating plant about 10 km (6 mi) south of the plant in Early County, Georgia, uses groundwater. The water is withdrawn periodically from a well screened in the lower part of the major shallow aquifer.

No well users in the vicinity of Farley use significantly large amounts of groundwater. While localized cones of depression will occur where groundwater is pumped from a limited area for municipal and industrial purposes, such as Dothan, Alabama, 27 km (17 mi) west of the plant, well surveys have shown that municipalities and industries near the site do not require or use large amounts of groundwater (SNC 1996). As a result, no significant cones of depression exist in the area surrounding the site.

The staff reviewed the available information including relevant technical reports and the ER relative to potential groundwater use conflicts. Based on this review, the staff has concluded that the potential impacts are SMALL, and that no additional mitigation measures are warranted.

4.5.2 Groundwater Use Conflicts (Plants Using Cooling Towers Withdrawing Makeup Water From a Small River)

As discussed in Section 2.1.3, the Farley groundwater well system is capable of supplying 2330 L/min (615 gpm). Because the normal system demand is 454 L/min (129 gpm), almost 1900 L/min (500 gpm) capacity is available to supplement the water treatment system supply during low river flow conditions. Therefore, it would not become necessary to use additional surface water for these purposes, thus there are no surface water use conflicts for these plant water uses.

An estimated 223 people live within 5 km (3 mi) of the plant. The Geological Survey of Alabama has suggested 189 L (50 gal) per day to be the normal per capita use (GSA 1991). Therefore, the total present usage from all of the aquifers is estimated to be 42,200 L (11,150 gal) per day, or 29 L (7.7 gal) per minute. The population within the same area is expected to increase to 347 by the year 2015.

By conservatively assuming that per capita use will increase to 379 L (100 gal) per day, the total projected groundwater usage by the year 2015 is estimated to be 131,300 L (34,700 gal) per day, or 91 L (24 gal) per minute.

The staff reviewed the available information including relevant technical reports and the ER relative to potential groundwater-use conflicts. Based on this review, the staff has concluded that the potential impacts are SMALL, and that no additional mitigation measures are warranted.

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. This issue is listed in Table 4-9.

The issue of threatened or endangered species present at the Farley site requires consultation with appropriate agencies to determine whether any such species are present and whether they would be adversely affected by continued operation of the nuclear plant during the license renewal term. The staff is currently consulting with the FWS under provisions of Section 7 of the Endangered Species Act (ESA) concerning the potential impacts of an additional 20 years of operation and maintenance activities at Farley on Federally listed species. The staff initiated consultation by requesting a list of threatened and endangered species (Kuo 2003d,e). FWS

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

responded with a list of species in the project area (Goldman 2004). The staff issued a biological assessment (BA) in July 2004 (NRC 2004b). The FWS concurred with the BA on October 27, 2004 (Snyder-Conn 2004). This consultation correspondence is in Appendix E.

4.6.1 Aquatic Species

Federally listed threatened and endangered aquatic species that have the potential to occur on or in the vicinity of the Farley site or the aquatic habitats crossed by the transmission lines associated with Farley are described in Section 2.2.5. The species include one fish, the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), and six unionid mussels: the fat threeridge (*Amblema neislerii*), shinyrayed pocketbook (*Lampsilis [Villosa] subangulata*), Gulf moccasinshell (*Medionidus penicillatus*), oval pigtoe (*Pleurobema pyriforme*), Chipola slabshell *(Elliptio chipolaensis*) and purple bankclimber *(Elliptoideus sloatianus*). The staff has evaluated the potential impact on these seven species resulting from an additional 20 years of operation of Farley and has documented its evaluation in a BA (see Appendix E).

Based on its evaluation in the BA, the staff has concluded that continued operation of the plant under license renewal will have no effect on the Gulf sturgeon and the fat threeridge, and may affect, but is not likely to adversely affect, the Chipola slabshell, purple bankclimber, shinyrayed pocketbook, Gulf moccasinshell, or oval pigtoe. Based on its evaluation, the staff concludes that the potential impacts on threatened and endangered aquatic species from an additional 20 years of operation of Farley would be SMALL and no additional mitigation is warranted.

4.6.2 Terrestrial Species

There are 17 Federally listed threatened or endangered terrestrial species and one Federally listed candidate terrestrial species that have the potential to occur on or in the vicinity of Farley and its associated transmission line ROWs. These species are discussed in Section 2.2.6.

Threatened or endangered animal species known to occur at Farley and the associated transmission line ROWs include the bald eagle (*Haliaeetus leucocephalus*) and the American alligator (*Alligator mississippiensis*). Threatened or endangered animal species potentially occurring, but not yet observed, on the Farley site or its associated transmission line ROWs include flatwoods salamander (*Ambystoma cingulatum*), eastern indigo snake (*Drymarchon corais couperi*), wood stork (*Mycteria americana*), red-cockaded woodpecker (*Picoides borealis*), gray bat (*Myotis grisescens*), and Indiana bat (*Myotis sodalis*).

No threatened or endangered plant species were observed on the Farley site or the associated transmission line ROWs during the 2001 to 2002 surveys (Tetra Tech 2002a,b). Threatened or endangered plant species potentially occurring on the Farley site or the associated transmission line ROWs, but not yet observed, include pondberry (*Lindera melissifolia*), Crystal Lake nailwort (*Paronychia chartacea minima*), mock bishop-weed (*Ptilimnium nodosum*), chaffseed (*Schwalbea americana*), fringed campion (*Silene polypetala*), gentian pinkroot *(Spigelia* *gentianoides*), Cooley's meadowrue (*Thalictrum cooleyi*), Florida torreya (*Torreya taxifolia*), and relict trillium (*Trillium reliquum*). In addition, one candidate plant species, Hirst's panic grass (*Panicum hirstii*), is potentially found along transmission line ROWs.

The staff has evaluated the potential impacts resulting from an additional 20 years of operation of Farley on terrestrial threatened or endangered species and has documented its evaluation in a BA (see Appendix E). In its BA, the staff concluded that continued operation of Farley may affect, but is not likely to adversely affect, the bald eagle, red-cockaded woodpecker, flatwoods salamander, American alligator, pondberry, Hirst's panic grass, Crystal Lake nailwort, mock bishop-weed, chaffseed, fringed campion, gentian pinkroot, Cooley's meadowrue, Florida torreya, or relict trillium. In addition, the staff concluded that continued operation would have no effect on the eastern indigo snake, wood stork, gray bat, or Indiana bat.

Based on this information, the staff concludes that the potential impacts on threatened or endangered terrestrial species from an additional 20 years of operation of Farley on terrestrial threatened and endangered species are SMALL.

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

The staff has not identified any 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, reviewed a separate report by SNC dated June 30, 2003 (SNC 2003b), and conducted its own independent review, including public meetings, to identify issues with new and significant information. Processes for identification and evaluation of new information are described in Section 1.2.2.

4.8 Cumulative Impacts

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

The impacts of the proposed action, as described in Section 4.0, are combined with other past, present, and reasonably foreseeable future actions which would affect the same resources impacted by Farley regardless of what agency (Federal or non-Federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

4.8.1 Cumulative Impacts Resulting from the Operation of the Plant Cooling System

For the purposes of this analysis, the geographic area considered is the watershed of the Chattahoochee River in the immediate vicinity of the Farley plant and, more broadly, the ACF river and reservoir system, of which the Chattahoochee River is a critical element. As described in Section 4.1, the staff found no new and significant information to indicate that the conclusions regarding any of the cooling system-related Category 1 issues as related to Farley are inconsistent with the conclusions in the GEIS. Additionally, the staff determined that none of the cooling system-related Category 2 issues were likely to have greater than a SMALL impact on local water quality or aquatic resources.

Cumulative impacts to the Chattahoochee River involve water use conflicts that have been building in the ACF Basin since the droughts of the 1980s as demands on ACF basin water resources have continued to increase. These conflicts have resulted in the following: State-to-State litigation; the development of the ACF River Basin Compact in 1997 (since expired), which established the ACF Compact Commission for future management of ACF resources (ADECA 2004); and the resulting studies that culminated in the 1998 Draft EIS, *Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia* (USACE 1998), and a proposed river allocation formula. The future of these efforts is uncertain at this time. Future water withdrawals by the Farley plant could be affected by these uncertainties.

The Farley plant is operated as a closed-cycle system using cooling towers for main condenser cooling. Evaporation and blowdown losses are replaced by makeup water from an onsite pond resupplied by the Chattahoochee River. As discussed previously in this chapter, consumptive water use by Farley, and any effect they may have on downstream water levels, are insignificant compared to water level changes controlled by the USACE via its operation of the ACF reservoirs. Nor have situations been encountered where makeup water withdrawals by Farley affected USACE activities that are intended to maintain flows and reservoir levels in the ACF system. USACE personnel have stated that changes in water levels downstream of Farley due to its water consumption cannot even be measured or distinguished relative to flow and water-level changes in the ACF system due to USACE water management operations (Bradley 2004; Jangula 2004; Vaughan 2004). Therefore, the staff has determined that the cumulative impact of continued operation of Farley would be SMALL and that no additional mitigation is warranted.

4.8.2 Cumulative Impacts Resulting from Continued Operation of Transmission Lines

The continued operation of the electrical transmission facilities with license renewal of Farley was evaluated to determine if there is a potential for interactions with other past, present, and future actions that could result in adverse cumulative impacts to terrestrial resources, (e.g., wildlife populations and the size and distribution of habitat areas), wetlands, floodplains, or aquatic resources. For the purposes of this analysis, the geographic area that encompasses the past, present, and foreseeable future actions that could contribute to adverse cumulative effects, is the area within 80 km (50 mi) of the Farley site as depicted in Figure 2-1.

Transmission line ROWs associated with Farley provide habitat for plant and animal species that prefer open, early successional habitats. This type of habitat, which was once common throughout Alabama, Florida and Georgia prior to establishment of current fire management regimes, has been greatly reduced in modern times due to fire suppression. Maintenance of the associated transmission line ROWs as early successional habitats helps slow the loss of open habitats occurring throughout the region on surrounding properties. Therefore, transmission line ROW maintenance has a generally beneficial effect on the cumulative regional impact by providing habitat for species relying on open habitats and preventing conversion of this habitat type to later successional habitats and to urban development.

Based on the expectation that best management practices (BMPs) for protecting Federally listed threatened or endangered species and their habitats will be implemented by Farley and its contractors while carrying out vegetation management activities along associated transmission lines, the staff's determination is that the cumulative impacts of the continued operation of Farley would be SMALL and that no additional mitigation is warranted. The BMPs will also ensure that impacts on other species would be SMALL.

4.8.3 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers have been developed by EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. As described in Section 2.2.7, the public and occupational doses resulting from operation of Farley are within regulatory limits, and as described in Section 4.3, the impacts of these doses are SMALL. For the purposes of this analysis, the areas within an 80-km (50-mi) radius of Farley were included (see Figure 2-1). EPA regulations in 40 CFR Part 190 limit the dose to members of the public from all sources in the nuclear fuel cycle in the United States, including all the nuclear power plants, fuel fabrication facilities, waste disposal facilities, and transport of fuel and waste. In addition, the radiological environmental monitoring program conducted by SNC in the vicinity of Farley measures radiation and radioactive material from all sources, including Farley; therefore, the monitoring program measures cumulative radiological impacts. The NRC and the State of Alabama would regulate any reasonably foreseeable future actions in the vicinity of Farley that could contribute to cumulative radiological impacts.

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

4.8.4 Cumulative Socioeconomic Impacts

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

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

4.8.5 Cumulative Impacts on Groundwater Use and Quality

Farley plant average groundwater usage is 3.35 million L (885,600 gal) per day. Groundwater used on the Farley site is typically supplied by three onsite wells, one having a five-year average daily use of 443 L/min (117 gpm), and the other two having a five-year combined average daily use of 45 L/min (12 gpm). The current impact of Farley on the alluvial aquifer due to plant operations and current groundwater withdrawals is small, as discussed in Section 4.5. There are no known or planned projects requiring withdrawal of groundwater, either at the plant or within its vicinity that, if implemented in addition to Farley license renewal, would potentially cause an adverse impact on groundwater. Therefore, the staff determined that the cumulative groundwater impacts of continued operation on the Farley site would be SMALL and no additional mitigation is warranted.

4.8.6 Cumulative Impacts on Threatened or Endangered Species

The geographic area considered in the analysis of potential cumulative impacts to threatened or endangered species includes those counties that contain the Farley site and its associated transmission line ROWs (Barbour, Dale, Geneva, Henry, Houston, Montgomery, and Pike Counties, in Alabama; Baker, Decatur, Early, Miller, Mitchell, Seminole, Tift, and Worth Counties, in Georgia; and Jackson County, Florida) and the waters of the Chattahoochee River, particularly between the George W. Andrews and the Jim Woodruff Lock and Dams. No critical habitat, as designated by the Endangered Species Act, occurs in the area affected by the Farley site; therefore, cumulative impacts on critical habitats have not been addressed. As discussed in Sections 2.2.5 and 2.2.6, there are several Federally listed threatened or endangered species that could occur within this area. The staff's determination, presented in Section 4.6, is that continued operation of Farley Units 1 and 2 would have a SMALL impact on Federally listed species. The staff's findings have been documented in a biological assessment (included in Appendix E) and were forwarded to the FWS in a letter dated July 2, 2004 (NRC 2004b). By letter dated October 27, 2004, the FWS concurred with the staff's determination (Snyder-Conn 2004).

- **Aquatic Species**

The Federally listed aquatic species that historically occurred in the project area include six freshwater mussels (purple bankclimber, shinyrayed pocketbook, Gulf moccasinshell, oval pigtoe, fat threeridge, and Chipola slabshell) and the Gulf sturgeon. As discussed in Sections 2.2.5 and 4.6.1, the six mussel species are considered relicts and are no longer thought to have viable populations in the project area. Likewise, the Gulf sturgeon is not thought to be in the project area due to the presence of dams on the Chattahoochee River that limit its distribution. These species could occur in portions of the Chattahoochee River that are crossed by transmission line ROWs. As discussed in Sections 2.1.7, 4.6.1, and 4.6.2, SNC ROW management practices reduce the likelihood of adverse impacts to sensitive habitats (e.g., wetlands and streams) and any listed species that may be present within the ROW. These management practices are expected to remain effective for the foreseeable future and, therefore, the cumulative adverse impacts that could result from the continuation of transmission line ROW maintenance activities are not expected to be noticeable.

Adverse impacts to Federally listed aquatic species resulting from continued operation of Farley Units 1 and 2 are unlikely. As mentioned in Section 2.2.5, past actions have adversely affected the Gulf sturgeon and the freshwater mussels within the Chattahoochee River. The construction in 1957 of the Jim Woodruff Lock and Dam (downstream of Farley) blocked the migration of the Gulf sturgeon upstream into the Chattahoochee River. This adversely impacted the Gulf sturgeon, which is considered extirpated from the reach on the river on which the Farley plant is located. Continued operation of Farley Units 1 and 2 does not block the migration of the Gulf sturgeon and therefore does not add to the cumulative impact on the Gulf sturgeon.

The freshwater mussels were also impacted by past actions that included impoundments, channelization and sedimentation. The subsequent decline of the species occurred decades ago. Farley Units 1 and 2 operate with cooling towers in a closed-cycle mode for main condenser cooling, reducing the amount of water drawn into the plant and the amount of heat discharged from the cooling system. In addition, no refurbishment activities are planned that could result in new construction and thus disturb aquatic habitat. Consequently, continued operation of Farley Units 1 and 2 is not expected to contribute to adverse cumulative impacts on Federally listed aquatic threatened or endangered species.

The staff has determined that the cumulative impacts to aquatic threatened or endangered species due to continued operation of Farley Units 1 and 2 and associated transmission lines would be SMALL, and that no further mitigation measures are warranted.

- **Terrestrial Species**

As described in the staff's biological assessment dated July 2, 2004, (included in Appendix E), 17 Federally listed terrestrial species and one candidate for listing may occur in the area of the Farley site and its associated transmission lines (NRC 2004b). These species (see Table 2-2) include the bald eagle, red-cockaded woodpecker, American alligator, flatwoods salamander, pondberry, mock bishop-weed, fringed campion, gentian pinkroot, Florida torreya, relict trillium, Crystal Lake nailwort, chaffseed, Cooley’s meadowrue, wood stork, eastern indigo snake, gray bat, and Indiana bat. Hirst’s panic grass, a candidate for Federal listing, is also present in the project area.

Listed and candidate terrestrial species in the project could occur on the Farley site or in portions of the ROWs that cross habitats preferred by these species. Although much of the land crossed by transmission lines is devoted to agriculture, several segments of the line cross natural areas that could contain suitable habitat for listed species. As discussed in Sections 2.1.7, 4.6.1, and 4.6.2, SNC ROW management practices (SNC 2003b; SNC 2004) reduce the probability of impacts to sensitive habitats and could benefit those listed species dependent on open canopy habitat. These management practices are expected to be carried out for the foreseeable future and will continue to limit adverse cumulative impacts that could result from transmission line ROW maintenance activities.

Adverse impacts to Federally listed terrestrial species resulting from continued operations of Farley Units 1 and 2 are unlikely. Undeveloped portions of the Farley site that could support listed species are not affected by ongoing plant operations and no refurbishment activities that could disturb these areas are planned. Consequently, continued operation of Farley Units 1 and 2 is not expected to contribute to adverse cumulative impacts on Federally listed terrestrial threatened or endangered species.

The staff has determined that the cumulative impacts to terrestrial threatened or endangered species due to continued operation of Farley Units 1 and 2 and associated transmission lines would be SMALL, and that additional mitigation measures would not be warranted.

4.8.7 Conclusions Regarding Cumulative Impacts

The staff considered the potential impacts resulting from operation of Farley during the license renewal term and other past, present, and future actions in the Farley area. For each impact area, the staff's determination is that the potential cumulative impacts resulting from operation during the license renewal term are SMALL, and additional mitigation is not warranted.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither SNC nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with the Farley 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 additional 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 Farley operation during the renewal term and for environmental justice and chronic effects of electromagnetic fields. For the 11 issues and environmental justice, the staff concluded that the potential environmental impact of renewal term operations of Farley would be of SMALL significance in the context of the standards set forth in the GEIS, and that additional mitigation would not be warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the staff did not conduct an evaluation of this issue.

4.10 References

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

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

36 CFR 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property,* Part 800, "Advisory Council on Historic Preservation."

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

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

Alabama Department of Economic and Community Affairs (ADECA). 2004. Apalachicola-Chattahoochee-Flint (ACF) River Basin Compact. Accessed at: http://www.acfcompact.alabama.gov/ on March 23, 2004.

Alabama Department of Environmental Management (ADEM). 2001, *Compliance Guide, NO_x Trading Program.*

Beasley, J.B. 2003. Letter from Vice President, SNC, to U.S. NRC. Subject: *Joseph M. Farley Nuclear Plant NRC Environmental Scouting Trip Requested Additional Information in Support of NRC TAC nos. MC0768, MC0769.* (November 3, 2003)

Bellew, Serena G. 2002. Letter from Environmental Review Coordinator, Historic Preservation Division, Georgia Department of Natural Resources, to C.R. Pierce, License Renewal Services Manager, SNC. No subject. (June 14, 2002)

Bellew, Serena G. 2004. Letter from Environmental Review Coordinator, Historic Preservation Division, Georgia Department of Natural Resources, to U.S. NRC. Subject: *Finding of "No Historic Properties Affected."* (August 26, 2004)

Bradley, K.P., Chief, Navigation Section, U.S. Army Corps of Engineers (USACE), Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 23, 2004).

Brown, Elizabeth Ann. 2002. Letter from Deputy State Historic Preservation Officer, Alabama Historical Commission, to C.R. Pierce, License Renewal Services Manager, SNC. No subject. (June 11, 2002)

Brown, Elizabeth Ann. 2004. Letter from Deputy State Historic Preservation Officer, Alabama Historical Commission, to J. Cushing, Environmental Project Manager, U.S. NRC. Subject: *Notice of Availability of Plant-Specific Supplement 18 to General EIS, Joseph M. Farley Nuclear Plant Houston County.* (September 2, 2004)

Dothan Chamber of Commerce. 2004. Interview. January 8, 2004.

Electric Power Research Institute (EPRI). 1991. *TL Workstation Code, Volume 7: AC/DCLINE User's Manual, Version 1.0*, EPRI, Palo Alto, California.

Executive Order 12898. "Federal Actions to Address Environmental justice in Minority Populations and Low Income Populations." *Federal Register*, Vol. 59, No. 32, pp. 7629. Washington, D.C. February 16, 1994.

Geological Survey of Alabama (GSA). 1991. Wells and Springs in Southeastern Alabama; to Accompany Map 201a.

Goldman, L. 2004. Letter from Field Supervisor, U.S. FWS, to P.T. Kuo, Program Director, License Renewal and Environmental Impact Division of Regulatory Improvement Programs, NRC. Subject: *Request for List of Protected Species Within the Area Under Evaluation for the Joseph M. Farley Nuclear Plant License Renewal*. (February 6, 2004)

Institute of Electrical and Electronics Engineers (IEEE). 1997. *National Electrical Safety Code*. New York.

Jangula, T., USACE, Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 23, 2004).

Kuo, P.T. 2003a. Letter from Program Director, License Renewal and Environmental Impacts Division of Regulatory Improvement Programs, Office of Nuclear Reactor Regulation, NRC, to L. Warner, State Historic Preservation Officer, Alabama Historical Commission. Subject: *Joseph M. Farley Nuclear Plant License Renewal Review (Reference No. AHC 02-0940)*. (November 26, 2003)

Kuo, P.T. 2003b. Letter from Program Director, License Renewal and Environmental Impacts Division of Regulatory Improvement Programs, Office of Nuclear Reactor Regulation, NRC, to L.C. Barrett, Georgia State Historic Preservation Officer/DNR. Subject: *Joseph M. Farley Nuclear Plant License Renewal Review (Reference No. HP-020513-004)*. (November 26, 2003)

Kuo, P.T. 2003c. Letter from Program Director, License Renewal and Environmental Impacts Division of Regulatory Improvement Programs, Office of Nuclear Reactor Regulation, NRC, to D. Klima, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation. Subject: *Joseph M. Farley Nuclear Plant License Renewal Review*. (December 18, 2003)

Kuo, P.T. 2003d. Letter from Program Director, License Renewal and Environmental Impact Division of Regulatory Improvement Programs, NRC, to R. Crabtree, Regional Administrator, NOAA Fisheries. Subject: *Request for List of Protected Species Within the Area Under Evaluation for the Joseph M. Farley Nuclear Plant License Renewal*. (November 26, 2003)

Kuo, P.T. 2003e. Letter from Program Director, License Renewal and Environmental Impact Division of Regulatory Improvement Programs, NRC, to L. Goldman, Field Supervisor, U.S. FWS. Subject: *Request for List of Protected Species Within the Area Under Evaluation for the Joseph M. Farley Nuclear Plant License Renewal*. (November 26, 2003)

Matthews, J.S. 2002. Letter from State Historic Preservation Officer (signed by Frederick P. Gaske, Deputy State Historic Preservation Officer), Florida Department of State, Division of Historical Resources, to C.R. Pierce, License Renewal Services Manager, SNC. No subject. (June 11, 2002)

Mettee, M.F., P.E. O'Neil, and J.M. Pierson. 1996. *Fishes of Alabama and the Mobile Basin*. A Cooperative Effort of the Geological Survey of Alabama, Game and Fish Division of the Alabama Department of Conservation and Natural Resources, and the Region 4 Office of the U.S. Fish and Wildlife Service. Oxmoor House, Birmingham, Alabama.

National Historic Preservation Act (NHPA). 16 USC 470, et seq.

National Institute of Environmental Health Sciences (NIEHS). 1999. “NIESH Report on Health Effects from Exposure to Power Line Frequency and Electric and Magnetic Fields.” Publication No. 99-4493, Research Triangle Park, North Carolina.

Pierce, C.R. 2002a. Letter from License Renewal Services Manager, SNC, to L. Warner, State Historic Preservation Officer, Alabama Historical Commission. Subject: *Joseph M. Farley Nuclear Plant License Renewal Request for Information on Historic and Archaeological Resources*. (May 7, 2002)

Pierce, C.R. 2002b. Letter from License Renewal Services Manager, SNC, to R. Luce, Director Historic Preservation Division, Georgia DNR. Subject: *Joseph M. Farley Nuclear Plant License Renewal Request for Information on Historic and Archaeological Resources*. (May 7, 2002)

Pierce, C.R. 2002c. Letter from License Renewal Services Manager, SNC, to J. Mathews, Division Director/Deputy State Historic Preservation Officer, Florida Bureau of Historic Preservation. Subject: *Joseph M. Farley Nuclear Plant License Renewal Request for Information on Historic and Archaeological Resources*. (May 7, 2002)

Southern Nuclear Operating Company (SNC). 1996. *Joseph M. Farley Nuclear Plant Units 1 and 2—Final Safety Analysis Report (FSAR)*. Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 2003a. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant’s Environmental Report*. Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 2003b. *Review of New and Significant Information Relative to License Renewal*. Dothan, Alabama.

Southern Nuclear Operating Company (SNC). 2004. *Joseph M. Farley Nuclear Plant Environmental Audit Follow-Up Documents*, SNC Letter NL-04-0172, Enclosure 2. February 2004.

Snyder-Conn, E. 2004. Letter from Acting Field Supervisor, Daphne Field Office, U.S. Fish and Wildlife Service, to P.T. Kuo, Program Director, License Renewal and Environmental Impact Division of Regulatory Improvement Programs, NRC. Subject: *Concurrence with Biological Assessment*. (October 27 2004)

Tetra Tech NUS, Inc. 2002a. *Final Report, Threatened and Endangered Species Surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Corridors (2001–2002)*. Prepared for SNC. June 21, 2002.

Tetra Tech NUS, Inc. 2002b. *Threatened and Endangered Species Survey: Sinai Cemetery Transmission Line Corridor, 2002*. Prepared for SNC. October 25, 2002.

U.S. Army Corps of Engineers (USACE), Mobile District. 1998. *Draft Environmental Impact Statement, Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia*. Mobile, Alabama. September, 1998.

U.S. Atomic Energy Commission (AEC). 1974. *Final Environmental Statement Related to Operation of Joseph M. Farley Nuclear Plant Units 1 and 2,* Alabama Power Company Docket No. 50-348 and 50-364. Washington, D.C.

U.S. Census Bureau. 2000a. *Census 2000. Table DP-1 Profile of General Demographic Characteristics: 2000. Geographic Area: Houston County, Alabama.*

U.S. Census Bureau (USCB). 2000b. Summary File 1: Census 2000. Available online at: http://www.census.gov/PressRelease/www/2001/sumfile1.html.

U.S. Census Bureau (USCB). 2000c. *American Factfinder. Census 2000 Redistricting Data (Public Law 94-171) Summary File. Alabama-County*. Available online at: http://factfinder.census.gov/.

U.S. Geological Service (USGS). 2002. *Apalachicola River Basin, 2002 Water Year, Station Number 02343801 Chattahoochee River Near Columbia, Alabama*. Includes summary statistics for Water Years 1976–2002.

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

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

U.S. Nuclear Regulatory Commission (NRC). 2004a. *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues*, Office of Nuclear Reactor Regulation Office Instruction LIC-203, Revision 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004b. *Biological Assessment for License Renewal of the Joseph M. Farley Nuclear Plant, Units 1 and 2, and a Request for Informal Consultation*. (July 2, 2004)

U.S. Nuclear Regulatory Commission (NRC). 2004c. "Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Vol. 69, No. 163, pp. 52040-52049. Washington, D.C. August 24, 2004.

Vaughan, M., Jr., Chief, Water Management Section, USACE, Mobile District. 2004. Email correspondence documenting telephone conversation with P. Schumann, Los Alamos National Laboratory, March 3, 2004 (email dated March 4 and 23, 2004).

5.0 Environmental Impacts of Postulated Accidents

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

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

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

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

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

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

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

5.1 Postulated Plant Accidents

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

5.1.1 Design-Basis Accidents

In order to receive NRC approval to operate a nuclear power facility, an applicant for an initial operating license must submit a safety analysis report (SAR) as part of its application. The

(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.

SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents, without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in 10 CFR Part 50 and 10 CFR Part 100.

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

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

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	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that:

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

Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2003) that it is not aware of any new and significant information associated with the renewal of the Farley Units 1 and 2 OLs. The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to design basis accidents beyond those discussed in the GEIS.

5.1.2 Severe Accidents

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

Severe accidents initiated by external phenomena such as tornadoes, floods, earthquakes, fires, and sabotage have not traditionally been discussed in quantitative terms in FESs and were not specifically considered for the Farley site in the GEIS (NRC 1996). However, in the GEIS the staff did evaluate existing impact assessments performed by NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from sabotage and beyond design basis earthquakes at existing nuclear power plants is SMALL. Additionally, the staff concluded that the risks from other external events are adequately addressed by a generic consideration of internally initiated 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.

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

The staff has not identified any new and significant information with regard to the consequences from severe accidents during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 Farley Units 1 and 2. The results of its review are discussed in Section 5.2.

5.2 Severe Accident Mitigation Alternatives

Section 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 (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for the Farley Nuclear Plant; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

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

The SAMA evaluation for Farley was a four-step approach. In the first step SNC quantified the level of risk associated with potential reactor accidents using plant-specific probablistic risk assessments (PRAs) and other risk models.

In the second step SNC examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and/or training. SNC initially identified 124 potential SAMAs. (The discussion in the ER indicates that 128 SAMAs were identified; however four SAMAs were not used, leaving 124 identified SAMAs). SNC screened out SAMAs that were not applicable to Farley due to design differences, or were already addressed by the existing design, procedures, training programs. This screening reduced the list of potential SAMAs to 40. Preliminary cost estimates were made for these 40 SAMAs, and any SAMA costing more than the maximum attainable benefit (discussed in Section 5.2.3) were removed from further consideration.

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

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). SNC determined in its ER that none of the SAMAs would be cost-beneficial (SNC 2003).

The NRC reviewed SNC's SAMA analysis. As a result of the NRC's review, additional conservative assumptions identified three potential cost-beneficial SAMAs (SNC 2004a). SNC has implemented one of the SAMAs and will further evaluate the other two SAMAs (SNC 2004b). None of these SAMAs relate to adequately managing the effects of aging during the period of extended operation, and they, therefore, need not be implemented as part of license renewal pursuant to 10 CFR Part 54. SNC's SAMA analysis and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

SNC submitted an assessment of SAMAs for Farley as part of the ER (SNC 2003). This assessment was based on the most recent Farley PRA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the Farley Individual Plant Examination (IPE) (SNC 1993) and Individual Plant Examination of External Events (IPEEE) (SNC 1995).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 3.4 x 10^{-5} per year. The CDF is based on the risk assessment for internally initiated events. SNC did not include the contribution to risk from external events within the Farley risk estimates; however, it did account for the potential risk reduction benefits associated with external events by tripling the estimated benefits for internal events. The breakdown of CDF by initiating event is provided in Table 5-3. As shown in this table, special initiators and loss of offsite power (LOOP) are dominant contributors to the CDF. Special initiators relate to loss of a support system and include, for example, a loss of one or both trains of service water or component cooling water (CCW), and loss of instrument air or a DC bus. Bypass events (i.e., interfacing systems loss of coolant accident (ISLOCA) and steam generator tube rupture) contribute less than two percent to the total internal events CDF.

Table 5-3. Farley Core Damage Frequency

Initiating Event	CDF (per year)	% Contribution to CDF
Loss of offsite power (LOOP)	7.76 x 10^{-6}	23.2
Loss-of-coolant accident (LOCA)	1.97 x 10^{-6}	5.9
Interfacing system LOCA (ISLOCA)	3.34 x 10^{-7}	1.0
Steam generator tube rupture (SGTR)	7.45 x 10^{-8}	0.2
Transients	5.59 x 10^{-6}	16.7
Special initiators	1.61 x 10^{-5}	48.1
Internal floods	1.63 x 10^{-6}	4.9
Total CDF (from internal events)	**3.35 x 10^{-5}**	**100**

In the ER, SNC estimated the dose to the population within 80 km (50 mi) of the Farley site to be approximately 0.0121 person-Sv (1.21 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. ISLOCA events dominate the population dose risk at Farley. As indicated in the Farley IPE and confirmed in response to a request for additional information (RAI), early containment failures are a negligible contributor to offsite release in the Farley PRA.

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

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

Containment Release Mode	Population Dose (person-rem[a] per year)	% Contribution
Late containment failure	0.06	5
SGTR	0.05	4
ISLOCA	0.69	57
Containment isolation failure	0.17	14
No containment failure	0.24	20
Total Population Dose	**1.21**	**100**

(a) One person-Rem per year = 0.01 person-Sv per year

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, SNC searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, SNC considered SAMA analyses performed for other operating plants which have submitted license renewal applications, as well as industry and NRC documents that discuss potential plant improvements, such as NUREG-1560 (NRC 1997a). SNC identified 124 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures, and/or training.

All but 40 of the these SAMAs were removed from further consideration because: (1) the SAMA is not applicable at Farley due to design differences, (2) the SAMA has already been addressed in the existing Farley design, (3) the SAMA has already been addressed in Farley's procedures and/or training program, or (4) the SAMA is sufficiently similar to other SAMA candidates and was combined or dropped.

Preliminary cost estimates were prepared for each of the 40 remaining candidates. The cost estimates were compared to the maximum attainable benefit or MAB. The MAB is the dollar value of the benefit that would be achieved if the plant risk and population dose from postulated accidents could be reduced to zero. If the cost of a SAMA exceeds the MAB, it could not be cost-beneficial because no single SAMA could eliminate all the risk. To account for external events, the maximum attainable benefit or MAB was doubled, and then applied to the remaining candidates. In an RAI, the staff asked SNC to justify the doubling of the internal events CDF to account for external events, particularly since the fire CDF reported in the IPEEE is greater than the internal events CDF (NRC 2003). In response to the RAI, SNC stated that a multiplying factor of three is more appropriate than the factor of two used in the baseline analysis (SNC 2004a), and re-evaluated the SAMAs using a factor of three.

Based on the re-evaluation, SNC identified a total of 24 candidate SAMAs for further evaluation. Four of the candidate SAMAs were eliminated because they would not contribute to a significant reduction in CDF or were very expensive. One additional candidate SAMA (SAMA 121) relates to a plant modification that is currently in progress. Specifically, for SAMA 121, SNC noted that prior to the performance of the SAMA analysis, SNC management had approved implementation of proposed SAMA 121. The modifications have been completed on three of the five pumps. The remaining pumps are currently scheduled to be completed by the end of 2005. Thus, SAMA 121 was not considered further. Therefore, these five SAMA candidates were eliminated from further evaluation, leaving 19 SAMAs for further evaluation.

The 19 remaining SAMAs, plus two additional SAMAs identified in response to an RAI (for a total of 21 SAMAs) were further evaluated. The staff concludes that SNC used a systematic and comprehensive process for identifying potential plant improvements for Farley, and that the set of potential plant improvements identified by SNC is reasonably comprehensive and, therefore, acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

SNC evaluated the risk-reduction potential of the remaining 21 SAMAs that were applicable to Farley. A majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. Such bounding calculations overestimate the benefit of the risk reduction and are conservative.

SNC estimated the costs of implementing the 21 candidate SAMAs through the application of engineering judgment and review of other plants' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include recurring maintenance and surveillance costs or contingency costs associated with unforeseen implementation obstacles. Cost estimates typically included engineering, procedures, training, documentation, procurement, and construction (SNC 2004a).

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

The staff concludes that the risk reduction and the cost estimates provided by SNC are sufficient and appropriate for use in the SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by SNC was based primarily on NUREG/BR-0184 (NRC 1997b) and was executed consistent with this guidance. The total benefit associated with each of the 21 SAMAs was evaluated by SNC. These values were determined for the various averted costs based on the estimated annual reductions in CDF and person-rem dose. Based on a revised assessment (SNC 2004a), the estimated benefits were then tripled to account for additional risk reduction in external events.

In response to an RAI, SNC considered the uncertainties associated with the internal events CDF. Since SNC does not currently have an uncertainty analysis for the Farley PRA, SNC estimated the uncertainty distribution by reviewing representative distributions for similar plants (SNC 2004a). To provide an upper bound estimate of the uncertainties in the CDF for internal and external events, the baseline benefit, which includes a factor of three for external events, was increased by an additional factor of two, yielding an MAB of $4.2M. As a result, SNC found three of the 21 SAMAs to be potentially cost beneficial:

- SAMA 7: Increase the charging pump lube oil capacity by adding a supplemental lube oil reservoir for each charging pump;

- SAMA 11: Use existing hydro test pump for reactor coolant pump (RCP) seal injection;

- SAMA S166: Proceduralize local manual operation of auxiliary feedwater (AFW) when control power is lost.

In addition to the above SAMAs, the staff questioned SNC about lower cost alternatives to some of the SAMAs evaluated, including the use of portable battery chargers and a direct-drive diesel AFW pump (NRC 2003). In response (SNC 2004b), SNC estimated that the costs for each of these modifications would easily exceed the $500,000 estimated benefit. Based on these estimates, SNC concluded that neither of these alternatives would be cost beneficial. The staff concurs with SNC's conclusion.

The staff concludes that, with the exception of the three potentially cost-beneficial SAMAs, the costs of the SAMAs would be higher than the associated benefits. This conclusion is supported by uncertainty assessment and sensitivity analysis. Risk reduction and cost estimates were found to be reasonable, and generally conservative.

5.2.6 Conclusions

The staff reviewed SNC's SAMA analysis and concluded that the methods used and the implementation of those methods were sound. Based on its review of the SNC SAMA analysis, the staff concurs that out of the 124 candidate SAMAs only SAMAs 7, 11 and 166 are potentially cost beneficial. This is based on conservative treatment of costs and benefits. This conclusion is consistent with the low residual level of risk indicated in the Farley PRA and the fact that Farley has already implemented all of the plant improvements identified from the IPE and IPEEE processes. Given the potential risk reduction and the relatively modest implementation costs of the three SAMAs identified above, the staff concludes that further evaluation to determine whether the SAMAs are cost beneficial. In response to an RAI, SNC stated that it planned to implement SAMA S166 (SNC has since implemented this SAMA), and will evaluate SAMAs 7 and 11 for implementation (SNC 2004b). However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

5.3 References

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

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

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

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

Southern Nuclear Operating Company (SNC). 1993. Letter from J.D. Woodard (SNC) to U.S. NRC Document Control Desk. Subject: *Joseph M. Farley Nuclear Plant, Results of Individual Plant Examination for Severe Accident Vulnerabilities (Generic Letter 88-20)*, June 14, 1993.

Southern Nuclear Operating Company (SNC). 1995. Letter from D. Morey (SNC) to U.S. NRC Document Control Desk. Subject: *Joseph M. Farley Nuclear Plant, Generic Letter 88-20, Supplement 4,* "Individual Plant Examination for External Events for Severe Accident Vulnerabilities," June 28, 1995.

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

Southern Nuclear Operating Company (SNC). 2004a. Letter from L.M. Stinson, SNC, to U.S. NRC Document Control Desk. Subject: *Joseph M. Farley Nuclear Plant Units 1 and 2, Application for License Renewal, December 12, 2003, Requests for Additional Information*, February 26, 2004.

Southern Nuclear Operating Company (SNC). 2004b. Letter from L.M. Stinson, SNC to U.S. NRC Document Control Desk. Subject: Joseph M. Farley Nuclear Plant SAMA Additional Information, April 22, 2004.

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

U.S. Nuclear Regulatory Commission (NRC). 1997a. *Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance*. NUREG-1560, Washington, D.C.

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

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

U.S. Nuclear Regulatory Commission (NRC). 2003. Letter from Jack Cushing, U.S. NRC to J.B. Beasley, Jr., Southern Nuclear Operating Company. Subject: *Request for Additional Information (RAI) Regarding Severe Accident Mitigation Alternatives for the Joseph M. Farley Nuclear Plant Units 1 and 2 (TAC Nos. MC0768 and MC0769)*, December 17, 2003.

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

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

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [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 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 for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to Farley 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 Power Reactor.” The GEIS also addresses the impacts from radon-222 and technetium-99.

(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.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Farley Units 1 and 2 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, Table B-1	GEIS Sections
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (spent fuel and high-level waste disposal)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste (LLW) 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
On-site 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 2003) that it is not aware of any new and significant information associated with the renewal of the Farley Units 1 and 2 operating licenses (OLs). The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

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

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

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

The staff has not identified any new and significant information on this issue during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. 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). In the GEIS, the staff found that

  The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem (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 National Environmental Policy Act (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 collective effects of the fuel cycle, this issue is considered Category 1.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- 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 radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 mrem (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 mrem (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 mrem (1 mSv) per year. The lifetime individual risk from 100 mrem (1 mSv) annual dose limit is about 3×10^{-3}.

  Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the U.S. Department of Energy in the *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste* (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 1000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other Federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1000 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.

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

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

Therefore, for the high-level waste and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, we assumed that limits would be developed along the lines of the 1995 National Academy of Sciences report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository that would comply with such limits could and likely would be developed at some site. Peak doses to virtually all individuals will be 1mSv (100 mrem) per year or less.

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

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and high-level waste disposal during the renewal term beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. 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.

- <u>Low-level waste storage and disposal</u>. 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 onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of LLW 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 new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. 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 new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

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

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

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. 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.

Farley Units 1 and 2 meet the fuel enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

There are no Category 2 issues for the uranium fuel cycle and solid waste management.

6.2 References

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

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

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

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

Energy Policy Act of 1992. 42 USC 10101, et seq.

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

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.

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

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

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

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002). The staff's evaluation of the environmental impacts of decommissioning presented in Supplement 1 resulted in a range of impacts for each environmental issue. These results may be used by licensees as a starting point for a plant-specific evaluation of the decommissioning impacts at their facilities.

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

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

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

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

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

Category 2 issues are those that do not meet one of more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

(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.

7.1 Decommissioning

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B that are applicable to Farley Units 1 and 2 decommissioning following the renewal term are listed in Table 7-1. Southern Nuclear Company (SNC) stated in its Environmental Report (ER; SNC 2003) that it is aware of no new and significant information regarding the environmental impacts of Farley Units 1 and 2 license renewal. The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of Farley Units 1 and 2 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 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 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 new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Decommissioning either after the initial operating period or after a 20-year license renewal period is not likely to have any direct ecological impacts.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

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

  Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

The staff has not identified any new and significant information during its independent review of the SNC ER (SNC 2003), the staff's site visit, the scoping process, the staff's evaluation of other available information, and public comments on the draft SEIS. Therefore, the staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

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

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report,* Section 6.3—Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Vols. 1 and 2, Washington, D.C.

8.0 Environmental Impacts of Alternatives to Operating License Renewal

This chapter examines the potential environmental impacts associated with denying the application for the renewal of the operating licenses (OLs) for Farley Units 1 and 2 (the no-action alternative); the potential environmental impacts from electric generating sources other than Farley Units 1 and 2; the possibility of purchasing electric power from other sources to replace power generated by Farley Units 1 and 2 and the associated environmental impacts; the potential environmental impacts from a combination of generating and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by Farley Units 1 and 2. The environmental impacts are evaluated using the Nuclear Regulatory Commission's (NRC's) three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B:

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

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] with the additional impact category of environmental justice.

8.1 No-Action Alternative

NRC's regulations implementing the National Environmental Policy Act (NEPA) of 1969 specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS), (see 10 CFR Part 51, Subpart A, Appendix A[4]). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the Farley OLs. Southern Nuclear Operating Company (SNC) would then cease plant operations by the end of the current license and initiate the decommissioning of the plants.

(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.

SNC would be required to shut down Farley and to comply with NRC decommissioning requirements in 10 CFR 50.82 whether or not the OLs are renewed. If the Farley OLs are renewed, shutdown of the units and decommissioning activities will not be avoided, but will be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning following a license renewal period of up to 20 years or following the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the license renewal GEIS, (NRC 1996), Chapter 7 of this supplemental environmental impact statement (SEIS), and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

Impacts from the decision to permanently cease operations are not considered in NUREG-0586, Supplement 1.[a] Therefore, immediate impacts that occur between plant shutdown and the beginning of decommissioning are considered here. These impacts, which will occur when the units shut down regardless of whether the licenses were to be renewed or not, are discussed below, with the results presented in Table 8-1. Plant shutdown will result in a net reduction in power production capacity. The power not generated by Farley during the license renewal term would likely be replaced by (1) power purchased from other electricity providers, (2) generating alternatives other than Farley, (3) demand-side management (DSM) and energy conservation, or (4) some combination of these options. The environmental impacts of these options are discussed in Section 8.2.

- **Land Use**

In Chapter 4, the staff concluded that the impacts of continued plant operation on land use would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project would be expected to remain in service after the plants stop operating. As a result, maintenance of the rights-of-way (ROWs) will continue as before. Therefore, the staff concludes that the impacts on land use from plant shutdown would be SMALL.

(a) Appendix J of NUREG-0586 Supplement 1 discusses the socioeconomic impacts of plant closure, but the results of the analysis in Appendix J are not incorporated in the analysis presented in the main body of the NUREG.

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

Impact Category	Impact	Comment
Land Use	SMALL	Impacts are expected to be SMALL because plant shutdown is not expected to result in changes onsite or offsite land use.
Ecology	SMALL	Impacts are expected to be SMALL because current aquatic impacts are SMALL. Terrestrial impacts are not expected because there will not be any land use changes.
Water Use and Quality	SMALL	Impacts are expected to be SMALL because surface water intake and discharges will decrease and groundwater use will decrease.
Air Quality	SMALL	Impacts are expected to be SMALL because releases related to plant operation and worker transportation will decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste will stop, and generation of low-level and mixed waste will decrease.
Human Health	SMALL	Impacts are expected to be SMALL because radiological doses to workers and members of the public, which are within regulatory limits, will be reduced.
Socioeconomic	MODERATE to LARGE	Impacts are expected to be MODERATE to LARGE because of a decrease in employment and tax revenues. Transportation impacts would be SMALL because the decrease in employment would reduce traffic.
Aesthetics	SMALL	Impacts are expected to be SMALL because plant structures will remain in place.
Historic and Archaeological Resources	SMALL	Impacts are expected to be SMALL because shutdown of the plant will not change onsite or offsite land use.
Environmental Justice	SMALL to MODERATE	Impacts are expected to be SMALL to MODERATE because loss of employment opportunities is expected.

- **Ecology**

In Chapter 4 of this SEIS, the NRC staff concluded that the ecological impacts of plant operation were SMALL. Cessation of operations will be accompanied by a reduction in cooling water flow and the thermal plume from the plant. The environmental impacts to aquatic species, including threatened and endangered species, associated with these changes are generally positive. The impact of plant closure on the terrestrial ecosystem will be negligible because the transmission lines to the plant will remain in use. Therefore, the staff concludes that ecological impacts from shutdown of the plant would be SMALL.

- **Water Use and Quality—Surface Water**

In Chapter 4 of this SEIS the NRC staff concluded that impacts of plant operation on surface water use and quality were SMALL. When the plant stops operating, there will be an immediate reduction in the consumptive use of water because of the reduction in cooling water flow. Therefore, the staff concludes that the impacts on surface water use and quality from plant shutdown would be SMALL.

- **Water Use and Quality—Groundwater**

In Chapter 4, the staff concluded that impacts of plant groundwater use on groundwater availability and quality were SMALL. When the plant stops operating, there will be an immediate reduction in the limited current use of groundwater for makeup. In addition, there will be a gradual reduction in groundwater use for potable water as the plant staff decreases. Therefore, the staff concludes that groundwater use and quality impacts from shutdown of the plant would be SMALL.

- **Air Quality**

In Chapter 4, the staff found the impacts of plant operation on air quality to be SMALL. When the plant stops operating, there will be a reduction in emissions from activities related to plant operation such as use of diesel generators and workers' transportation. Therefore, the staff concludes that the impact on air quality from shutdown of the plant would be SMALL.

- **Waste**

The impacts of waste generated by plant operation are discussed in Chapter 6. The impacts of low-level and mixed waste from plant operation are characterized as SMALL. When the plant stops operating, the plant will stop generating high-level waste, and generation of low-level and mixed waste associated with plant operation and maintenance will be reduced. Therefore, the staff concludes that the impact of waste generated after shutdown of the plant would be SMALL.

- **Human Health**

In Chapter 4 of this SEIS the NRC staff concluded that the impacts of plant operation on human health were SMALL. After the cessation of operations the amount of radioactive material released to the environment in gaseous and liquid forms will be reduced. Therefore, the staff concludes that the impact of shutdown of the plant on human health will be SMALL. In addition, the variety of potential accidents at the plant will be reduced to a limited set associated with shutdown events and fuel handling. In Chapter 5 of this SEIS the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, the staff concludes that the impacts of potential accidents following shutdown of the plant would be SMALL.

- **Socioeconomics**

In Chapter 4, the NRC staff concluded that the socioeconomic impacts of continued plant operation would be SMALL. There would be immediate socioeconomic impacts associated with the shutdown of the plant because of the reduction in the staff at the plant. The plant is also one of the largest and highest paying companies in the metropolitan area. Some employees would be required to take lower paying jobs or relocate for similar jobs. There may also be an immediate reduction of up to 30 percent of total property tax revenues. The NRC staff concludes that the socioeconomic impacts of plant shutdown would range from MODERATE to LARGE. Some of these impacts could be offset if new power generating facilities are built at or near the current site. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential socioeconomic impacts of plant shutdown.

- **Transportation**

In Chapter 4, the staff concluded that the impacts of continued plant operation on transportation would be SMALL. Cessation of operations will be accompanied by reduction in traffic in the vicinity of the plant. Most of the reduction will be associated with a reduction in the plant workforce, but there will also be a reduction in shipment of material to and from the plant. Therefore, the staff concludes that the impact of plant closure on transportation would be SMALL.

- **Aesthetics**

In Chapter 4, the staff concluded that the aesthetic impacts of continued plant operation would be SMALL. Cessation of operations will be accompanied by reduction in visible plumes from the cooling towers. Plant structures and other facilities are likely to remain in place until decommissioning. Therefore, the staff concludes that the aesthetic impacts of plant closure would be SMALL.

- **Historic and Archaeological Resources**

In Chapter 4, the staff concluded that the impacts of continued plant operation on historic and archaeological resources would be SMALL. Onsite land use will not be affected immediately by the cessation of operations. Plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the plant stops operating. As a result, maintenance of transmission line ROWs will continue as before. Therefore, the staff concludes that the impacts on historic and archaeological resources from plant shutdown would be SMALL.

- **Environmental Justice**

In Chapter 4, the staff concluded that the environmental justice impact of continued operation of the plant would be SMALL because continued operation of the plant would not have a disproportionately high and adverse impact on minority and low-income populations. Shutdown of the plant could have disproportionately high and adverse impacts on minority and low-income populations because of secondary socioeconomic impacts. The staff concludes that the environmental justice impacts of plant shutdown could range from SMALL to MODERATE. Some of these impacts could be offset if new power generating facilities are built at or near the current site. See Appendix J to NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of these impacts.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electricity to replace the electricity generated by Farley Units 1 and 2, assuming that the OLs for Units 1 and 2 are not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts.

The following generation alternatives are considered in detail:

- Coal-fired generation at the Farley site and at an alternate site (Section 8.2.1)
- Natural gas-fired generation at the Farley site and at an alternate site (Section 8.2.2)
- Nuclear generation at the Farley site and at an alternate site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at Farley Units 1 and 2 is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for the full production at Farley Units 1 and 2 are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an Annual Energy Outlook. The Annual Energy Outlook 2004 was issued in January 2004 (DOE/EIA 2004). EIA projects that natural gas-fired and coal-fired electricity generation will constitute over 90 percent of electrical capacity additions between 2001 and 2025. Natural gas-fired generation is typically based on combined-cycle[a] or combustion-turbine technology, which can supply peak and intermediate capacity and can also

(a) In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. The hot exhaust from the combustion turbine is routed through a heat recovery boiler to make steam to generate additional electricity.

be used to meet base load requirements.[a] Coal-fired plants are generally used to meet base load requirements. Renewable energy sources, including conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power are projected by EIA to account for 5 percent of capacity additions.

EIA projects that oil-fired generation will decrease in the United States through 2025 because of rising fuel costs and lower efficiencies. EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. The cost of new oil-fired generation is not expected to be competitive with that of coal and natural gas.

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States during the 2002 to 2005 time period because natural gas and coal-fired plants are projected to be more economical (DOE/EIA 2004). In spite of this projection, a new nuclear plant alternative for replacing power generated by Farley is considered for reasons stated in Section 8.2.3. NRC established a new reactor licensing program organization in 2001 to prepare for and manage future reactor and site licensing applications (NRC 2001).

Note that this section discusses the impacts of alternative generation technologies. It does not address the impacts of decommissioning. Further, it does not consider the impacts to the Farley site of building alternative generation elsewhere, when such options are addressed. The no-action alternative discussed in Section 8.1 covers the impacts at the Farley site of shutting down Farley Units 1 and 2.

8.2.1 Coal-Fired Generation

The environmental impacts of the coal-fired alternative are examined in this section. Unless otherwise indicated, the assumptions and numerical values used in this section are from the SNC Environmental Report (ER; SNC 2003). The staff reviewed this information and compared it to environmental impact information in the GEIS, as well as other relevant information and sources where appropriate. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant). The staff assumed that Farley Units 1 and 2 would remain in operation while the coal-fired alternative was constructed.

The coal-fired alternative is analyzed both for the existing Farley site and for an unnamed alternate site. Siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts (NRC 1996). Further, siting a new facility at the existing Farley site would allow it to take advantage of existing infrastructure. Hence, although the staff

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(a) A base load plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for base load generation; that is, these units generally run near full load.

considered an alternate site, it is unlikely that it would be beneficial to place a new coal-fired facility at an alternate site based purely on environmental considerations.

Consistent with SNC's ER, the staff assumes construction of two 800-megawatt electric (MW[e]) units, for a combined capacity of 1600 MW(e), as potential replacements for Farley Units 1 and 2. SNC chose this size to be consistent with the natural gas-fired alternative, which was chosen to match "standard" sizes for new combined-cycle facilities. The assumption of 1600 MW(e) understates the environmental impacts of replacing the 1699-MW(e) from Farley Units 1 and 2. The remaining capacity would be made up from other sources. As a rough estimate, if a coal-fired plant of exactly 1699 MW(e) were to be built, any numerical impacts, for example, quantities of air pollutants, in this section might simply be adjusted upward accordingly. However, given these adjustments, the staff has determined that the differences between 1600 MW(e) and 1699 MW(e) of coal-fired generation would not be significant and would not change the standard of significance (SMALL, MODERATE, or LARGE) of any impacts.

SNC assumes the coal-fired alternative would use tangentially fired, dry-bottom combustors with an associated heat rate[a] of 10,200 Btu/kWh (a thermodynamic efficiency of approximately 30 percent) and a capacity factor[b] of 0.85 (SNC 2003). According to SNC, the coal-fired plant would consume approximately 5.4 million MT (5.9 million tons) per year of pulverized bituminous coal with an ash content of approximately 9.4 percent (SNC 2003). The facility would be outfitted with low-nitrogen oxide (NO_x) burners, overfire air, and selective catalytic reduction for NO_x control. Fabric filters would control particulate emissions, and a wet scrubber using limestone would control sulfur dioxide (SO_2) emissions.

The coal-fired alternative would require converting a significant quantity of land to industrial use for the power plant, coal storage, as well as landfill disposal of ash, spent catalytic reduction catalyst (used for control of NO_x emissions), and scrubber sludge. SNC believes that the Farley site is adequate to support these requirements. The Farley site consists of approximately 750 ha (1850 ac) (SNC 2003). The GEIS asserts that approximately 700 ha (1700 ac) would be required to build a 1000-MW(e) coal-fired power plant at an alternate site (NRC 1996). Locating a coal-fired power plant at an existing nuclear site would reduce this land requirement below the GEIS estimate, and would allow the new facility to take advantage of existing infrastructure at the Farley site, including transmission facilities, roads, parking areas, office buildings, and the existing cooling system. SNC estimates that the coal-fired alternative would require approximately 170 ha (425 ac) for waste disposal and approximately 120 ha (300 ac) for the powerblock and coal storage area.

(a) Heat rate is a measure of generating station thermal efficiency. It is generally expressed in British thermal units (Btu) per net kilowatt-hour (kWh). It is computed by dividing the total Btu content of fuel burned for electricity generation by the resulting net kWh generation.

(b) The capacity factor is the ratio of electricity generated in the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

SNC assumes that coal and lime (calcium oxide) would be delivered by rail after upgrading the existing rail spur into the Farley site. Rail upgrades would consist of replacing track and culverts, and rebuilding train trestles. The staff has concluded that the rail option is feasible, and therefore serves as the basis for the remainder of this discussion. SNC assumes that delivery of large plant components would be by barge on the Chattahoochee River. Barge transport would require maintenance dredging in the river and possibly releases of water from upstream reservoirs during low flow or drought periods.

The staff assumed a coal-fired plant at the Farley site would use the existing closed-cycle cooling system, which includes six mechanical draft cooling tower units. Each unit has three 14-cell cooling towers. As part of the plant's normal operating and maintenance activities, the existing towers are to be replaced with new mechanical draft towers. Construction commenced in January 2003 and is scheduled to be completed by May 2005. Through a phased implementation process, the six 14-cell towers will be replaced by four 18-cell and two 16-cell towers (SNC 2003). This system would be sufficient to support the cooling requirements of the coal-fired alternative. The staff also assumed that a similar cooling system would be used if the replacement were located at an unnamed alternate site.

The overall impacts of the coal-fired generating system using a closed-cycle cooling system are discussed in the following sections and are summarized in Table 8-2.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at the Farley site and an Alternate Site Using Closed-Cycle Cooling

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Land Use	MODERATE	The coal-fired alternative would use undeveloped portions of Farley site. It would require approximately 290 ha (725 ac) for power block, coal storage, and waste disposal. It would use existing infrastructure, minimizing new land requirements. There would be additional land impacts for coal and limestone mining.	MODERATE to LARGE	Land requirements would be well above the 290 ha (725 ac) required if the facility were to be located at the Farley site, but below the 1100 ha (2720 ac) based on scaling up the GEIS estimates to a 1600-MW(e) plant. Land use requirements would be larger because of the need for transmission facilities, rail spurs, roads, parking areas, office buildings, and cooling system. There would be additional land impacts for coal and limestone mining. The total impact would depend on whether the alternate site has been previously disturbed or has existing infrastructure.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Ecology	SMALL to MODERATE	The coal-fired facility would use both developed and undeveloped areas at Farley site. In particular, waste disposal would use undisturbed portions of the site. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land. Delivery of large equipment components would be by barge. It is assumed that sufficient water would be present either as natural flow or in navigation windows created by releases from upstream reservoirs. It is also assumed that releases would be managed by the U.S. Army Corps of Engineers (USACE) to minimize impacts to riparian communities at upstream reservoirs and in the river channel.	MODERATE to LARGE	Impacts would depend on whether the site has been previously developed. Factors to consider include location and ecology of the site, transmission line route, and rail spur route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality	SMALL	The coal-fired alternative would use the existing closed-cycle cooling system using river water. There would be consumptive use of water due to evaporation from the cooling towers. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids, and intermittent low concentrations of biocides (e.g., chlorine). Limited groundwater use would continue. Delivery of equipment by barge may require releases from upstream reservoirs to allow navigation on the river during low flow periods. This could result in a short-term loss of recreational opportunities in the affected reservoirs.	SMALL to MODERATE	The coal-fired alternative would use closed-cycle cooling. There would be consumptive use of water due to evaporation from the cooling towers. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids, and intermittent low concentrations of biocides (e.g., chlorine). In total, the impacts on water use and quality would depend on the characteristics of the surface or groundwater sources and sinks.

Impact Category	Farley Site		Alternate Site	
	Impact	Comment	Impact	Comment
Air Quality	MODERATE	Sulfur oxides: 4950 MT/yr (5450 tons/yr). National and regional impacts would be minimal because of emissions offsets through the SO_2 trading program. Nitrogen oxides: 1290 MT/yr (1420 tons/yr). Particulates: 250 MT/yr (275 tons/yr) particulates, 57 MT/yr (63 tons/yr) PM_{10}. Carbon monoxide: 1330 MT/yr (1460 tons/yr). Other: (1) hazardous air pollutants, including mercury, (2) uranium and thorium, (3) CO_2 emissions, which contribute to global warming, and (4) increased emissions from train delivery of coal and coal handling.	MODERATE	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Waste	MODERATE	The facility would produce 490,000 MT (549,000 tons) of ash and 193,000 MT (213,000 tons) of scrubber sludge annually. This waste would be disposed of on-site, requiring approximately 170ha (425ac).	MODERATE	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Human Health	SMALL	Impacts are uncertain but are considered SMALL in the absence of more quantitative data.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Socio-economics	SMALL to MODERATE	During construction, impacts would be MODERATE. Upwards to 2500 workers might be required at the peak of the construction period, placing noticeable burdens on existing infrastructure, including housing and transportation. During operation, employment would decrease from 900 permanent workers to approximately 300, reducing impacts on transportation. Impacts on housing and vitality of the local economy would be negative. Overall, socioeconomic impacts from operation are SMALL.	SMALL to LARGE	The characteristics of the construction period at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE. The characteristics of the operation of the coal-fired alternative at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Aesthetics	MODERATE	There would be visual aesthetic impacts associated with plant buildings and structures, along with cooling tower plumes and rail cars for transport of coal and limestone. There could also be aesthetic impacts associated with drawdown of upstream reservoirs if required for barge navigation. There would be both continuous and intermittent noise impacts from plant operation and from transportation of coal and limestone.	SMALL to LARGE	The structures and operation would be similar to the Farley site, but the significance of the impacts would depend on the characteristics of the alternate site. The coal-fired alternative at an alternate site could require transmission lines, with attendant aesthetic impacts. Noise impacts would depend upon the site chosen and the surrounding use.
Historic and Archaeo-logical Resources	SMALL	Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant.	SMALL	At the unnamed alternate site, cultural studies would be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant on unnamed alternate site.
Environ-mental Justice	SMALL	No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations. Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL to LARGE	Impacts would vary depending on population distribution and characteristics at new site.

- **Land Use**

For siting a new facility at the Farley site, the existing infrastructure would be used to the extent practicable, thus limiting the amount of new construction that would be required. Specifically, the staff assumed that the new coal-fired facility would use the transmission facilities, roads, parking areas, office buildings, and the existing cooling system. If the coal-fired facility is built at the existing Farley site, SNC estimates that construction of the power block and coal-storage area would impact approximately 120 ha (300 ac) of land and associated terrestrial habitat (SNC 2003). SNC further estimates that ash and scrubber sludge disposal over a 40-year facility lifetime would require approximately 170 ha (425 ac) (SNC 2003). In total, the facility is expected to require approximately 290 ha (725 ac) of land.

SNC assumed that coal and lime would be delivered by rail after upgrading the existing rail spur. This would result in minimal land-use impacts because it would be an upgrade rather than new construction.

Using the GEIS estimates for a new 1000-MW(e) facility and scaling upwards to account for the larger capacity of the coal-fired alternative, the GEIS estimates as much as 1100 ha (2720 ac) would be needed for the coal-fired alternative at an unnamed alternate site. More land would be needed than if the coal-fired alternative were located at the Farley site because at a new site, the coal-fired alternative could not use existing infrastructure, including the rail spur, transmission facilities, roads, parking areas, office buildings, and the existing cooling system.

Regardless of whether the coal-fired alternative is built at the Farley site or at an alternate site, additional land use changes would occur offsite in an undetermined coal mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be affected for mining the coal and disposing the waste to support a 1000-MW(e) coal plant during its operational life (NRC 1996). These numbers can be scaled up to represent the requirements for the 1600-MW(e) coal-fired alternative. Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for Farley Units 1 and 2. In the GEIS, the staff estimated that approximately 400 ha (1000 ac) would be affected for mining the uranium and processing it during the operating life of a 1000-MW(e) nuclear power plant.

Overall, the impacts of the coal-fired alternative at the Farley site are considered MODERATE. Previously unused land would need to be converted to industrial use. Overall, the impacts of the coal-fired alternative at an alternate site are considered MODERATE to LARGE, depending on whether the alternate site had been developed previously or not and what new infrastructure might be required.

- **Ecology**

Locating a coal-fired plant at the Farley site would alter ecological resources during construction, and over the life of the facility as a result of the conversion of currently unused land to industrial use for the plant, coal storage, and ash and scrubber sludge disposal. While some of this land would have been previously disturbed, SNC asserts that undisturbed land would likely be used for waste disposal. As a result of construction activities and conversion of land to industrial use, impacts could include habitat degradation, fragmentation, or loss. Ecological communities may experience reduced productivity and biological diversity from disturbing previously intact land. Short-term impacts would occur if barge navigation requires drawdown of upstream reservoirs and releases into the Chattahoochee River. As is the current practice, it is assumed that releases of water by the U.S. Army Corps of Engineers (USACE) during the license renewal term would be coordinated with the U.S. Fish and Wildlife Service (FWS), and State and local resource agencies to minimize impacts to riparian species and communities. Other minor, short-term impacts in riparian areas could occur during replacement of culverts and construction of train trestles. Overall, the impacts of the coal-fired alternative at the Farley site are considered SMALL to MODERATE.

At an alternate site, the coal-fired alternative would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts may alter the ecology. Impacts could include habitat degradation, fragmentation or loss, reduced ecosystem productivity (including wildlife species), and a reduction in biological diversity. Construction and maintenance of transmission lines and a rail spur could have similar ecological impacts. Use of makeup cooling water from a nearby surface water body could have adverse aquatic resource impacts. Overall, the impacts of the coal-fired alternative at an alternate site are considered MODERATE to LARGE, depending on the nature of the site and the degree to which the site has already been disturbed by industrial use.

- **Water Use and Quality**

The coal-fired alternative at the Farley site would use the existing cooling towers. There would still be consumptive use of water due to evaporation from the cooling towers. At both the Farley site and an alternate site, plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature, increased concentration of dissolved solids relative to the receiving body of water, and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary waste water would also be discharged. All discharges would likely be regulated through modifications to the existing permit. Some erosion and sedimentation probably would occur during construction of the plant and refurbishment of the rail line. At the Farley site, groundwater would still be used for potable water, as makeup for fire protection services, and as an alternate source of makeup for the demineralizer. Use of groundwater for a coal-fired plant at an alternate site is a possibility.

Delivery of large equipment components would be by barge up the Chattahoochee River. As described in Section 2.2.2, flows in the Chattahoochee River are managed by the USACE. Barge navigation is not possible during low flow and drought conditions. To allow barge navigation during these periods, the USACE releases water from upstream reservoirs in two-week "navigation windows." Prior to releases, the USACE coordinates with the FWS and appropriate State and local agencies to minimize impacts to riparian habitats and species, and to upstream users. It is assumed that coordination between the licensee, the USACE and responsible agencies would occur prior to releases for coal-fired plant equipment transport by barge, and that these releases would be managed in a way that minimizes significant habitat loss or fragmentation, or would avoid interrupting the reproductive cycles of aquatic species.

Short-term loss of recreational opportunities could occur at upstream reservoirs if drawdowns are necessary to facilitate barge traffic. Maintenance dredging in the river may also be required for barge traffic which would result in a short-term reduction in water quality. Overall, the impacts of the coal-fired alternative at the Farley site are SMALL. The impacts of the coal-fired alternative at an alternate site are considered SMALL to MODERATE.

- **Air Quality**

The air-quality impacts of coal-fired generation are significantly higher than those of nuclear generation due to emissions of sulfur oxide(s) (SO_x), nitrogen oxide(s) (NO_x), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

The Farley site is located in the Southeast Alabama Intrastate Air Quality Control Region (40 CFR 81.267). This air quality control region is designated as unclassifiable or in attainment for all criteria pollutants (40 CFR 81.301). The nearest non-attainment areas, which are designated as marginal for ozone, are Jefferson and Shelby counties in Alabama, approximately 320 km (200 mi) from the Farley site, and Fulton County in Georgia, which is approximately 300 km (185 mi) from the Farley site (EPA 2003).

A new coal-fired generating plant located at the Farley site would likely need a prevention of significant deterioration (PSD) permit and an operating permit under the Clean Air Act (CAA). The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60 Subpart D(a). The standards establish limits for particulate matter and opacity [40 CFR 60.42(a)], SO_2 [40 CFR 60.43(a)], and NO_x [40 CFR 60.44(a)].

Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future, and remedying existing, impairment of visibility or mandatory Class 1 Federal areas (listed in 40 CFR Part 81) when impairment results from man-made air pollution. In addition, the U.S. Environmental Protection Agency (EPA) issued a new regional haze rule on July 1, 1999 (64 FR 35714 [EPA 1999]). The rule specifies that for each mandatory Class 1 Federal area located within a state, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308[d][1]). If a coal-fired power plant were located close to a mandatory Class 1 area, additional air pollution control requirements could be imposed. However, there are no mandatory Class 1 areas within 160 km (100 mi) of the Farley site. It is assumed that an alternate site would not be chosen near a mandatory Class 1 area.

EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for the review of any new major stationary source in an area designated as attainment or unclassified under the CAA. As noted above, the Farley site is in a region that is either unclassifiable or in attainment for all criteria pollutants.

In 1998, EPA issued a rule requiring 22 eastern states, including Alabama, to revise their state implementation plans to reduce nitrogen oxide emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone. The total amount of nitrogen oxides that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 to September 30) is set out at 40 CFR 41.121(e). For Alabama the amount is 198,280 MT (218,610 tons).

Impacts and issues for particular pollutants follow. Unless otherwise stated, the impacts would be the same at the Farley site or at an alternate site.

Sulfur oxides. A new coal-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but they are required to have allowances to cover their SO_2 emissions. Owners of new units must, therefore, purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions although it might do so locally.

Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative. However, SNC states in its ER that the alternative coal-fired power plant would minimize air emissions through a combination of boiler technology and post-combustion pollution removal. SO_2 would be removed using lime in a flue-gas desulfurization process (SNC 2003). SNC estimates that by using a wet-scrubber control technology, 95 percent of the stack emissions of SO_2 could be collected, so that total annual stack emissions, after scrubbing, would be approximately 4950 MT (5450 tons) of SO_2 (SNC 2003).

Nitrogen oxides and volatile organic compounds (VOCs). Section 407 of the CAA establishes technology-based limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for nitrogen oxide emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

SNC estimates that by using the best available control technology, the total annual nitrogen oxide emissions for a new coal-fired power plant would be approximately 1290 MT (1420 tons) (SNC 2003). Because the coal-fired alternative will not be within the jurisdiction of a NO_x trading program, these emissions will add to regional emissions.

Particulates. SNC estimates that the total annual stack emissions would include 250 MT (275 tons) of filterable total suspended particulates (particulates that range in size from less than 0.1 micron up to approximately 45 microns) (SNC 2003). This would include 57 MT (63 tons) per year of particulate matter having an aerodynamic diameter less than or equal to 10 microns (PM_{10}) (SNC 2003). Fabric filters with a 99.9 percent removal efficiency would be used to control particulates (SNC 2003).

During the construction of a coal-fired plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process.

Carbon monoxide. SNC estimates that the total carbon monoxide emissions would be approximately 1330 MT (1460 tons) per year (SNC 2003). This level of emissions would be greater than the OL renewal alternative.

Hazardous air pollutants, including mercury. In December 2000, EPA issued a regulatory finding on the emissions of hazardous air pollutants from electric utility steam-generating units (65 FR 79825 [EPA 2000b]). EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000b). EPA concluded that mercury is the hazardous air pollutant of greatest concern. EPA found that (1) there is a link between coal consumption and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from the consumption of contaminated fish (EPA 2000b). 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 (EPA 2000b).

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant released roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Carbon dioxide. A coal-fired plant would have unregulated carbon dioxide (CO_2) emissions that would contribute to global warming. The level of emissions from a coal-fired plant would be greater than the OL renewal alternative.

Summary. The GEIS analysis did not quantify emissions from coal-fired power plants, but the analysis implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated CO_2 emissions and acid rain from SO_2 and NO_x emissions as potential impacts (NRC 1996). Adverse human health effects from coal combustion such as cancer and emphysema have been associated with the products of coal combustion. Overall, the air quality impacts from coal-fired generation at either the Farley or an alternate site are considered MODERATE. The impacts would be clearly noticeable, but they would not destabilize air quality.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. Assuming 99.9 percent ash removal, the coal-fired alternative would generate approximately 490,000 MT (549,000 tons) of this ash annually (SNC 2003). In addition, approximately 193,000 MT (213,000 tons) per year of scrubber sludge would be generated by SO_2 controlled equipment (SNC 2003). This equipment would use approximately 162,000 MT (179,000 tons) of limestone (calcium carbonate) in the scrubbing process to control SO_2 emissions. Debris would be generated during construction activities.

The waste would be disposed of on site, assuming approvals were obtained from regulatory agencies. According to SNC, disposal of ash and scrubber sludge over the 40-year plant life would require approximately 170 ha (425 ac) (SNC 2003). Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses.

In May 2000, EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (EPA 2000a). EPA concluded that some form of national regulation is warranted to address coal-combustion waste products because (a) the composition of these wastes could present danger to human health and the environment under certain conditions; (b) EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (c) present disposal practices are such that in 1995, these wastes were being managed in 40 to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (d) EPA identified gaps in the State oversight of coal combustion wastes. Accordingly, EPA announced its intention to issue regulations for the disposal of coal-combustion waste under Subtitle D of the Resource Conservation and Recovery Act.

Overall, the waste impacts of the coal-fired alternative at the Farley site or at an alternate site are considered MODERATE. The impacts would be clearly noticeable, but they would not destabilize any important resource.

- **Human Health**

Coal-fired power generation introduces worker risks from fuel and limestone mining, from fuel and limestone transportation, and from disposal of coal combustion waste. In addition there are public risks from inhalation of stack emissions. Emission impacts can be widespread and health risks difficult to quantify. The coal alternative also introduces the risk of coal-pile fires and associated inhalation risks.

In the GEIS, the staff stated that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but it did not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal are characterized as SMALL.

- **Socioeconomics**

Construction of the coal-fired alternative would take approximately five years. The staff assumed that construction of the coal-fired alternative would take place while Farley Units 1 and 2 continues operation and would be completed by the time Farley Units 1 and 2 permanently cease operation. The GEIS estimates a peak workforce during construction of between 1200 and 2500 workers for a 1000-MW(e) power plant (NRC 1996). This workforce would likely be larger for the 1600-MW(e) coal-fired alternative.

If the facility were constructed at the Farley site, the total workforce would include approximately 900 permanent employees, 375 contract workers, and up to 2500 construction workers. Surrounding communities would experience significant, but not destabilizing, demands on housing and public services. After construction, the nearby communities would be impacted by the loss of the construction jobs. In addition, the large construction workforce might put significant pressure on existing highways near the Farley site. At the same time, this construction workforce would add to the local tax base. In total, the socioeconomic impacts during the construction period for the coal-fired alternative at the Farley site are considered MODERATE.

At an unnamed alternate site, the construction impacts could be smaller or larger than those at the Farley site, depending on how close the site is to a vital economic center and the character of the existing transportation infrastructure. These impacts are considered SMALL to LARGE, depending on the site.

During operation at the Farley site, the coal-fired alternative would put a lower burden on local housing and transportation than continued operation as a nuclear-fired facility. SNC estimates that the new coal-fired plant would have a workforce of approximately 300 (SNC 2003). If the coal-fired alternative were constructed at the Farley site and Farley Units 1 and 2 were decommissioned, there would be a loss of 600 permanent, high-paying jobs (900 for Farley Units 1 and 2 down to 300 for the coal-fired alternative), along with the loss of up to 375 contract jobs. Transportation impacts for commuting would be smaller than for the existing Farley Units 1 and 2 because of the smaller size of the workforce. At the same time, the coal-fired alternative would require significant transportation of coal by rail. Positive impacts on the local tax base would help to offset losses from decommissioning Farley Units 1 and 2. For these reasons, the socioeconomic impacts of operating the coal-fired alternative at the Farley site are considered SMALL.

The impacts of operating the coal-fired alternative at an unnamed alternate site could be smaller or larger than those at the Farley site, depending on how close the alternate site is to a vital economic center and the character of the existing transportation infrastructure, including rail for transportation of coal. These impacts are considered SMALL to LARGE, depending on the site.

- **Aesthetics**

The coal-fired alternative would result in aesthetic impacts, both visual and auditory. Visual impacts would result from several structures, including, most prominently, the power plant units, the boiler exhaust stacks, and the cooling towers. Coal-fired power plant units can stand as high as 60 m (200 ft) tall. The exhaust stacks can stand as high as 120 to 185 m (400 to 600 ft) tall. Cooling towers may be as high as 160 m (520 ft) high in the case of natural draft towers and up to 30 m (100 ft) high in the case of mechanical draft towers. Cooling tower plumes are visible from greater distances than the towers themselves. At the Farley site, a portion of this infrastructure would be visible from both State Road 95 and the Chattahoochee River (SNC 2003). Further, the Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). Visual impacts of buildings and structures could be mitigated to some degree by landscaping and color selection that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting to meet FAA requirements, and appropriate use of shielding. In addition to the plant infrastructure, there would be noticeable visual impacts from rail delivery of coal and limestone to the Farley site. Also, short-term aesthetic impacts could occur at upstream reservoirs and in the Chattahoochee River if releases were required to facilitate barge delivery of plant components. Overall, the visual aesthetic impacts of the coal-fired alternative at the Farley site are considered MODERATE.

At an alternate site, the structures and other factors that drive the visual aesthetic impacts would be similar to those occurring if the coal-fired alternative were placed at the Farley site. However, the significance of the impacts would depend crucially on the nature of the site—whether it sits in an industrial area versus in a pristine wilderness, or whether it is visible from local roads or recreation areas. The largest change could be a potential need for significant transmission line infrastructure. Overall, the visual aesthetic impacts associated with the coal-fired alternative at an unnamed alternate site are considered MODERATE to LARGE and will depend on the exact location and characteristics of the alternate site.

Coal-fired generation would introduce mechanical sources of noise, including noise both from plant operation and from rail delivery of coal and limestone. The noise sources are both continuous and intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. At the Farley site, the plant operation noises would not be largely noticeable in any important nearby recreation or dwelling areas. The noise impacts from the rail deliveries would most certainly be noticeable over a wide range of areas outside the Farley site and along the rail ROW. Although noise from passing trains significantly raises noise levels near the rail ROW, the short duration of the noise reduces its impact. The noise impacts of a coal-fired plant at the Farley site are considered to be MODERATE. At an alternate site, these noise impacts would be SMALL to LARGE, depending on the site.

- **Historic and Archaeological Resources**

At the Farley site or an alternate site, a cultural-resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of cultural resources, identification, and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing related to physical expansion of the plant site.

Before construction at the Farley site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated ROWs where new construction would occur (e.g., roads, transmission ROWs, rail lines, or other rights-of-way). Historic and archaeological resource impacts can be effectively managed, and are considered SMALL.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the Farley site. Other impacts might disproportionately impact minority or low-income populations, including impacts on housing availability and prices during construction. Overall, at the Farley site, the environmental justice impacts are considered SMALL. The impacts around the alternate site would depend upon the site chosen and the nearby population distribution. These impacts could vary between SMALL and LARGE.

8.2.2 Natural Gas-Fired Generation

The environmental impacts of the natural gas alternative are examined in this section. Unless otherwise indicated, the assumptions and numerical values used in this section are from the SNC ER (SNC 2003). The staff reviewed this information and compared it to environmental impact information in the GEIS, as well as other relevant information and sources when appropriate. Although the OL renewal period is only 20 years, the impact of operating the natural gas-fired alternative for 40 years is considered as a reasonable projection of the operating life of a natural gas-fired plant.

The staff assumed that Farley Units 1 and 2 would remain in operation while the natural gas-fired alternative was constructed. Consistent with the SNC ER (SNC 2003), the staff assumed a combined-cycle natural gas facility based on two 800-MW(e) combined-cycle units, for a total facility size of 1600 MW(e) (SNC 2003). The 800-MW(e) units are a standard size, which would minimize the cost of the new facility. Any shortfall in energy and capacity would be made up from other sources. This assumption understates the environmental impacts of replacing the 1699-MW(e) from Farley Units 1 and 2. As a rough estimate, if a natural gas-fired plant of exactly 1699 MW(e) were to be built, any numerical impacts in this section, for example, quantities of air pollutants, might simply be adjusted upward accordingly. However, given these adjustments, the staff has determined that the differences in impacts between 1600 MW(e) and 1699 MW(e) of natural gas-fired generation would not be significant and would not change the standard of significance (SMALL, MODERATE, or LARGE) of any impacts.

The natural gas-fired alternative is analyzed both for the existing Farley site and for an unnamed alternate site. Siting a new natural gas-fired plant at the site of an existing nuclear plant would reduce environmental impacts by allowing the new facility to take advantage of existing infrastructure at the Farley site, including transmission facilities, roads, parking areas, office buildings, and the existing cooling system (to the extent needed). Hence, although the staff considered an unnamed alternate site, it is unlikely that it would be beneficial to place a new natural gas-fired facility at an alternate site based purely on environmental considerations. The GEIS estimates that 45 ha (110 ac) would be required for a new 1000-MW(e) combined-cycle facility, a much smaller land requirement than for a coal-fired facility. SNC concluded in its ER that the Farley site would be a reasonable site for location of a natural gas-fired generating unit (SNC 2003).

SNC made the following estimates to describe the combined-cycle facility (SNC 2003):

- Heat Rate: 5940 Btu/kWh
- Natural Gas Heating Value: 1019 Btu/ft^3
- Capacity Factor: 0.85

These assumptions were deemed by the staff to be consistent with current practice with combined-cycle facilities. For emissions control, the facility would be outfitted with standard technologies, which include selective catalytic reduction and steam/water injection for nitrogen oxide control.

As with the coal-fired alternative, delivery of large plant components for a gas-fired plant would be by barge. During low flow or drought conditions, barge navigation may require releases from upstream reservoirs by the USACE.

For purposes of this SEIS, the staff assumed a natural gas-fired plant would use a closed-cycle cooling system at the Farley site, to the extent necessary. The overall impacts of the natural gas-fired generating system using a closed-cycle cooling system at the Farley site and at an unnamed alternate site are discussed in the following sections and summarized in Table 8-3.

- **Land Use**

For siting a new facility at the Farley site, the existing infrastructure would be used to the extent practicable, thus limiting the amount of new construction that would be required. Specifically, the staff assumed that the new combined-cycle facility would make use of transmission facilities, roads, parking areas, office buildings, and the existing cooling system (to the extent needed). The GEIS assumes that approximately 45 ha (110 ac) would be needed for a 1000-MW(e) natural gas facility (NRC 1996). Scaling up for the 1600-MW(e) facility considered by SNC would indicate a proportionally larger land requirement. According to SNC, previously disturbed acreage already exists and is available at the Farley site, minimizing land-use impacts (SNC 2003).

Operation of a new combined-cycle facility at the Farley site would require a new gas line. SNC estimated that approximately 160 km (100 mi) of buried, 61-cm (24-in.) diameter gas pipeline would be required (SNC 2003). SNC further estimated that this pipeline would require approximately 200 ha (500 ac) for an easement (SNC 2003). The likely route for the pipeline from the plant to an existing gas transmission line would be adjacent to existing utility ROWs. SNC asserts that this pipeline would likely have a minimal impact, because SNC would use best management practices (BMPs) during construction, such as minimizing soil loss and restoring vegetation immediately after the excavation is backfilled (SNC 2003). For construction at an alternate site, the full land requirement for a natural gas-fired facility would be necessary because no existing infrastructure would be available. Additional land could be impacted for construction of a transmission line, and natural gas pipelines to serve the plant. The gas line requirements at an alternate site would depend on the characteristics and location of the alternate site.

Table 8-3. Summary of Environmental Impacts of Natural Gas-Fired Generation at the Farley site and an Alternate Site Using Closed-Cycle Cooling

Impact	Farley Site		Alternate Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	SMALL to MODERATE	The natural gas-fired alternative would use undeveloped portions of the Farley site. It would require upwards of 45 ha (110 ac) for power block, offices, roads, and parking areas. It would use existing infrastructure, minimizing new land requirements. There would be additional land impacts for construction of an underground gas pipeline.	SMALL to LARGE	Land use requirements would be larger at the alternate site than at the Farley site because of the need for infrastructure such as transmission facilities, roads, parking areas, office buildings, and cooling system. The total impact would depend on whether the alternate site is previously disturbed.
Ecology	SMALL to MODERATE	The natural gas-fired alternative would use previously disturbed areas at the Farley site. The gas supply pipe would be located in undeveloped areas adjacent to existing utility rights-of-way. There would be potential for significant habitat loss and fragmentation and reduced productivity and biological diversity. Delivery of large equipment components would be by barge. It is assumed that sufficient water would be present either as natural flow or in navigation windows created by releases from upstream reservoirs. It is also assumed that releases would be managed by the USACE to minimize impacts to riparian communities at upstream reservoirs and in the river channel.	SMALL to LARGE	Impacts would depend on whether the alternate site is previously developed. Factors to consider include location and ecology of site and transmission line route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality	SMALL	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use closed-cycle cooling system to the degree necessary. The facility would continue very limited groundwater use. Delivery of equipment by barge may require releases from upstream reservoirs to allow navigation on the river during low flow periods. This could result in a short-term loss of recreational opportunities in the affected reservoirs.	SMALL to MODERATE	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use closed-cycle cooling system to the degree necessary. Total impacts would depend on volume of water withdrawal, the constituents of the discharge water, the characteristics of surface water or groundwater source, and the new intakes structures required.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Air Quality	MODERATE	Sulfur oxides: 110 MT/yr (125 tons/yr) Nitrogen oxides: 364 MT/yr (401 tons/yr) Carbon monoxide: 75 MT/yr (83 tons/yr) PM_{10} particulates: 64 MT/yr (70 tons/yr) Other: (1) hazardous air pollutants, including arsenic, formaldehyde, and nickel and (2) CO_2 emissions, which contribute to global warming.	MODERATE	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Waste	SMALL	Minimal waste product from fuel combination.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Human Health	SMALL	Impacts are considered to be minor.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Socio-economics	MODERATE	During construction, impacts would be MODERATE. Construction workers could place noticeable burdens on existing infrastructure, including housing and transportation. During operation, employment would decrease from 900 permanent workers to approximately 50, reducing impacts on transportation. Impacts on housing and vitality of the local economy would be negative. Overall, socioeconomic impacts from operation are MODERATE	SMALL to LARGE	The characteristics of the construction period at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to MODERATE. The characteristics of the operation of the gas-fired alternative at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE.
Aesthetics	MODERATE	There would be visual aesthetic impacts associated with plant buildings and structures. There would also be aesthetic impacts associated with drawdown of upstream reservoirs for barge navigation, and there would be both continuous and intermittent noise impacts from plant operation.	SMALL to LARGE	The structures and operation would be similar to the Farley site, but the significance of the impacts would depend on the characteristics of the alternate site. The natural gas-fired alternative at an alternate site could require transmission lines, with attendant aesthetic impacts.
Historic and Archaeo-logical Resources	SMALL	Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant.	SMALL	At the unnamed alternate site, cultural studies would be needed. Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant on unnamed alternate site.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Environ-mental Justice	SMALL	No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations. Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL to LARGE	Impacts would vary depending on population distribution and characteristics at new site.

Regardless of whether the natural gas facility is built at the Farley site or at an alternate site, additional land could be required for natural gas wells and collection stations. In the GEIS, the staff estimated that approximately 1500 ha (3600 ac) would be needed for a 1000-MW(e) plant (NRC 1996). Proportionately more land would be needed for the 1600-MW(e) facility considered here. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for Farley Units 1 and 2. In the GEIS (NRC 1996), the staff estimated that approximately 400 ha (1000 ac) would be affected for mining the uranium and processing it during the operating life of a 1000-MW(e) nuclear power plant.

Overall, the land-use impacts of constructing the natural gas-fired alternative at the Farley site are considered SMALL to MODERATE. Overall, the land-use impacts of siting the natural gas-fired alternative at an alternate site would depend on the chosen site, but are characterized as SMALL to LARGE.

- **Ecology**

Locating a natural gas-fired plant at the Farley site would alter ecological resources because of the need to convert currently unused land to industrial use for the plant and for building a new natural gas line to the site. The likely route to an existing regional gas transmission line would be adjacent to existing utility ROWs. It is assumed that some of this land would not have been previously disturbed. These ROWs do not pass through habitats or ecosystems identified as being sensitive or supporting sensitive species, or any managed parks or reserves. SNC asserts the new gas pipeline would likely be of only minimal impact, because SNC would use BMPs during construction, such as minimizing soil loss and restoring vegetation immediately after the excavation is backfilled (SNC 2003). There could be onsite habitat degradation, fragmentation or loss, reduced ecological productivity, and a reduction in biological diversity, resulting from disturbing previously intact land. Use of a closed-cycle cooling system would limit operational impacts on the aquatic ecosystem, and would reduce the use of water beyond current levels. Short-term impacts would occur if barge navigation required drawdown of upstream reservoirs and releases into the Chattahoochee River. As is the current practice, it is assumed that releases of water by the USACE during the license renewal term would be managed in cooperation with the FWS and State and local resource agencies to minimize significant habitat loss or fragmentation, or interruption of the reproductive cycles of aquatic species. Overall, the ecological impacts of the natural gas-fired alternative at the Farley site are considered SMALL to MODERATE.

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts may alter the ecology. Impacts could include habitat degradation, fragmentation or loss, reduced ecosystem productivity (i.e., including wildlife species), and a reduction in biological diversity. Construction and maintenance of transmission lines and a barge offloading facility could result in the same types of ecological impacts. Use of makeup cooling water from a nearby surface water body could have adverse aquatic resource impacts. Overall, the impacts of the natural-gas alternative at an alternate site would be SMALL to LARGE.

- **Water Use and Quality**

Overall, water requirements for combined-cycle generation are much less than for conventional generators such as nuclear-fired generators and coal-fired generators. The natural gas-fired alternative at the existing or at an alternate site would use a closed-cycle cooling system with cooling towers. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids relative to the receiving body of water, and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary waste water may also be discharged. All discharges would likely be regulated through a National Pollutant Discharge Elimination System (NPDES) permit. Some erosion and sedimentation probably would occur during construction (NRC 1996). At the Farley site, groundwater would still be used for potable water, as makeup for fire protection services, and as an alternate source of makeup for the demineralizer. Use of groundwater for a natural gas-fired plant at an alternate site is a possibility.

Delivery of large equipment components would be by barge up the Chattahoochee River. As described in Section 2.2.2, barge navigation may require releases from upstream reservoirs during low flow and drought conditions. It is assumed that coordination between the licensee, the USACE, and responsible agencies would occur prior to releases for gas-fired plant equipment transport by barge. Short-term loss of recreational opportunities could occur at upstream reservoirs if drawdowns are necessary to facilitate barge traffic. Maintenance dredging in the river may also be required for barge traffic, which would result in a short-term reduction in water quality. Overall, the impacts of the natural gas-fired alternative at the Farley site are SMALL. The impacts of the natural gas-fired alternative at an alternate site are considered SMALL to MODERATE.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The natural gas-fired alternative would release similar types of emissions, but in lesser quantities, than the coal-fired alternative. Hence, it would be subject to the same type of air quality regulations as a coal-fired plant, discussed in Section 8.2.1. The greatest concern from combined-cycle facilities are the emissions of ozone precursors, NO_x and VOCs.

SNC projects the following emissions for the natural gas-fired alternative (SNC 2003):

- Sulfur oxides: 110 MT/yr (125 tons/yr)
- Nitrogen oxides: 364 MT/yr (401 tons/yr)
- Carbon monoxide: 75 MT/yr (83 tons/yr)
- PM_{10} particulates: 64 MT/yr (70 tons/yr)

A combined-cycle facility would also have unregulated carbon dioxide emissions that could contribute to global warming. While these emissions have not traditionally been an important environmental concern, they are becoming increasingly relevant at both a national and an international level.

In December 2000, EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units. Natural gas-fired power plants were found by EPA to emit arsenic, formaldehyde, and nickel (EPA 2000a). Unlike coal and oil-fired plants, EPA did not determine that emissions of hazardous air pollutants from natural gas-fired power plants should be regulated under Section 112 of the CAA.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process and by employee and delivery vehicles during operations.

The emissions discussed above would likely be the same at the Farley site or at the alternate site. Impacts from the above emissions would be clearly noticeable, but they would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural gas-fired generating facility sited at the Farley site or at an alternate site is considered MODERATE.

- **Waste**

There will be spent catalyst from NO_x emissions control and small amounts of solid-waste products (i.e., ash) from burning natural gas fuel. In the GEIS, the staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities. Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at the Farley site or at an alternate site.

- **Human Health**

In Table 8-2 of the GEIS, the staff identifies cancer and emphysema as potential health risks from natural gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contributes to health risks. NO_x emissions from the plant would be regulated. Human health effects are not expected to be detectable or would be sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural gas-fired alternative at the Farley site or at an alternate site are considered SMALL.

- **Socioeconomics**

Construction of a natural gas-combined facility at the Farley site would take approximately 2 to 3 years. The staff assumed that construction would take place while Farley Units 1 and 2 continued operation and would be completed by the time the units permanently ceased operations. In the GEIS (NRC 1996), the staff concluded that socioeconomic impacts from constructing a natural gas-fired power plant would be low compared to other steam plants.

If the facility were constructed at the Farley site, the construction workers required would be in addition to the 900 permanent employees and up to 375 contract workers that work at the Farley site. Surrounding communities would experience significant, but not destabilizing, demands on housing and public services. After construction, the nearby communities would be impacted by the loss of the construction jobs. In addition, the construction workforce might put significant pressure on existing highways near the Farley site. At the same time, this construction workforce would add to the local tax base. In total, the socioeconomic impacts during the construction period for the natural gas-fired alternative at the Farley site are considered MODERATE.

At an unnamed alternate site, the construction impacts could be smaller or larger than those at the Farley site, depending on how close the site is to a vital economic center and the character of the existing transportation infrastructure. These impacts are considered SMALL to MODERATE, depending on the site.

SNC estimates that the new combined-cycle facility would have a workforce of approximately 25 to 40 (SNC 2003), significantly less than the 150 assumed in the GEIS for a 1000-MW(e) natural gas facility. Assuming a workforce of approximately 50 workers, if the combined-cycle facility were constructed at the Farley site and Farley Units 1 and 2 were decommissioned, there would be a loss of approximately 850 permanent, high-paying jobs, along with the loss of up to 375 contract workers. Transportation impacts for commuting would be smaller than for the existing Farley Units 1 and 2 because of the smaller size of the workforce. Positive impacts on the local tax base would help to offset losses from decommissioning of Farley Units 1 and 2. For all of these reasons, the socioeconomic impacts of operating the natural gas-fired alternative at the Farley site are considered MODERATE.

The impacts of operating the natural gas-fired alternative at an unnamed alternate site could be smaller or larger than those at the Farley site, depending on how close the alternate site is to a vital economic center and the character of the existing transportation infrastructure. These impacts are considered SMALL to LARGE, depending on the site.

- **Aesthetics**

The natural gas-fired alternative would result in aesthetic impacts, both visual and audible. Visual impacts would result from several structures, including, most prominently, the power plant units, the boiler exhaust stacks, and the gas pipeline compressors. The turbine buildings, the exhaust stacks (approximately 60 m [200 ft] tall), and the gas pipeline compressors would be visible from offsite during daylight hours. Buildings and structures would also be visible at night because of outside lighting. Visual impacts of buildings and structures could be mitigated by landscaping and selecting a color that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting and appropriate use of shielding. The expansion of the existing utility ROWs would probably require additional clearing of trees and shrubs, which would expand the visual impact of the existing lines. Also, short-term aesthetic impacts could occur at upstream reservoirs and in the Chattahoochee River if releases were required to facilitate barge delivery of plant components. At the Farley site, visual aesthetic impacts of a natural gas combined-cycle facility are considered MODERATE.

At an alternate site, the structures and other factors that drive the visual aesthetic impacts would be similar to those occurring if the natural gas-fired alternative were placed at the Farley site. However, the significance of the impacts would depend crucially on the nature of the site—whether it sits in an industrial area as opposed to a pristine wilderness, or whether it is visible from local roads or recreation areas. The largest change could be a potential need for significant transmission line and gas pipeline infrastructure. Overall, the visual aesthetic impacts associated with the natural gas-fired alternative at an unnamed alternate site are considered MODERATE to LARGE and will depend on the exact location and characteristics of the alternate site.

Natural gas generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the use of outside loudspeakers, and the commuting of plant employees. At the Farley site, the plant operation noises would not be largely noticeable in any important nearby recreation or dwelling areas. The noise impacts of a natural gas-fired plant at the Farley are considered MODERATE.

At an alternate site, these noise impacts would be SMALL to LARGE, depending on the site and location.

- **Historic and Archaeological Resources**

At the Farley site or an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the Farley site or an alternate site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated ROWs where new construction would occur (e.g., roads, transmission ROWs, rail lines, or other ROWs). Impacts to cultural resources can be effectively managed under current laws and regulations and kept SMALL.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural gas-fired plant were built at the Farley site. Other impacts might disproportionately impact minority or low-income populations, including impacts on housing availability and prices during construction. Overall, at the Farley site, the environmental justice impacts are considered SMALL. The impacts around the alternate site would depend upon the site chosen and the nearby population distribution. These impacts could vary between SMALL and LARGE.

8.2.3 Nuclear Power Generation

Since 1997 the NRC has certified three new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the System 80+ design (10 CFR 52, Appendix B), and the AP600 design (10 CFR 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. Recent volatility in prices of natural gas and electricity have made new nuclear power plant construction more attractive from a cost standpoint. Additionally, System Energy Resources, Inc., Exelon Generation Company, LLC, and Dominion Nuclear North Anna, LLC, have recently submitted applications for early site permits for new advanced nuclear power plants under the procedures in 10 CFR Part 52, Subpart A (Eaton 2003; Christian 2003; Kray 2003). Therefore, construction of a new nuclear plant at either the Farley site or alternate site is considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime.

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at Farley or an alternate site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect impacts of 1699-MW(e) of new nuclear power. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR 51 Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using closed-cycle cooling is presented below.

For purposes of this SEIS, the staff assumed a nuclear plant would use the existing closed-cycle cooling system at the Farley site. The overall impacts of the nuclear generating system using closed-cycle cooling at the Farley site and at an unnamed alternate site are discussed in the following sections and summarized in Table 8-4.

- **Land Use**

The existing infrastructure would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the new nuclear facility would use the transmission facilities, roads, parking areas, office buildings, and the existing cooling system. According to the GEIS, a light-water reactor requires approximately 200 to 400 ha (500 to 1000 ac) excluding transmission lines (these estimates are not scaled to any particular facility size). The Farley site consists of 750 ha (1850 ac) and should be adequate to support a new nuclear facility. There would be no net change in land needed for uranium mining because land needed to supply the new nuclear plant would offset the land needed to supply uranium for fueling the existing reactors at Farley Units 1 and 2. Overall, the impact of a replacement nuclear generating plant on land use at the existing Farley site is characterized as MODERATE. The impact would be greater than the OL renewal alternative.

Land-use requirements at an alternate site would be approximately 200 to 400 ha (500 to 1000 ac) plus the possible need for land for a new transmission line (NRC 1996). In addition, it may be necessary to construct a rail spur or barge offloading facility to an alternate site to deliver equipment during construction. There would be no net change in land needed for uranium mining because land needed to supply the new nuclear plant would offset the land needed to supply uranium for fueling the existing reactors at Farley Units 1 and 2. Overall, the impacts of a new nuclear power plant at an alternate site would result in MODERATE to LARGE land-use impacts.

Table 8-4. Summary of Environmental Impacts of New Nuclear Power Generation at the Farley site and an Alternate Site Using Closed-Cycle Cooling

Impact	Farley Site		Alternate Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	The nuclear facility would use unused portions of Farley site. It would require approximately 200 to 400 ha (500 to 1000 ac). It would use existing infrastructure, minimizing new land requirements.	MODERATE to LARGE	The impacts would be the same as for the Farley site, plus land for transmission line and any existing infrastructure. Overall impacts would depend on whether the alternate site is previously disturbed.
Ecology	SMALL to MODERATE	The nuclear facility would use both developed and undeveloped areas at Farley. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land. Delivery of large equipment components would be by barge. It is assumed that sufficient water would be present either as natural flow or in navigation windows created by releases from upstream reservoirs. It is also assumed that releases would be managed by the USACE to minimize impacts to riparian communities at upstream reservoirs and in the river channel.	MODERATE to LARGE	Impacts would depend on whether site is previously developed. Factors to consider include location and ecology of the site, transmission line route, and rail spur route. In total, impacts could include habitat degradation, fragmentation or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality	SMALL	The nuclear alternative would use the existing closed-cycle cooling system using river water. There would be consumptive use of water due to evaporation from the cooling towers. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids and intermittent low concentrations of biocides (e.g., chlorine). Limited groundwater use would continue. Delivery of equipment by barge may require releases from upstream reservoirs to allow navigation on the river during low flow periods. This could result in a short-term loss of recreational opportunities in the affected reservoirs.	SMALL to MODERATE	The nuclear alternative would use closed-cycle cooling. There would be consumptive use of water due to evaporation from the cooling towers. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids and intermittent low concentrations of biocides (e.g., chlorine). In total, the impacts on water use and quality would depend on the characteristics of the surface or groundwater sources and sinks.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Air Quality	SMALL	Emissions would be minimal and would primarily consist of fugitive emissions and emissions from vehicles and equipment during construction and small amount of emissions from diesel generators and possibly other sources during operation.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Socio-economics	SMALL to MODERATE	During construction, impacts would be MODERATE. Upwards to 2500 workers might be required at the peak of the construction period, placing noticeable burdens on existing infrastructure, including housing and transportation.	SMALL to LARGE	The characteristics of the construction period at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE.
		During operation, employment levels would be similar to those for Farley Units 1 and 2. Hence, impacts on transportation and impacts on housing and vitality of the local economy would be similar to the Farley Units 1 and 2. Overall, socioeconomic impacts from operation are SMALL.		The characteristics of the operation at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE.
Aesthetics	MODERATE	There would be visual aesthetic impacts associated with plant buildings and structures, along with cooling tower plumes. There would be both continuous and intermittent noise impacts from plant operation. There would also be aesthetic impacts associated with drawdown of upstream reservoirs for barge navigation.	SMALL to LARGE	The structures and operation would be similar to the Farley site, but the significance of the impacts would depend on the characteristics of the alternate site. The nuclear alternative at an alternate site could require transmission lines, with attendant aesthetic impacts.
Historic and Archaeo-logical Resources	SMALL	Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant.	SMALL	At the unnamed alternate site, cultural studies would be needed. Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant on unnamed alternate site.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Environ-mental Justice	SMALL	No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations. Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL to LARGE	Impacts would vary depending on population distribution and characteristics at new site.

- **Ecology**

Locating a nuclear power plant at the Farley site would alter ecological resources because of construction, and because of the need to convert currently unused land to industrial use. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities may experience reduced productivity and biological diversity from disturbing previously intact land. Short-term impacts would occur if barge navigation required drawdown of upstream reservoirs and releases into the Chattahoochee River. As is the current practice, it is assumed that releases of water by the USACE during the license renewal term would be managed in cooperation with the FWS and State and local resource agencies to minimize significant habitat loss or fragmentation, or interruption of the reproductive cycles of aquatic species. Overall, the ecological impacts of the nuclear alternative at the Farley site are considered SMALL to MODERATE.

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts may alter the ecology. Impacts could include habitat degradation, fragmentation or loss, reduced ecosystem productivity (i.e., including wildlife species), and a reduction in biological diversity. Construction and maintenance of transmission lines, a rail spur, or a barge offloading facility could result in the same types of ecological impacts. Use of makeup cooling water from a nearby surface water body could have adverse aquatic resource impacts. Overall, the impacts of the nuclear alternative at an alternate site would be MODERATE to LARGE.

- **Water Use and Quality**

The replacement nuclear plant alternative at the Farley site would use the existing cooling towers. There would still be consumptive use of water due to evaporation from the cooling towers. At both the Farley site and an alternate site, plant discharges would consist mostly of cooling tower blowdown, characterized primarily by increased temperature and increased concentration of dissolved solids relative to the receiving body of water and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary waste water would also be discharged. All discharges would likely be regulated through modifications to the existing permit. Some erosion and sedimentation probably would occur during construction (NRC 1996). At the Farley site, groundwater would still be used for potable water, as makeup for fire protection services, and as an alternate source of makeup for the demineralizer. Use of groundwater for a nuclear plant at an alternate site is a possibility.

Delivery of large equipment components would be by barge up the Chattahoochee River. As described in Section 2.2.2, barge navigation may require releases from upstream reservoirs during low flow and drought conditions. It is assumed that coordination between the licensee, the USACE and responsible agencies would occur prior to releases for new nuclear plant equipment transport by barge. Short-term loss of recreational opportunities could occur at upstream reservoirs if drawdowns are necessary to facilitate barge traffic. Maintenance dredging in the river may also be required for barge traffic, which would result in a short-term reduction in water quality. Overall, the impacts of the nuclear alternative at the Farley site would be SMALL. The impacts of the nuclear alternative at an alternate site would be SMALL to MODERATE.

- **Air Quality**

Construction of a new nuclear plant at the Farley site or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with emergency diesel generators. These emissions would be regulated. Overall, emissions and associated impacts are considered SMALL at the Farley site or at an alternate site.

- **Waste**

The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR 51, Subpart A, Appendix B. Construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts are considered SMALL.

Siting the replacement nuclear power plant at a site other than Farley would not alter waste generation. Therefore, the impacts would be SMALL.

- **Human Health**

Human health impacts for an operating nuclear power plant are set out in 10 CFR 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts are considered SMALL.

Siting the replacement nuclear power plant at a site other than Farley would not alter human health impacts. Therefore, the impacts would be SMALL.

- **Socioeconomics**

The construction period and the peak workforce associated with the construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantified data, the staff assumed a construction period of 5 years and a peak workforce of 2500. The staff assumed that construction would take place while Farley Units 1 and 2 continue operation and would be completed by the time Farley Units 1 and 2 permanently cease operations.

If the facility were constructed at the Farley site, these construction workers would be in addition to the 900 permanent employees and up to 375 contract workers that work at the Farley site. Surrounding communities would experience significant, but not destabilizing, demands on housing and public services. After construction, the nearby communities would be impacted by the loss of the construction jobs. In addition, the large construction workforce might put significant pressure on existing highways near the Farley site. At the same time, this construction workforce would add to the local tax base. In total, the socioeconomic impacts during the construction period for the nuclear-fired alternative at the Farley site are considered MODERATE.

At an unnamed alternate site, the construction impacts could be smaller or larger to those at the Farley site, depending on how close the site is to a vital economic center and the character of the existing transportation infrastructure. These impacts are considered SMALL to LARGE, depending on the site.

The replacement nuclear units are assumed to have an operating workforce comparable to the 900 permanent employees and up to 375 contract workers that work at Farley Units 1 and 2. The new nuclear power plant alternative would provide a new tax base to offset the loss of tax base associated with decommissioning Farley Units 1 and 2. For all these reasons, the appropriate characterization of socioeconomic impacts for operating a new nuclear power plant constructed at the Farley site is considered SMALL.

The impacts of operating the nuclear alternative at an unnamed alternate site could be smaller or larger to those at the Farley site, depending on how close the alternate site is to an economic center and the character of the existing transportation infrastructure. These impacts are considered SMALL to LARGE, depending on the site.

- **Aesthetics**

The nuclear alternative would result in aesthetic impacts, both visual and auditory. Visual impacts would result from several structures, including, most prominently, the containment buildings and the cooling towers. Cooling tower plumes are visible from greater distances than the towers themselves. At the Farley site, a portion of this infrastructure would be visible from both State Road 95 and the Chattahoochee River. Further, the Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). Visual impacts of buildings and structures could be mitigated to some degree by landscaping and color selection that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting that meets FAA requirements, and appropriate use of shielding. Overall, the visual aesthetic impacts of the nuclear-fired alternative at the Farley site are considered MODERATE.

At an alternate site, the structures and other factors that drive the visual aesthetic impacts would be similar to those occurring if the nuclear alternative were placed at the Farley site. However, the significance of the impacts would depend crucially on the nature of the site—whether it sits in an industrial area versus in a pristine wilderness, or whether it is visible from local roads or recreation areas. The largest change could be a potential need for significant transmission line infrastructure. Overall, the visual aesthetic impacts associated with the nuclear alternative at an unnamed alternate site are considered MODERATE to LARGE and will depend on the exact location and characteristics of the alternate site.

Nuclear generation would introduce mechanical sources of noise from plant operation. The noise sources are both continuous and intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the use of outside loudspeakers and the commuting of plant employees. At the Farley site, the plant operation noises would not be largely noticeable in any important nearby recreation or dwelling areas. The noise impacts of the nuclear alternative at the Farley site are considered to be MODERATE.

At an alternate site, these noise impacts would be SMALL to LARGE, depending on the site.

- **Historic and Archaeological Resources**

At both Farley and an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at Farley or another site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated ROWs where new construction would occur (e.g., roads, transmission ROWs, rail lines, or other ROWs). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL, whether at the Farley site or at an alternate site.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear-fired plant were built at the Farley site. Other impacts, might disproportionately impact minority or low-income populations, including impacts on housing availability and prices during construction. The employment level during operation of a new nuclear facility is expected to be similar to the employment level at Farley Units 1 and 2. Overall, at the Farley site, the environmental justice impacts are considered SMALL. The impacts around the alternate site would depend upon the site chosen and the nearby population distribution. These impacts could vary between SMALL and LARGE.

8.2.4 Purchased Electrical Power

This section considers the option of SNC decommissioning Farley Units 1 and 2, not replacing the lost generation with a new power plant or other option, and then purchasing an equal amount of power and capacity to replace that generated by Farley Units 1 and 2. There are two possibilities for the source of this power. It could come from facilities that are already built but not producing power. Alternatively, it could come from new generation facilities. The likely outcome would be a combination of both sources. Initially, replacement power would come from existing sources. Under normal economic conditions, this will raise the price of capacity and energy because supply will be lowered while demand will remain the same. Over time, this increase in price will spur new generation capacity to take advantage of the new opportunities for profit. In this case, the new generation could be attributed to a mix of sources, most likely natural gas and coal-fired generation, which were discussed above. If there were significant excess supply in the U.S., then it might be the case that no new generation would be brought online to replace the lower supply.

If power to replace Farley Units 1 and 2 capacity and energy were to be purchased from sources within the United States or a foreign country, the generating technology would likely be one of those described in this SEIS and in the GEIS (probably coal, natural gas, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the purchased electrical power alternative to renewal of Farley Units 1 and 2. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or another country. For these reasons, the staff does not believe that purchasing power to make up for the generation at Farley Units 1 and 2 is a meaningful alternative that requires independent analysis.

8.2.5 Other Alternatives

Other generation technologies considered by the NRC are discussed in the following paragraphs.

8.2.5.1 Oil-Fired Generation

EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States through the year 2020 because of higher fuel costs and lower efficiencies (DOE/EIA 2001a). Oil-fired operation is more expensive than nuclear or coal-fired operation. Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. Increasing domestic concerns over oil security will only exacerbate the move away from oil-fired electricity generation. Therefore, the staff does not consider oil-fired generation, by itself, a feasible alternative to Farley Units 1 and 2.

8.2.5.2 Wind Power

According to the DOE (2003), Alabama and Florida do not have sufficient wind resources to use large-scale wind turbines. Georgia has good wind resources in the uppermost portion of the state, but if all of this resource were developed (which would likely conflict with other uses), the total generation would be 547,500 MWh(e). Hence, this represents the total possible wind resource for all three states combined. In contrast, Farley Units 1 and 2 produced approximately 13.7 million MWh(e) in 2002 (DOE/EIA 2003). Exploiting the full resources of the three states combined would replace less than 4 percent of the generation from Farley Units 1 and 2. Further, wind energy is an intermittent resource, whereas Farley Units 1 and 2 provide constant base load power. When there is little wind, wind energy simply would not compensate for Farley Units 1 and 2 energy production. For these reasons, the staff concludes that wind power alone is not a feasible substitute at this time for the base load generation from Farley Units 1 and 2. However, the staff recognizes that wind power projects are being developed in areas with significant wind potential. Therefore, it is reasonable to include wind power in a combination of alternatives that could replace the generation from Farley Units 1 and 2. Combined alternatives are discussed in Section 8.2.6.

The installation of large-scale wind farms requires construction of access roads for turbine installation and maintenance and installation of transmission lines. The impacts associated with large-scale construction, particularly in remote or sensitive areas, could be LARGE. After the turbines and transmission lines are installed, the continuing impacts from operation would be primarily the aesthetic impact of the turbines and transmission lines.

8.2.5.3 Solar Power

Solar technologies use the sun's energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. Solar-power technologies, both photovoltaic and thermal, cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. The average capacity factor of photovoltaic cells is about 25 percent (NRC 1996), and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996). These capacity factors are low because solar power is an intermittent resource, providing power when the sun is strong, whereas Farley Units 1 and 2 provide constant base-load power. Solar technologies simply cannot make up for the capacity from Farley Units 1 and 2 when the sun is not shining.

Currently available photovoltaic (PV) cell conversion efficiencies range from approximately 7 to 17 percent. The average annual solar energy flux throughout the year falling in Alabama and Georgia is approximately 4 kWh/m^2 per day (SNC 2003). Assuming a conversion efficiency of 10 percent, PV cells would yield an annual electricity production of approximately 146 kWh(e)/m^2 per year in the Alabama and Georgia area. At this assumed rate of generation, replacing the 13.7 million MWh(e) generated by Farley Units 1 and 2 in 2002 (DOE/EIA 2003) would require approximately 94 million m^2 or 94 km^2 (36 mi^2) of PV arrays. Because of the area's low rate of solar radiation, the high technology costs, and the intermittent nature of the resource, solar power is not considered a feasible base load alternative to license renewal of Farley Units 1 and 2. However, staff recognizes that distributed solar power does provide generation and that during the license renewal period, generation from solar power could continue to grow. Therefore, it is reasonable to include solar power in combinations of alternatives to replace the generation from Farley Units 1 and 2. Combined alternatives are discussed in Section 8.2.6.

Large-scale solar arrays require dedication of significant land for the arrays, access roads and transmission lines. Large portions of land would be taken out of use. Depending on the nature of the site, construction related impacts could occur in all resource areas including sensitive habitats and ecosystems, surface water quality due to erosion, and impacts to cultural resources, to name a few. There could also be socioeconomic impacts if the construction occurred in an area with low population. The primary operational impacts would be aesthetic and the continued loss of land for other productive use. These impacts would be significantly reduced if solar panels were distributed on commercial and residential roof space.

8.2.5.4 Hydropower

As stated in Section 8.3.4 of the GEIS, 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. According to the U.S. Hydropower Resource Assessments, there is a total of 363 MW of undeveloped hydroelectric capacity in Alabama (INEEL 1998a) and 613 MW of undeveloped hydroelectric capacity in Georgia (INEEL 1998b). Hence, if all this capacity were developed, it would replace approximately 55 percent of the capacity from Farley Units 1 and 2.

The staff estimated in the GEIS that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac or approximately 1600 mi^2) per 1000 MW(e). If hydroelectric power were somehow used to replace all of the 1699 MW(e) of capacity from Farley Units 1 and 2, it would result in a large impact on land use, much of which would be outside of Alabama and Georgia. Operation of a hydroelectric facility would alter aquatic habitats above and below the lock and dam, which would impact existing aquatic species. Due to the limited amount of undeveloped hydropower resource in Alabama and Georgia and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace Farley Units 1 and 2, the staff concludes that local hydropower is not a feasible alternative to Farley Units 1 and 2 OL renewal.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for base load power where available. However, geothermal technology is not widely used as base load generation due to the limited geographical availability of the resource and the immature status of the technology (NRC 1996). As illustrated by Figure 8.4 in the GEIS, geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. There is no feasible eastern location for geothermal capacity to serve as an alternative to Farley Units 1 and 2. The staff concludes that geothermal energy is not a feasible alternative to renewing the Farley Units 1 and 2 OLs.

8.2.5.6 Wood Waste

The use of wood waste to generate electricity is largely limited to those states with significant wood resources, such as California, Maine, Georgia, Minnesota, Oregon, Washington, and Michigan. Electric power is generated in these states by the pulp, paper, and paperboard industries, which consume wood and wood waste for energy, benefitting from the use of waste materials that could otherwise represent a disposal problem.

A wood-burning facility can provide base load power and can operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity 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 (NRC 1996). Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base load generating facility, the ecological impacts of large-scale timber cutting (e.g., soil erosion, reduction of biodiversity, habitat degradation, fragmentation and loss), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to renewing the Farley Units 1 and 2 OLs.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate the waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2001). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001b). Mass-burning technologies are most commonly used in the United States. This group of technologies process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion.

Growth in the municipal waste-combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive, waste disposal alternatives such as landfills; (2) the 1994 Supreme Court decision *(C&A Carbone, Inc. vs. Town of Clarkstown*), which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (DOE/EIA 2001b).

Municipal solid-waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to the portion of unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001b).

Currently, there are approximately 102 waste-to-energy plants operating in the United States. These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e) per plant (Integrated Waste Services Association 2001), much smaller than the amount needed to replace the 1826-MW(e) base load capacity of Farley Units 1 and 2. Therefore, the staff concludes that municipal solid waste would not be a feasible alternative to renewal of the Farley Units 1 and 2 OLs, particularly at the scale required.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the staff notes 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 Farley Units 1 and 2 (NRC 1996). For these reasons, such fuels do not offer a feasible alternative to renewing the Farley Units 1 and 2 OLs.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. These fuel cells are commercially available at cost of approximately $4500 per kW of installed capacity (DOE 2004). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

DOE had a performance target that in 2003, two second-generation, fuel cell technologies using molten carbonate and solid oxide technology, respectively, would be commercially available in sizes of approximately 3 MW at a cost of $1000 to $1500 per kW of installed capacity (DOE 2002). DOE has also launched a new initiative, the Solid State Energy Conversion Alliance, to being about significant reductions in fuel cell costs. The goal is to cut costs to as low as $400 per kW by the end of this decade (DOE 2004). For comparison, the installed capacity cost for a natural gas-fired combined-cycle plant is on the order of $500 to $600 per kW (NWPPC 2000). As market acceptance and manufacturing capacity increase, natural gas-fueled, fuel cell plants in the 50 to 100-MW range are projected to become available (DOE 2002). Until these goals are met, however, fuel cells are not economically or technologically competitive with other alternatives for base load electricity generation. Fuel cells are, consequently, not a feasible alternative to renewing the Farley Units 1 and 2 OLs.

8.2.5.10 Delayed Retirement

SNC has considered the delayed retirement of its older, less efficient base load plants. However, SNC estimated that the cost of refurbishing these plants to make them more efficient and consistent with modern emissions standards would exceed the costs of constructing entirely new plants (SNC 2003). Even if retirement of an existing fossil fuel plant were delayed, with more stringent environmental restrictions, the impact of delaying retirement of a fossil fuel plant to compensate for the loss of electricity from Farley Units 1 and 2 would be bounded by the impacts for the natural gas-fired and coal-fired alternatives, and would potentially be more severe because of the less efficient pollution control equipment from older plants. The staff therefore concluded that delayed retirement of other SNC generating units could not provide a replacement of the power supplied by Farley Units 1 and 2 and could not be a feasible alternative to Farley Units 1 and 2 license renewal.

8.2.5.11 Utility-Sponsored Conservation

The utility-sponsored conservation alternative refers to a situation in which Farley Units 1 and 2 cease to operate, no new generation is brought online to meet the lost generation, and the lost generation is instead replaced by more efficient use of electricity. More efficient use would arise from utility-sponsored conservation programs, potentially including energy audits, incentives to install energy-efficient equipment, and informational programs to inform electricity consumers of the benefits of, and possibilities for, electricity conservation.

Conservation alone is not a viable option because the potential that the supply of cost-effective energy conservation measures, above and beyond what is already planned, may not be large enough to replace the energy and capacity of Farley Units 1 and 2. While it is possible, for example with large incentives, to decrease usage of electricity to meet the lost generation, it is the cost of such measures that ultimately matters. If the costs are high, for example, significantly higher than the costs of coal-fired or natural gas-fired generation or new nuclear generation, then it is infeasible to consider such measures as a replacement for Farley Units 1 and 2. Hence, the feasibility of the utility-sponsored conservation alternative hinges largely on the costs of reducing demand, which will increase with the level of demand reduction. The cost of these measures has been under debate for many years. One estimate of utility DSM programs in 1992 gave an average cost of $0.040/kWh in 1992 dollars (Eto et al. 1996), more than competitive with new generation. However, others have argued that if such measures are this cost-effective, consumers would undertake them irrespective of utility programs, so such cost estimates must understate full consumer costs. Regardless, replacing the capacity and energy from Farley Units 1 and 2 would require a significant increase in the magnitude and energy conservation in the United States. According to EIA (DOE/EIA 2001c), the sum of all large, electric-utility energy conservation programs up through 2000 saved approximately 54 million MWh in 2000. In 2001, Farley Units 1 and 2 provided approximately 13.7 million MWh of electricity (DOE/EIA 2003). Hence, to replace the lost generation at Farley Units 1 and 2 would require an increase of over 25 percent in the total effect of large-utility sponsored conservation since the time that utilities have been reporting these numbers to EIA. Such an increase would clearly increase the cost of energy conservation by moving beyond the more cost-effective measures. For this reason, the staff does not consider energy efficiency, by itself, as a feasible alternative to license renewal. However, staff recognizes that energy conservation is promoted and increases in energy efficiency occur as a normal result of replacing older equipment with modern equipment. Therefore, it is reasonable to include conservation in a combination of generation sources that could replace the generation of Farley Units 1 and 2. Combined alternatives are discussed in Section 8.2.6.

8.2.6 Combination of Alternatives

Should the OLs not be renewed, the lost energy and capacity would potentially be replaced by a combination of more than one, and perhaps many of the alternatives discussed thus far. As discussed in Section 8.2, Farley Units 1 and 2 have a combined net summer rating of 1699 MW(e).

There are many possible combinations of alternatives. As discussed previously, these combinations could include base load gas-fired or coal-fired plants, purchased power, alternative and renewable technologies, and conservation. For the purpose of this discussion, one combination has been assumed: 1100 MW(e) of generation from a combined-cycle facility at the Farley site, 300 MW(e) of energy conservation, and 299 MW(e) purchased from other generators. The impacts of other combinations, such as those from combinations that include wind or solar power, would be different and possibly less than the assumed combination. In some areas, such as the aesthetic impact of solar panel or wind turbines, the impacts would be at least as large as the impact of the assumed combination of alternatives. In other areas, such as waste, impacts would be smaller for these alternative technologies.

Table 8-5 contains a summary of the environmental impacts of an assumed combination. The impacts associated with the combined-cycle natural gas-fired units are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generation capacity. While the DSM measures would have few environmental impacts, operation of the new natural gas-fired plant would result in increased emissions and environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region or nation, as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-5. The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewing the Farley Units 1 and 2 OLs.

Table 8-5. Summary of Environmental Impacts of an Assumed Combination of Generation and Acquisition Alternatives—Does Not Include Impacts from Purchased Generation

Impact	Farley Site		Alternate Site	
Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	SMALL to MODERATE	The natural gas-fired alternative would use undeveloped portions of the Farley site. It would require upwards of 45 ha (110 ac) for power block, offices, roads, and parking areas. It would use existing infrastructure, minimizing new land requirements. There would be additional land impacts for construction of an underground gas pipeline.	SMALL to LARGE	Land use requirements would be larger at the alternate site than at the Farley site because of the need for infrastructure such as transmission facilities, roads, parking areas, office buildings, and cooling system. The total impact would depend on whether the alternate site is previously disturbed.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Ecology	SMALL to MODERATE	The natural gas-fired alternative would use undeveloped areas at Farley site. There would be potential for significant habitat loss and fragmentation and reduced productivity and biological diversity.	SMALL to LARGE	Impacts would depend on whether the alternated site is previously developed. Factors to consider include location and ecology of site and transmission line route. In total, impacts could include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use and Quality	SMALL	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use closed-cycle cooling system to the degree necessary. The facility would continue very limited groundwater use.	SMALL to MODERATE	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use closed-cycle cooling system to the degree necessary. Total impacts would depend on volume of water withdrawal, the constituents of the discharge water, the characteristics of surface water or groundwater source, and the new intakes structures required.
Air Quality	MODERATE	Sulfur oxides: 76 MT/yr (84 tons/yr) Nitrogen oxides: 250 MT/yr (276 tons/yr) Carbon monoxide: 52 MT/yr (57 tons/yr) PM_{10} particulates: 44 MT/yr (49 tons/yr) Other: (1) hazardous air pollutants, including arsenic, formaldehyde, and nickel and (2) carbon dioxide emissions, which contribute to global warming.	MODERATE	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Waste	SMALL	Minimal waste product from fuel combination.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.
Human Health	SMALL	Impacts are considered to be minor.	SMALL	The impacts at an unnamed alternate site would be the same as those for the Farley site.

Impact	Farley Site		Alternate Site	
Category	Impact	Comment	Impact	Comment
Socio-economics	SMALL to MODERATE	During construction, impacts would be MODERATE. Construction workers could place noticeable burdens on existing infrastructure, including housing and transportation. During operation, employment would decrease from 900 permanent workers to less than 50, reducing impacts on transportation. Impacts on housing and vitality of the local economy would be negative. Overall, socioeconomic impacts from operation are SMALL.	SMALL to LARGE	The characteristics of the construction period at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to MODERATE. The characteristics of the operation of the natural gas-fired alternative at an alternate site would be similar to those at Farley site. Socioeconomic impacts to the local community would depend on the characteristics of the alternate site, and might vary from SMALL to LARGE.
Aesthetics	MODERATE	There would be visual aesthetic impacts associated with plant buildings and structures There would be both continuous and intermittent noise impacts from plant operation	MODERATE to LARGE	The structures and operation would be similar to the Farley site, but the significance of the impacts would depend on the characteristics of the alternate site. The natural gas-fired alternative at an alternate site could require transmission lines, with attendant aesthetic impacts.
Historic and Archaeo-logical Resources	SMALL	Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant.	SMALL	At the unnamed alternate site, cultural studies would be needed. Studies would likely be needed to identify, evaluate, and address mitigation of the potential cultural resource impacts from construction of a new plant on unnamed alternate site.
Environ-mental Justice	SMALL	No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations. Impacts on minority and low-income communities should be similar to those experienced by the population as a whole.	SMALL to LARGE	Impacts would vary depending on population distribution and characteristics at new site.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, license renewal, are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high level waste and spent fuel disposal, for which a single significance level was not assigned). The alternative actions, i.e., no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear, discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

The no-action alternative would require the replacement of electrical generating capacity by (1) demand-side management and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Farley Units 1 and 2, or (4) some combination of these options. For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of Farley Units 1 and 2. The impacts of purchased electrical power (imported power) would still occur, but would occur elsewhere. Individual alternative technologies, by themselves, are not considered feasible at this time and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the Farley Units 1 and 2 OLs.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

8.4 References

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

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

10 CFR 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

40 CFR 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

64 FR 35714. "Regional Haze Regulations, Final Rule." *Federal Register,* Vol. 64, No. 126, pp. 35714-3577. Washington, D.C. July 1, 1999.

Alabama Department of Environmental Management (ADEM). 2001. *Compliance Guide, NO_x Trading Program.*

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

C&A Carbone, Inc. v. Town of Clarkstown, New York, 511 U.S. 383, (U.S. Supreme Court 1994).

Christian, D.A. 2003. Letter from Dominion Nuclear North Anna, LLC, to J.E. Dyer, NRC. Subject: "North Anna Early Site Permit Application." (September 25, 2003)

Culligan, E. and M. Krolewski. 2002. "EPA Update on NO_x Regulation." Paper presented at the 2002 Conference on Selective Catalytic Reduction and Non-Catalytic Reduction for NO_x Controls, May 15–16, 2002, Pittsburgh, PA.

Eaton, W.A. 2003. Letter from System Energy Resources, Inc. (SERI), to NRC. Subject: "Early Site Permit Application." (October 16, 2003)

Eto, J., et al. 1996. "The Total Cost and Measured Performance of Utility-Sponsored Energy Programs." *The Energy Journal*, Volume 17, Number 1.

Gabbard, A. 1993. *Coal Combustion: Nuclear Resource or Danger. Oak Ridge National Laboratory Review.* Oak Ridge National Laboratory, Oak Ridge, Tennessee. Summer/Fall 1993. Accessed at: http://www.ornl.gov/ORNLReview/rev26-34/text/colmain.html on October 20, 2003.

Idaho National Engineering and Environmental Laboratory (INEEL). 1998a. *U.S. Hydropower Resource Assessment for Alabama. DOE/ID-10430(AL)*. Idaho Falls, Idaho. Accessed at: http://hydropower.inel.gov/state/il/il.pdf.

Idaho National Engineering and Environmental Laboratory (INEEL). 1998b. *U.S. Hydropower Resource Assessment for Georgia. DOE/ID-10430(GA)*. Idaho Falls, Idaho. Accessed at: http://hydropower.inel.gov/state/il/il.pdf.

Integrated Waste Services Association. 2001. *About Waste to Energy*. Accessed at: http://www.wte.org/waste.html on September 20, 2002.

Kray, M.C. 2003. Letter from Exelon Generation Company, LLC, to NRC. Subject: "Early Site Permit Application." (September 25, 2003)

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

Northwest Power Planning Council (NWPPC). 2000. Northwest Power Supply Adequacy/Reliability Study Phase I Report. Accessed at: http://www.nwcouncil.org/library/2000/2000-4.pdf on September 20, 2002.

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

U.S. Department of Energy (DOE). 2002. *Fuel Cell Technology*. Accessed at: http://www.fe.doe.gov/coal_power/fuelcells/index.shtml on March 25, 2002.

U.S. Department of Energy (DOE). 2003. *State Wind Resources*. Accessed at: http://www.eere.energy.gov/state_energy/tech_wind.cfm?state=ga, http://www.eere.energy.gov/state_energy/tech_wind.cfm?state=fl, and http://www.eere.energy.gov/state_energy/tech_wind.cfm?state=al on November 3, 2003.

U.S. Department of Energy (DOE). 2004. *Fuel Cell Technology*. Accessed at: http://www.fe.doe.gov/coal_power/fuelcells/index.shtml on April 7, 2004.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2001a. *Annual Energy Outlook 2002 with Projections to 2020.* Washington D.C.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2001b. *Renewable Energy 2000: Issues and Trends*. DOE/EIA-0628(2000). Washington, D.C. Accessed at: http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/rea_issues_sum.html on September 19, 2002.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2001c. *Electric Power Annual, Volume II*, DOE/EIA_0348(2000). Washington, D.C.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2003. *Nuclear Power Plants Operating in the U.S. in 2001.* Accessed at: http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/states.html.

U.S. Department of Energy/Energy Information Administration (DOE/EIA). 2004. *Annual Energy Outlook 2004 With Projections to 2025.* DOE/EIA-0383(2004). Washington, D.C. Accessed at: http://www.eia.doe.gov/oiaf/aeo/index.html on June 21, 2004.

U.S. Environmental Protection Agency (EPA). 1998. "Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units; Revisions to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam Generating Units." *Federal Register*, Vol. 63, No. 179, pp. 49453-49455. Washington, D.C. September 16, 1998.

U.S. Environmental Protection Agency (EPA). 1999. "Regional Haze Regulations," *Federal Register*, Vol. 64, No. 126, pp. 35714. Washington, D.C. July, 1999.

U.S. Environmental Protection Agency (EPA). 2000a. "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels." *Federal Register*, Vol. 65, No. 99, pp. 32214-32237. Washington, D.C. May 22, 2000.

U.S. Environmental Protection Agency (EPA). 2000b. "Regulatory Finding on the Emissions of Hazardous Air Pollutants From Electric Utility Steam Generating Units." *Federal Register*, Vol. 65, No. 245, pp. 79825-79831. Washington, D.C. December 20, 2000.

U.S. Environmental Protection Agency (EPA). 2001. *Municipal Solid Waste Disposal*. Accessed at: http://www.epa.gov/epaoswer/non-hw/muncpl/disposal.htm on February 19, 2002. (No longer accessible)

U.S. Environmental Protection Agency (EPA). 2003. *Currently Designated Nonattainment Areas for All Criteria Pollutants*. Accessed at: http://www.epa.gov/oar/oaqps/greenbk/ancl.html on October 17, 2003

U.S. Federal Aviation Administration (FAA). 2000. "Obstruction marking and lighting." Advisory Circular AC 70/7460-1k.

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

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

U.S. Nuclear Regulatory Commission (NRC). 2001. *NRC Organizes Future Licensing Project Organization.* Press Release No. 01-035, March 30, 2001. Accessed at: http://www.nrc.gov/reading-rm/doc-collections/news/1001/01-035.html on August 3, 2004.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Vols. 1 and 2, Washington, D.C.

9.0 Summary and Conclusions

By letter dated September 12, 2003, the Southern Nuclear Operating Company (SNC) submitted an application to the NRC to renew the operating licenses (OLs) for Farley Units 1 and 2, for an additional 20-year period (SNC 2003). If the OLs are renewed, State regulatory agencies and SNC will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plants must be shut down at or before the expiration of the current OLs, which expire on June 25, 2017, for Unit 1, and March 31, 2021, for Unit 2.

Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4321) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).[a]

Upon acceptance of the SNC application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping (65 FR 63636 [NRC 2003]) on December 5, 2003. The staff visited the Farley site in January 2004 and held public scoping meetings on January 8, 2004, in Dothan, Alabama (NRC 2004). The staff has reviewed the SNC Environmental Report (ER; SNC 2003) and has compared it to the GEIS, consulted with other agencies, and has conducted an independent review of the issues following the guidance set forth in NUREG-1555, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff also considered the public comments received during the scoping process for preparation of this Supplemental Environmental Impact Statement (SEIS) for Farley Units 1 and 2. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff held two public meetings in Dothan, Alabama in September 2004, to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on this SEIS. All of the comments received on the draft SEIS were considered by the staff in developing this SEIS, and are presented in Appendix A, Part 2.

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

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 mitigation measures available for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

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

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

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

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

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

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

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b).[a]

(a) The title of 10 CFR 51.23 is "Temporary Storage of Spent Fuel After Cessation of Reactor Operations—Generic Determination of No Significant Environmental Impact."

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

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

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

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

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

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

This SEIS documents the staff's consideration of all 92 environmental issues identified in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for Farley Units 1 and 2) and alternative methods of power generation. These alternative methods of power generation were evaluated assuming that the replacement power generation plant is located at either the Farley site or some other unspecified location.

9.1 Environmental Impacts of the Proposed Action—License Renewal

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 information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither public comments, SNC, nor the staff has identified any new issue applicable to Farley Units 1 and 2, that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to Farley Units 1 and 2.

SNC's license renewal application presents an analysis of the Category 2 issues that are applicable to Farley Units 1 and 2, plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the SNC analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Five Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at Farley. Four Category 2 issues are not discussed in this SEIS because they are specifically related to refurbishment. 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 as necessary to support the continued operation of Farley Units 1 and 2, for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the 1974 *Final Environmental Statement Related to Operation of Farley Nuclear Plant Units 1 and 2* (AEC 1974).

Twelve Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this SEIS in relation to operation during the renewal term. For all 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 determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required.

For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Farley Units 1 and 2, and the plant improvements already made, the staff concludes that three of the candidate SAMAs are potentially cost-beneficial. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they do not need to implemented as part of license renewal pursuant to 10 CFR Part 54.

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

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the facility is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

The adverse impacts of continued operation identified are considered to be of SMALL significance, and none warrants implementation of additional mitigation measures. The adverse impacts of likely alternatives if Farley Units 1 and 2, cease operation at or before the expiration of the current OLs will not be smaller than those associated with continued operation of these units, and they may be greater for some impact categories in some locations.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of Farley Units 1 and 2, during the current license period was made when the facility was built. The resource commitments to be considered in this SEIS are associated with continued operation of the units for an additional 20 years. These resources include materials and equipment required for facility maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent offsite storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent HLW storage space. Farley currently operates on a staggered nominal 18-month refueling cycle.

The likely power generation alternatives if Farley ceases operation on or before the expiration of the current OLs will require a commitment of resources for construction of the replacement plants as well as for fuel to run them.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the Farley site was set when the units were approved and construction began. That balance is now well established. Renewal of the OLs for Farley Units 1 and 2, and continued operation of the plant will not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OLs will lead to shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the Farley site into a park or an industrial facility are quite different.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the OLs for Farley Units 1 and 2. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at Farley Units 1 and 2. Chapters 4 through 7 discuss environmental issues associated with renewal of the OLs. Environmental issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OLs), the no-action alternative (denial of the application), alternatives involving nuclear or coal- or gas-fired generation of power at the Farley site and an unspecified site, and a combination of alternatives are compared in Table 9-1. Continued use of a closed-cycle cooling system for Farley Units 1 and 2, is assumed for Table 9-1.

Substitution of once-through cooling for the cooling system in the evaluation of the gas- and coal-fired generation alternatives would result in somewhat greater environmental impacts in some impact categories.

Table 9-1 shows that the significance of the environmental effects of the proposed action are SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

9.3 Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996; 1999), (2) the ER submitted by SNC (SNC 2003), (3) consultation with Federal, State, Tribal, and local agencies, (4) the staff's own independent review, and (5) the staff's consideration of public comments, the recommendation of the staff is that the Commission determine that the adverse environmental impacts of license renewal for Farley Units 1 and 2, are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using Once-Through Cooling

	Proposed Action	No-Action Alternative	Coal-Fired Generation		Natural Gas-Fired Generation		New Nuclear Generation		Combination of Alternatives	
Impact Category	License Renewal	Denial of Renewal	Farley Site	Alternate Site	Farley Site	Alternate Site	Farley Site	Alternate Site	Farley Site	Alternate Site
Land Use	SMALL	SMALL	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE
Ecology	SMALL	SMALL	SMALL to MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	MODERATE	SMALL	SMALL	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL[(a)]	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE	MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Aesthetics	SMALL	SMALL	MODERATE	SMALL to LARGE	MODERATE	SMALL to LARGE	MODERATE	SMALL to LARGE	MODERATE	MODERATE to LARGE
Historic and Archaeological Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL to MODERATE	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE

(a) Except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal, for which a significance level was not assigned. See Section 6 for details.

9.4 References

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

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

Southern Nuclear Operating Company (SNC). 2003. *Joseph M. Farley Nuclear Plant Application for License Renewal, Appendix D—Applicant's Environmental Report*. Birmingham, Alabama.

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

U.S. Atomic Energy Commission (AEC). 1974. *Final Environmental Statement Related to Operation of Joseph M. Farley Nuclear Plant Units 1 and 2*, Alabama Power Company. Dockets No. 50-348 and 50-364. December 1974.

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

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

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

U.S. Nuclear Regulatory Commission (NRC). 2003. "Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 65, No. 206, pp. 63636-63637. Washington, D.C. December 5, 2003.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Environmental Impact Statement Scoping Process: Summary Report—Farley Units 1 and 2, Dothan, Alabama*. Washington, D.C.

Appendix A

Comments Received on the Environmental Review

Appendix A: Comments Received on the Environmental Review

Part I—Comments Received During Scoping

On December 5, 2003, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (68 FR 68125), to notify the public of the staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] to support the renewal application for the Farley operating licenses and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) guidance, and 10 CFR Part 51. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register Notice*. The NRC invited the applicant; Federal, State, and local government agencies; Native American tribal organizations; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting written suggestions and comments no later than February 6, 2004.

The scoping process included two public scoping meetings, which were held at Quality Inn in Dothan, Alabama, on January 8, 2004. Approximately 80 members of the public attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process and the NEPA process. After the NRC's prepared statements, the meetings were open for public comments. Sixteen attendees provided oral statements that were recorded and transcribed by a certified court reporter and written statements that were appended to the transcript. The meeting transcripts are an attachment to the February 5, 2004, Scoping Meeting Summary. In addition to the comments received during the public meetings, 24 comment letters were received by the NRC in response to the Notice of Intent.

At the conclusion of the scoping period, the NRC staff and its contractor(s) reviewed the transcripts and all written material to identify specific comments and issues. Each set of comments from a given commenter was given a unique identifier (Commenter ID), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Specific comments were numbered sequentially within each comment set. Several commenters submitted comments through multiple sources (e.g., letter and afternoon or evening scoping meetings). All of the comments received and the staff responses are included in the Farley Scoping Summary Report dated April 5, 2004.

Table A.1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set(s) of comments. The

(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.

individuals are listed in the order in which they spoke at the public meeting, and in alphabetical order for the comments received by letter or e-mail. To maintain consistency with the Scoping Summary Report, the unique identifier used in that report for each set of comments is retained in this appendix.

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by the commenters. The comments fall into one of the following general groups:

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 or Category 2 issues or issues that were not addressed in the GEIS. They also address alternatives and related Federal actions.

- General comments (1) in support of or opposed to nuclear power or license renewal or (2) on the renewal process, NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the Farley license renewal application.

- Questions that do not provide new information.

- Specific comments that address issues that do not fall within or are specifically excluded from the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number
FS-A	Jim Phillips	Chattahoochee Riverkeeper	Afternoon scoping meeting
FS-B	Selden Bailey	Citizen	Afternoon scoping meeting
FS-C	Mark Culver	Houston County Commission	Afternoon scoping meeting
FS-D	Jack Manley	City of Headland	Afternoon scoping meeting
FS-E	Mike Stinson	Joseph M. Farley Nuclear Plant	Afternoon scoping meeting
FS-F	Don Grissette	Joseph M. Farley Nuclear Plant	Afternoon scoping meeting

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number
FS-G	Steve Turkoski	Dothan Area Chamber of Commerce	Afternoon scoping meeting
FS-H	Kaye Barbaree	Houston County	Afternoon scoping meeting
FS-I	Bob Hendrix	Convention and Visitor's Bureau	Afternoon scoping meeting
FS-J	Walter Hill	Wiregrass United Way	Afternoon scoping meeting
FS-K	David Hendrix	City of Dothan	Afternoon scoping meeting
FS-L	Steve Mashburn	Troy State University Dothan	Evening scoping meeting
FS-M	Tim Pritchard	Houston County High School	Evening scoping meeting
FS-N	Barbara Alford	Troy State University Dothan	Evening scoping meeting
FS-O	Cindy Huff	Teacher	Evening scoping meeting
FS-P	Jack Kale	Citizen	Evening scoping meeting
FS-Q	R. Lawson Bryan	First United Methodist Church	Letter (ML033580670)
FS-R		Dothan Area Chamber of Commerce	Letter (ML033430559)
FS-S	Pat Dalbey	WTVY News 4	Letter (ML033500400)
FS-T	Billy Davis	Henry County Board of Education	Letter (ML033381197)
FS-U	David Hanks	Wiregrass United Way Food Bank	Letter (ML033570387)
FS-V	Donald Smith	City of Headland	Letter (ML033360580)
FS-W	Edward Jackson	Twentieth Judicial Circuit of Alabama	Letter (ML033570382)
FS-X	Kenneth Lord	Houston County Schools	Letter (ML033570388)
FS-Y	Clark Matthews	Dothan/Houston County EMA	Letter (ML033300346)
FS-Z	William Parker	Headland Industrial Development Board	Letter (ML033570385)
FS-AA	Coy Poitevint	Veterinarian	Letter (ML033570381)
FS-AB	Dennis Rubin	City of Dothan	Letter (ML033250320)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession Number
FS-AC	Don Clements	City of Dothan	Letter (ML033250552)
FS-AD	Amos Newsome	City of Dothan	Letter (ML033250316)
FS-AE	James Reading	City of Dothan	Letter (ML033250325)
FS-AF	Jason Rudd	City of Dothan	Letter (ML033250311)
FS-AG	Pat Thomas	City of Dothan	Letter (ML033250288)
FS-AH	Phillip Tidwell	City of Dothan	Letter (ML033250298)
FS-AI	Ronald Owen	Southeast Alabama Medical Center	Letter (ML040060643)
FS-AJ	Bruce McNeal	Southeast Alabama Medical Center	Letter (ML033640623)
FS-AK	Steven Mashburn	Troy State University Dothan	Letter (ML033640576)
FS-AL	Selden Bailey	Financial Service Company of Dothan	Letter (ML040060632)
FS-AM	Barbara Alford	Troy State University Dothan	Letter (ML033430381)
FS-AN	Starla Moss Matthews	Houston County Revenue Commissioner	Letter (ML040210786)

Comments applicable to this environmental review and the staff's responses are summarized in this appendix. The parenthetical alpha-numeric identifier after each comment refers to the comment set (Commenter ID) and the comment number. This information, which was extracted from the Farley Scoping Summary Report, is provided for the convenience of those interested in the scoping comments applicable to this environmental review. The comments that are general or outside the scope of the environmental review for Farley are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report. The ADAMS accession number for the Scoping Summary Report is ML040900537.

This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) http://www.nrc.gov/reading-rm.html.

Comments in this section are grouped in the following categories:

(1) Comments Concerning Water Quality and Use Issues

(2) Comments Concerning Aquatic Ecology Issues

(3) Comments Concerning Terrestrial Resource Issues

(4) Comments Concerning Air Quality Issues

(5) Comments Concerning Socioeconomic Issues

(6) Comments Concerning Alternatives

A.1 Comments and Responses

A.1.1 Comments Concerning Water Quality and Use Issues

Comment: I think the paper mill is being run just as well and just like Farley, but at that time I'm positive that they promised that the water that went back into the river would be of the same temperature and would not disturb that water. And I have not heard any fishermen's complaints over this period of time. Now I have not been on that river fishing below the Farley Plant perhaps in the last 20 years, but fishing still goes on over there and I don't know that there's been any discharge there of any consequence at all that stopped anybody from putting their boats in down at Gordon. (FS-B-1)

Comment: Our environmental review of the water shows that Plant Farley is a very good steward of the valuable resource and has no significant impact on the flow and the habitat in the Chattahoochee River. (FS-F-2)

Response: *The comments are noted. Altered current patterns at intake and discharge structures and other water quality issues were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new information on water quality and will not be evaluated further. Water quality will be discussed in Chapters 2 and 4 of the supplemental environmental impact statement (SEIS).*

Comment: The other is more logistics and that relates to the fact that this river is one of the arteries that's vital for Plant Farley, not only do you have connections via rail and highway but you've also got river connections. And river connections, of course, can be important as regards incoming materials or incoming equipment, and the scheduling of access to the plant is problematic only because the Apalachicola River south of us is severely stressed in the sense of its depth, it's hard to get up and down this river with barges. And so we hope that whatever is done here will have reflection of some of those realities on the river as regards navigation; in other words, access of the plant for equipment, supplies, whatever may be needed for the plant. (FS-A-2)

Response: *The comment is noted. Water use conflicts will be discussed in Chapter 4 of the SEIS.*

A.1.2 Comments Concerning Aquatic Ecology Issues

Comment: And because of that stress, we have the environmental concerns about the river, one of which is thermal history in terms of any releases to the river. I've discussed with some of the representatives here earlier some of our questions about thermal releases and I'm confident that I'm going to get the data that is needed to answer any questions about the history of the plant. (FS-A-1)

Response: *The comment is noted. Aquatic ecology issues such as cold shock and thermal plume barriers were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new information on aquatic ecology and will not be evaluated further. Aquatic ecology will be discussed in Chapters 2 and 4 of the SEIS.*

A.1.3 Comments Concerning Terrestrial Resource Issues

Comment: License renewal will not result in any modification of the plant or transmission lines. We have concluded that the extended operation due to license renewal will have no adverse impact or threaten any endangered or threatened species living in or near Plant Farley. (FS-F-3)

Comment: Because of our habitat and wildlife protection efforts, the National Wildlife Council has certified Farley as a wildlife habitat. The Wildlife Habitat Enhancement Council has twice recognized Plant Farley for its wildlife and land management stewardship. (FS-F-7)

Comment: Another major area that Farley impacts greatly in our community is in our environment and our local habitats. Farley is classified as a certified wildlife habitat. I think Don mentioned this earlier. They implement strict land management practices and they provide a safe, healthy community for our local flora and fauna. They set up nesting boxes for many, many species of birds. (FS-L-4)

Comment: Plant Farley also plays an active role in environmental protection. It constantly monitors key factors in the local biome, both onsite and off. Through wildlife and land management efforts, the plant site has been designated as a Certified Wildlife Habitat. (FS-AK-6)

Response: *The comments are noted. The comments relate to terrestrial resource issues and will be discussed in Chapter 4 of the SEIS.*

A.1.4 Comments Concerning Air Quality Issues

Comment: For the past 26 years, the operation of Plant Farley has not had any adverse impact on the quality of air in this area. In fact, the operation of Plant Farley prevents about 10 million tons of carbon dioxide and other pollutants every year from going into the air that we breathe and entering the environment. (FS-F-4)

Response: *The comment is noted. Air quality issues were evaluated in the GEIS and determined to be Category 1 issues. The comments provide no new information on air quality and will not be evaluated further.*

A.1.5 Comments Concerning Socioeconomic Issues

Comment: Just north of the plant, the county owns a park that's open to children and families and people come in and out with boats and we have never had one incident there of anybody complaining about anything environmentally. (FS-C-6)

Comment: We're a strong contributor to educating the State's children. Our community outreach programs reach about 10,000 children each year. (FS-E-5)

Comment: We are completing our 2004 campaign right now and Farley, with their corporate donation and their employees' donations, pledge $151,335. And out of the $2.2 million budget, that is very important to us and to the 35 agencies that will receive those funds. (FS-J-1)

Comment: I would also echo the comments made by many who have noted the contributions that employees have made and in ways that you can quantify such as the contribution to the United Way, but also in ways that are very difficult to quantify and yet are very important. (FS-K-2)

Comment: The first of these is the impact that Plant Farley has upon the local educational community. The plant has been an exceedingly strong supporter of education over the past many years in our tri-state area. The economic impact that Farley has had on educational institutions in this county since its inception is really immeasurable. (FS-L-2)

Comment: When many systems throughout the state have been taken over by the State Department of Education and suffered drastic cuts that eliminated a lot of basic education service for the children of our state, the schools in Houston County have been able to garner enough local support, largely through tax base that is provided by Farley Nuclear Plant, to provide our children with strong educational programs. (FS-L-3)

Comment: Farley professionals and Farley executives actively and enthusiastically participate on our advisory board in arts and sciences, in business administration, and on my community advisory board for the college at large. (FS-N-1)

Comment: Farley not only assists TSUD in growing our campus and our curriculum, it helps us to ensure that we become the economic development asset for this community. (FS-N-2)

Comment: The Henry County schools have directly benefitted as a result of donations from Farley through local employees. I have personally carried students on field trips to visit Farley when I was a classroom teacher. The educational involvement of the plant and its employees is tremendous. (FS-T-2)

Comment: We are dependent on the Joseph M. Farley Nuclear Plant for a number of reasons. Financially speaking it would be almost impossible for us to operate without the tax revenue from ad-valorem taxes paid by Plant Farley. Over one half of all local ad-valorem taxes come from this one source. Considering that Alabama ranks dead last in funding for public schools puts this in an even clearer perspective. (FS-X-1)

Comment: Plant Farley is also notably recognized for the working relationships between area elementary schools on environmental protection concerns and the enhancement of wildlife. (FS-AB through AH-3)

Comment: With the current crisis in public education funding within the state of Alabama, many of our local schools would suffer extensive budget shortfalls without the tax income generated by Plant Farley. (FS-AK-3)

Comment: As a long-time member of the educational community, I have worked on a large number of projects in which Farley played a critical role. Through workshops, seminars, in-school presentations, fund-raising efforts, teacher education projects, and many other avenues, the plant has consistently worked to better educate our children as well as adults. (FS-AK-4)

Comment: The Farley Management has supported the public school system by being open to the graduation classes as potential employees and career development. (FS-AL-3)

Comment: The leadership of Plant Farley has been instrumental in the growth and development of this university and in our ability to fulfill our educational mission. Farley professionals have been and continue to be primary participants on the advisory boards and task forces that guide the institution, including the design of our strategic plans. In addition, Farley has been a key player in the development and delivery of science institutes for teachers within a tri-state region, dramatically impacting the K-12 science curricula and student achievements. (FS-AM-3)

Response: *The comments are noted. The comments are supportive of license renewal at Joseph M. Farley Nuclear Plant, Units 1 and 2. Public services involving education and recreation were evaluated in the GEIS and were determined to be Category 1 issues. The* *comments provide no new information on these public service issues, and will not be evaluated further.*

Comment: It's that important to us—a tremendous portion of our budget and we thank Farley and Southern Nuclear and Alabama Power for the millions of dollars that they put into our economy and tax base. (FS-C-3)

Comment: We just were notified that we are the—our tax base this year, our sales tax increases are up eight percent over last year. Well, you know, we have a lot of in-shopping, but a lot of it is because of people like the employees that we have at Farley that are tremendous community citizens, that live here and stay here and raise families here. (FS-C-4)

Comment: In addition, Farley impacts the community in out-sourcing. I know Mark Sellers, for example, one friend of mine, that has a company here in town that works directly with Farley, and there are many, many, many other organizations that feed off of Farley, although they're not actually working with the Nuclear Regulatory Commission or with Southern Nuclear. (FS-C-5)

Comment: The economic impact of the Farley plant, there's no doubt is tremendous in the Wiregrass or the state. (FS-D-3)

Comment: Plant Farley is also an important part of the local economy. With some 900 employees, the plant has an annual payroll of over $50 million. The plant pays annual property taxes of some $8 million. (FS-E-6)

Comment: License renewal will not require additional land usage and our activities will remain within the existing site boundary. Based upon these evaluations, we determined that the renewal of the Plant Farley license will not impact historic, archeological or land resources on the site or in the community. (FS-F-5)

Comment: With Farley's $50 million payroll and using a modest 2.5 turnover rate on the dollar, we estimate the impact to the economy is $125 million annually. (FS-G-1)

Comment: Since the location of Farley in the 1970s, Dothan has emerged and grown with a diversified manufacturing base tied to aviation, automotive, electronics, distribution, fabricated metals as well as a strong healthcare service and retail businesses. Plant Farley's influence in all of these areas cannot be over-estimated. (FS-G-2)

Comment: Farley pays $8.12 million in property taxes, which is the largest single payment in the county. Of this amount, $2,500,000 goes to education. (FS-G-4)

Comment: If in fact the plant was not renewed, the loss of 900 jobs with the multiplier would include an effect of basically 2250 lost jobs. The lost of $50 million in payroll with the turnover value of these dollars would result in the loss of $125 million. The loss of over $8 million tax infusion into the county would leave a substantial hole in the county's budget. (FS-G-5)

Comment: I represent the 26 hotels that are in the Dothan area and our hotels love Farley, because every 12 to 18 months, we have something called a refueling outage and when they have a refueling outage, they bring in many workers and engineers for many, many, many days that stay in the Dothan area and in our hotels and eat in our restaurants and shop in our stores. (FS-I-1)

Comment: I followed one of your Farley Nuclear employees as chairman of the Houston County Board of Directors for the Wiregrass Humanity, and I would simply say that if we lost these people, yes, there would be a real monetary loss, a great tax base loss, but the civic and community life of Dothan and Houston County and the surrounding Wiregrass area would suffer a loss that would be, in my mind, even greater than those quantifiable financial losses. (FS-K-3)

Comment: And finally, Plant Farley has had and continues to have a major economic impact on our community, our state and the entire southeastern United States. (FS-L-9)

Comment: And I say that to say this, that that's just one example of thousands of people in this area who have, because of the employment opportunities at Farley, have achieved their goals and lived—fulfilled their life long goals because of those opportunities. (FS-M-1)

Comment: As one of the largest employers in its region, Plant Farley's economic impact is huge (some 900 plant jobs and $8 million in tax revenue). (FS-Q-1)

Comment: Whereas, Plant Farley provides jobs for some 900 citizens of the Wiregrass? (FS-R-2)

Comment: Whereas, Plant Farley provides extensive support for the quality of life and the infrastructure needs in the Wiregrass as the county's largest taxpayer. (FS-R-3)

Comment: Farley management and employees are excellent corporate citizens in helping to improve our city through economic development, educational outreach, community service, charitable donations, and so much more. (FS-S-1)

Comment: Farley Management has also been extremely supportive of the Chambers efforts to recruit new businesses and jobs to our area, and in many cases, they have been a key to our success. (FS-S-2)

Comment: Because Farley is located in our area, I am very familiar with the impact of this fine facility owned by Alabama Power Company. The economic impact from the large number of employees on our county and the entire area is enormous. (FS-T-1)

Comment: The Farley Plant has an obvious economic impact on the Wiregrass Area through the taxes paid and the retail impact of its employees; the Food Bank would like to bring attention to the impact of the Farley employees that might go unnoticed. (FS-U-2)

Comment: The Farley plant has a positive economic impact on our community by improving our quality of life. We are fortunate to have a number of Farley employees living in Headland, whom not only contribute in the buying of homes and shopping with local merchants, but whom serve in volunteer capacities for charitable organizations, local churches, and the city's recreational programs. (FS-V-2)

Comment: Plant Farley provides a stable source of jobs for many of our parents. This gives us a unique blend of local parents and parents bringing with them different ideas and a strong work ethic. There is not a community in our county that has not reaped the benefits of employment at Plant Farley. (FS-X-2)

Comment: The economic impact of normal purchases for its operation and the payroll of some 900 employees is substantial. It is one of the largest contributors to our local economy. (FS-Z-2)

Comment: It supports the economy with 900+ jobs and presently $8 million in tax revenue. I provide housing to several of the contractors that work outages at Plant Farley and I hear them discuss their jobs. I hear only positive comments from the employees and the public as well. Plant Farley supports various community activities and emphasizes safety first. (FS-AA-2)

Comment: As one of the area's largest employers, with more than 900 local residents working at the plant, substantial contributions are made each year by Plant Farley and its employees to the local economy through property and sales taxes. Additionally, the present $7 million generated in local revenue by the plant help pay for a variety of services in the community such as schools, police and fire protection, and road improvements. (FS-AB through AH-2)

Comment: Plant Farley, along with its employees, is a good neighbor to the Wiregrass area. We are fully aware of Farley's positive economic impact within our community. (FS-AI, -AJ-3)

Comment: Plant Farley has a tremendous impact upon the local and state economy. It employs more than 900 people and provides upwards of $7 million in tax revenues. Such revenues provide a basis for support of many local initiatives and services, especially public schools throughout the area. (FS-AK-2)

Comment: The annual payment of the property tax to Houston County has always been timely and the management attitude is they are gracious and pleased to make those payments. The Plant Management and employees participate in the business and social activities of Houston County and are open to participate in events of the area communities. (FS-AL-2)

Comment: Undoubtedly, the Commission will receive many letters attesting to the critical impact that Plant Farley has on the overall economy and quality of life in our region. Thanks to Southern

Nuclear, 900 area citizens are employed in well-paying, prestigious jobs that elevate the business profile of our county and have a tremendous effect on the upward mobility of families. Our community, specifically Houston County and Houston County Schools, benefits greatly from the $7 million in tax revenue that makes possible everything from infrastructure improvements to enhanced classroom learning for children. (FS-AM-2)

Comment: The impact that the plant has on the economy is tremendous. It currently provides over 8 million annually in tax revenue and provides quality jobs for over 900 employees. (FS-AN-2)

Response: *The comments are noted. Socioeconomic issues specific to the plant are Category 2 issues and will be addressed in Chapter 4 of the SEIS. The comments support license renewal at Joseph M. Farley Nuclear Plant, Units 1 and 2.*

A.1.6 Comments Concerning Alternatives

Comment: It is an undeniable fact that fossil fuel-based plants produce thousands of tons of harmful emissions each year. For example, coal-fired plants release harmful particulates that emit both alpha and beta radiation into the atmosphere. Nuclear power plants such as Farley do not emit these harmful particulates. Nuclear power plants also do not emit carbon dioxide, they do not emit sulfur compounds, they do not emit any kind of nitrogen oxides and therefore, they don't influence the greenhouse effect and they don't contribute to global warming like many of our petroleum-based or fossil-based plants do. (FS-L-6)

Comment: If you choose not to renew that license, you need to examine some other things—what are the environmental impacts of not renewing the license? Well, if we don't renew the license and we go without the generation, we'll make the grid less stable. The northeast United States can tell you about the environmental and social impact of a less stable grid. (FS-P-1)

Comment: Or maybe we say well, we'll generate the electricity somewhere else and bring it in. Now you've got the environmental impact of running additional power lines into the area to supply this area because there's no other major local generation and this plant was put here to control the voltage in this area. (FS-P-2)

Response: *The comments are noted. Impacts from reasonable alternatives for the Joseph M. Farley Nuclear Plant, Units 1 and 2 license renewal will be evaluated in Chapter 8 of the SEIS.*

Part II—Comments Received on the Draft SEIS

Pursuant to 10 CFR Part 51, the staff transmitted the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Joseph M. Farley Nuclear Plant, Units 1 and 2, Draft Report for Comment* (NUREG-1437, Supplement 18, referred to as the draft SEIS) to Federal, State, and local government agencies, Native American Tribal organizations, and interested members of the public. As part of the process to solicit public comments on the draft SEIS, the staff:

- placed a copy of the draft SEIS in the NRC's electronic Public Document Room, its license renewal website, and at the Houston Love Memorial Library in Dothan, Alabama, and the Lucy Maddox Memorial Library in Blakely, Georgia.

- sent copies of the draft SEIS to the applicant, members of the public who requested copies, certain Federal, State, and local government agencies, and Native American Tribal organizations.

- published a notice of availability of the draft SEIS in the *Federal Register* on August 12, 2004 (69 FR 49916).

- issued public announcements, such as advertisements in the local newspapers and posting in public places, of the availability of the draft SEIS.

- announced and held two public meetings in Dothan, Alabama, on September 30, 2004, to describe the results of the environmental review and answer related questions.

- issued public service announcements and press releases announcing the issuance of the draft SEIS, the public meeting, and instructions on how to comment on the draft SEIS.

- established a website to receive comments on the draft SEIS through the Internet.

During the comment period, the staff received a total of three comment letters in addition to comments received during the public meetings.

The staff has reviewed the public meeting transcripts and the comment letters that are part of the docket file for the application, all of which are available in the NRC's electronic Public Document Room. Appendix A, Part II, Section A.2, contains a summary of the comments and the staff's responses. Related issues are grouped together. Appendix A, Part II, Section A.3, contains copies of the public meeting transcripts and the comment letters.

Each comment identified by the staff was assigned a specific alphanumeric identifier (marker). That identifier, listed in parentheses after each summary comment in Section A.2, is also typed in the margin of the transcript or letter reproduced in Section A.3. A complete list of comments, the speaker or author, the page on which the comment may be found, and the section(s) of this report in which the comment is addressed are provided in Table A-2. The accession number is provided for the written comments after the letter date to facilitate access to the document through the Public Electronic Reading Room (ADAMS) http://www.nrc.gov/reading-rm/adams/login.html.

The staff made a determination on each comment that it was one of the following:

- A comment that was either related to support or opposition of license renewal in general (or specifically the Joseph M. Farley Nuclear Plant) or that makes a general statement about the license renewal process. It may make only a general statement regarding Category 1 and/or Category 2 issues. In addition, it provides no new information and does not pertain to 10 CFR Part 54.

- A comment regarding environmental issues pertaining to 10 CFR Part 51.

- A comment that raised an environmental issue that was not addressed in the GEIS or the Draft SEIS.

- A comment regarding severe accident mitigation alternative analysis.

- A comment outside the scope of license renewal (not related to 10 CFR Parts 51 or 54).

- A comment regarding alternatives to the proposed action.

There was no significant new information provided on Category 1 issues or information that required further evaluation on Category 2 issues. Therefore, the conclusions in the GEIS and draft SEIS remained valid and bounding, and no further evaluation was performed.

Comments without a supporting technical basis or without any new information are discussed in this appendix, and not in other sections of this report. Relevant references that address the issues within the regulatory authority of the NRC are provided where appropriate. Many of these references can be obtained from the NRC Public Document Room.

Within each section of Part II of this appendix (A.2.1 through A.2.7), similar comments are grouped together for ease of reference, and a summary description of the comments is given, followed by the staff's response. Where the comment or question resulted in a change in the text of the draft report, the corresponding response refers the reader to the appropriate section of this report where the change was made. Revisions to the text in the draft report are designated by vertical lines beside the text.

Table A-2. Comments Received on the Draft SEIS

Comment Number	Speaker or Author	Source	Page of Comment	Section(s) Where Addressed
FS01-1	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.1
FS01-2	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.1
FS01-3	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.1
FS01-4	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.4
FS01-5	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.6
FS01-6	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.4
FS01-7	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.6
FS01-8	M. Stinson	Afternoon meeting transcript (9/30/04)	A-24	A.2.1
FS02-1	W. Hill	Afternoon meeting transcript (9/30/04)	A-25	A.2.4
FS02-2	W. Hill	Afternoon meeting transcript (9/30/04)	A-25	A.2.4
FS02-3	W. Hill	Afternoon meeting transcript (9/30/04)	A-25	A.2.4
FS03-1	M. Stinson	Evening meeting transcript (9/30/04)	A-27	A.2.1
FS03-2	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.1
FS03-3	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.1
FS03-4	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.4
FS03-5	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.6
FS03-6	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.4
FS03-7	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.6
FS03-8	M. Stinson	Evening meeting transcript (9/30/04)	A-28	A.2.1

Comment Number	Speaker or Author	Source	Page of Comment	Section(s) Where Addressed
FS04-1	S. Mashbum	Evening meeting transcript (9/30/04)	A-29	A.2.4
FS04-2	S. Mashbum	Evening meeting transcript (9/30/04)	A-29	A.2.4
FS04-3	S. Mashbum	Evening meeting transcript (9/30/04)	A-30	A.2.4
FS04-4	S. Mashbum	Evening meeting transcript (9/30/04)	A-30	A.2.4
FS04-5	S. Mashbum	Evening meeting transcript (9/30/04)	A-30	A.2.4
FS04-6	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.4
FS04-7	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.2
FS04-8	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.6
FS04-9	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.5
FS04-10	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.5
FS04-11	S. Mashbum	Evening meeting transcript (9/30/04)	A-31	A.2.1
FS04-12	S. Mashbum	Evening meeting transcript (9/30/04)	A-32	A.2.6
FS04-13	S. Mashbum	Evening meeting transcript (9/30/04)	A-32	A.2.6
FS04-14	S. Mashbum	Evening meeting transcript (9/30/04)	A-32	A.2.4
FS04-15	S. Mashbum	Evening meeting transcript (9/30/04)	A-32	A.2.1
FS05-1	K. Chisholm	Oct. 1, 2004, e-mail (ML042990516)	A-34	A.2.3
FS-06-1	H.J. Mueller, EPA	Nov. 5, 2004, letter (ML043210408)	A-35	A.2.6
FS-06-2	H.J. Mueller, EPA	Nov. 5, 2004, letter (ML043210408)	A-36	A.2.6
FS-07	G. Hogue, Department of the Interior (DOI)	Oct. 29, 2004 letter (ML043350249)	A-38	N/A

Comments in this section are grouped in the following categories:

(1) General Comments in Support of License Renewal at Farley Nuclear Plant Units 1 and 2

(2) Comments Concerning Aquatic or Terrestrial Ecology Issues

(3) Comments Concerning Meteorology

(4) Comments Concerning Socioeconomic Issues

(5) Comments Concerning Alternatives

(6) Comments Concerning Issues Outside the Scope of the Environmental Review for License Renewal: Operational Safety, Security, & Emergency Preparedness; Safeguards and Security; and Need for Power

A.2 Comments and Responses

A.2.1 General Comments in Support of License Renewal at Farley Nuclear Plant Units 1 and 2

Comment: We wouldn't be going through this process in pursuit of license renewal if we didn't feel as a company that it's the right thing to do. And I wouldn't be promoting it personally if I didn't feel it was the right thing to do, considering all of the contributions that Plant Farley makes to the state and local economy, as well as the local Wiregrass Community. (FS01-1, FS03-1)

Comment: I do believe the report summary of which you heard today demonstrates the same conclusions we reached. The impact of the renewal is small and certainly acceptable for the renewal period. (FS01-2, FS03-2)

Comment: They try to be good citizens and good environmental stewards. They are committed to being a good neighbor while we carry out our mission to generate electric power for this area of the country. (FS01-3, FS03-3)

Comment: I believe that license renewal is the right thing to do. It’s right for Plant Farley and it’s right for the local economy. (FS01-8, FS03-8)

Comment: In closing, I would like to state that in my opinion there are few, if any, reasons to delay or delay this relicensing request and every reason to grant it. I can't list all of those reasons but I want to take about thirty more seconds just to re-iterate one or two things. (FS04-11)

Comment: I wholeheartedly support the relicensing of the Joseph M. Farley Nuclear Plant and I strongly urge the Nuclear Regulatory Commission to do the same. (FS04-15)

Response: *The comments are noted. The comments support license renewal at the Joseph M. Farley Nuclear Plant, and are general in nature. The comments provide no new information. There were no changes made to the supplement because of these comments.*

A.2.2 Comments Concerning Aquatic or Terrestrial Ecology Issues

Comment: A major area in which Farley has a great deal of impact in our local community is our environment, particularly our local wildlife. Plant Farley is classified as a certified wildlife habitat. They implement strict land management practices and provide a safe, healthy habitat for our local flora and fauna. They set up nesting boxes for many species of birds. They practice timber management programs designed to enhance indigenous plants and animal species.

They are extremely diligent with environmental monitoring programs. They monitor air and water quality in the entire tri-state area, not just plant property. I believe it extends eighteen miles or so around the plant.

They utilize wildlife biologists and they encourage healthy environmental practices throughout the region. Consequently, local flora and fauna actually benefit from the presence of Farley Nuclear Plant in our area. (FS04-7)

Response: *The comment is noted. The comment supports license renewal at the Joseph M. Farley Nuclear Plant, and is general in nature. The comment provides no new information. There were no changes made to the supplement because of this comment.*

A.2.3 Comments Concerning Meteorology

Comment: I realize that Farley Nuclear provides a generous tax income to the local communities, and I am by no means a meteorologist, but I have lived in Dothan, Alabama for fifteen years. I have noticed that a curious weather pattern exists here year round. There are extended periods of drought here from Dothan to the Chattahoochee River: however, the rain seems to begin again once a weather system passes the mentioned area. This pattern seems to have become more intense in recent years. There was significant rainfall here in September 2004, but was chiefly because of a hurricane. I have no proof that this condition is related to Farley's operation; it is pure speculation based on my observations over the last 15 years. I thank you for your indulgence. Perhaps you could furnish me with information that would put this curiosity to rest for me. (FS05-1)

Response: *The staff does not expect the plant to have an effect that would significantly change the intensity of the local precipitation associated with a frontal system. Because the energy released by the plant is small compared to the energies being released in such precipitation processes, the potential for impact resulting from station operations is small.*

A.2.4 Comments Concerning Socioeconomic Issues

Comment: We think we make a significant contribution to the local and state economy as well as to the quality of life in this area by supplying electrical power. (FS01-4, FS03-4)

Comment: We certainly do have an impact on the local economy, on the environment and on the local area as far as civic organizations, charitable groups and community involvement are concerned. We believe our employees participate in many efforts that help make the local economy and local community better.

In addition to our being good environmental stewards, we're significant contributors to the community. (FS01-6, FS03-6)

Comment: To tell you briefly about the impact that Farley as a corporation and Farley with its employees have had, just in the last several years we have had board members serve on at least two of our county boards for Houston and Henry counties. We've had board chairs that have been Farley employees, numerous committee chairs representing our nominating committee, planning committee and most importantly our campaign chairs, as well as numerous volunteers on our funds distribution, which is a very important part of what we do because not only do we spend a lot of time raising money but we spend a great deal of time determining how that money is distributed. And that takes a lot of work and those volunteers that have been involved with Farley have been very dedicated to that process. (FS02-1)

Comment: And of course, they have a tremendous impact financially on our campaign each year raising just over the last several years hundreds and hundreds of thousand of dollars.

Last year alone was over a hundred and fifty-six thousand dollars out of the 3.2 million that we raised in this five county area, the majority of that coming from payroll deduction from employees but also corporate donation, as well. (FS02-2)

Comment: Those agencies -- almost every agency today has a volunteer or a board member that's an employee out at Farley and many of them have leadership positions, people on their executive committee or officers that are employees at Farley. And they have a tremendous impact on our community and in so many different ways. And I wanted to make sure that I took the opportunity to thank them today and to let you know the impact that they have on our community. (FS02-3)

Comment: We certainly do have an impact on the local economy, on the environment and the local area as far as civic organizations, charitable groups and community involvement are concerned. We believe our employees participate in many efforts that help make the local community better. (FS03-6)

Comment: Southern Nuclear and Plant Farley have been exceedingly strong supporters of education in the tri-state area for many, many years. The economic impact that Farley has had upon the educational institutions in this area since its inception is immeasurable. There is absolutely no possible way to measure the positive impact that Farley has had upon the educational institutions throughout the southeast.

While the large majority of the support is local, institutions throughout the State of Alabama and even neighboring states have and continue to have a benefit from the generous support of Plant Farley. The plant generates some eight million dollars of tax revenue each year and a large amount of that money goes to support our local public school systems. (FS04-1)

Comment: Fortunately for the schools in Houston County the tax revenue from Farley has provided a means of continuing strong educational programs for our children. Should something happen to halt that large tax revenue from Farley, it will most certainly deal a devastating blow to the funding for local educational systems. (FS04-2)

Comment: One exceedingly important area that Farley and Southern Nuclear Company has pioneered is that of teacher training, and I want to say a personal word of thanks to Farley and Southern Company for this. I am very proud of what they have accomplished in this area. They have an established themselves as leaders in training teachers in the area of nuclear science education by planning, hosting, staffing and financing nuclear science education workshops for high school teachers throughout the State of Alabama. (FS04-3)

Comment: Southern Nuclear also provides many excellent resources such as lessen plans and science equipment to our local educators, not only elementary but secondary and even post secondary. (FS04-4)

Comment: Farley has provided many, many meaningful experiences for students in science classes at Troy University. (FS04-5)

Comment: Farley has had some very positive influences upon students as they choose their life's vocation. (FS04-6)

Comment: And last, Plant Farley has had and continues to have a major economic impact upon our local community our state and the entire Southeastern United States. (FS04-14)

Response: *The comments are noted. The comments support license renewal at the Joseph M. Farley Nuclear Plant, and are general in nature. The comments provide no new information. There were no changes made to the supplement because of these comments.*

A.2.5 Comments Concerning Alternatives

Comment: Farley produces clean electricity. That is to say, Farley produces a steady, reliable supply of power without harming the world in which we live. When produced properly, nuclear energy production is one of the most environmental friendly methods used today. (FS04-9)

Comment: It is an undeniable fact that fossil fuel based plants produce thousands of tons of harmful emissions each and every year. For example, coal-fired plants release particulates that emit both alpha and beta radiation into our atmosphere. Nuclear power plants such as Plant Farley do not.

Nuclear power plants also do not emit carbon dioxide. They do not emit sulfur compounds. They do not emit nitrogen oxides. Therefore, they do not influence the greenhouse effect and contribute to global warming like many petroleum based or fossil fuel based plants do. (FS04-10)

Response: *The comments are noted. The comments support license renewal at the Joseph M. Farley Nuclear Plant, and are general in nature. The comments provide no new information. There were no changes made to the supplement because of these comments.*

A.2.6 Comments Concerning Issues Outside the Scope of the Environmental Review for License Renewal: Operational Safety, Security, & Emergency Preparedness; Safeguards and Security; and Need for Power

Comment: Availability of our product effects homes, schools, hospitals and businesses. It touches many people. Therefore, we think we have a mission that promotes improvement in the quality of life. (FS01-5, FS03-5)

Comment: I also believe that Plant Farley provides safe, secure and reliable electric power. It contributes to an energy plan made up of diverse sources. It is a viable and valuable contributor to energy security. (FS01-7, FS03-7)

Comment: Perhaps the greatest single factor that supports the relicensing effort for Plant Farley is that they provide a safe, reliable means of generating electricity for the southeastern Unites States. (FS04-8)

Comment: First of all, Farley produces a safe, reliable means of general electricity. One that is not harming our environment and makes us less dependent upon foreign petroleum and waning coal resources. (FS04-12)

Comment: Secondly, Farley has an exemplary safety record. It is as good or better than any in the United States. Farley is a world class nuclear facility. You won't find one any safer or any more efficient anywhere. (FS04-13)

Comment: Based on EPA's review of the DGSEIS, this document received an EC-1 rating, meaning that environmental concerns exist regarding some aspects of the proposed project. Specifically, protecting the environment involves the continuing need for appropriate storage and ultimate disposition of radioactive wastes generated on-site.

The DGSEIS acknowledges that OL renewals for the Farley Station will require continuing radiological monitoring of all plant effluents. Appropriate storage of spent fuel assemblies and radioactive wastes on-site is required, in order to prevent impacts. In the Waste Confidence Rule (10 CFR 51.23), the Commission generically determined that the spent fuel generated by any reactor can be safely stored onsite for at least 30 years beyond the licensed operating life of the reactor. Ultimately, long-term radioactive waste disposition will require transportation of wastes to a permitted repository site. We are aware of the expected availability of a geological repository within the first quarter of the twenty-first century. (FS06-1)

In conclusion, the document states that the operating license renewals would result in fewer environmental impacts than the feasible alternatives for generating power, and the NRC considers impacts of operating license renewals to be small. Overall, the impacts as defined in the DGSEIS appear to be within acceptable limits. (FS06-2)

Response: *The comments are noted. The comments support license renewal at the Joseph M. Farley Nuclear Plant, and are general in nature. The comments provide no new information. There were no changes made to the supplement because of these comments.*

A.3 Public Meeting Transcripts and Comment Letters

Transcript of the Afternoon Public Meeting on September 30, 2004, Dothan, Alabama

[Introduction by Mr. Zalcman]
[Presentation by Mr. Kugler]
[Presentation by Ms. Davis]
[Presentation by Ms. Quinly]
[Presentation by Mr. Cushing]

FACILITATOR ZALCMAN: Thank you, Jack and again, Crystal. This is the second break that we have where we can respond to any questions you have. The first was on the general overview and the processes.

This is now an opportunity to respond to any questions that you may have regarding the process for this review, the specific document that was prepared by the staff, as well as what steps you can take after this meeting is over to communicate with us, offer your comments in written form. I'm sure the staff is ready and prepared to respond to any questions.

I'm not seeing any. Thank you very much for listening to the staff and the presentation. What we will do now is go into the second part of today's meeting, where the staff is now prepared to formally accept any comments that you are prepared to make today.

We have a couple of folks that have pre-registered. The first will be the representative of the applicant. That will be Michael Stinson. And I will give him the floor. And we do have one other person that is pre-registered and see if others have an interest to speak. Whether you have registered you will have an opportunity to share your views.

MR. STINSON: Good afternoon. My name is Mike Stinson. I'm vice-president of the Farley plant. The Farley Nuclear plant and I appreciate the opportunity to speak to you today. I want to begin by giving you a little background information about myself.

I've been with the Southern Company for more than thirty years. Most of that time was spent here at Plant Farley in the Dothan area. My wife and I raised our family here. We have many friends here and are very concerned about any potential effects that Plant Farley might have on the environment and this community.

I started working at Plant Farley in 1972 during the construction phase. Throughout my career I've held various positions at the plant, including numerous engineering, supervisory and management positions. I also received a senior reactor operator's license while here at Farley.

Prior to becoming vice-president I served as the General Manager of Plant Farley here in Dothan and the General Manager of Nuclear Support in Birmingham. I share this with you because I want to give you some perspective about my affiliation with this plant and my experience in the nuclear industry.

Also, I want to thank the NRC for what I believe to be a very complete review. The Agency has put much time and effort in conducting this review. I believe it to be thorough and comprehensive.

Furthermore, the conclusions the Commission reached are consistent with the Plant Farley environmental report conclusions we reached for license renewal.

We wouldn't be going through this process in pursuit of license renewal if we didn't feel as a company that it's the right thing to do. And I wouldn't be promoting it personally if I didn't feel it was the right thing to do, considering all of the contributions that Plant Farley makes to the state and local economy, as well as the local Wiregrass Community.

FS01-1 We have been working on the license renewal process since 2001. We've been involved in this project for some time and there's a tremendous amount of work that goes on. Not only in the environmental review but in other parts of the license renewal process which you will not be seeing here today.

FS01-2 I do believe the report summary of which you heard today demonstrates the same conclusions we reached. The impact of the renewal is small and certainly acceptable for the renewal period.

People that operate and maintain Plant Farley reside in the local area. This area is home to FS01-3 them and their families. They try to be good citizens and good environmental stewards. They are committed to being a good neighbor while we carry out our mission to generate electric power for this area of the country.

FS01-4 We think we make a significant contribution to the local and state economy, as well as to the quality of life in this area by supplying electric power.

FS01-5 Availability of our product effects homes, schools, hospitals and businesses. It touches many people. Therefore, we think we have a mission that promotes improvement in the quality of life.

I want to thank all of our neighbors who have continued to support us. We appreciate the confidence you have placed in us and we will work hard to continue to earn your trust.

FS01-6 We certainly do have an impact on the local economy, on the environment and on the local area as far as civic organizations, charitable groups and community involvement are concerned. We believe our employees participate in many efforts that help make the local economy and local community better.

In addition to our being good environmental stewards, we're significant contributors to the community.

FS01-7 I also believe that Plant Farley provides safe, secure and reliable electric power. It contributes to an energy plan made up of diverse sources. It is a viable and valuable contributor to energy security.

FS01-8 I believe that license renewal is the right thing to do. It's right for Plant Farley and it's right for the local economy.

I appreciate the review the NRC has provided. I believe that as time goes on we will continue to demonstrate that we are good environmental stewards of our facility and surrounding environment. Thank you.

FACILITATOR ZALCMAN: Thank you, Mr. Stinson. Next up, Mr. Walter Hill. Mr. Walter Hill is from Wiregrass United Way. And I will give you the floor.

MR. HILL: It's my pleasure to be here today and talk about other significant contributions made by Plant Farley and the employees out at Plant Farley.

Not only do I speak for myself, but we have five board of directors, we're a five county United Way, Coffeedale, Geneva, Henry and Houston counties, which have a hundred board members in those five counties and then a board of trustees with representatives of all five counties with thirty-two members.

In addition to that, I represent thirty-six agencies ranging from American Red Cross and Salvation Army to the Boys and Girls Scouts, Boys and Girls Clubs, House of Ruth and numerous other health and human service agencies in the Wiregrass area.

FS02-1 To tell you briefly about the impact that Farley as a corporation and Farley with its employees have had, just in the last several years we have had board members serve on at least two of our county boards for Houston and Henry counties. We've had board chairs that have been Farley employees, numerous committee chairs representing our nominating committee, planning committee and most importantly our campaign chairs, as well as numerous volunteers on our funds distribution, which is a very important part of what we do because not only do we spend a lot of time raising money but we spend a great deal of time determining how that money is distributed. And that takes a lot of work and those volunteers that have been involved with Farley have been very dedicated to that process.

FS02-2 And of course, they have a tremendous impact financially on our campaign each year raising just over the last several years hundreds and hundreds of thousand of dollars.

Last year alone was over a hundred and fifty-six thousand dollars out of the 3.2 million that we raised in this five county area, the majority of that coming from payroll deduction from employees but also corporate donation, as well.

And then on top of that has been the leadership positions that have just been important not only as I mentioned to our organization but to the agencies that we represent, the thirty-six different
FS02-3 agencies, as well as numerous other agencies. Those agencies -- almost every agency today has a volunteer or a board member that's an employee out at Farley and many of them have leadership positions, people on their executive committee or officers that are employees at Farley. And they have a tremendous impact on our community and in so many different ways.

And I wanted to make sure that I took the opportunity to thank them today and to let you know the impact that they have on our community.

FACILITATOR ZALCMAN: Thank you very much, Mr. Hill. Now it's an opportunity for those of you that have thoughts or insights or would like the moment to share some views with us, we're happy to give you the podium or give you the microphone.

Okay. Let me indicate that the meeting will be coming to a close. We will have another meeting tonight. Open house begins at six o'clock. Public meeting again at seven o'clock.

Before I hand it over to Mr. Kugler to wrap it up for us, let me just indicate the staff will still be here after the meeting. We still have some of the open house material in the back so make sure if you do want a copy of the documents you can take it with you. Or if you want to chat with any of us that are here from the staff, particularly the environmental review team, the resident inspector or the safety project manager, we will stay, as well.

MR. KUGLER: Well, I would just like to thank everyone again for coming out to our meeting today. Your participation in this process is very important to us.

If you do have comments on the Draft Environmental Impact Statement, we ask you to submit them in any form that Jack explained and that you prefer. We will be accepting those comments through November 5th. Jack is our main point of contact.

I did want to mention again the meeting feedback forms that were in the package of papers you received when you came in. We appreciate any comments we get on those forms. Anything you can tell us that would help us to serve you better in these meetings we would appreciate that. And you can either drop it off in the back, if you want to fill it out now or if you want to fill it out later you can mail it in. It's prepaid postage so you can send it in by mail.

As Barry mentioned, the NRC staff and our contractor will be staying after the meeting and if you want to talk to any of us we would be happy to do that.

Other than that, again, I thank you all for coming and I guess we're adjourned. Thank you.

FACILITATOR ZALCMAN: With that, we'll close the record on the afternoon meeting. Thank you very much.

(Whereupon the meeting was concluded)

Transcript of the Evening Public Meeting on September 30, 2004, Dothan, Alabama

[Introduction by Mr. Zalcman]
[Presentation by Mr. Kugler]
[Presentation by Ms. Davis]
[Presentation by Ms. Quinly]
[Presentation by Mr. Cushing]

FACILITATOR ZALCMAN: Thanks. This now completes the staff's formal presentations on both the process and the document that has been prepared. It will be the last opportunity to ask questions specifically of the staff on the materials presented as part of this formal portion of the meeting. And if you do have those questions we would be happy to answer them now.

And let me just indicate that after the meeting is over, after the formal part of the meeting is over, the staff will still remain if you want more informal interactions with the staff, not just the environmental team but also the safety folks and the resident will be here to respond to you directly.

With that, let me enter the formal portion of the comment collection process. The first individual to speak tonight Michael Stinson of the applicant and will go on and see how far we need to run tonight.

Okay. Mr. Stinson.

MR. STINSON: Good evening. My name is Mike Stinson. I'm the vice-president of the Farley plant and we appreciate the opportunity to speak with you tonight.

I'm going to start off by thanking the NRC for what I believe to be a very complete review. The agency has put much time and effort into conducting this. I believe it to be thorough and comprehensive.

Furthermore, the conclusions the Commission reached are consistent with the Plant Farley environmental report conclusions we reached for license renewal.

FS03-1 We wouldn't be going through this process in pursuit of license renewal if we didn't feel like it was the right thing to do. And I wouldn't be promoting it personally if I didn't feel like it was the right thing to do. We've been working on license renewal process since 2001. We've been involved in this process for some time and there's a tremendous amount of work that goes into not only the environmental review but the other aspects of the license renewal process which we're not seeing here today.

I do believe the report summary of which you heard today demonstrates the same conclusions
FS03-2 we reached. The impact of the renewal is small and certainly acceptable for the renewal period.

FS03-3 People that operate and maintain Plant Farley reside in the local area. This area is home to them and their families so they try to be good citizens and environmental stewards.

We are committed at the Farley Nuclear Plant to being a good neighbor while we carry out our mission of carrying out nuclear power in this area of the country.

FS03-4 We think we make a significant contribution to the local and state economy as well as to the quality of life in this area by supplying electrical power.

FS03-5 The availability of our product effects homes, schools, hospitals and businesses. It touches many people. Therefore, we think we have a mission that promotes improvement in the quality of life.

Also, I want to thank our neighbors who have continued to support us. We appreciate the confidence you have placed in us and we will work hard to continue to earn your trust.

FS03-6 We certainly do have an impact on the local economy, on the environment and the local area as far as civic organizations, charitable groups and community involvement are concerned. We believe our employees participate in many efforts that help make the local community better.

In addition to our being good environmental stewards and significant contributors to the
FS03-7 community, I also believe that Plant Farley provides safe, secure and reliable electrical power. It contributes to an energy plan made up of diverse sources, is viable and valuable contributor to energy security.

FS03-8 License renewal is right for Plant Farley and it's right for the local community. I appreciate the reviews NRC has provided. I believe as time goes on we will continue to demonstrate that we're good environmental stewards of our facility and the surrounding environment. Thank you.

FACILITATOR ZALCMAN: Thank you, Mr. Stinson. Next up, Steve Mashburn indicated a request to have some time. Identify your affiliation, as well.

MR. MASHBURN: My name is Steve Mashburn. I appreciate the opportunity to speak to you this evening and express my support of the Farley Nuclear Plant relicensing project. I am a longstanding member of the academic community and have taught in this area in excess of twenty-six years in secondary and post secondary education.

My area is not the nuclear science arena but rather biological sciences, and I am currently an adjunct professor of biology at Troy University. I'm also a long-standing member of this community and quite familiar with the impact that Plant Farley has had and continues to have on the Wiregrass and the surrounding area.

I would like to make a few comments that I feel are of great importance regarding the Farley license renewal issue. Some of these comments are going to be dealing with economics and education because of my familiarity with the academic arena but I feel it has pertinence to environmental science and the environmental impact because environmental education plays a role in how we maintain and preserve our environment.

FS04-1 Southern Nuclear and Plant Farley have been exceedingly strong supporters of education in the tri-state area for many, many years. The economic impact that Farley has had upon the educational institutions in this area since its inception is immeasurable. There is absolutely no possible way to measure the positive impact that Farley has had upon the educational institutions throughout the southeast.

While the large majority of the support is local, institutions throughout the State of Alabama and even neighboring states have and continue to have a benefit from the generous support of Plant Farley. The plant generates some eight million dollars of tax revenue each year and a large amount of that money goes to support our local public school systems.

Public education in Alabama has and continues to be underfunded and consequently many schools throughout the state have been forced to make substantial budget cuts, including discontinuation of programs and study and employee layoffs.

FS04-2 Fortunately for the schools in Houston County the tax revenue from Farley has provided a means of continuing strong educational programs for our children. Should something happen to halt that large tax revenue from Farley, it will most certainly deal a devastating blow to the funding for local educational systems.

Being an educator, I personally shutter to think what might happen to the public school system in Houston County should this occur.

Plant Farley also impacts the educational community in many other ways. Farley works in elementary and secondary schools directly with teachers and students. The Farley Visitor's center and its employees provide educational programs in general science, ecology and environmental science to hundreds of school children throughout the state, not just in this region but throughout the state and some neighbor states.

A good example of this is Farley's longstanding bluebird nesting box program for elementary school children. The visitor's Center staff also encourages and engages children in elementary, middle and high school in hands-on and inquiry based science activities.

FS04-3 One exceedingly important area that Farley and Southern Nuclear Company has pioneered is that of teacher training, and I want to say a personal word of thanks to Farley and Southern Company for this. I am very proud of what they have accomplished in this area. They have an established themselves as leaders in training teachers in the area of nuclear science education by planning, hosting, staffing and financing nuclear science education workshops for high school teachers throughout the State of Alabama.

In addition, Southern Nuclear with Plant Farley employees carrying the torch to pave the way for the Alabama State Board of Education to strengthen the state mandated course of study in the area of nuclear science for students across our entire state.

This work has been accomplished within about the last four years and it is an undertaking that requires planning, money and many, many man hours of work from Farley and Southern Nuclear employees at many, many levels, including some of the administrative levels and corporate levels.

Due to their efforts the science curriculum in our state has been strengthened and will now provide a basis for high school graduates to be scientifically literate citizens.

Several years ago Farley instituted a teacher and residence program that has been a tremendous learning tool for outstanding science educators in our area. This program provides teachers with actual hands-on experience in many areas of science, such as chemistry, nuclear physics, engineering, ecology and environmental science.

The teacher in residence program provides opportunities for these teachers to take part in real world industrial activities where science is applied. They can then take that experience back into the schools and make those experiences real for children and their classrooms.

FS04-4 Southern Nuclear also provides many excellent resources such as lessen plans and science equipment to our local educators, not only elementary but secondary and even post secondary. A few examples are websites with teaching ideas and lesson plans for educators; Alabama water watch testing kits and training on the use of these kits; Geiger counters and manuals designed to use with the Geiger counters for classroom activity.

Southern Nuclear and Farley have also been extremely involved at the post secondary level. They were instrumental in the establishment of a collaboration between Troy University and Alabama (Roll Tide) through which area students can obtain a four year engineering degree right here in Dothan, Alabama.

FS04-5 Farley has provided many, many meaningful experiences for students in science classes at Troy University. I know because many of my students at Troy here in Dothan have benefitted from these experiences.

FS04-6 Farley has had some very positive influences upon students as they choose their life's vocation. I have had many students who have pursued degrees in chemistry, physics, engineering and environmental science in college because of the positive influence of Farley and its employees.

I could say a lot more about Farley and its impact upon education but there are time limitations and I want to be certain to just mention a couple of key things before I close.

FS04-7 A major area in which Farley has a great deal of impact in our local community is our environment, particularly our local wildlife. Plant Farley is classified as a certified wildlife habitat. They implement strict land management practices and provide a safe, healthy habitat for our local flora and fauna. They set up nesting boxes for many species of birds. They practice timber management programs designed to enhance indigenous plants and animal species.

They are extremely diligent with environmental monitoring programs. They monitor air and water quality in the entire tri-state area, not just plant property. I believe it extends eighteen miles or so around the plant.

They utilize wildlife biologists and they encourage healthy environmental practices throughout the region. Consequently, local flora and fauna actually benefit from the presence of Farley Nuclear Plant in our area.

FS04-8 Perhaps the greatest single factor that supports the relicensing effort for Plant Farley is that they provide a safe, reliable means of generating electricity for the southeastern Unites States.

FS04-9 Farley produces clean electricity. That is to say, Farley produces a steady, reliable supply of power without harming the world in which we live. When produced properly, nuclear energy production is one of the most environmental friendly methods used today.

And friends, you can rest assured that at the Joseph M. Farley Plant, they do it right.

FS04-10 It is an undeniable fact that fossil fuel based plants produce thousands of tons of harmful emissions each and every year. For example, coal-fired plants release particulates that emit both alpha and beta radiation into our atmosphere. Nuclear power plants such as Plant Farley do not.

Nuclear power plants also do not emit carbon dioxide. They do not emit sulfur compounds. They do not emit nitrogen oxides. Therefore, they do not influence the greenhouse effect and contribute to global warming like many petroleum based or fossil fuel based plants do.

FS04-11 In closing, I would like to state that in my opinion there are few, if any, reasons to delay or delay this relicensing request and every reason to grant it. I can't list all of those reasons but I want to take about thirty more seconds just to re-iterate one or two things.

FS04-12 First of all, Farley produces a safe, reliable means of general electricity. One that is not harming our environment and makes us less dependent upon foreign petroleum and waning coal resources.

FS04-13 Secondly, Farley has an exemplary safety record. It is as good or better than any in the United States. Farley is a world class nuclear facility. You won't find one any safer or any more efficient anywhere.

FS04-14 And last, Plant Farley has had and continues to have a major economic impact upon our local community our state and the entire Southeastern United States.

FS04-15 Thank you very much for allowing me to express my views this evening. I wholeheartedly support the relicensing of the Joseph M. Farley Nuclear Plant and I strongly urge the Nuclear Regulatory Commission to do the same.

FACILITATOR ZALCMAN: Thank you, Mr. Mashburn. Okay. We have addressed the time request for anybody that had preregistered. Now is the opportunity if you would like to make comments we would be happy to receive them. We still have the record open.

Without any additional requests, let me hand it back to Mr. Kugler, the environmental section chief again. We will be here after the meeting if you have questions of the staff of the environmental review team or the safety folks will be here to react and interact with you informally. Mr. Kugler?

MR. KUGLER: I would just like to thank everyone again for coming out this evening. We consider your participation in this process to be very important. If you do have comments on the Draft Environmental Impact Statement that you would like to provide later, we're accepting those comments through November 5th and Jack Cushing is our principle point of contact, as mentioned earlier.

I would also like to reiterate as he mentioned we have a meeting feedback form that was included in the package you received this evening. We would appreciate any comments that you have concerning the way we ran the meeting, how helpful the meeting was to you or not helpful, what we can do differently.

If you can provide those comments we would appreciate it. We would like to improve how we do things. You can either fill it out this evening and drop it off or fill it out later and mail it in. It is pre-postage paid.

Finally, we will be staying after the meeting if you have any questions or comments, if you would like to talk to any one of the staff we'll be here. And again, we appreciate you coming out. Thank you.

FACILITATOR ZALCMAN: Okay. With that, we'll close the record. Again, thank you very much for spending the time with us tonight, and drive home safely.

(Whereupon the meeting was concluded)

From: “kenneth chisholm” <foreword1@comcast.net>
To: <FarleyEIS@NRC.gov>
Date: Fri, Oct 1, 2004 5:30 PM
Subject: Public input

FS05-1 I realize that Farley Nuclear provides a generous tax income to the local communities, and I am by no means a meteorologist, but I have lived in Dothan, Alabama for fifteen years. I have noticed that a curious weather pattern exists here year round. There are extended periods of drought here from Dothan to the Chattahoochee River: however, the rain seems to begin again once a weather system passes the mentioned area. This pattern seems to have become more intense in recent years. There was significant rainfall here in September 2004, but was chiefly because of a hurricane. I have no proof that this condition is related to Farley’s operation; it is pure speculation based on my observations over the last 15 years. I thank you for your indulgence. Perhaps you could furnish me with information that would put this curiosity to rest for me.

Sincerely,
Kenneth Chisholm

A

11/12/04
RDB received

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 5, 2004

8/12/04
69FR 49916
(2)

Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, D.C. 20555-0001

RE: EPA Review and Comments on
Draft Generic Supplemental Environmental Impact Statement (DGSEIS)
License Renewal of Nuclear Plants, Supplement 18
Regarding Joseph M. Farley Nuclear Plant, Units 1 and 2
CEQ No. 040378

Dear Sir:

EPA Region 4 reviewed the Draft Generic Supplemental Environmental Impact Statement (DGSEIS) pursuant to Section 309 of the Clean Air Act and Section 102 (2)(C) of the National Environmental Policy Act (NEPA). The purpose of this letter is to provide the Nuclear Regulatory Commission (NRC) with EPA's comments regarding potential impacts of the proposed renewal of the Joseph M. Farley Nuclear Plant, Units 1 and 2 Operating Licenses (OLs).

Southern Nuclear Operating Company (SNC) submitted an application to renew the Operating Licenses (OLs) for the Farley Nuclear Station for an additional 20 years. The proposed action, (license renewals), would provide for continued operation and maintenance of existing facilities and transmission lines.

FS06-1 Based on EPA's review of the DGSEIS, this document received an EC-1 rating, meaning that environmental concerns exist regarding some aspects of the proposed project. Specifically, protecting the environment involves the continuing need for appropriate storage and ultimate disposition of radioactive wastes generated on-site.

The DGSEIS acknowledges that OL renewals for the Farley Station will require continuing radiological monitoring of all plant effluents. Appropriate storage of spent fuel assemblies and radioactive wastes on-site is required, in order to prevent impacts. In the Waste Confidence Rule (10 CFR 51.23), the Commission generically determined that the spent fuel generated by any reactor can be safely stored onsite for at least 30 years beyond the licensed operating life of the reactor. Ultimately, long-term radioactive waste disposition will require transportation of wastes to a permitted repository site. We are aware of the expected availability of a geological repository within the first quarter of the twenty-first century.

E-RIDS = ADM-03
Add = S. Cushing (SXC9)

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Further, Farley Nuclear Plant has an NPDES permit for discharges to the Chattahoochee River, and uses the river as a source of water for some plant operations. The DGSEIS notes that future water withdrawals from the river may be affected by allocation of water by state government.

FS06-2 In conclusion, the document states that the operating license renewals would result in fewer environmental impacts than the feasible alternatives for generating power, and the NRC considers impacts of operating license renewals to be small. Overall, the impacts as defined in the DGSEIS appear to be within acceptable limits.

Thank you for the opportunity to comment on this document. If we can be of further assistance, please contact Ramona McConney of my staff at (404) 562-9615.

Sincerely,

Heinz J. Mueller

Heinz J. Mueller, Chief
Office of Environmental Assessment

Enclosed: Summary of Rating Definitions

SUMMARY OF RATING DEFINITIONS AND FOLLOW UP ACTION*

Environmental Impact of the Action

LO-Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impacts. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS sate, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1-Adequate
The EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alterative and those of the alternatives reasonably available to the project or action. No further analysis or data collecting is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information
The draft EIS does not contain sufficient information for the EPA to fully assess the environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of the Federal Actions Impacting the Environment

United States Department of the Interior

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Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

TAKE PRIDE IN AMERICA

RDB received 11/26/04

ER 04/599

October 29, 2004

8/12/04
69FR 49916
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Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555

RE: Joseph M. Farley Nuclear Plant, Units 1 and 2, Houston County, AL
NUREG-1437, Supplement 18, Draft

FS07-1 The Department of the Interior has reviewed the Generic Environmental Impact Statement for License Renewal regarding the referenced nuclear plant. We appreciate the opportunity to review this document but we have no comments to provide for your consideration.

I can be reached at 404-331-4524 if you should have any comments and concerns regarding this matter.

Sincerely,

Gregory Hogue
Regional Environmental Officer

cc:
FWS, R4
OEPC, WASO

E-RIDS=ADM-03
Add= J. Cushing (JXC9)

Template=ADM-013
SISP Review Complete