Appendix D

Applicant's Environmental Report – Operating License Renewal Stage
Joseph M. Farley Nuclear Plant Units 1 and 2

PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

List of Attachments

List of Tables

TABLE OF CONTENTS (Continued)

List of Figures

ACRONYMS AND ABBREVIATIONS

ACF	Apalachicola-Chattahoochee-Flint
ADCNR	Alabama Department of Conservation and Natural Resources
ADEM	Alabama Department of Environmental Management
APC	Alabama Power Company
APSC	Alabama Public Service Commission
AQCR	Air Quality Control Region
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
DOE	U.S. Department of Energy
DSM	demand-side management
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
FDACS	Florida Department of Agriculture and Consumer Services
FES	Final Environmental Statement
FFWCC	Florida Fish and Wildlife Conservation Commission
FNAI	Florida Natural Areas Inventory
FNP	Joseph M. Farley Nuclear Plant, Units 1 and 2
fps	feet per second
FWS	U.S. Fish and Wildlife Service
GADNR	Georgia Department of Natural Resources
GEIS	Generic Environmental Impact Statement
GPC	Georgia Power Company
gpd	gallons per day
gpm	gallons per minute
GPSC	Georgia Public Service Commission
IPA	integrated plant assessment
kV	kilovolt
ml	milliliter
MW	megawatt
MWe	megawatts-electrical
MWt	megawatts-thermal
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NMFS	National Marine Fisheries Service
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRR	(Office of) Nuclear Reactor Regulations
NSSS	nuclear steam supply system

ROW	right-of-way
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan (for nitrogen oxides)
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SNC	Southern Nuclear Operating Company
SO	Southern Company
SO_2	Sulfur dioxide
SSCs	structures, systems, and components
SW	Service Water
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey

1.0 INTRODUCTION

1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Southern Nuclear Operating Company (SNC) operates the Joseph M. Farley Nuclear Plant (FNP) Units 1 and 2 pursuant to NRC Operating Licenses NPF-2 and NPF-8, respectively. FNP Unit 1 began commercial operation December 1, 1977, and is licensed to operate through June 25, 2017. FNP Unit 2 began commercial operation July 30, 1981, and is licensed to operate through March 31, 2021. SNC has prepared this environmental report in connection with its application to NRC to renew the FNP Units 1 and 2 operating licenses, as provided by the following NRC regulations.

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and

- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

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

> "…The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capacity beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers." (NRC 1996a, pg. 28472)

The renewed operating licenses would allow for 20 additional years of Plant operation beyond the current FNP licensed operation period of 40 years for each of the units.

1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

NRC regulations at 10 CFR 51.53(c) require that an applicant for renewal of a license to operate a nuclear power plant submit with its application a separate document entitled "Applicant's Environmental Report - Operating License Renewal Stage." In determining the information to include in the FNP environmental report, SNC has principally relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996b; NRC 1999a)
- NRC supplemental information in the *Federal Register* (NRC 1996a, pp. 28467-28497; NRC 1996c, pp. 39555-39556; NRC 1996d, pp. 66537-66554; and NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (NRC 1996f)

SNC has prepared **Table 1-1** to verify conformance with NRC environmental regulatory requirements applicable to license renewal. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, the portions of the Environmental Report identified in Table 1-1 are prefaced by a boxed quote of the relevant regulations and regulatory guidance.

1.3 FARLEY NUCLEAR PLANT LICENSEE AND OWNERSHIP

FNP is owned by Alabama Power Company (APC) and operated by SNC. APC and SNC are the facility's licensees. SNC was formed from the support organizations of Southern Company Services, Inc., Georgia Power Company (GPC), and APC. SNC has exclusive responsibility for and control over the physical construction, operations, and maintenance of the facility. The transmission lines and associated rights-of-way that originate at FNP and connect FNP to the distribution grid are owned and maintained by APC, GPC, and Gulf Power Company. SNC is a wholly-owned subsidiary of The Southern Company. The Southern Company is involved in the generation, transmission, and delivery of electric power to customers across the southeastern United States.

Table 1-1. Environmental Report Responses to Nuclear Regulatory Commission License Renewal Environmental Regulatory Requirements

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(1)		Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible or Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers Withdrawing Make-Up Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment or Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Impact on Public Health of Microbiological Organisms

Table 1-1. Environmental Report Responses To License Renewal Environmental Regulatory Requirements (Cont'd)

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(3)(iv)	6.2	Mitigation
	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2 4.21	Minority and Low-Income Populations Environmental Justice

PAGE INTENTIONALLY LEFT BLANK

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 LOCATION AND FEATURES

FNP is located in Houston County in southeastern Alabama, on the west bank of the Chattahoochee River. It is approximately 5.5 miles north of Gordon, Alabama, 16.5 miles east of Dothan, Alabama, 100 miles southeast of Montgomery, Alabama, and 180 miles south-southwest of Atlanta, Georgia. **Figures 2-1** and **2-2** are FNP 50-mile and 6-mile vicinity maps, respectively. 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 FNP from the Chattahoochee River and is stored in a 108-acre pond for use as service and makeup water for the facility. Three cooling towers per unit are used to dissipate heat from each closed-loop circulating water system (**Figure 2-3**). A small portion of the circulating water flow is returned to the Chattahoochee River.

The FNP property is approximately 1,850 acres and its boundaries are depicted in Figure 2-2. The FNP property or "Owner Controlled Area" is the owned by APC and operated by SNC. The Owner Controlled Area is posted and access to the area is controlled. (**SNC 2000a,** pg. 2.1-1).

Section 3.1 describes key features of the plant, including reactor and containment systems, cooling and auxiliary water systems, and transmission facilities.

2.2 AQUATIC AND RIPARIAN ECOLOGICAL COMMUNITIES

FNP is located on the west (Alabama) bank of the lower Chattahoochee River at approximately River Mile 43.5 (**Figure 2-2**). The Chattahoochee River rises in the Blue Ridge Mountains of northeast Georgia and flows south along the entire length of the state for approximately 430 miles before it merges with the Flint River (the two rivers meet at Lake Seminole) to form the Apalachicola River. From Lake Seminole, the Apalachicola River flows south for 106 miles 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 3,000 feet in elevation (**USGS 2000a**). It drains an area of 8,770 square miles and, according to the U.S. Geological Survey (USGS), is "the most heavily used water resource in Georgia" (USGS 2000a). For much of its length, the flow of the Chattahoochee River is controlled by hydroelectric plants releasing water for hydropower production. These hydroelectric plants are used to augment regional power supplies during periods of peak electrical demand. At Cornelia, Georgia, upriver of Lake Lanier, the Chattahoochee River is free-flowing; however, for the rest of its length, the river's hydrograph shows the influence of peaking hydroelectric operations (USGS 2000a).

Flows in the lower Chattahoochee River (the portion of the river between Walter F. George Reservoir and the Chattahoochee-Flint confluence) are influenced by a series of locks and dams built in the 1950s for flow regulation, hydroelectric power generation, and improved navigation. 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, via a 9-foot-deep and 100-foot-wide channel maintained by the U.S. Army Corps of Engineers. Columbus, Georgia, is approximately 75 miles north of FNP.

The Walter F. George Lock and Dam, 31 miles upstream of FNP (Figure 2-2), forms the 45,200-acre Walter F. George Reservoir (known locally as Lake Eufala). This multi-purpose reservoir was built for flood control and hydroelectric power generation.

The George W. Andrews Lock and Dam, three miles upstream of FNP, forms Lake Andrews. Lake Andrews is a long (28.5 miles), narrow impoundment with a surface area of only 1,540 acres. The lock and dam was built to regulate downstream flow and improve navigation, and is not used for hydroelectric power generation. The flows, circulation patterns, and retention times in George Andrews reservoir are more characteristic of a river than a reservoir. The USGS maintains a gauging station at George W. Andrews Lock and Dam (River Mile 46.5). The USGS annual report notes that flows in this reach of the river are regulated by releases from five upstream reservoirs (**USGS 2000b,** pg. 495). For water years 1976-1999, annual mean flow ranged from 5,718 cubic feet per second (cfs) to 16,000 cfs, and averaged 11,000 cfs (USGS 2000b, pg. 497). Flows in this portion of the Chattahoochee River are highest in winter and early spring (January-April) and lowest in late summer and fall (August-October), a pattern observed throughout the river system.

The Jim Woodruff Lock and Dam is 44 miles downstream of FNP and south of the Florida-Georgia border (**Figure 2-1**). It was completed in 1957 and is located downstream of the confluence of the Chattahoochee and Flint Rivers to form Lake Seminole. It is part of a multi-purpose project built for navigation, hydroelectric power production, and related uses. Lake Seminole is a relatively shallow, 37,500-acre impoundment and a popular destination for boaters, fishermen, and waterfowl hunters in the region.

Demand for Chattahoochee River water from upstream users has increased dramatically in recent years. The increased demand in the Apalachicola-Chattahoochee-Flint (ACF) river basin, has created water use conflicts between Alabama, Georgia, and Florida. The largest user of the Chattahoochee River is metro Atlanta, Georgia. This area plans to increase its consumptive use which would reduce the amount available for downstream users. Increased upstream water withdrawal also decreases the navigability of the river below Columbus, Georgia. The ACF Compact was created in 1997 and includes the States of Florida, Georgia, and Alabama as well as 12 federal agencies, including the U.S. Army Corps of Engineers. Its purpose is develop an allocation formula for the resource, and monitor use of the resource (**University of Florida 2000; State of Georgia 1997; JSU 2001; Tallahassee News Herald 1997**).

The aquatic communities of the lower Chattahoochee River in the vicinity of FNP have not been the subject of a great deal of scientific study in recent years, presumably because this reach of the river is so heavily influenced by up- and downstream dams, hydroelectric power plant operations, and activities (such as dredging) intended to keep the river navigable. The most comprehensive source of information on local aquatic communities is the *Cooling Water Intake Study 316(b) Demonstration* for FNP, which contains detailed information on phytoplankton, zooplankton, and fish populations (**APC 1983**). Updated information on the distribution, abundance, and conservation status of Unionid mollusks of the Apalachicola Basin (including the lower Chattahoochee River) may be found in Brim Box and Williams (**2000**). Information on the habitat preferences and life histories of Chattahoochee River fishes, as well as species distribution maps and collections by county, may be found in *Fishes of Alabama* (**Mettee, O'Neil, and Pierson 1996**).

Benthic macroinvertebrate populations in the portion of the Chattahoochee River adjacent to FNP have not been systematically surveyed. The *Final Environmental Statement related to construction of Joseph M. Farley Nuclear Plant, Units 1 and 2* (FES) (**AEC 1972,** pg. II-35) noted that "rapidly shifting bottom sands" prevent the establishment of a diverse benthic community in the vicinity of the site. Although the *Cooling Water Intake Study 316(b) Demonstration* (APC 1983) was focused on plankton and fish, it reported that the introduced Asiatic clam, *Corbicula fluminea*, was routinely observed in impingement samples, indicating that this nuisance species had become established in the vicinity of FNP by the early 1980s.

Brim Box and Williams (2000) present detailed information on the historic and current distribution of 33 unionids (freshwater mollusks) in the Apalachicola, Chattahoochee, and Flint Rivers, which together comprise the Apalachicola Basin. Noting that species diversity and abundance of freshwater mussels have been declining in the Chattahoochee River since the early part of the 20th century, Brim Box and Williams state (pg. 87) that "freshwater mussels appear to be extirpated from most of the entire length of the Chattahoochee River." 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*) has invaded the Chattahoochee River system, competing with native mussels for space and nutrients. At present, it appears that the once rich and abundant Chattahoochee River mussel fauna has 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 and Williams 2000).

The fish community of the Chattahoochee River in the vicinity of FNP is diverse, comprised 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 (AEC 1972; AEC 1974; APC undated; Mettee, O'Neil, and Pierson 1996). More than 80 fish species occur in the Chattahoochee River system and perhaps two-thirds of these species are found in the lower Chattahoochee (AEC 1974; Mettee, O'Neil, and Pierson 1996).

Stream fishes commonly observed and occasionally collected in the lower Chattahoochee River near FNP include longnose gar (*Lepisosteus osseus*), redfin pickerel (*Esox americanus*), river redhorse (*Moxostoma carinatum*), greater jumprock (*Moxostoma lachneri*), green sunfish (*Lepomis cyanellus*), redbreast sunfish (*Lepomis auritus*), channel catfish (*Ictalurus punctatus*), and several common minnow species (e.g., longnose shiner [*Notropis longirostris*] and weed shiner [*Notropis texanus*]). 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 FNP 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 (*Lepomis machrochirus*), and largemouth bass (*Micropterus salmoides*).

Three *Morone* species (striped bass, white bass, and hybrid bass) are found in the lower Chattahoochee and are sought by anglers in the spring of the year near George W. Andrews Lock and Dam, three miles upstream of FNP. In addition to these anadromous (striped bass) and semi-anadromous (white bass and hybrid bass) populations, small numbers of catadromous American eels 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 in the vicinity of FNP.

The construction of locks and dams along the lower Chattahoochee in the 1950s severely reduced or eliminated surviving runs of most anadromous fishes native to the river system, including the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), Alabama shad (*Alosa alabamae*), and Gulf Coast striped bass (*Morone saxatilis*). Gulf sturgeon were abundant in the Chattahoochee before European settlement in the 19th century, ascending the river as far as the Fall Line. Habitat destruction and overfishing in the late 19th and early 20th centuries decimated the Chattahoochee River population, and completion of the Jim Woodruff Lock and Dam in 1957 effectively eliminated it. Reproducing populations of Gulf sturgeon survive in a few Gulf Coast river systems: the Apalachicola River downstream of Lake Seminole, the Choctawhatchee River in Alabama and Florida, and the Suwannee River in Florida. This species has been listed as threatened by the U.S. Fish and Wildlife Service (FWS) since 1991. Alabama shad still migrate from the Gulf of Mexico into the Apalachicola River below Jim Woodruff Dam (**Mettee, O'Neil, and Pierson 1996**, pg. 115), but are blocked from moving upstream into the Chattahoochee River. A landlocked population of striped bass occurs in the Chattahoochee River above Jim Woodruff Dam (Mettee, O'Neil, and Pierson 1996, pg. 503), but there is little or no movement to and from the Gulf of Mexico. Some Chattahoochee River striped bass do move downstream and pass the Jim Woodruff Lock and Dam when river flows are unusually high, but the Dam prevents upstream movement, so these fish are unable to return to the Chattahoochee River to spawn. Striped bass are not plentiful in the Chattahoochee River adjacent to FNP, but they are occasionally caught by anglers pursuing the more common white and hybrid bass up- and downstream of George W. Andrews Lock and Dam.

2.3 GROUNDWATER RESOURCES

FNP site upland topography ranges from 150 to 210 feet above mean sea level, with 180 feet being generally representative. The FNP Final Safety Analysis Report describes site geology and groundwater resources in detail (**SNC 2000a** , Sections 2.5.1.2 and 2.4.13, respectively). The U. S. Geological Survey has published descriptions of these resources for the site vicinity (**USGS 1996**, pp. 8 – 20; and **1997,** pp. 13 - 17). There are three groundwater resources of interest at FNP and in the site vicinity, the shallow aquifer, the major shallow aquifer, and the major deep aquifer. The aquifers are separated by materials that form a barrier to water migration between the aquifers (i.e., an aquiclude) and each aquifer spans multiple geologic formations.

FNP Groundwater Resources

Aquifer	Geologic Formation	Approximate Elevation[1]
	Surface	
	Alluvium	+180
	Residuum	+135
Shallow	Moodys Branch	+100 to +110
	Upper Lisbon	+90 to +100
None (20- to 40-foot aquiclude)		
	Lower Lisbon	+ 25 to +45
Major shallow (Lisbon)	Tallahatta	-10 to -40
	Hatchetigbee	-160
None (220-foot aquiclude)	Tuscahoma	-200
		-419
Major deep (Nanafalia-Clayton)	Nanafalia	-440
	Clayton	-550
	Providence	-850
	Ripley	-940

Source: Drawn from text (SNC 2001, pp. 2.4-25 to 2.4-27)
1. Elevation in feet above (+) or below (-) mean sea level.

The uppermost site groundwater resource is the shallow aquifer. This aquifer extends from within 5 to 10 feet of the surface to a depth of approximately 90 feet. The aquifer occupies the alluvium and residuum soils and the Moodys Branch and upper portion of the Lisbon geologic formations and is hydraulically connected to area streams, with water table elevation responding to stream water level changes. The water table slopes towards the Chattahootchee River on the eastern boundary of the site. Within the floodplain, the river controls groundwater levels to a large extent and provides recharge during high river stages. Because of the lenticular nature of water bearing strata in the surficial deposits, they are not important as regional aquifers. Ground water levels in the residuum reflect changes in precipitation, rather than changes in river level, and a number of shallow, dug wells collect water from these deposits in the area. Within three miles of the site, wells finished in the shallow aquifer are between 70 and 150 feet deep. The shallow aquifer is an important source of water for area farms and residences, all located upgradient from FNP, but yield is low (**AEC 1972,** Section II.D.2.b). Site shallow aquifer information is consistent with recent regional documentation, which identifies this uppermost area groundwater resource and characterizes it as thin and not a major aquifer, generally yielding less than 100 gallons per minute (USGS 1997, page 14). Alabama state data for large wells (reported to yield 50 gallons per minute or more) identifies only one off site well located within 3 miles of FNP and finished in this aquifer. The well owner is the U.S. Army Corps of Engineers (**GSA 1991,** page 72) and is located at the lock and dam three miles upstream from FNP.

The second site groundwater resource of interest is the major shallow aquifer. The top of the major shallow aquifer at FNP is approximately 145 feet below the surface and the aquifer is approximately 200 feet thick. An overlaying 20- to 40-foot thick layer of silty claystone and siltstone forms a confining layer, an aquiclude, that restricts water movement between the shallow and major shallow aquifers and results in artesian conditions in the latter. Wells tapping this aquifer within 3 miles of the site are between 210 and 360 feet deep. Regional documentation indicates that this is known as the Lisbon aquifer in Alabama and the Claiborne aquifer in Georgia and yields generally less than 100 gallons per minute (USGS 1997, page 16). Alabama state records show no large wells located within three miles of FNP that tap the major shallow aquifer.

Below the major shallow aquifer are about 220 feet of laminated clays and silty sandstone that form an aquiclude that prevents migration of groundwater between the major shallow aquifer and the third site groundwater resource of interest, the deep major aquifer. Regionally, the deep major aquifer is known as the Nanafalia-Clayton aquifer in Alabama and the Clayton aquifer in Georgia. The top of this aquifer is located approximately 600 feet below the site and the aquifer is more than 400 feet thick. The aquifer yields about 100 to 700 gallons per minute (**USGS 1997,** page 17). Aquifer physical characteristics include a storage coefficient of 3 x 10–4, transmissivity of 7,800 ft^2 per day, an assumed aquifer thickness at the site of 435 feet, and a calculated conductivity of 17.9 ft per day. Alabama state records show only one large well located within 3 miles of FNP and tapping the major deep aquifer. The owner is listed as the McNair Estate (GSA 1991, page 70). This appears to be the well identified in the FNP Final Safety Analysis Report as located immediately south of the plant site (**SNC 2000a,** Figure 2.4-22).

2.4 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

The FNP site consists of 1,850 acres on the west bank of the Chattahoochee River in Houston County, Alabama (**Figure 2-2**). Approximately 500 acres are used for generation and maintenance facilities, laydown areas, parking lots, and roads. The developed areas are primarily located on a plateau approximately one-half mile west of the river, with the area adjacent to the river mostly undeveloped. The remainder of the site consists of forested areas, ponds, wetlands, and open fields. There are two major topographical subdivisions 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 at FNP consist of river bluff forest, ravine forest, floodplain forest, pine-mixed hardwood forest, pine forest, non-floodplain wetlands, and mechanically-maintained grassy areas.

Forests along the steep river bluffs occur adjacent to the Chattahoochee River at the FNP site and are dominated by white ash (*Fraxinus americana*), southern magnolia (*Magnolia grandiflora*), black walnut (*Juglans nigra*), water oak (*Quercus nigra*), cherrybark oak (*Quercus pagoda*), box elder (*Acer negundo*), and willow oak (*Quercus phellos*). Ravine forests occur at FNP where Wilson Creek has eroded deeply into the local limestone (marl). The canopies of these ravine forests are dominated by beech (*Fagus grandifolia*), sweet gum (*Liquidambar styraciflua*), water oak, southern magnolia, tulip poplar (*Liriodendron tulipifera*), Florida maple (*Acer barbatum*), white oak (*Quercus alba*), and white ash. Some of the beeches and maples are over two feet in diameter.

Most of the floodplain forests at FNP are dominated by high floodplain or ridge floodplain species. On the highest ridges and in high floodplains, willow oak, Shumard oak (*Quercus shumardii*), bitternut hickory (*Carya cordiformis*), sweet gum, swamp chestnut oak (*Quercus michauxii*), and cherrybark oak are present. Along the river in early successional areas, sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), and black willow (*Salix nigra*) are dominant. In sloughs, backwaters, and poorly-drained areas, bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), red maple (*Acer rubrum*), and laurel oak (*Quercus laurifolia*) are commonly found.

The pine-mixed hardwood forests at FNP are primarily successional, recovering from past logging. Loblolly pine (*Pinus taeda*) is the dominant species in most areas. Common hardwood species include red maple, sweet gum, water oak (*Quercus nigra*), hickories (*Carya* spp.), and other upland oaks (*Quercus* spp.). Pine forests at FNP are dominated by loblolly pine and are second growth or planted pine forests.

Several non-floodplain wetlands occur at FNP. Most of these are weedy marshes areas with scattered red maple, sweet gum, black willow, and buttonbush (*Cephalanthus occidentalis*) as woody species. Plume grass (*Erianthus* sp.), woolgrass bulrush (*Scirpus cyperinus*), needlerushes (*Juncus* spp.), and other emergent, nonwoody wetland species are also found in these wetlands. The largest wetland of this type has a broad expanse of open water dominated by water lilies (*Nuphar lutea* and *Nymphaea odorata*), water shield (*Brasenia screberi*), and nonwoody marsh grasses such as woolgrass bulrush and common needlerush (*Juncus effusus*).

Terrestrial wildlife species that occur in the forested portions of the FNP property 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., common bobwhite [*Colinus virginianus*], blue jay [*Cyanocitta cristata*], and various warblers), as well as several reptile and amphibian species, including the gopher tortoise (*Gopherus polyphemus*), occur at the site. The gopher tortoise is listed as protected by the Alabama Department of Conservation and Natural Resources (ADCNR).

APC maintains approximately 1,300 acres of the FNP site as a wildlife preserve. The FNP Wildlife Management Plan strategies include managing vegetation to promote and protect diverse habitats, periodic thinning and burning 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*). 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*." The Wildlife Habitat Council recognized FNP in 1999 for its wildlife and land management efforts. FNP was originally certified through the Wildlife Habitat Council in 1992 (**SO 2001b**).

Section 3.1.3 describes the transmission lines constructed to connect FNP to the transmission system. The principal land use categories traversed by the transmission corridors are row crops, pasture, and forest. Wooded habitats along transmission corridors consist of pine forest, pine-hardwood forest, and bottomland hardwood forest.

No areas designated by the U.S. Fish and Wildlife Service (FWS) as critical habitat for endangered species exist at FNP or adjacent to associated transmission lines. The Raccoon Creek transmission corridor crosses the 1.2-mile-wide Elmodel Wildlife Management Area in western Georgia, approximately 38 miles east-northeast of FNP. The South Bainbridge corridor crosses the Lake Seminole Wildlife Management Area in southwestern Georgia, approximately 36 miles southeast of FNP. Otherwise, the transmission corridors do not cross any state or federal parks, wildlife refuges, or wildlife management areas.

APC, GPC, and Gulf Power Company use several methods to control vegetation in FNP transmission corridors. As a general rule, dry upland areas (particularly those that are 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. 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. Some portions of the transmission corridors 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 corridors 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 corridors (**Heitschmidt 2000**). During 2000, 24 applicants (representing 212 acres of FNP transmission line corridors) participated in this program to enhance wildlife habitats (Heitschmidt 2000). GPC participates in a wildlife management program with GADNR on FNP transmission line corridors. *The Wildlife Incentives for Non-Game and Game Species* (WINGS) program is designed to help land users convert Georgia Power transmission corridors 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 3 years. GPC is one of two utilities funding the WINGS program in Georgia.

2.5 THREATENED OR ENDANGERED SPECIES

SNC wrote the FWS, the National Marine Fisheries Service (NMFS), the Alabama Department of Conservation and Natural Resources (ADCNR), the Georgia Department of Natural Resources (GADNR), the Florida Fish and Wildlife Conservation Commission (FFWCC), and the Florida Natural Areas Inventory (FNAI) requesting information on any listed species or critical habitats that might occur on the FNP site or along associated transmission line ROWs, with particular emphasis on species that might be adversely affected by operations over the license renewal term. Responses from these agencies are provided in **Attachment C.** They were the primary sources of data used to generate **Table 2-1,** which lists plant and animal species that are federally- or state-listed and are known or likely to occur on the FNP site or in counties traversed by FNP transmission lines. Data provided by FWS, ADCNR, and FFWCC consisted of special status species known to occur in counties crossed by the transmission lines. FNAI provided a list of special status species known to occur in Jackson County, and included more precise data than county occurrences. Specifically, the FNAI database indicated no recorded occurrences of special status species within one mile of the Farley-Sinai Cemetery transmission line (the only FNP-transmission line in Florida). GADNR provided lists of special status species occurrences within three miles of the Farley-Raccoon Creek and Farley-South Bainbridge transmission lines.

In order to update various surveys and studies of plants and animals that are summarized in a number of unpublished documents and government reports, SNC commissioned field surveys in 2001 and 2002 of state- and federally-listed plant and animal species on the FNP site and its transmission corridors. These surveys, described in reports entitled *Threatened and Endangered Species Surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Corridors, 2001-2002* (**Tetra Tech NUS 2002a**) and *Threatened and Endangered Species Survey: Sinai Cemetery Transmission Line Corridor* (**Tetra Tech NUS 2002b**) were intended to: (1) identify listed species on the FNP site and associated transmission corridors and (2) provide a sound basis for the assessment of potential impacts to these species from operations over the license renewal term. In Table 2-1 the species observed during SNC-commissioned field surveys conducted in 2001-2002 are indicated by bolded species and county names.

No federally listed or proposed-for-listing plants were found during the 2001-2002 surveys of the FNP site and associated transmission line corridors. Yellow pitcher plants (*Sarracenia flava)* and hooded pitcher plants (*Sarracenia minor*), both listed as Unusual by GADNR, were found on the Farley-Raccoon Creek transmission corridor. Thorne's (swamp) buckthorn (*Sideroxylon thornei*), listed as Endangered by GADNR, was also found on the Farley-Raccoon Creek transmission corridor. One population of Florida willow (*Salix floridana)*, which had been previously identified by GPC biologists, was noted on the edge of the Farley-Raccoon Creek and Farley-South Bainbridge corridors (these two corridors overlap for the first seven miles east of FNP). The Florida willow is listed as Endangered by GADNR. No other state-listed plant species were observed on the transmission line corridors during the surveys. Details regarding the methods and results of the endangered and threatened plant surveys can be found in the two aforementioned reports (Tetra Tech NUS 2002a,b).

A single bald eagle (*Haliaeetus leucocephalus*), federally listed as Threatened and state-listed by GADNR as Endangered, was observed during the 2001 Summer survey perched in a tree on the eastern shoreline of the Chattahoochee River adjacent to FNP. No nests of this species are known in the vicinity. With the exception of this single bald eagle, no federally listed wildlife species were found on the FNP site during the 2001-2002 surveys.

Alligator (*Alligator mississippiensis*) tracks were observed at the entrance to an alligator den on the Farley-Sinai Cemetery transmission corridor. Alligators have been observed on the FNP site. The alligator is state-listed in Florida as a Species of Special Concern. The alligator is federally-listed as Threatened due to its similarity in appearance to the Endangered American crocodile (*Crocodylus acutus*). With the exception of the alligator, no federally listed wildlife species were found on the transmission line corridors during the 2001-2002 surveys.

State-listed animal species observed during the 2001-2002 field surveys consisted of the gopher tortoise (*Gopherus polyphemus*), osprey (*Pandion haliaetus)*, Bachman's sparrow (*Aimophila aestivalis*), and little blue heron (*Egretta caerulea*). Active gopher tortoise burrows were observed at FNP and within all six FNP-associated transmission corridors. The gopher tortoise is listed as Protected by ADCNR, Threatened by GADNR, and as a Species of Special Concern by FFWCC. Adult and nestling ospreys were observed at the FNP site on a nesting platform erected for this species. Ospreys are listed as Protected by ADCNR. Bachman's sparrows, listed as Rare by GADNR, were heard singing at two locations on the Farley-South Bainbridge corridor. A little blue heron, listed by FFWCC as a Species of Special Concern, was observed foraging in a marsh on the Farley-Sinai Cemetery corridor. Details regarding the methods and results of the endangered and threatened animal surveys can be found in the two survey reports (**Tetra Tech NUS 2002a,b**).

SNC is unaware of any candidate species (species that may warrant listing in the future, but have no current statutory protection under the Endangered Species Act) or species proposed for listing by the FWS that occur on the FNP site or along associated transmission line corridors.

2.6 DEMOGRAPHY

2.6.1 Regional Demography

The GEIS presents a population characterization method that is based on two factors: "sparseness" and "proximity" (**NRC 1996b,** Section C.1.4). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

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

Source: NRC 1996b.

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

Demographic Categories Based on Proximity

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

Source: NRC 1996b.

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

GEIS Sparseness and Proximity Matrix

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

Low Population Area (1.1, 1.2, 2.1) — Medium Population Area — High Population Area (3.4, 4.3, 4.4)

Source: NRC 1996b, pg. C-159.

Southern Company 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 FNP vicinity.

As derived from 2000 USCB information, approximately 93,120 people live within 20 miles of FNP. Applying the GEIS sparseness measures, FNP has a population density of 74 persons per square mile within 20 miles and falls into a less sparse category, Category 3 (having 60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles). 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 50 miles of FNP. This equates to a population density of 50 persons per square mile. Applying the GEIS proximity measures, FNP is classified as Category 2 (having no city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the FNP ranks of sparseness Category 3 and proximity Category 2, result in the conclusion that FNP is located in a medium population area.

All or parts of 28 counties and the City of Dothan are located within 50 miles of FNP (**Figure 2-1**).

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,** and 2000b).

In 1995, Alabama reported a population count of 4.3 million people, or 1.6 percent of the U.S. population, ranking 22nd 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 22nd 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 NUS 2001a**).

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

2.6.2 Minority and Low-Income Populations

Background

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

SNC used ArcView geographic information system software to combine USCB TIGER line data with USCB 2000 census data to determine the minority characteristics by block group. USCB 2000 low-income census data are not currently available; therefore, SNC used 1990 tract data for its low-income analysis. SNC included all block groups or tracts if any part of their area lay within 50 miles of FNP. The 50-mile radius includes 371 block groups and 138 tracts.

2.6.2.1 <u>Minority Populations</u>

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; other; multi-racial; aggregate of all minorities; and Hispanic ethnicity (**NRC 2001,** Appendix D). The Hispanic population is considered an "ethnic" and not a "racial" population. An ethnic population is generally identified by its cultural similarities, as opposed to racial (or biological) similarities. The U. S. Census Bureau makes this distinction for the Hispanic population because there have been difficulties in determining the differences and similarities of the numerous racial subgroups claiming to be Hispanic.

The guidance indicates that a minority population exists if either of the following two conditions exists:

1. Minorities comprise more than 50 percent of the population of the census block or environmental impact site.

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

NRC guidance calls for use of the most recent USCB decennial census data. SNC used 2000 census data from the USCB website (**USCB 2000a**) in determining the percentage of the total population within Alabama, Florida, and Georgia for each minority category, and in identifying minority populations within 50 miles of FNP.

SNC divided USCB population numbers for each minority population within each block group by the total population for that block group to obtain the percent of the block group's population represented by each minority. For each of the 371 block groups within 50 miles of FNP, SNC calculated the percent of the population in each minority category and compared the result to the corresponding geographic area's minority threshold percentages to determine whether minority populations exist. SNC defines the geographic area for FNP as all of Alabama when the block group is within Alabama, all of Florida when the block group is within Florida, and all of Georgia when the block group is within Georgia. USCB data (USCB 2000a) for Alabama characterizes 0.5 percent of the State as American Indian or Alaskan Native, 0.7 percent Asian, 0.0 percent Native Hawaiian or other Pacific Islander, 26.0 percent Black races, 0.7 percent all other single minorities, 1.0 percent multi-racial, 28.9 percent aggregate of minority races, and 1.7 percent Hispanic ethnicity. USCB data (**USCB 2000a**) for Florida characterizes 0.3 percent of the State as American Indian or Alaskan Native, 1.7 percent Asian, 0.1 percent Native Hawaiian or other Pacific Islander, 14.6 percent Black races, 3.0 percent all other single minorities, 2.4 percent multi-racial, 22.0 percent aggregate of minority races, and 16.8 percent Hispanic ethnicity. USCB data (USCB 2000a) for Georgia characterizes 0.3 percent of the State as American Indian or Alaskan Native, 2.1 percent Asian, 0.1 percent Native Hawaiian or other Pacific Islander, 28.7 percent Black races, 2.4 percent all other single minorities, 1.4 percent multi-racial, 34.9 percent aggregate of minority races, and 5.3 percent Hispanic ethnicity.

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, all other single minorities, or multi-racial minorities exist in the geographic area. Table 2-3 presents the numbers of block groups within each county, in the three relevant states, that exceed the threshold for establishing the presence of minority populations.

Based on the "more than 20 percent" criterion, Black race minority populations exist in 95 block groups (Table 2-3). **Figure 2-4** displays the locations of these minority block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, an aggregate of minority race populations exist in 93 block groups (**Table 2-3**). **Figure 2-5** displays the locations of these block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Hispanic ethnicity minority populations exist in one block group (Table 2-3). **Figure 2-6** displays the minority block group in Gadsden County, Florida.

2.6.2.2 <u>Low-Income Populations</u>

NRC guidance defines "low-income" by using U.S. Census Bureau statistical poverty thresholds (NRC 2001, Appendix D). U.S. Census Bureau (**USCB 2000c**) characterizes 16.8 percent of Alabama, 11.8 percent of Florida and 12.7 percent of Georgia households as low-income.

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

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

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

Based on the "more than 20 percent" criterion, four census tracts contain low-income populations (**USCB 2002**). Three of these tracts are in Georgia and one in Alabama. **Figure 2-7** locates low-income household tracts.

2.7 TAXES

FNP, through APC, pays annual property taxes to Houston County, Alabama. Property tax revenues fund Houston County operations, school systems, the County General Fund, hospitals, forestry activities, and individual town funds (**Moss 2001**). For the years 1995 to 1999, FNP's property taxes provided 32 to 38 percent of Houston County's total property tax revenues. Table 2-4 compares FNP's tax payments to Houston County tax revenues.

SNC projects that FNP's annual property taxes will remain constant at about $5 - 6 million through the license renewal period. The Alabama legislature is studying the issue of electric power industry deregulation. The effects of deregulation are not yet fully known, but could affect FNP's tax payments to Houston County. Any changes to FNP tax rates due to deregulation would, however, be independent of license renewal.

2.8 LAND USE PLANNING

This section focuses on Houston County because the majority of the permanent FNP workforce lives in this County (see **Section 3.4**) and FNP pays property taxes to Houston County. Houston County has experienced growth over the last several decades and land use planning tools, 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 incompatible land use mixes in contiguous areas and strip development. 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), 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**).

Current Land Use

Houston County occupies roughly 371,456 acres of land area (SEARP & DC 1998, Table 38). Major county-wide land use categories are classified as follows: 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), and forest (33.7 percent)[1]. Most land in the County is rural in nature, either vacant, forested, or in agricultural production. Approximately 286,428 acres or 77 percent of the county, is forested or used as farmland (SEARP & DC 1998, Table 38). 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 City of Dothan is the largest urban area in Houston County. Land in the City has been devoted to various uses that are 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) (City of Dothan 1999). Most land (58 percent) identified as forest, agricultural, and other (non-urban) is located outside of the City proper. Residential and commercial use are the two largest urban categories.

Most development in Dothan has centered around the existing infrastructure, notably the transportation and sanitary sewer networks. The overall effect has been to create an unbalanced pattern of development (City of Dothan 1999). 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. 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. Development has historically been less intense in the southern, eastern, and northern areas of the City, outside of the Ross Clark Circle (**City of Dothan 1999**).

As of 1999, Dothan had completed a program to build three new fire stations, construct new wells, and install approximately 40,000 linear feet of sanitary sewer collection and interceptor lines (City of Dothan 1999).

Most residential property in Dothan, approximately 61 percent, is owner-occupied (City of Dothan 1999). This includes conventional detached dwellings, townhouses, garden homes, and manufactured homes. Over the past 20 years, approximately 2,400 apartments and other multi-family housing units have been constructed (City of Dothan 1999). The vast majority of these units were constructed between 1977 and

[1] These percentages, as reported by the Southeast Alabama Regional Planning and Development Commission, total 86.7 percent, not 100 percent.

1984. Potential developers have indicated that relatively low lease rates in the City and reductions in federal assistance and loan guarantees largely account for the relatively few apartments constructed in recent years (**City of Dothan 1999**). In response to rising construction costs, manufactured housing has become an increasingly popular alternative (City of Dothan 1999). A considerable portion of the residential growth in the county consists of manufactured housing, in both individually-sited locations and manufactured home parks (City of Dothan 1999).

Commercial land uses account for approximately eight percent of the land in Dothan (City of Dothan 1999). 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 (City of Dothan 1999). In recent years, substantial commercial development has also occurred near the intersection of South Oates Street and Ross Clark Circle and the intersection of East Main Street and Ross Clark Circle. 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." In addition to a minor revival in traditional retail activity, a number of restaurants, clubs, and specialty shops have opened in downtown Dothan (City of Dothan 1999).

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 (City of Dothan 1999). 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 (City of Dothan 1999).

Future Land Use

Zoning and other land use mechanisms are in place in the more urbanized areas of the County. Development in rural areas of Houston County has been impeded by the lack of infrastructure improvements (**SEARP & DC 1998**). County-wide water systems are being built as funding becomes available. The City of Dothan continues to experience measurable residential growth (SEARP & DC 1998).

The City is pursuing a policy of "balanced growth", based upon the following policies (City Of Dothan 1999):

1. All land uses will be considered to be necessary to Dothan's orderly growth and development.
2. In the development of property, adjacent and neighboring land uses should complement each other to the greatest practical extent.
3. The balanced growth of the City will be encouraged.
4. Only that land which can be cost effectively served by existing or planned infrastructure and municipal services will be considered for annexation into the City.
5. The City will attempt to maximize the cost effectiveness of existing and planned infrastructure in order to assure the greatest return on taxpayer investments.
6. The City should consider the implementation of impact fees for new developments.

2.9 SOCIAL SERVICES AND PUBLIC FACILITIES

2.9.1 Public Water Supply

Houston County

In analyzing water supply facilities in the southeast Alabama region, water-related resource problems were identified as potential barriers to future development. Over the past 20 years, groundwater overdraft areas have developed within the region. The potentiometric surface in the vicinity of Dothan, Ft. Rucker (Dale County), and Enterprise (approximately 25 miles west of Dothan and 31 miles from FNP) has 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 100 feet and a recommendation has been made by the U.S. Department of Agriculture, 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 FNP, is serviced by Dothan Utilities. Dothan Utilities is 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 by as early as 2020. One of the options the city is considering is constructing, by 2011, a 10 million gallon per day (MGD) (expandable to 20 MGD) surface water treatment plant on the Chattahoochee River up stream of FNP between Columbia and FNP. The plant would connect to the City via a 36-inch pipe. The City should make a decision on constructing this plant by 2006 (**POLY 2001**).

Table 2-5 provides the details of Houston County's respective water suppliers and capacities.

2.9.2 Transportation

Road access to FNP is via State Road 95, a two-lane paved road with a north-south orientation. State Road 95 passes through the Towns of Columbia to the north and Gordon to the south (See **Figure 2-2**). 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 does not maintain level-of-service designations for roadways in the State. 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 FNP and the average number of vehicles per day, as determined by the Alabama Department of Transportation.

2.10 METEOROLOGY AND AIR QUALITY

FNP 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). The nearest nonattainment areas, designated as marginal for ozone, are Jefferson and Shelby Counties (Birmingham), Alabama, approximately 200 miles northwest of FNP and Fulton County (Atlanta), Georgia (designated as severe for ozone), approximately 185 northeast of FNP (**EPA 2001a**).

2.11 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Area History in Brief

Native Americans from the Early Archaic period inhabited the Chattahoochee region 6,000 to 8,000 years ago (**Fretwell 1980,** pg. 5). Archaeological evidence also indicates that two groups occupied this area about 800 AD; one group represented a local culture, while the other represented a culture from Florida (Fretwell 1980, pg. 5). By 1000 AD, these Native Americans had developed into mound builders and founded towns built around large, flat-topped earthen pyramids (**McGregory 1997,** pg. 11). For no apparent reason, the mound builders abandoned the area about 1300 AD (Fretwell 1980, pg. 5).

Many Native American town sites and relics of Seminole and Creek origin have been identified along the Chattahoochee and Choctawhatchee Rivers. The Omussee Tribe of the Yamasee Indians was driven out of the Carolinas by the British and settled in Southeast Alabama in 1715 (APC 1971, pg. 2-8). For the next 100 years, groups of this Tribe hunted locally and cultivated the area until they were forced to relocate again (**AEC 1972,** pg. II-15). Until 1814, the Lower Creek Indian town of Yufala was located about six miles south of FNP near Gordon, Alabama (**APC 1971,** pg. 2-8).

Pre-Operation

The FES for construction of FNP listed one historic (National Register of Historic Places) site in the vicinity of the Plant, the Kolomoki Mounds. These Indian mounds are 22 miles northeast of FNP in Early County, Georgia, and are preserved in a state park named for the mounds (AEC 1972, pg. II-15). The FES reports that pre-construction site visits by amateur archaeologists and Indian historians did not identify any cultural resources or places of historical interest on the FNP site (AEC 1972, pg. II-15). The Alabama Historical Commission conducted a thorough review of its inventories, files, maps, and documents in reference to the FNP site and determined that "the operation of this generating facility will not impair, encroach upon or destroy any significant, historical and archaeological landmark in Houston County, Alabama" (**Floyd 1974**).

Current Status

As of 2001, the National Register of Historic Places listed seven locations in Houston County, Alabama, four sites in Early County, Georgia, and two sites in Henry County, Alabama (**National Park Service 2001**). Of these 13 locations, only 2 fall within a 6-mile radius of FNP (**Figure 2-2**). One site is located in Early County, Georgia, and one in Houston County, Alabama; both are described below.

Purcell-Killingsworth House (Houston County, Alabama)

This Victorian mansion was completed in 1890 and was the boyhood home of Bishop Clare Purcell. Bishop Purcell was elected President of the Council of Bishops, the highest recognition ever achieved by a native-born Alabama Methodist minister. The house is currently a private residence with a historical marker (**Historic Chattahoochee Commission 1998**).

Coheelee Creek Bridge (Early County, Georgia)

This bridge is the southernmost covered bridge remaining in Georgia. It was built in 1891 and is 121 feet long. J. W. Baughman and 36 workers built the bridge, using a modification of the queen post truss design, under the authorization of the Early County Commissioners. Construction of the bridge on Old River Road lasted four months and cost $490.41 (**GDOT 2000**).

2.12 OTHER PROJECTS AND ACTIVITIES

As stated in Section 2.2, 44 miles downstream of FNP lies Lake Seminole, a 37,500-acre 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, hydro-power, recreation and related use purposes on the Apalachicola, Chattahoochee, and Flint River systems (**USACE 2002**). The dams were constructed to provide a 9-foot deep channel from the Gulf Intercoastal Waterway to Columbus, Georgia. The channel traverses the Apalachicola and the Chattahoochee Rivers, and the Flint River to Bainbridge, Georgia. Construction of this muti-purpose project began in 1947 and was completed in 1957 at a cost of 46.5 million (USACE 2002). Lake Seminole is operated at a relatively constant level at elevation 77.5 feet 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 (**Pool 2001**).

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 FNP. 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 (Pool 2001). Staffed 24 hours a day, the powerhouse control room regulates water flows and power generation for the lower end of the Chattahoochee River (USACE 2000). The George W. Andrews Lock and Dam is not a hydropower facility (Pool 2001).

As discussed in Section 2.9.1, Dothan, AL likely will need additional water sources by as early as 2020. One of the options Dothan is considering is constructing, by 2011, a 10 million gallon per day (MGD) (expandable to 20 MGD) surface water treatment plant on the Chattahoochee River upstream of FNP between Columbia and FNP. The plant would connect to the City via a 36-inch pipe. The City should make a decision on constructing this plant by 2006 (**POLY 2001**).

Georgia Power is relicensing three hydroelectric facilities near Columbus, GA 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 (**Georgia Power 2002**).

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a].

Common Name	Scientific Name	Federal Status	State Status Georgia	State Status Alabama	State Status Florida	Occurrence (State: County)[c]
Mammals						
Gray bat	*Myotis grisescens*	E	E	SP	E	Florida: Jackson
Southeastern bat	*Myotis austroriparius*	-	-	SP	-	Alabama: Barbour
Indiana bat	*Myotis sodalis*	E	E	SP	E	Florida: Jackson
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	-	R	SP	-	Florida: Jackson
Southeastern pocket gopher	*Geomys pinetis*	-	-	SP	-	Alabama: Dale, Houston
Sherman's fox squirrel	*Scirus niger shermani*	-	-	-	SSC	Florida: Jackson
Birds						
Bald eagle	*Haliaeetus leucocephalus*	T	E	SP	T	Alabama: Barbour, Henry; **Houston** Georgia: Baker, Early, Decatur
Osprey	*Pandion haliaetus*	-	-	SP	-	Alabama: **Houston**, Montgomery,
Wood stork	*Mycteria americana*	E	E	SP	E	Florida: Jackson Alabama: Barbour, Montgomery
Bachman's sparrow	*Aimophila aestivalis*	-	R	-	-	Florida: Jackson; Georgia: **Decatur**
Red-cockaded woodpecker	*Picoides borealis*	E	E	SP	T	Alabama: Geneva; Georgia: Worth; Florida: Jackson
Limpkin	*Aramus guarauna*	-	-	-	SSC	Florida: Jackson
Little blue heron	*Egretta caerulea*	-	-	-	SSC	Florida: **Jackson**
Snowy egret	*Egretta thula*	-	-	-	SSC	Florida: Jackson
Tricolored heron	*Egretta tricolor*	-	-	-	SSC	Florida: Jackson
White ibis	*Eudocimus albus*	-	-	-	SSC	Florida: Jackson
Southeastern American kestrel	*Falco sparverius paulus*	-	-	-	T	Florida: Jackson
Arctic peregrine falcon	*Falco peregrinus tundrius*	-	E	SP	E	Florida: Jackson
Black skimmer	*Rynchops niger*	-	-	-	SSC	Florida: Jackson

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a]. (Cont'd)

Common Name	Scientific Name	Federal Status	State Status Georgia	Alabama	Florida	Occurrence (State: County)[c]
Reptiles						
Barbour's map turtle	*Graptemys barbouri*	-	T	SP	SSC	Alabama: Houston; Florida: Jackson; Georgia: Baker, Decatur
Alabama map turtle	*Graptemys pulchra*	-	R	SP	-	Alabama; Montgomery
American alligator	*Alligator mississippiensis*	T(S/A)	-	-	SSC	Alabama: Houston Florida: **Jackson**
Eastern indigo snake	*Drymarchon corais couperi*	T	T	SP	T	Alabama: Barbour, Dale, Geneva, Henry, Houston, Montgomery, Pike; Florida: Jackson
Florida pine snake	*Pituophis melanoleucus mugitus*	-	-	SP	SSC	Florida: Jackson
Southern hognose snake	*Heterodon simus*	-	-	SP	-	Georgia: Early
Eastern coachwhip	*Masticophis flagellum flagellum*	-	-	SP	-	Alabama: Barbour
Gopher tortoise	*Gopherus polyphemus*	-	T	SP	SSC	Alabama: **Dale, Henry, Houston**; Florida: **Jackson**; Georgia: **Baker, Decatur, Early, Mitchell, Seminole, Worth**
Alligator snapping turtle	*Macroclemys temminckii*	-	T	SP	SSC	Florida: Jackson; Georgia: Decatur
Suwanee cooter	*Pseudemys concinna suwanniensis*	-	-	-	SSC	Florida: Jackson
Amphibians						
Pine barrens treefrog	*Hyla andersonii*	-	-	SP	SSC	Alabama: Geneva
Dusky gopher frog	*Rana capito sevosa*	-	-	SP	SSC	Alabama: Barbour; Florida: Jackson
Seal salamander	*Desmognathus monticola*	-	-	SP	-	Alabama: Henry
Georgia blind salamander	*Haideotriton wallacei*	-	T	-	SSC	Florida: Jackson
Flatwoods salamander	*Ambystoma cingulatum*	T	T	SP	SSC	Alabama: Houston; Florida: Jackson

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a]. (Cont'd)

Common Name	Scientific Name	Federal Status	State Status Georgia	State Status Alabama	State Status Florida	Occurrence (State: County)[c]
Fish						
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	-	-	SSC	Florida: Jackson; Alabama: Geneva
Shoal bass	*Micropterus sp 1*	-	-	-	SSC	Florida: Jackson
Redeye chub	*Notropis harperi*	-	R	-	-	Georgia: Baker, Decatur
Bluenose shiner	*Pteronotropis welaka*	-	R	-	SSC	Florida: Jackson; Georgia: Early
Crystal darter	*Crystallaria asprella*	-	-	SP	-	Georgia: Miller
Invertebrates						
Fat three-ridge	*Amblema neislerii*	E	E	-	-	Florida: Jackson
Chipola slabshell	*Elliptio chipolaensis*	T	-	SP	-	Florida: Jackson
Purple bankclimber	*Elliptoideus sloatianus*	T	T	-	-	Florida: Jackson; Georgia: Baker, Decatur, Miller
Southern kidneyshell	*Ptychobranchus jonesi*	-	-	SP	-	Alabama: Barbour,
Southern sandshell	*Lampsilis australis*	-	-	SP	-	Alabama: Barbour, Dale, Geneva, Henry, Pike
Shinyrayed pocketbook	*Lampsilis (Villosa) subangulata*	E	E	SP	-	Florida: Jackson, Georgia: Baker, Decatur
Gulf moccasinshell	*Medionidus penicillatus*	E	E	-	-	Florida: Jackson; Georgia: Baker, Decatur
Oval pigtoe	*Pleurobema pyriforme*	E	E	SP	-	Florida: Jackson; Georgia: Baker, Decatur
Vascular Plants						
Marianna columbine	*Aquilegia canadensis australis*	-	-	-	E	Florida: Jackson
Sicklepod	*Arabis canadensis*	-	-	-	E	Florida: Jackson
Variable-leaved Indian plantain	*Arnoglossum diversifolium*	-	T	-	E	Florida: Jackson, Georgia: Early
Purple honeycomb head	*Balduina atropurpurea*	-	R	-		Georgia: Tift, Worth
Apalachicola wild indigo	*Baptisia megacarpa*	-	-	-	E	Florida: Jackson

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a]. (Cont'd)

Common Name	Scientific Name	Federal Status	State Status Georgia	Alabama	Florida	Occurrence (State: County)[c]
Flyr's brickell-bush	*Brickellia cordifolia*	-	-	-	E	Florida: Jackson
Poppy mallow	*Callirhoe papaver*	-	-	-	E	Florida: Jackson
Sweet shrub	*Calycanthus floridus*	-	-	-	E	Florida: Jackson
Catesby's bindweed	*Calystegia catesbiana*	-	-	-	E	Florida: Jackson
Velvet sedge	*Carex dasycarpa*	-	R	-	-	Georgia: Early
Canada honewort	*Crytotaenia canadensis*	-	-	-	E	Florida: Jackson
Green fly orchid	*Epidendrum conopseum*	-	R	-	-	Georgia: Baker, Early, Seminole
Creeping morning-glory	*Evolvulus sericeus sericeus*	-	E	-	-	Georgia: Miller
Harper fmbry	*Fimbristylis perpusilla*	-	E	-	-	Georgia: Baker
Godfrey's privet	*Forestiera godfreyi*	-	-	-	E	Florida: Jackson
Liverleaf	*Hepatica nobilis*	-	-	-	E	Florida: Jackson
Florida anise tree	*Illicium floridanum*	-	E	-	T	Florida: Jackson
Mountain laurel	*Kalmia latifolia*	-	-	-	T	Florida: Jackson
Southern red lilly	*Lillium catesbaei*	-	-	-	T	Florida: Jackson
West's flax	*Linum westii*	-	-	-	E	Florida: Jackson
Curtiss loosestrife	*Lythrum curtissii*	-	T	-	E	Georgia: Decatur
Pondspice	*Litsea aestivalis*	-	T	-	E	Georgia: Seminole
Hummingbird flower	*Macranthera flammea*	-	-	-	E	Florida: Jackson
Ashe's magnolia	*Magnolia ashei*	-	-	-	E	Florida: Jackson
Pyramid magnolia	*Magnolia pyramidata*	-	-	-	E	Florida: Jackson
Green adders'-mouth	*Malaxis unifolia*	-	-	-	E	Florida: Jackson
Barbara's buttons	*Marshallia obovata*	-	-	-	E	Florida: Jackson
Baldwyn's spiny-pod	*Matalea baldwyneana*	-	-	-	E	Florida: Jackson
Florida spiny-pod	*Matalea floridana*	-	-	-	E	Florida: Jackson
Allegheny spurge	*Pachysandra procumbens*	-	-	-	E	Florida: Jackson
Crystal Lake nailwort	*Paronychia chartacea minima*	T	-	-	E	Florida: Jackson

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a]. (Cont'd)

Common Name	Scientific Name	Federal Status	State Status Georgia	Alabama	Florida	Occurrence (State: County)[c]
Purple cliff brake	*Pellaea atropurpurea*	-	-	-	E	Florida: Jackson
Eastern ninebark	*Physocarpus opulifolius*	-	-	-	E	Florida: Jackson
Hairy fever tree	*Pinckneya bracteata*	-	-	-	T	Florida: Jackson
Chapman's butterwort	*Pinguicula planifolia*	-	-	-	T	Florida: Jackson
Clearwater butterwort	*Pinguicula primuliflora*	-	T	-	E	Georgia: Early
Yellow fringed orchid	*Platanthera ciliaris*	-	-	-	T	Florida: Jackson
Yellow fringeless orchid	*Platanthera integra*	-	-	-	E	Florida: Jackson
Snowy orchid	*Platanthera nivea*	-	-	-	T	Florida: Jackson
Orange azalea	*Rhododendron austrinum*	-	-	-	E	Florida: Jackson
White-flowered wild petunia	*Ruellia noctiflora*	-	-	-	E	Florida: Jackson
Heart-leaved willow	*Salix eriocephala*	-	-	-	E	Florida: Jackson
Florida willow	*Salix floridana*	-	E	-	E	Florida: Jackson: Georgia: **Early**
Nettle-leaved sedge	*Salivia urtcifolia*	-	-	-	E	Florida: Jackson
Yellow flytrap	*Sarracenia flava*	-	U	-	-	Georgia: Tift, **Worth**
Hooded pitcherplant	*Sarracenia minor*	-	U	-	T	Georgia: Early, Tift, **Worth**
Parrot pitcherplant	*Sarracenia psittacina*	-	T	-	T	Florida: Jackson, Georgia, Early, Worth
Decumbent pitcherplant	*Sarracenia purpurea*	-	E	-	T	Florida: Jackson
Sweet pitcherplant	*Sarracenia rubra*	-	E	-	T	Georgia: Early
Scarlet magnoliavine	*Schisandra coccinea*	-	-	-	E	Florida: Jackson
Chaffseed	*Schwalbea americana*	E	E	-	E	Georgia: Baker, Early, Miller
Thorne's buckthorn	*Sideroxylon (Bumelia) thornei*	-	E	-	E	Florida: Jackson Georgia: **Early**, Decatur, Seminole
Silky buckthorn	*Sideroxylon (Bumelia) lycioides*	-	-	-	E	Florida: Jackson
Fringed campion	*Silene polypetala*	E	E	-	E	Florida: Jackson

Table 2-1. Special-Status Species Known or Likely to Occur at FNP or in Counties Traversed by FNP Transmission Line Corridors[a]. (Cont'd)

Common Name	Scientific Name	Federal Status	State Status Georgia	Alabama	Florida	Occurrence (State: County)[c]
Gentian pinkroot	*Spigelia gentianoides*	E	-	-	E	Florida: Jackson
Florida torreya	*Torreya taxifolia*	E	E	-	E	Florida: Jackson
Narrow-leaved trillium	*Trillium lancifolium*	-	-	-	E	Florida: Jackson
Relict trillium	*Trillium reliquum*	E	E	-	-	Alabama: Henry
Harper's yellow-eyed grass	*Xyris scabrifolia*	-	-	-	T	Florida: Jackson; Georgia: Worth
Northern prickley ash	*Zanthoxylum americanum*	-	-	-	E	Florida: Jackson

a. Species that the USFWS or NMFS has listed or proposed for listing as endangered or threatened; species that GADNR has listed or proposed for listing as endangered, threatened, rare, or unusual; species that ACDNR has listed as "state protected"; species that FDACS or FFWCC has listed or proposed for listing as endangered, threatened, or special concern.

b. E = Endangered – A species which is in danger of extinction throughout all or part of its range.
T = Threatened – A species which is likely to become an endangered species in the foreseeable future throughout all or part of its range.
T(S/A) = Threatened due to similarity of appearance – A species which is protected because it is very similar in appearance to a listed species.
R = Rare – A species which may not be endangered or threatened but which should be protected because of its scarcity (Georgia only).
U = Unusual – An unusual species that deserves special consideration (Georgia only).
SP = State Protected – Animal species that is protected by Alabama nongame species regulations. Note: Alabama has no special status for plant species.
SSC = Species of Special Concern – A species, subspecies, or isolated population which is facing a moderate risk of extinction in the future (Florida only).
– = Not Listed.

c. Species included in this table meet at least one of the following conditions:
- Species has been recorded to occur (or is likely to occur) on FNP or in at least one county traversed by FNP transmission lines (see **Attachment** C)
- Species has been recorded within three miles of the South Bainbridge or Raccoon Creek transmission lines (see **Attachment** C)
- Species was observed during SNC-commissioned field surveys conducted in 2001-2002 (Tetra Tech NUS 2002a, b)

Note: Bolded species and county names indicate species was observed during SNC-commissioned field surveys conducted in 2001-2002 (Tetra Tech NUS 2002a,b)

Table 2-2. Estimated Populations and Annual Growth Rates in Houston County, Alabama, from 1980 to 2040.

Year	Number	Percent
1970[a]	56,574	
1980[a]	74,632	3.2
1990[a]	81,331	0.9
2000[b]	88,787	0.9
2010[c]	98,766	1.1
2020[d]	109,580	1.1
2030[d]	119,434	0.9
2040[d]	129,288	0.8

a. USCB 1995.
b. USCB 2000b.
c. University of Alabama 1999.
d. Tetra Tech NUS 2001a.

Table 2-3. Minority and Low-Income Population Census Block Groups and Tracts.

County	State	2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	2000 Tracts	2000 Tracts Low-Income
Barbour	AL	21	0	0	0	11	0	0	11	0	9	0
Coffee	AL	21	0	0	0	2	0	0	2	0	10	0
Dale	AL	42	0	0	0	1	0	0	1	0	14	0
Geneva	AL	21	0	0	0	0	0	0	0	0	5	0
Henry	AL	17	0	0	0	5	0	0	5	0	6	0
Houston	AL	67	0	0	0	13	0	0	13	0	21	1
Pike	AL	4	0	0	0	2	0	0	2	0	2	0
Bay	FL	1	0	0	0	0	0	0	0	0	1	0
Calhoun	FL	10	0	0	0	0	0	0	0	0	3	0
Gadsden	FL	14	0	0	0	10	0	0	10	1	4	0
Holmes	FL	13	0	0	0	0	0	0	0	0	4	0
Jackson	FL	41	0	0	0	15	0	0	12	0	11	0
Liberty	FL	1	0	0	0	1	0	0	1	0	1	0
Washington	FL	12	0	0	0	1	0	0	1	0	3	0
Baker	GA	4	0	0	0	2	0	0	3	0	2	0
Calhoun	GA	6	0	0	0	5	0	0	5	0	2	0
Clay	GA	4	0	0	0	3	0	0	3	0	2	1
Decatur	GA	21	0	0	0	6	0	0	7	0	7	0
Dougherty	GA	1	0	0	0	0	0	0	0	0	1	0
Early	GA	13	0	0	0	5	0	0	5	0	5	0
Grady	GA	3	0	0	0	0	0	0	0	0	2	0
Miller	GA	5	0	0	0	1	0	0	1	0	3	0
Mitchell	GA	5	0	0	0	1	0	0	1	0	3	1
Quitman	GA	3	0	0	0	1	0	0	1	0	2	0
Randolph	GA	7	0	0	0	5	0	0	5	0	2	0
Seminole	GA	9	0	0	0	3	0	0	3	0	3	0
Stewart	GA	1	0	0	0	1	0	0	0	0	0	0
Terrell	GA	4	0	0	0	1	0	0	1	0	3	1
TOTALS		371	0	0	0	95	0	0	93	1	131	4

State Averages

States	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	Low-Income
Alabama	0.5%	0.7%	0.0%	26.0%	0.7%	1.0%	28.9%	1.7%	16.8%
Florida	0.3%	1.7%	0.1%	14.6%	3.0%	2.4%	22.0%	16.8%	11.8%
Georgia	0.3%	2.1%	0.1%	28.7%	2.4%	1.4%	34.9%	5.3%	12.7%

Table 2-4. Property Tax Revenues Generated in Houston County, Alabama; Property Taxes Paid to Houston County by Farley Nuclear Plant 1995 - 1999.

Year	Total Houston County Property Tax Revenues[a]	Property Tax Paid by Farley Nuclear Plant	Percent of Total Property Taxes
1995	$14,183,071	$5,359,687	38
1996	$14,526,166	$5,269,035	36
1997	$14,755,813	$5,022,201	34
1998	$15,273,543	$5,002,654	33
1999	$17,147,072	$5,413,050	32

a. Moss 2001.

Table 2-5. Houston County Public Water Suppliers and Capacities. (Use is per day and capacity is per minute.)

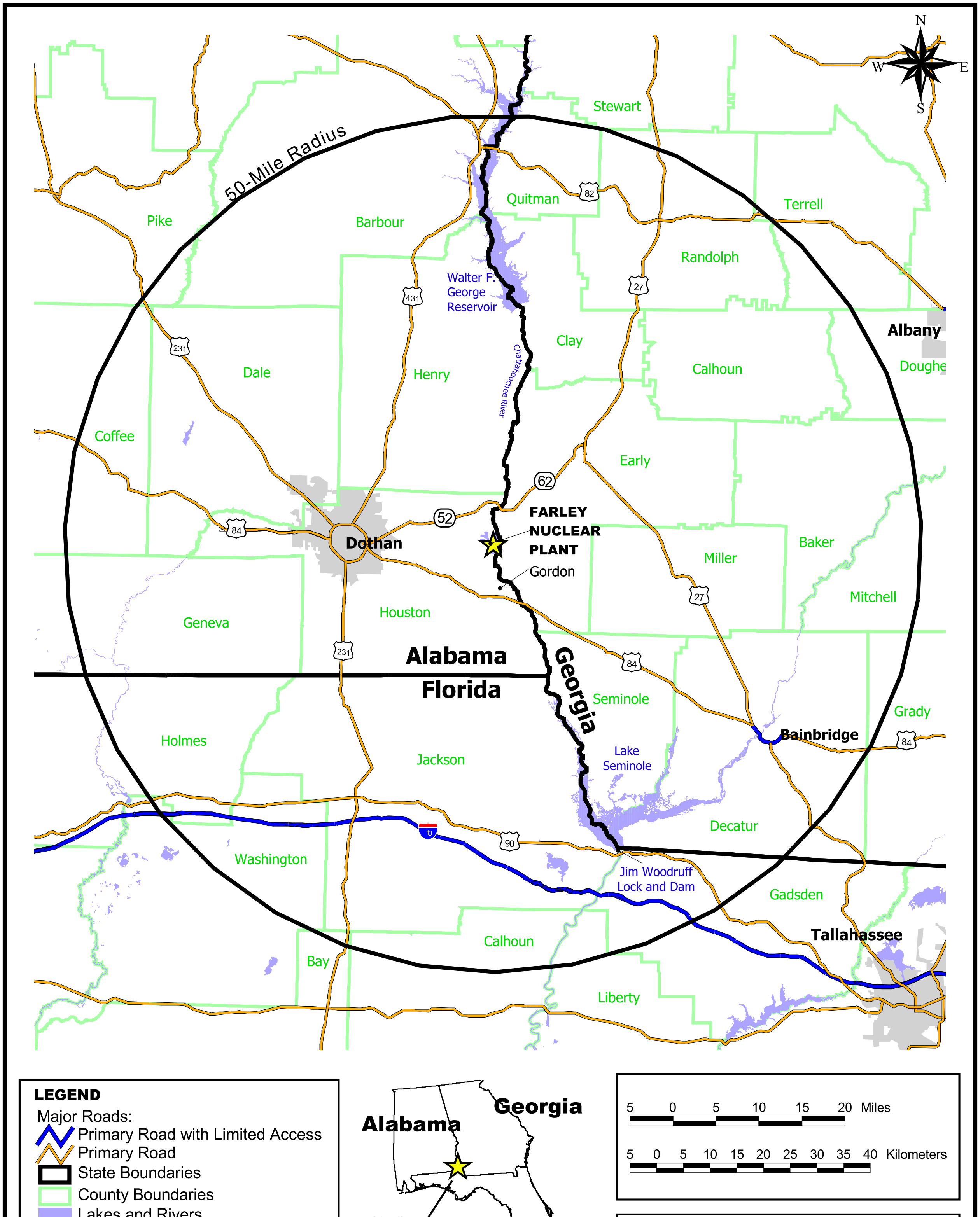
Water Supplier	Average Daily Use (gallons **per day**)	Maximum Capacity (gallons **per minute**)
Avon Water Supply	54,600	N/A
Columbia Water Works	115,000	350
Cottonwood Water Works	239,000	600
Cowarts Water System	257,000	600
Gordon Water Works	45,000	250
Houston County Water Authority	193,000	400
Kinsey Water System	181,000	585
Taylor Water System	461,000	1075
Webb Water System	139,000	200
Dothan Utilities	13,820,000	22,220

Source: Chapman 2001.
N/A = not available.

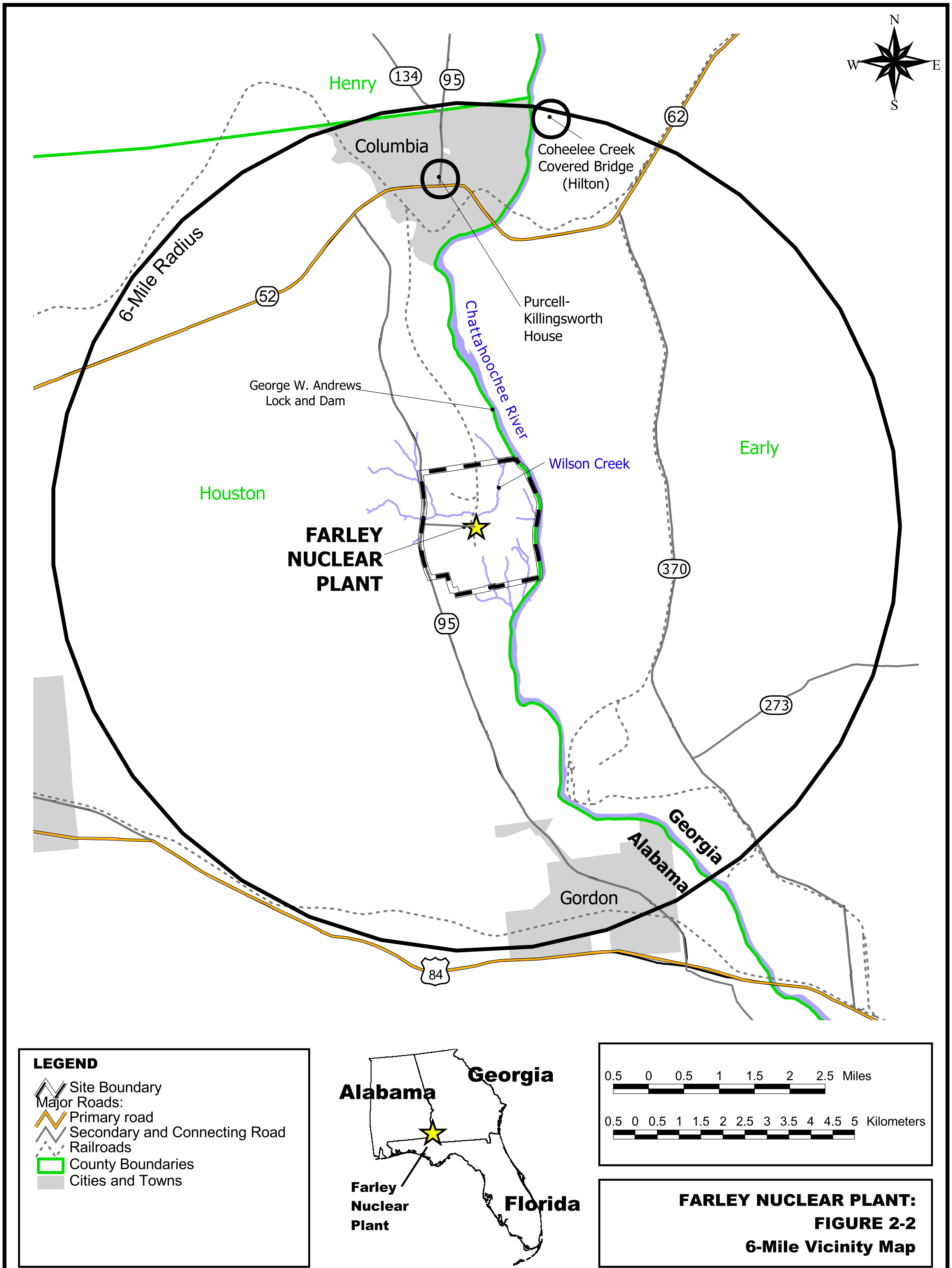
Table 2-6. Traffic Counts for Roads in the Vicinity of FNP.

Roadway and Location	Annual Average Daily Traffic
State Road 95, near FNP	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

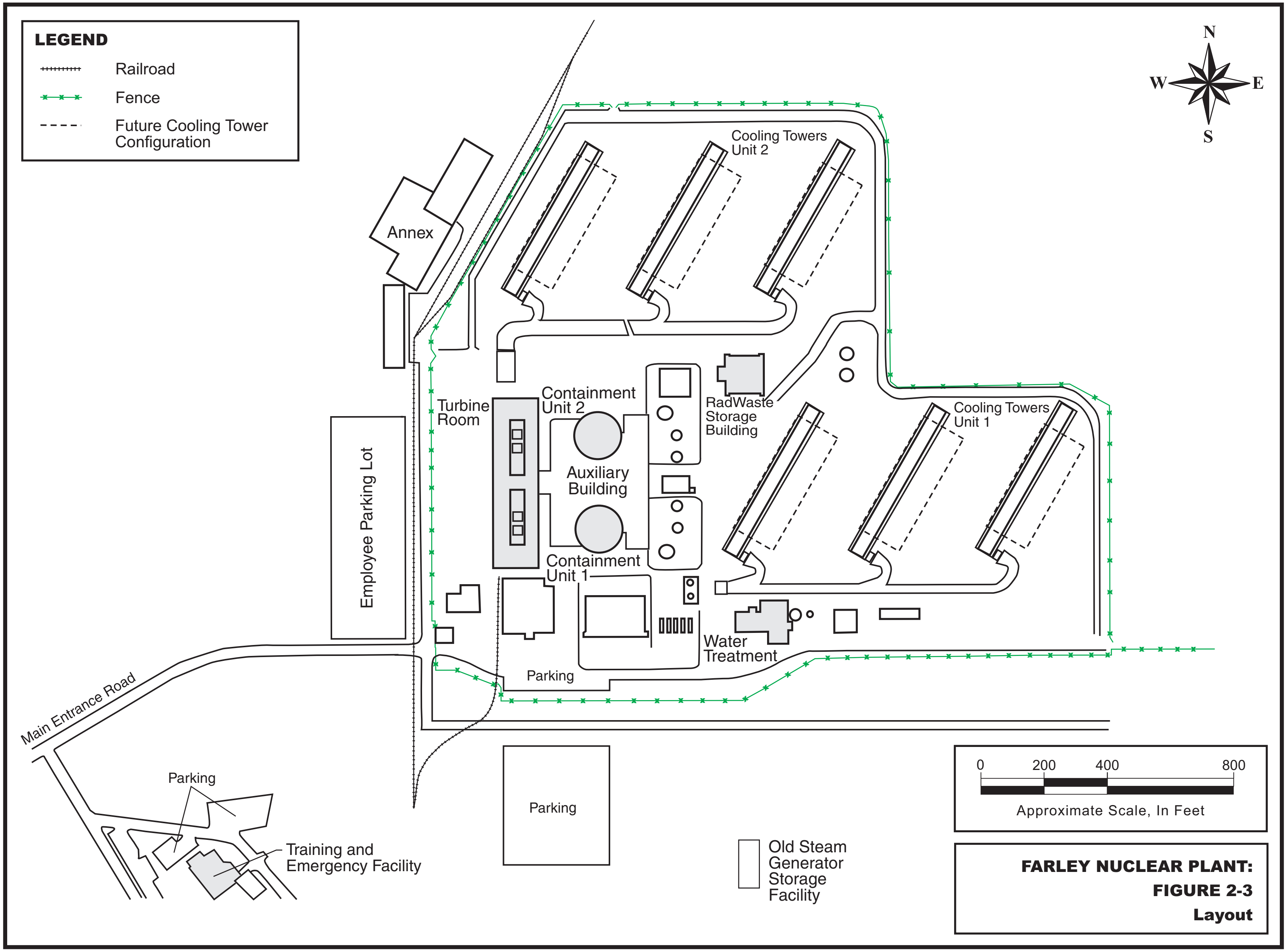
Source: ADOT 1999.



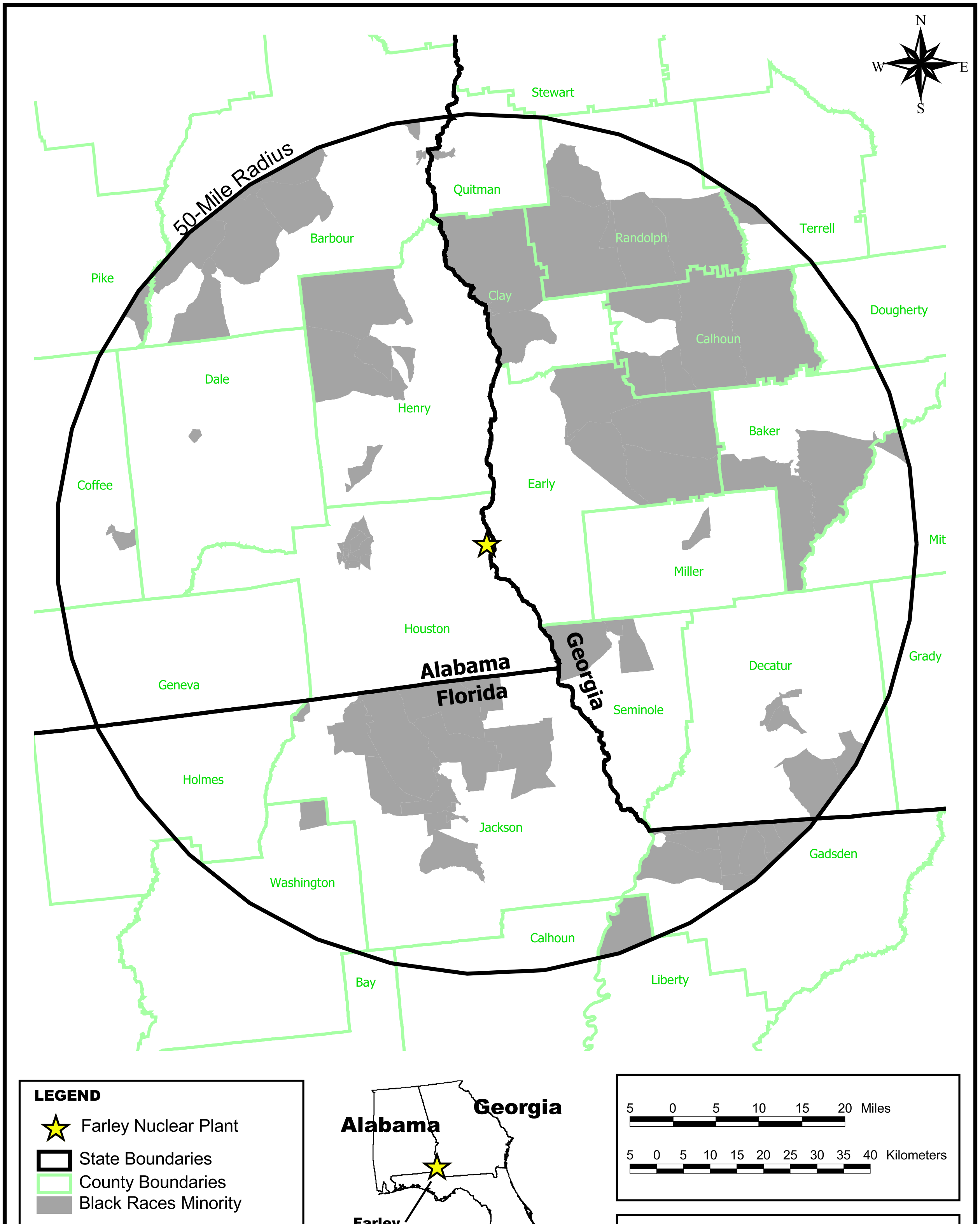
FARLEY NUCLEAR PLANT: FIGURE 2-1 50-Mile Vicinity Map



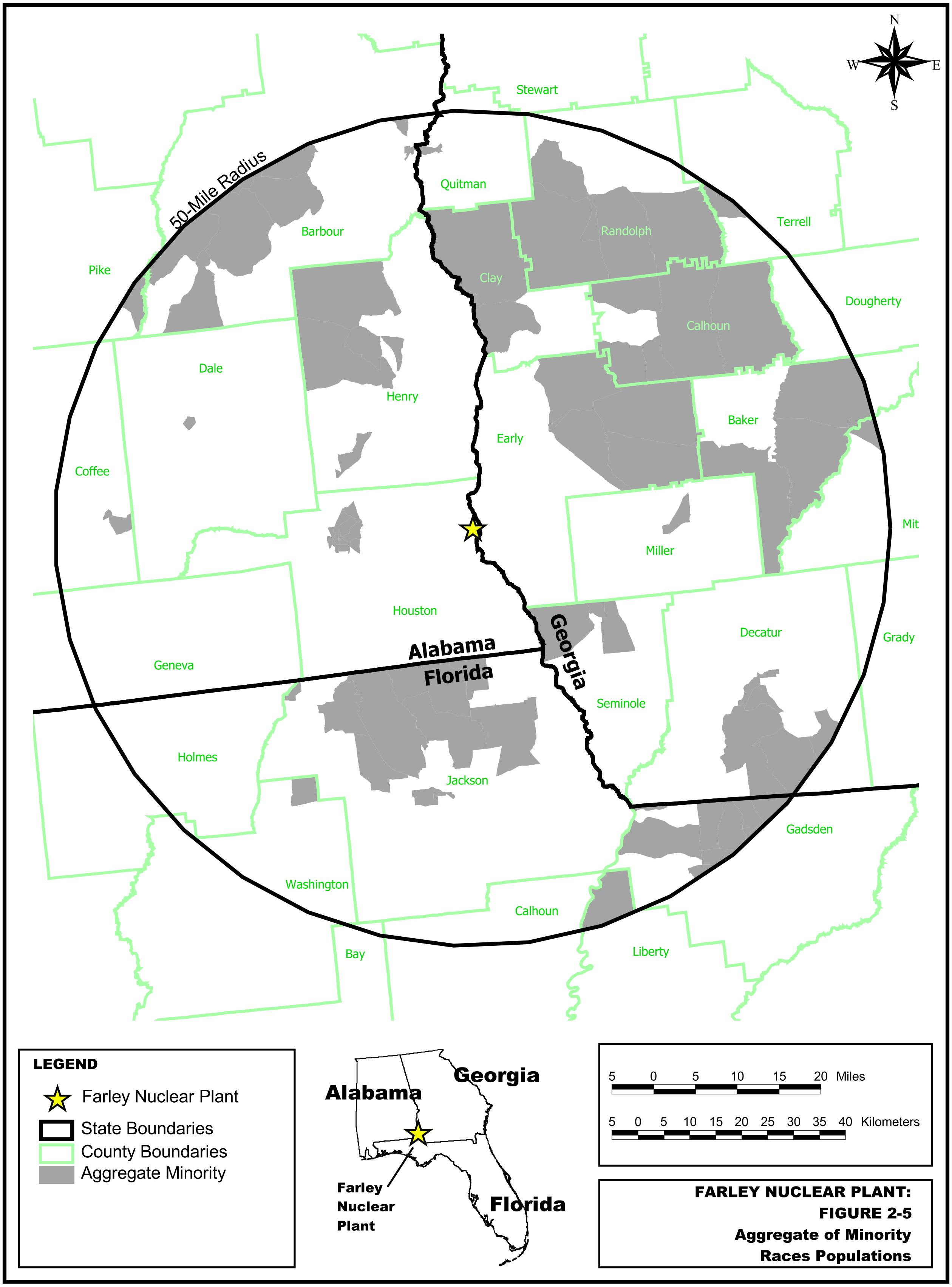
FARLEY NUCLEAR PLANT:
FIGURE 2-2
6-Mile Vicinity Map



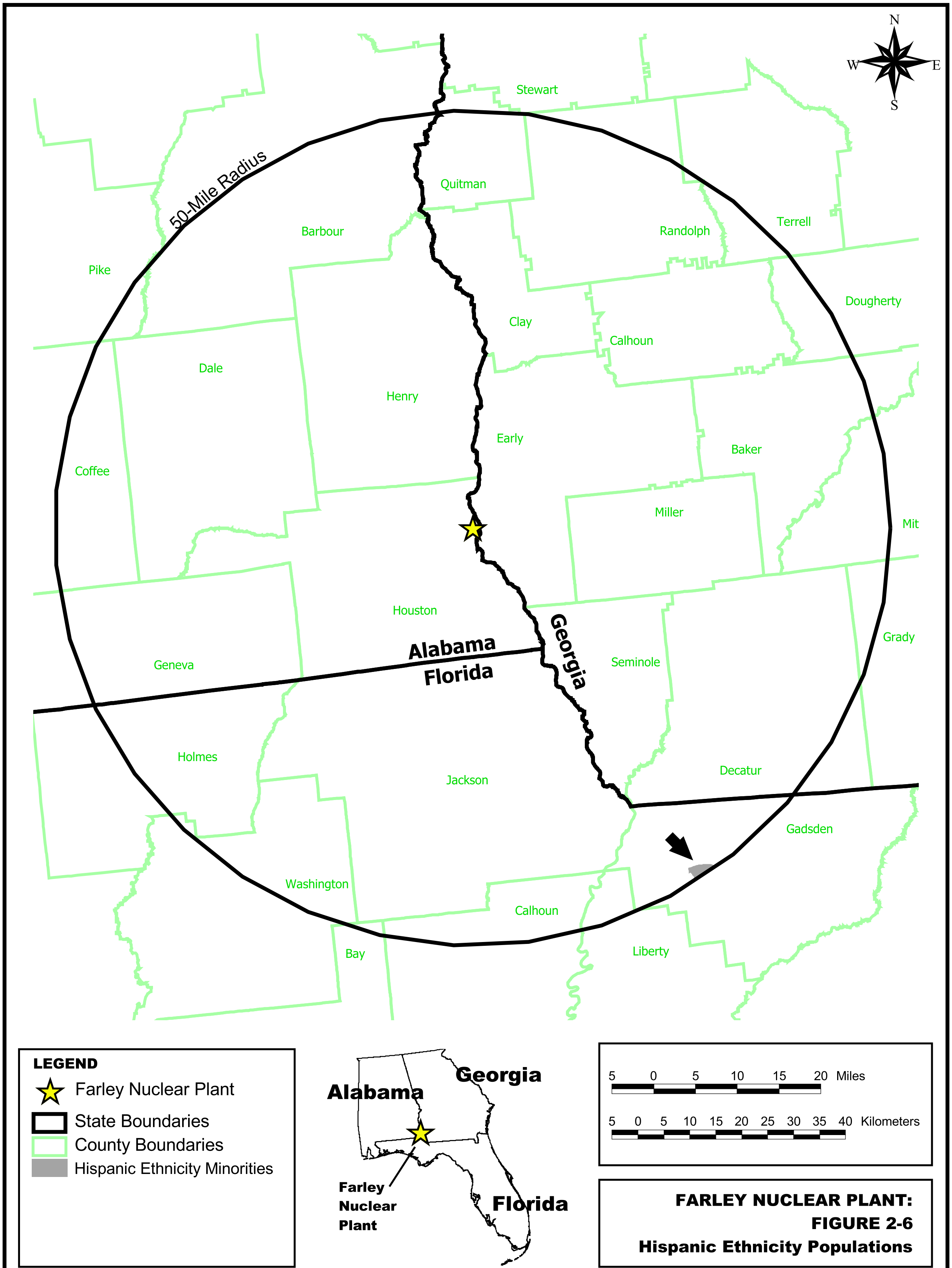
FARLEY NUCLEAR PLANT:
FIGURE 2-3
Layout



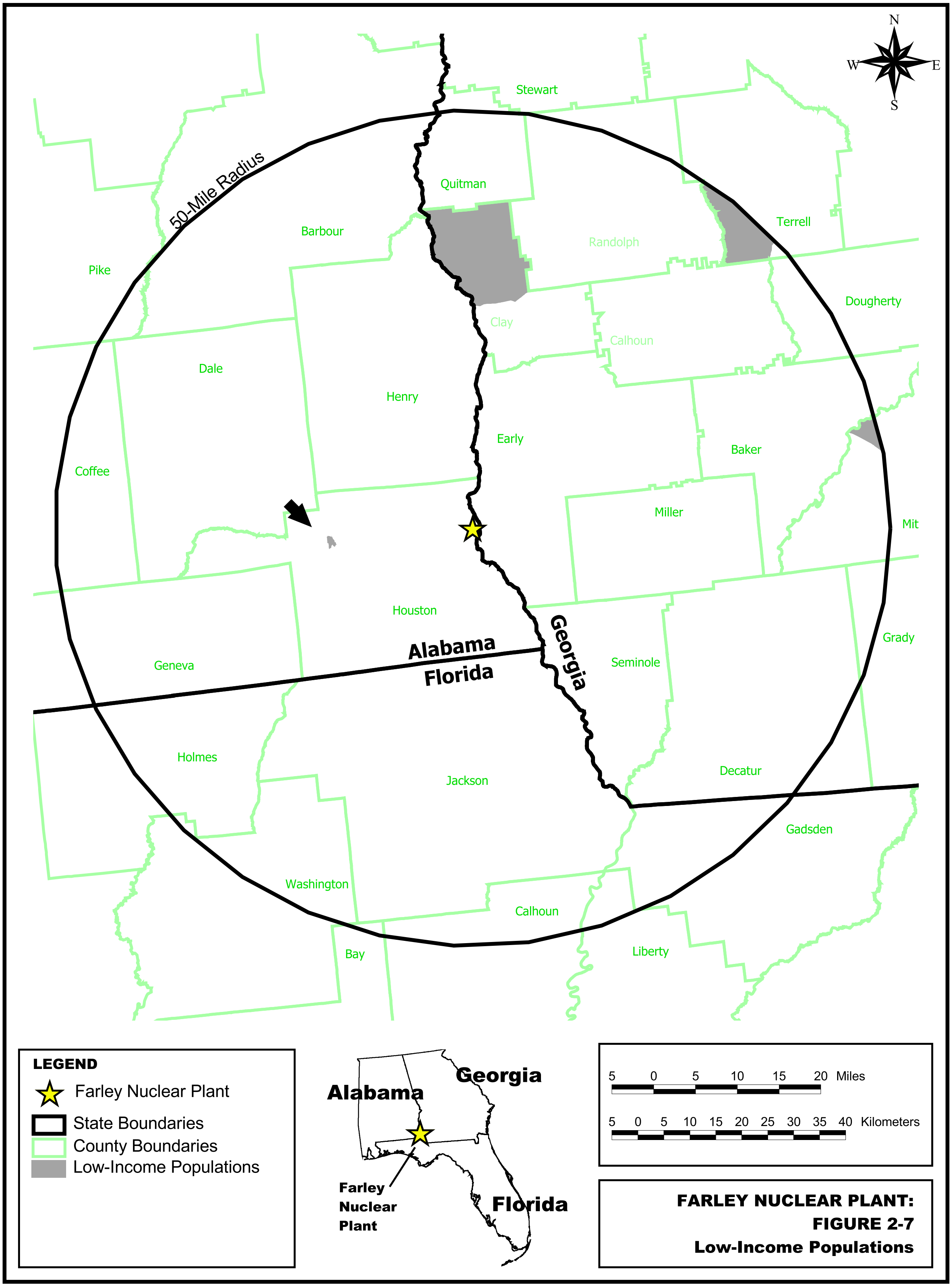
FARLEY NUCLEAR PLANT:
FIGURE 2-4
Black Minority Populations



FARLEY NUCLEAR PLANT:
FIGURE 2-5
Aggregate of Minority Races Populations



FARLEY NUCLEAR PLANT:
FIGURE 2-6
Hispanic Ethnicity Populations



FARLEY NUCLEAR PLANT:
FIGURE 2-7
Low-Income Populations

PAGE INTENTIONALLY LEFT BLANK

3.0 PROPOSED ACTION

NRC

"…The report must contain a description of the proposed action..." 10 CFR 51.53(c)(2)

SNC proposes that NRC renew the operating licenses for FNP for an additional 20 years. Renewal would give SNC and the States of Alabama, Georgia, and Florida the option of continuing to rely on FNP to meet future electricity needs. Section 3.1 discusses the Plant, in general (See **Figure 3-1**). Sections 3.2 through 3.4 address potential issues that license renewal could effect.

3.1 GENERAL PLANT INFORMATION

General information about FNP is available in several documents. In 1972, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared an FES related to the construction of FNP (**AEC 1972**). In 1974, AEC prepared an FES related to the operation of FNP (**AEC 1974**). The GEIS (NRC 1996b) describes important FNP features and, in accordance with NRC requirements, SNC maintains an Updated Final Safety Analysis Report for the Plant. SNC has referred to all of these documents while preparing this environmental report for license renewal.

3.1.1 Reactor and Containment Systems

FNP is a two-unit electric generating plant. Each unit is equipped with a nuclear steam supply system (NSSS) that utilizes a pressurized water reactor (**SNC 2000a,** pg. 1.1-1). Westinghouse Electric Corporation designed and supplied the NSSS and the turbine generators. FNP Units 1 and 2 achieved initial criticality in July 1977 and March 1981, respectively, and began commercial operations in December 1977 and July 1981, respectively.

The reactor containment structures are steel-lined, reinforced concrete, 138-foot-diameter cylinders with hemispheric 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 (SNC 2000a, pg. 1.2-9; AEC 1972, pg. III-1). 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. FNP fuel is slightly enriched uranium dioxide, with the highest enrichment to date of 4.6 percent. The Updated Final Safety Analysis Report indicates a 5 percent enrichment limit. SNC operates the reactors below the Updated Final Safety Analysis Report-mandated burnup rate limit of 60,000 megawatt-days per metric ton uranium.

As originally designed and operated, FNP Units 1 and 2 each had core thermal ratings of 2,660 megawatts-thermal (MWt), and a gross electrical output of approximately 861 megawatts-electrical (MWe) (SNC 2000a, pg. 1.1-2). In 1997, an uprate license amendment was submitted to NRC. Prior to the amendment submittal and as part of the power uprate review, SNC performed an environmental impact evaluation (**SNC 1997**), as required by the FNP Environmental Protection Plan. The amendment was approved on April 29, 1998 (**NRC 1998**). The current rated thermal power level for each unit is 2,775 MWt. The uprated gross electrical output for each unit is approximately 910 MWe. Unit 1 has a net electrical output of 847 MWe, and Unit 2's net output is 852 MWe (**EIA 2001c**).

3.1.2 Cooling and Auxiliary Water Systems

The FNP cooling system is a closed-cycle system utilizing six mechanical draft cooling towers (**NRC 1996b**). Each unit has three 14-cell cooling towers. As part of the plant's normal operating and maintenance activities, FNP is in the planning stages of constructing new mechanical draft cooling towers to replace the current towers for both units. Construction is to commence in January 2003 and be completed by May 2005. Through a phased implementation process, six 14-cell towers will be replaced by four 18-cell and two 16-cell towers. The new towers will be constructed on and adjacent to current tower locations (see **Figure 2-3**).

FNP uses both surface water and groundwater to meet its water supply needs. Groundwater is used for potable water, and as make-up fire-protection systems. Groundwater is also available as an alternate source of make-up for the demineralizer. The cooling water systems include a river water system that supplies the service water and circulating water systems for each unit. Chattahoochee River water provides service water, make-up to the circulating water system, and dilution water during periods of low flow, when releases to the river would exceed permit limits. The following sections discuss how surface water and groundwater are used at FNP.

3.1.2.1 Surface Water

A 200-foot canal moves water from the Chattahoochee River to the intake structure. The intake structure consists of three bays, each with 3/8-inch mesh vertical traveling screens to prevent small fish and debris from being entrained. The design velocity is less than 0.5 feet per second (fps) in the approach canal, and less than 1.0 fps across the traveling screens when the mean water elevation in the canal is 77 feet above mean sea level (**AEC 1974,** pg. 3-6). Accumulated debris is washed from the screens into a trough and collected for disposal. Ten pumps behind the intake bays move the water to a 108-acre storage pond (Service Water [SW] storage pond) at a rate of about 70,000 gpm (**NRC 1998**). These pumps have a total capacity of 97,500 gpm (AEC 1974, pg. 3-6).

Water is moved from the storage pond into the service water systems by 10 pumps (five for each unit). The service water intake structure has three pump bays, each with two entrances. Each entrance is 13 feet wide and 25.5 feet high. These entrance bays also are equipped with trash racks and vertical traveling screens. The velocity of water through these screens is 0.5 fps. These pumps withdraw water from the 108-acre storage pond at a rate of approximately 61,000 gpm (for both units; AEC 1974, pg. 3-8), but can pump as much as 90,000 gpm (AEC 1974, pg. 3-8).

During normal operations both service water systems' combined intake rate is approximately 61,000 gpm (AEC 1974, pg. 3-8). Make-up water for each circulating water system is withdrawn from each service water system at about 18,000 gpm (per unit; NRC 1998).

The water discharged from both units' service water and circulating water systems is combined and carried through a single pipe to the discharge structure, approximately 1,740 feet downstream of the intake. During normal operations water from both units discharges to the river at a rate of approximately 32,000 gpm (AEC 1974, pg. 3-11).

An oxidizing biocide is added to the service water system at the service water intake structure using best management practices to maintain concentrations adequate to control Asiatic clams *(Corbicula fluminea*) and microfouling organisms while maintaining total residual chlorine concentrations within permit limits. Biocides and other treatment chemicals are also added to the circulating water system. SNC monitors the discharge to ensure NPDES permit limits are complied with.

3.1.2.2 Groundwater

FNP uses groundwater for domestic purposes and for make-up to the fire protection system. **Figure 3-1** shows the location of the three onsite wells that currently supply the plant. Production Well No. 2, located north of the plant facilities, supplies the majority of FNP groundwater, with a 5-year average daily use of 117 gallons per minute (**SO 1997; SO 1998; SO 1999; SO 2000a; SO 2001a**). This well is located approximately 1,000 feet north of the plant and is 775 feet deep, drawing from the deep major aquifer (see **Section 2.3** for description of site groundwater resources). Construction[2] Wells No. 1 and 2 are located at the northern edge of the plant facilities, have a combined average daily use of 12 gallons per minute and draw from the major shallow aquifer, at depths of 240 feet and 385 feet, respectively. The site elevation at all three wells is approximately 183 above mean sea level.

In the past, the site has used additional wells. Production Well No. 3, located south of the plant facilities, is finished in the major shallow aquifer. FNP generally does not use Production Well No. 3 but had to in 1997 and 1998 due to operational issues that resulted in an unusually high water demand. During that time, Production Well No. 3 produced an average of 120 gpm and made up the balance of the 5-year total well usage of 169 gpm. Production Well No. 1 was been capped and retired in 1996.

3.1.3 Transmission Facilities

APC built five transmission lines specifically to connect FNP to the transmission system. Construction on a sixth transmission line (Farley-Sinai Cemetery) has recently been completed (**Figure 3-2**). The transmission system that connects FNP to the transmission grid has changed from original FES. New substations and lines have been constructed. The environmental report describes and evaluates all lines from FNP to the first substation that connects FNP to the transmission grid.

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

- <u>Farley-Webb</u> – This 230-kilovolt (kV) line provides power to and from the Webb Substation located approximately two miles east of Dothan, Alabama. The line is 10.5-miles long with a right-of-way (ROW) width of 125-feet and occupies 159 acres.

- <u>Farley-Pinckard</u> – This 230-kV line provides power to and from the Pinckard Substation approximately five miles west of Dothan. The line is 31 miles long with a ROW width of 125 feet and occupies 468.5 acres.

- <u>Farley-S. Bainbridge</u> – This 230-kV line provides power to and from the S. Bainbridge Substation 0.5 mile southwest of Bainbridge, Georgia. The line shares the ROW with the Farley-Raccoon Creek line for approximately the first seven miles of the ROW from the Farley site. The line is 46-miles long with a ROW width of 125 feet and occupies 697 acres.

- <u>Farley-Raccoon Creek</u> – This 500-kV line to the Raccoon Creek Substation. The line shares the ROW with the Farley-S. Bainbridge line for approximately the first seven miles of the ROW from the Farley site. The line is 62 miles long with a ROW width of 150 feet and occupies 1127 acres

- <u>Farley-Snowdoun</u> – This 500-kV line provides power to and from Snowdoun Substation, approximately four miles south of Montgomery, Alabama. The line is 96-miles long with a ROW 200-feet- and occupies 2321.4 acres.

- <u>Farley-Sinai Cemetery</u> – This 230-kV line has been newly constructed in an existing corridor 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 48 miles long with a ROW width of 125 feet, and occupies 582 acres.

For the specific purpose of connecting FNP to the transmission system, approximately 293.5 miles of transmission lines have been constructed and occupy approximately 5,355 acres of corridor (**AEC 1972,** pg. VIII-1). The corridors 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

[2] The name for these wells may be attributed to Daniel Construction Company; some records refer to them as Daniel Wells No. 1 and 2.

U.S. highways, including U.S. 231 and U.S. 431. Corridors 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.

All FNP 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. Maintenance practices are described in **Sections 2.4** and **4.13.**

3.2 REFURBISHMENT ACTIVITIES

NRC

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

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories…(2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." (NRC 1996b, Section 2.6.3.1)

SNC has addressed refurbishment activities in this environmental report in accordance with NRC regulations and the NRC GEIS for license renewal (NRC 1996b, Section 2.6.2). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list structures, systems, and components (SSCs) subject to an aging management review. Such SSCs that might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

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

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

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

SNC has performed some major modifications at FNP 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 FNP IPA that SNC conducted under 10 CFR 54, which SNC has included as part of its license renewal application, has not identified the need to undertake any refurbishment or replacement actions to maintain the functionality of important SSCs during the extended period of operation granted by the renewed licenses. Therefore, no refurbishment would be conducted as the result of license renewal that would directly affect the environment or plant effluents.

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

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

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item." NRC 1996b, Section 2.6.3.1, pg. 2-41. ("SMITTR" is defined in NRC 1996b, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21, identified 21 programs and inspections as managing aging effects at FNP. SNC does not anticipate that any additional personnel or resources above the current plant staffing will be required for the performance of the identified aging management programs. These programs are described in the *Application for Renewed Operation Licenses, Joseph M. Farley Nuclear Plant Units 1 and 2,* ***Appendix B***.

3.4 EMPLOYMENT

Current Workforce

SNC employs a nuclear-related permanent workforce of approximately 954 employees and up to an additional 375 (during the 2001 steam generator replacement) contract and matrixed employees at FNP; this is less than the range of 600 to 800 personnel per reactor unit estimated in the GEIS (**NRC 1996b,** Section 2.3.8.1). Approximately 77 percent of FNP's 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.

The FNP reactors are on an 18-month refueling cycle. During refueling outages, site employment can increase above the 830 permanent workforce by as many as 800 workers for temporary (30 to 60 days) duty. These numbers are within the GEIS range of 200 to 900 additional workers per reactor outage.

License Renewal Increment

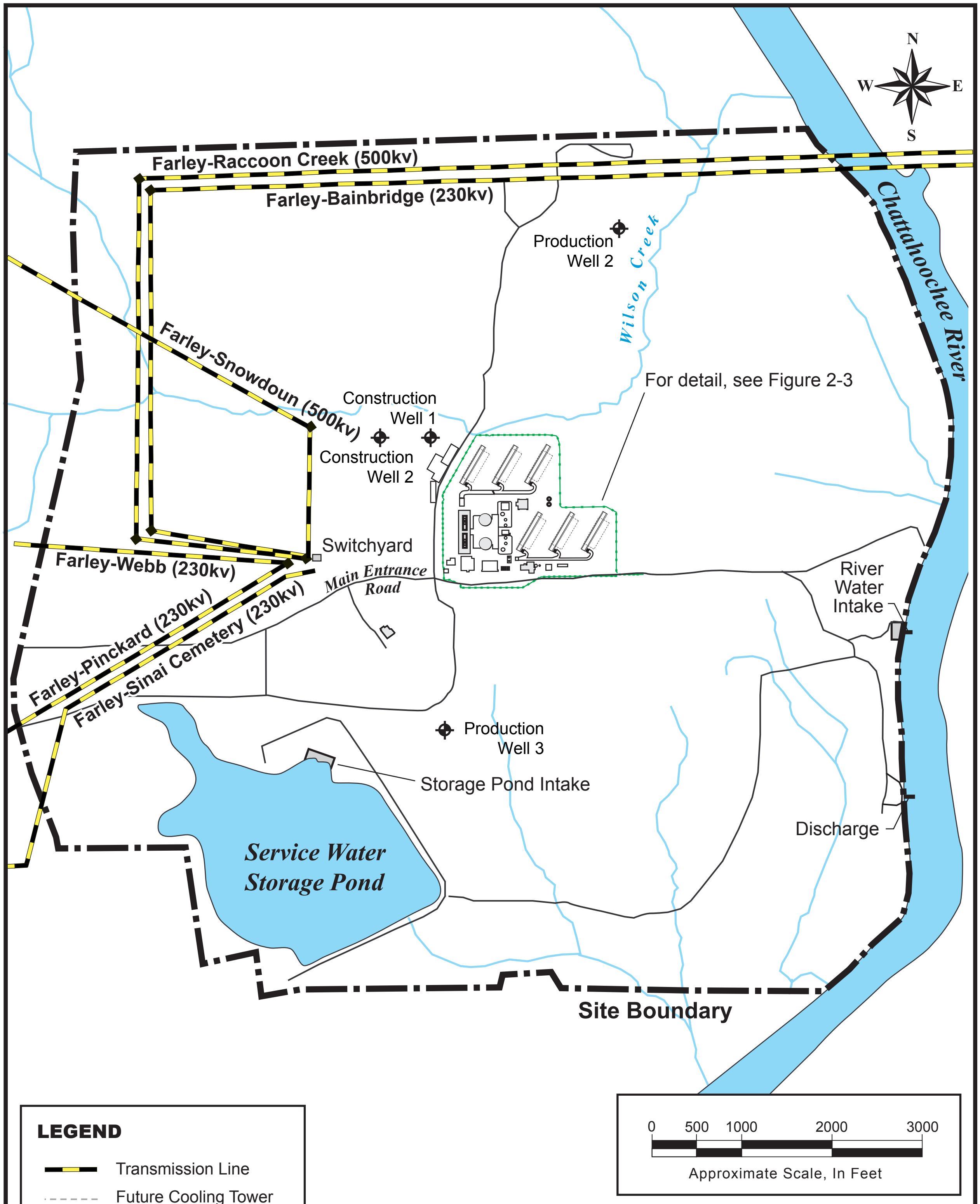
Performing the license renewal activities could necessitate increasing FNP staff workloads by some increment. The size of this increment would be a function of the schedule within which SNC must accomplish the work and the amount of work involved. Having determined that it would not undertake refurbishment (**Section 3.2**), SNC focused its analysis of the license renewal employment increment on programs and activities for managing the effects of aging (**Section 3.3**).

The GEIS (NRC 1996b, Section 2.6.2.7) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate SMITTR activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (NRC 1996b, Section B.3.1.3), but mostly during normal refueling and the 5- and 10-year in-service refueling outages (NRC 1996b, Table B.4).

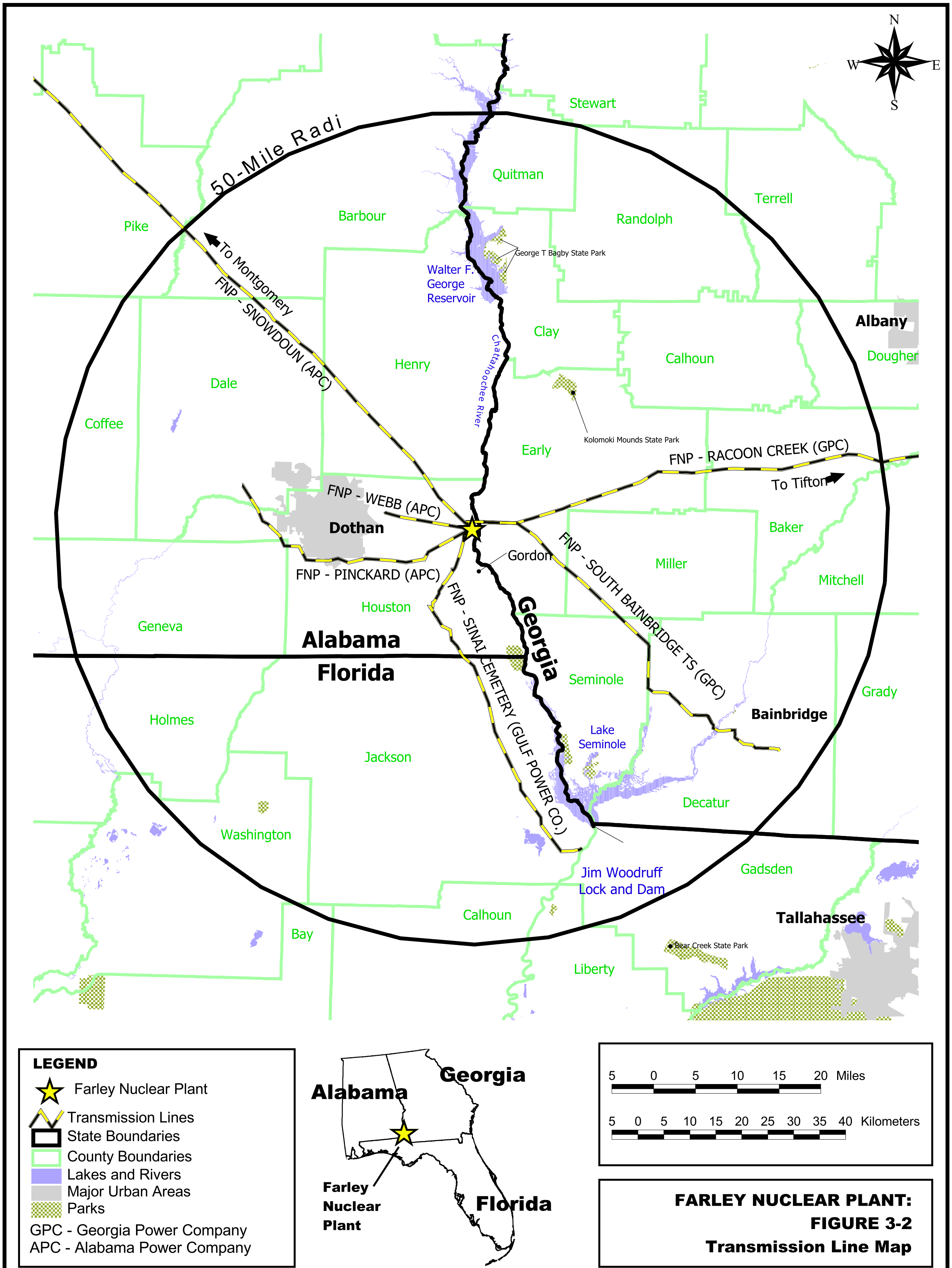
SNC has determined that the GEIS scheduling assumptions are reasonably representative of FNP incremental license renewal workload scheduling. Many FNP license renewal SMITTR activities would have to be performed during outages. Although some FNP license renewal SMITTR activities would be one-time efforts,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

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

SNC has identified no need for significant new aging management programs or significant modifications to existing programs. SNC expects that existing "surge" capabilities for routine activities will enable SNC to perform the increased SMITTR workload with existing staff. Therefore, SNC has no plans to add non-outage employees to support FNP operations during the license renewal term. Refueling and maintenance outages typically have durations of approximately 30 to 40 days and, as described above, result in a large, temporary increase in employment at FNP. SNC believes that increased SMITTR tasks can be performed within this schedule and employment level. Therefore, SNC has no plans to add outage employees for license renewal term outages.



FARLEY NUCLEAR PLANT:
FIGURE 3-1
Site Boundary



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

PAGE INTENTIONALLY LEFT BLANK

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

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

"…The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

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

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

Chapter 4 presents an assessment of the environmental consequences associated with the renewal of FNP operating licenses and, where appropriate, potential mitigating actions. NRC has identified and analyzed 92 environmental issues that are associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (categorization not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

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

If NRC analyses concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues. NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues. NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51, Appendix B, Table B-1) as described in the GEIS (**NRC 1996b**). An applicant may reference the generic findings or GEIS analyses for Category 1 issues. **Attachment A** of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

CATEGORY 1 LICENSE RENEWAL ISSUES

NRC

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

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

SNC has determined that, of the 69 Category 1 issues, 8 do not apply to FNP because they apply to design or operational features that do not exist at the facility. In addition, because SNC does not plan to conduct any refurbishment activities, NRC findings for the 7 Category 1 issues that apply only to refurbishment do not apply. **Table 4-1** lists these 15 issues and explains the SNC basis for determining that these issues are not applicable to FNP.

Table 4-2 lists the 54 Category 1 issues that SNC has determined to be applicable to FNP. The table includes the findings that NRC codified and references to supporting GEIS analyses. SNC has reviewed the NRC findings and has identified no new and significant information or become aware of any such information that would make the NRC findings inapplicable to FNP. Therefore, SNC adopts by reference the NRC findings for these Category 1 issues.

CATEGORY 2 LICENSE RENEWAL ISSUES

NRC

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

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

NRC designated 21 issues as Category 2. Sections 4.1 through 4.21 address each of the Category 2 issues, beginning with a statement of the issue. Some Category 2 issues (five) apply to operational features that do not exist at FNP. In addition, some Category 2 issues (four) apply only to refurbishment activities, none of which are necessary to renew the FNP operating licenses. If an issue does not apply to FNP, then the appropriate section below explains the basis for inapplicability.

For the remaining 12 Category 2 issues that SNC has determined to be applicable to FNP, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating licenses for FNP and, when applicable, discuss potential mitigative alternatives. SNC has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

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

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

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

In accordance with NEPA practice, SNC considered potential mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to chronic effects from electromagnetic fields, Issue 60, and environmental justice, Issue 92; however, SNC included these issues in **Table 4-2.** NRC noted that applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). SNC has included environmental justice demographic information in **Section 2.6.2** and an environmental justice analysis in **Section 4.21.**

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

NRC

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

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

NRC made surface water use conflicts a Category 2 issue because of possible water use conflicts. Some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (**NRC 1996b,** Section 4.3.2.1).

As discussed in **Section 3.1.2,** FNP has a cooling-water-tower-based heat dissipation system. Circulated cooling water lost to cooling tower evaporation and blowdown is replaced by make-up water pumped from the Chattahoochee River. Make-up water is pumped from the river to an onsite storage pond and added to the Plant's cooling water system, as needed.

The annual mean flow of the Chattahoochee River is 3.469×10^{11} cubic feet per year (1.1×10^{4} cfs) (**USGS 2000a**), which means that the Chattahoochee River meets the NRC definition of a small river. Therefore, this issue does apply.

FNP pumps river water to the Site (SW) Storage Pond to be used as make-up cooling water at an average rate of 69,854 gpm (155 cfs) (**SO 2001a, 2000a, 1999, 1998, 1997**), which is less than the approximately 90,000 gpm (201 cfs) projected in the 1974 FES. Cooling tower blowdown is returned to the river via National Pollutant Discharge Elimination System (NPDES) discharge at a rate of 8,476 gpm (19 cfs) (SNC 1997). Evaporative loss from the cooling towers is 27,140 gpm (60 cfs) (SNC 1997).

FNP discharged, via NPDES-permitted outfalls, service water composed of surface water and groundwater to the Chattahoochee River, an unnamed tributary to the Chattahoochee River, and to Wilson Creek, a tributary to the Chattahoochee River, at a rate of 57,844 gpm (129 cfs) over the 5-year period from 1996 to 2000 (SO 2001a, 2000a, 1999, 1998, 1997). Between 1976 and 1999, the Chattahoochee River's lowest annual mean flow was 2.6 million gpm (5,718 cfs) at the gauging station at Andrews Lock and Dam near Columbia, Alabama. The Alabama Department of Environmental Management uses a 7Q10 flow of 920,000 gpm (2,050 cfs) and a Most Probable flow of 3.6 million gpm (8,000 cfs) for NPDES permitting purposes.

If one assumes a discharge flow of 57,844 gpm from water use data, the net loss to the Chattahoochee River is 11,692 gpm (26 cfs) or 0.4 percent of the river's lowest annual mean flow between 1996 and 2000, 1 percent of the 7Q10 flow and 0.3 percent of the Most Probable flow.

The net loss to the river is small and creates little to no additional impact on riparian communities in the vicinity of the Plant. SNC has determined that this impact is SMALL and does not warrant mitigation.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

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

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

The issue of entrainment of fish and shellfish in early life stages does not apply to FNP because the Plant does not utilize once-through cooling or cooling pond heat dissipation systems.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

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

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

The issue of impingement of fish and shellfish does not apply to FNP because the Plant does not utilize once-through cooling or cooling pond heat dissipation systems.

4.4 HEAT SHOCK

NRC

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

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

The issue of heat shock does not apply to FNP because the Plant does not utilize once-through cooling or cooling pond heat dissipation systems.

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

NRC

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

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

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

Section 2.3 describes FNP groundwater resources, **Section 3.1.2.2** describes FNP wells, and **Figure 3-1** shows the location of the three operating wells. The combined average well usage is 169 gpm of groundwater. The usage being greater than 100 gpm, the issue of groundwater use conflicts applies to FNP license renewal.

SNC used data from Production Well 2 to evaluate the potential for groundwater use conflicts. Construction Wells No. 1 and 2 are smaller, having a combined usage of 4 gpm, are located further from the plant boundary, approximately 3,500 feet, and draw from a different aquifer than Production Well 2.

SNC used data taken from a specific-capacity test performed on Production Well 2 in 1972, from testing done in the same aquifer at an offsite location (**Robinson 2001**), and from a non-leaky aquifer scenario used to simulate site conditions. The equations used in the calculations conservatively assume that the aquifer is homogeneous, isotropic, with negligible recharge and gradient, and that boundary impacts do not occur. Based on the results of the modeling, drawdown at the closest site boundary attributable to Production Well 2 would have stabilized at approximately 2.6 feet after 10 years of operation (i.e., occurred approximately 1987). Drawdown through the current license period (40 years) in 2017 is predicted to increase to approximately 3.0 feet. At the end of the license renewal period (2037), drawdown is projected to be approximately 3.1 feet. Therefore, additional offsite drawdown attributable to pumpage during the license renewal period would be slightly more than 1 inch, effectively indiscernible (**Tetra Tech NUS 2001b**).

Because the effect of FNP groundwater use would effectively be indiscernible offsite, SNC concludes that the impact from groundwater use conflicts would be SMALL and that mitigation measures such as compensating for lost groundwater access or deepening offsite wells would be unwarranted.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS OR COOLING PONDS THAT WITHDRAW MAKE-UP WATER FROM A SMALL RIVER)

NRC

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

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

The issue of groundwater use conflicts applies because FNP is located on and withdraws make-up water from a small river, the Chattahoochee River, that has an annual flow of 3.469×10^{11} cubic feet per year (**USGS 2000b**). FNP uses a circulating cooling water system that takes water from a Site Service Water Storage Pond and discharges it to the Chattahoochee River. Make-up water for the Site Service Water Storage Pond is supplied from the Chattahoochee River.

Section 4.1 evaluates the effect that FNP consumptive use of Chattahoochee River water has, through cooling tower evaporation, on river water levels. The section concludes that plant consumption represents 1 percent of the 7Q10 river flow. **Section 2.3** describes area groundwater resources, noting that during high water flows the river provides recharge to the most shallow of the alluvial deposits in the floodplain but that these deposits are not an important aquifer due to their lenticular nature. Precipitation controls groundwater levels in the shallowest aquifer that is significant in the area.

Given the small percentage of the Chattahoochee River low flow that FNP consumptive use represents, 1 percent, and information indicating that floodplain alluvium groundwater that might be affected by river water level is not a significant aquifer, SNC concludes that impacts of withdrawing water from the river on the alluvial aquifer would be SMALL and that mitigation measures such as compensating for lost groundwater access or deepening offsite wells would be unwarranted.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

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

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

The issue of groundwater use conflicts does not apply to FNP because the Plant does not use Ranney wells. As **Section 3.1.2** describes, FNP uses cooling towers with make-up water from the Chattahoochee River.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

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

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

The issue of groundwater degradation does not apply to FNP because the Plant does not use cooling water ponds. As **Section 3.1.2** describes, FNP employs a closed circulating cooling system that uses cooling towers with make-up water from the Chattahoochee River.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

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

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

"…If no important resource would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." (NRC 1996b, Section 3.6, pg. 3-6)

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

4.10 THREATENED OR ENDANGERED SPECIES

NRC

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

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

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

Section 2.5 discusses threatened or endangered species that may occur at FNP or along associated transmission line corridors. As discussed in **Section 3.2,** SNC has no plans to conduct refurbishment or construction at FNP during the license renewal period. Therefore, there would be no refurbishment-related impacts to threatened or endangered species, and no further analysis of refurbishment-related impacts is applicable.

License renewal will not result in operational changes at FNP that would alter current natural resource management practices. FNP and its transmission lines have been in existence for more than 20 years, long enough for operational impacts to have stabilized. Current vegetation management practices in transmission corridors could actually be working to the benefit of species that depend on open conditions (e.g., gopher tortoise).

SNC wrote to the ADCNR, the GADNR, the FFWCC, the FNAI, the NMFS, and the FWS requesting information on any special status species or critical habitats that might occur on the FNP site or along associated transmission line ROWs, with particular emphasis on species that might be adversely affected by operations over the license renewal term. Copies of the SNC letters and agency responses are included in **Attachment C** of this environmental report.

Additionally, as discussed in Section 2.5, SNC commissioned its own field surveys in 2001 and 2002 of state- and federally-listed plant and animal species on the FNP site and along its transmission corridors. The results of these surveys may be found in the two SNC survey documents referenced in Section 2.5.

Based on the results of SNC's threatened and endangered species surveys and the responses from the federal and state agencies, SNC concludes that adverse impacts to threatened or endangered species from license renewal, would be SMALL and would not warrant mitigation.

4.11 AIR QUALITY DURING REFURBISHMENT

NRC

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

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

Air quality during refurbishment is not applicable to FNP because, as discussed in **Section 3.2,** SNC has no plans for refurbishment at FNP.

4.12 MICROBIOLOGICAL ORGANISMS

\

NRC

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

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

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

This issue is applicable to FNP because the Plant discharges to the Chattahoochee River, which has an average flow rate of 3.469×10^{11} cubic feet per year and is classified as a small river. Also, there is public access to the Chattahoochee River, including recreational fishing and swimming.

Organisms of concern include the enteric pathogens *Salmonella* and *Shigella,* the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba.

Bacteria pathogenic to humans have evolved to survive in the digestive tracts of mammals and accordingly have optimum temperatures of around 99 degrees Fahrenheit (°F) (**Joklik and Smith 1972,** pg. 65). Many of these pathogenic microorganisms (e.g., *Pseudomonas, Salmonella,* and *Shigella)* are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds (and thus in natural waters), but are usually only a problem when the host is immunologically compromised. Thermophilic bacteria generally occur at temperatures from 77°F to 176°F, with maximum growth at 122°F to 140°F (Joklik and Smith 1972, pg. 65).

SNC monitors water temperatures monthly as part of the Plant'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 88.0°F to 96.8°F. The highest temperature recorded was 96.8°F in July 2000 (**SNC 2000b**).

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 FNP sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the Chattahoochee River via FNP discharge. Wastewater, whether from domestic sewage or industrial sources, is frequently a source of pathogens in natural waters.

Fecal coliform bacteria are regarded as indicators of other pathogenic microorganisms, and are the organisms normally monitored by state health agencies. The NPDES permit for FNP 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). Samples are collected once per month for fecal coliform analysis and other parameters. The NPDES permit specifies a maximum 30-day average of 300 organisms per 100 milliliter (ml) sample (300/100ml), and a daily maximum of 300/100 ml. From 1998 to 2000, neither limit was exceeded during any sampling event.

It should also be noted that waterborne-disease outbreaks are generally rare and depend upon specific exposure conditions. The Centers for Disease Control and Prevention reports on waterborne-disease outbreaks throughout the United States. From 1997 to 1998, a total of 18 states reported 32 outbreaks associated with recreational water, which included both thermophilic and non-thermophilic microorganisms as confirmed etiological agents (**CDC 2000**). Most of the outbreaks associated with thermophilic microorganisms involved swimming and wading pools, hot tubs, and springs, with fecal contamination frequently a contributing factor. In 1998, only four cases of disease attributable to *Naegleria* were confirmed in the entire United States (CDC 2000). *Naegleria* infection usually occurs only in warm weather environments, when water near the bottom of a lake is forced up the nasal passage of a swimmer, and where pollution appears to be a factor (**EPA 1979**). However, studies have shown the absence of *Naegleria* infection and related disease among swimmers in lakes with high numbers of the pathogenic organism present (EPA 1979).

Given the thermal characteristics of the Chattahoochee River at the FNP thermal discharge and disinfection of sewage treatment plant effluent, SNC does not expect Plant operations to stimulate growth or reproduction of thermophilic microorganisms. Under certain circumstances, these organisms might be present in limited numbers in the discharge, where water temperatures can be as high as 96.8°F (**SNC 2000b**), but would not be expected in sufficient concentrations to pose a threat to recreational users of the Chattahoochee River.

SNC has written to the Watershed Planning and Monitoring Program in the Environmental Protection Division of the Alabama Department of Environmental Management, the Alabama Department of Public Health, and the Water Protection Branch of the Environmental Protection Division of the GADNR, requesting information on any studies that may have been conducted on thermophilic microorganisms in the Chattahoochee River and any concerns the agencies may have relative to these organisms. The agencies contacted did not identify any studies or concerns dealing with thermophilic microorganisms in the Chattahoochee River. Copies of the SNC letters and agency responses are included in **Attachment D** of this environmental report. SNC concludes that the impact of thermophilic organisms is SMALL and does not warrant mitigation.

4.13 ELECTRIC SHOCK FROM TRANSMISSION-LINE-INDUCED CURRENTS

NRC

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

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

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

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

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

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry
- the size of the charged object on the ground
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes an additional criterion to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt (kV) alternating current to ground.[3] The clearance must limit the steady-state induced current[4] to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

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

As described in Section 3.1.3, there are five existing lines that were specifically constructed to distribute power from FNP to the electric grid. Three of these lines are 230 kV and two are 500 kV. In addition, there is the 230-kV Farley-Sinai Cemetery line, which has recently been constructed in accordance with the NESC five-millampere requirement. Thus, SNC has not provided an analysis of this line in this report.

SNC's analysis of the five existing transmission lines began by identifying the limiting case for each line. The limiting case is the location along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, SNC calculated the electric field strength for each transmission line, then calculated the induced current of the sixth line.

SNC calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute (**EPRI 1991**). The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included design features of the limiting-case scenario, the NESC requirement that line sag be determined at 120°F conductor temperature, and the maximum vehicle size expected under the lines. For cases where paved roads exist, the vehicle size modeled was the largest permitted under Alabama or Georgia regulations (a tractor-trailer 55 feet long, 8 feet wide, and a maximum of 13.5 feet high). For cases without paved roads, a combine 30 feet long, 7.5 feet wide, and 11.5 feet high was modeled.

The analysis determined that the transmission lines are nominally in conformance with the five-milliampere NESC provision. Although the Farley-Snowdoun line analysis indicates a 5.1-milliampere induced current, the NESC limit specifies only one significant digit (5 milliamperes). The 5.1-milliampere induced current on the Farley-Snowdoun line is not considered significant as compared to the limit. Therefore, it is SNC's position that the FNP transmission line designs conform to the NESC provisions for preventing electric shock from induced current. The results for each transmission line are provided in **Table 4-3.** Details of the analysis, including the input parameters for each line's limiting case, can be found in Tetra Tech NUS (**2001c**).

APC, 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 corridors 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.

SNC's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance for the FNP transmission lines. This is because (1) the induced current is limited to 5 milliamperes, (2) the transmission lines would continue to be used regardless of license renewal, and (3) the proposed action has no effect on the current status of the lines. Due to the small significance of the issue, mitigation measures such as installing warning signs at road crossings or increasing clearances are not warranted. This conclusion would remain valid into the future, provided there are no material changes in line use, voltage, current, and maintenance practices and no changes in land use under the lines.

4.14 HOUSING IMPACTS

NRC

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

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

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996b, Section 4.7.1.1, pp. 4-101 to 4-102)

As described in **Section 3.2,** SNC has no plans to increase staff because no refurbishment-related activities required for extended operations due to license renewal have been identified. SNC concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required.

As **Section 3.4** indicates, SNC anticipates no increase in FNP employment attributable to license renewal. Therefore, SNC concludes there would be no impacts to housing.

4.15 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

NRC

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

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

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996b, Section 3.7.4.5, pg. 3-19)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996b, Section 4.7.3.5). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As **Section 3.4** indicates, SNC anticipates no increase in FNP employment attributable to license renewal. **Section 2.6** describes the FNP regional demography. **Section 2.9.1** describes the public water supply systems in the area, their permitted capacities, and current demands. As discussed in **Section 3.2,** no refurbishment is planned for FNP and no refurbishment impacts are therefore expected.

FNP does not use water from a municipal system and plant groundwater usage during the renewed license period of operations would be considered "indiscernible" (**Section 4.5**); therefore, SNC does not expect FNP operations to have an effect on local water supplies. Additionally, because SNC has no plans to increase Plant employment for license renewal purposes, SNC concludes that impacts on the public water supply would be SMALL and would not require mitigation.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

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

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

"…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service….Large impacts are associated with project-related enrollment increases above 8 percent…." (NRC 1996b, Section 3.7.4.1, pg. 3-15)

This issue is not applicable to FNP because, as discussed in **Section 3.2,** SNC has no plans for refurbishment at FNP.

4.17 OFFSITE LAND USE

4.17.1 Offsite Land Use – Refurbishment

NRC

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

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

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km^2), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)…." (NRC 1996b, Section 3.7.5, pg. 3-21)

This issue is not applicable to FNP because, as **Section 3.2** discusses, SNC has no plans for refurbishment at FNP.

4.17.2 Offsite Land Use – License Renewal Term

NRC

The environmental report must contain "An assessment of the impact of the proposed action on…land-use…" 10 CFR 51.53(c)(3)(ii)(I)

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

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996b, Section 3.7.5, pg. 3-21)

"…[I]f the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development…." (NRC 1996b, Section 4.7.4.1, pg. 4-108)

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

Population-Related Impacts

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996b, Section 4.7.4.1). Based on the GEIS case-study analysis, NRC concludes that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller "percentage of the local area's" total population than the percentage presented by operations-related growth (NRC 1996b, Section 4.7.4.2).

Tax-Revenue-Related Impacts

NRC has determined that the significance of tax payments as a source of local government revenue would be large, if the payments are greater than 20 percent of revenue (NRC 1996b, Section 3.7.3).

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

Small - very little new development and minimal changes to an area's land-use pattern

Moderate - considerable new development and some changes to land-use pattern

Large - large-scale new development and major changes in land-use pattern.

NRC further determined that, if a plant's tax payments are projected to be a dominant source of a community's total revenue (i.e., greater than 20 percent of revenue), new tax-driven land-use changes would be large.

Table 2-4 provides a comparison of total tax payments made by FNP to Houston County and the County's annual property tax revenues. For the five-year period from 1995 through 1999, FNP's tax payments to Houston County represented 32-38 percent of the County's total annual property tax revenues. Using NRC's criteria, FNP's tax payments are of large significance to Houston County. For the reasons presented below, however, Southern Company does not anticipate large land-use changes as a result of these tax revenues.

As described in **Section 3.2,** SNC does not anticipate refurbishment or construction during the license renewal period. Therefore, SNC does not anticipate any increase in the assessed value of FNP due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land-use and development patterns.

FNP has been, and would probably continue to be, a dominant 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 FNP environs have remained largely rural, county population growth rates after FNP construction have been minimal, and county planners are not projecting large land use changes (**Solomon 2001**). SNC believes continued operation of FNP 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.

Conclusion

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

4.18 TRANSPORTATION

NRC

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

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

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996b, Section 3.7.4.2, pp. 3-18 and 3-19)

As described in **Section 3.2,** no refurbishment is planned at FNP and no refurbishment impacts to local transportation are therefore anticipated. As discussed in **Section 3.4,** no additional license renewal employment increment is expected. Therefore, SNC expects no impacts from license renewal.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

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

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

"…Sites are considered to have small impacts to historic and archeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal-term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996b, Section 3.7.7, pg. 3-23)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (**NRC 1996b,** Section 4.7.7.3).

In its original evaluation of potential construction impacts, NRC staff concluded that no potentially valuable archaeological sites had been discovered in the project area by "amateur" archaeologists and local historians prior to construction and that no property listed in the National Register of Historic Places was jeopardized by construction of FNP (**AEC 1974,** pg. 11-16). After a review of potential operational impacts, NRC staff determined that no impacts to historically significant properties in the region were likely "...during the continuing operation of the transmission lines and while the plant is operational" (AEC 1974, pg. 11-16).

As discussed in **Section 3.2,** SNC has no refurbishment plans and no refurbishment-related impacts are anticipated. SNC is not aware of any historic or archaeological resources that have been affected to date by FNP operations, including operation and maintenance of transmission lines. SNC has no plans to change transmission line inspection and maintenance practices or ROW (vegetation) management practices over the license renewal term. Based on the fact that current practices are not expected to change significantly (there may well be minor changes in inspection and surveillance procedures, vegetation management procedures, etc.), SNC concludes that operation of these same generation and transmission facilities over the license renewal term would not impact cultural resources; hence, no mitigation would be warranted. Additionally, consultations with the State Historic Preservation Officers at the Florida Department of State – Division of Historic Resources, State of Alabama – Alabama Historical Resources – Historic Preservation Division, have confirmed that no historic properties or archeological resources that are listed in or are eligible for listing in the National Register of Historic Places would be affected by license renewal.

4.20 SAMA ANALYSIS

NRC

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

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

Section 4.20 describes how SNC analyzed a large number of alternatives to mitigate severe accidents and briefly summarizes the results of the analysis. **Attachment F** provides a more detailed description of the analysis methodology and the results.

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

Historically, the NRC has not included in its Environmental Impact Statements (EISs) or environmental assessments any analysis of alternative ways to mitigate the environmental impact of severe accidents. A 1989 court decision ruled that, in the absence of an NRC finding that severe accidents are remote and speculative, severe accident mitigation alternatives (SAMAs) should be considered in the NEPA analysis [*Limerick Ecology Action v. NRC*, 869 F.2d 719 (3d Cir. 1989)]. For most plants, including FNP, license renewal is the first licensing action that would necessitate consideration of SAMAs.

The NRC concluded in its generic license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because ongoing regulatory programs related to mitigation (i.e., Individual Plant Examination [IPE] and Accident Management) have not been completed for all plants. Since these programs have identified plant programmatic and procedural improvements (and in a few cases, minor modifications) as cost-effective in reducing severe accident and risk consequences, NRC thought it premature to draw a generic conclusion as to whether severe accident mitigation would be required for license renewal. Site-specific information to be presented in the environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes to key underlying assumptions.

Analysis

SNC maintains a probabilistic risk assessment (PRA) model to use in evaluating the most significant risks of radiological release from FNP fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, SNC used PRA model output as input to an NRC-approved model that calculated economic costs and dose to the public from hypothesized releases from the containment structure into the environment. The results of the FNP-specific analyses for severe accidents (Attachment F) show that the total core damage frequency is estimated at 3.35×10^{-5} per year (internal events), the off-site dose risk is estimated at 1.214 person-rem per year, and the off-site economic risk is estimated at $1,824. The contribution of external events to the total core damage frequency was not quantified, but was assumed to be bounded by the total frequency of internal event contributors.

Then, using NRC regulatory analysis techniques, SNC calculated the monetary value of the FNP severe accident risk based on the current plant operating characteristics. The result represents the monetary value of the base risk of dose to the public and workers, offsite and onsite economic costs, and replacement power. This value was used as a cost-benefit screening tool for potential SAMAs. The bounding analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvements) in excess of $1,400,000 are not cost-justified based on averted public health and economic risk. This baseline value was obtained by doubling the monetary value of the base risk due to internal event accident contributors to account for contributions from external events.

SNC used industry, NRC, and FNP-specific information to create a list of 128 SAMAs for consideration. SNC analyzed this list and screened out SAMAs that would not apply to the FNP design that SNC had already implemented at FNP, or that would achieve results that SNC had already achieved at FNP by other means. SNC prepared preliminary cost estimates for the remaining SAMAs and used the maximum averted cost-risk value to screen out SAMAs that would not be cost beneficial. Fifteen candidate SAMAs remained for further consideration, eleven of which required full model quantification for disposition.

SNC evaluated the remaining SAMAs using Plant Specific Analysis model insights or full model quantifications, which simulated SAMA implementation. The model runs simulating SAMA implementation yielded reduced cost-risk levels due to the impact of the modifications. The difference between the base case cost-risk value and the SAMA-reduced cost-risk value is defined as the averted risk, or a measure of the value of implementing the SAMA. SNC prepared more detailed estimates of the cost of implementing each SAMA and repeated the cost/benefit comparison. The results of this analysis are presented in **Table 4-4.**

The benefits of revising the operational strategies in place at FNP and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. The SAMA analysis has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected impact on a future population. All candidate SAMAs had costs that exceeded by far any attainable benefit. Several sensitivity analyses were conducted, but these indicated that none of the SAMA candidates could possibly attain a positive net benefit.

4.21 ENVIRONMENTAL JUSTICE

NRC

"The need for and the content of an analysis of environmental justice will be addressed in the plant-specific reviews." 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Background

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" (59 FR 7629, Feb. 11, 1994), requires federal agencies to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects" from their programs, policies, and activities on minority and low-income populations. The Presidential Memorandum that accompanied Executive Order 12898 emphasized the importance of using existing laws, including NEPA, to identify and address environmental justice concerns, "including human health, economic, and social effects, of federal actions." The Council on Environmental Quality (CEQ), which oversees the federal government's compliance with Executive Order 12898 and NEPA, issued "*Environmental Justice Guidance Under the National Environmental Policy Act*" (**CEQ 1997**) on December 10, 1997. This document provides general guidance and assists federal agencies with the development of NEPA procedures so that environmental justice concerns are effectively identified and addressed.

Although NRC is not subject to Executive Order 12898, it has voluntarily committed to conducting environmental justice reviews of actions under its jurisdiction. Specific guidance is provided in Attachment 4 to Office of Nuclear Reactor Regulation (NRR) Office Instruction No. Lic-203 "*Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues*" (NRC 2001).

These two documents (CEQ 1997; NRC 2001) do not provide a standard approach or formula for identifying and addressing environmental justice issues. Instead, they offer federal agencies general principles for conducting an environmental justice analysis under NEPA. They are the basis for the environmental justice review discussion that follows.

Environmental Impacts from the Proposed Action

SNC's analysis of the pertinent Category 2 issues [defined at 10 CFR 51.53(c)(3)(ii)] determined that impacts to human health and the environment from the operations of FNP over the license renewal term would be small. Based on the review of Category 2 issues, as discussed in Sections 4.1 through 4.20 of this document, an exhaustive demographic analysis and assessment of potential environmental justice impacts was not conducted. This phased approach to the assessment of potential environmental justice impacts is consistent with both CEQ and NRC guidance. NRC guidance makes clear that, if no significant impacts are anticipated from the proposed action, then "…no member of the public will be substantially affected" and, as a consequence, "…there can be no disproportionate high and adverse effects or impacts on any member of the public including minority or low-income populations."

Environmental Impact Site(s)

Per the Procedure for Environmental Justice Reviews (NRC 2001), environmental impact sites must be designated for all adverse human health or environmental impacts that are known to be significant or perceived as significant by groups or individuals. As noted above, based on the review of Category 2 issues, SNC has determined that no "environmental impact sites" exist at or around FNP. No significant adverse human or environmental impacts are expected as a result of operations over the license renewal term.

Selection of Geographic Area

The geographic area is defined as a larger area that encompasses all potential environmental impact sites (**NRC 2001**). SNC examined the geographic distribution of minority and low-income populations within a 50-mile radius of FNP. The 50-mile radius (geographic area) contains 371 census blocks and 131 census tracts (**USCB 2000a**). SNC included in the analysis all census blocks or tracts, if any part of a census block or tract fell within 50 miles of FNP. 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, as detailed in Section 2.6.2 of this document.

Conclusions

As part of its assessment of the proposed action, SNC examined potential impacts to air, land, water, and cultural resources within 50 miles of FNP. SNC has determined that no significant offsite impacts would be created by renewal of the FNP operating licenses. This conclusion is supported by the review performed of the Category 2 issues as defined in 10 CFR 51.53(c)(3)(ii). As the NRR Procedure acknowledges, if no significant offsite impacts occur in connection with the proposed action, then no member of the public will be substantially affected. Therefore, there can be no disproportionately high and/or adverse impacts on any member of the public, including minority and low-income populations, resulting from renewal of the FNP licenses. In such instances, a qualitative review of potential environmental justice impacts is adequate and no mitigation measures need be described.

Table 4-1. Category 1 Issues That Are NOT APPLICABLE to Joseph M. Farley Nuclear Plant[a].

Issues	Basis for Inapplicability to FNP
Surface Water Quality, Hydrology, and Use (for all plants)	
1. Impacts of refurbishment on surface water quality	Issue applies to activity, refurbishment, that FNP will not undertake.
2. Impacts of refurbishment on surface water use	Issue applies to activity, refurbishment, that FNP will not undertake.
4. Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter, not inland freshwaters.
5. Altered thermal stratification of lakes	Issue applies to plants that discharge to lakes.
12. Water use conflicts (plants with once-through cooling systems)	Issue applies to plants with once-through cooling systems.
Aquatic Ecology (for all plants)	
14. Refurbishment	Issue applies to activity, refurbishment, that FNP will not undertake.
Groundwater Use and Quality	
31. Impacts of refurbishment on groundwater use and quality	Issue applies to activity, refurbishment, that FNP will not undertake.
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	Issue applies to plants, that use less than 100 gpm of groundwater, not plants that use more.
36. Groundwater quality degradation (Ranney wells)	Issue applies to a plant feature, Ranney wells, that FNP does not have.
37. Groundwater quality degradation (saltwater intrusion)	Issue applies to plants in coastal areas, not inland sites such as FNP.
38. Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to cooling ponds[b] in salt marshes, not inland sites such as FNP. FNP has no cooling ponds.
Terrestrial Resources	
44. Cooling pond impacts on terrestrial resources	Issue applies to plants that use cooling ponds.
Human Health	
54. Radiation exposures to the public during refurbishment	Issue applies to activity, refurbishment, that FNP will not undertake.
55. Occupational radiation exposures during refurbishment	Issue applies to activity, refurbishment, that FNP will not undertake.
Socioeconomics	
72. Aesthetic impacts (refurbishment)	Issue applies to activity, refurbishment, FNP will not undertake.

< = less than
gpm = gallons per minute
NRC = U.S. Nuclear Regulatory Commission
a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. SNC added issue numbers for expediency.
b. NRC has defined "cooling pond" as "a manmade impoundment that does not impede the flow of a navigable system and that is used primarily to remove waste heat from condenser water prior to recirculating the water back to the main condenser...." (NRC 1996b, Section 4.4.1.1, pg. 4-51)

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a].

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
	Surface Water Quality, Hydrology, and Use (for all plants)	
3. Altered current patterns at intake and discharge structures	SMALL. 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.	4.3.2.2/4-3 (cooling tower)
6. Temperature effects on sediment transport capacity	SMALL. 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.	4.3.2.2/4-32
7. Scouring caused by discharged cooling water	SMALL. 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.	4.3.2.2/4-32
8. Eutrophication	SMALL. 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.	4.3.2.2/4-32
9. Discharge of chlorine or other biocides	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.	4.3.2.2/4-32
10. Discharge of sanitary wastes and minor chemical spills	SMALL. 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.	4.3.2.2/4-32
11. Discharge of other metals in waste water	SMALL. 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.	4.3.2.2/4-32
	Aquatic Ecology (for all plants)	
15. Accumulation of contaminants in sediments or biota	SMALL. 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.	4.3.3/4-33

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
16. Entrainment of phytoplankton and zooplankton	SMALL. 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.	4.3.3/4-33
17. Cold shock	SMALL. 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.	4.3.3/4-33
18. Thermal plume barrier to migrating fish	SMALL. 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.	4.3.3/4-33
19. Distribution of aquatic organisms	SMALL. Thermal discharge may have localized effects, but is not expected to affect the larger geographical distribution of aquatic organisms.	4.3.3/4-33
20. Premature emergence of aquatic insects	SMALL. 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.	4.3.3/4-33
21. Gas supersaturation (gas bubble disease)	SMALL. 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.	4.3.3/4-33
22. Low dissolved oxygen in the discharge	SMALL. 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.	4.3.3/4-33
23. Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	SMALL. 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.	4.3.3/4-33

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
24. Stimulation of nuisance organisms (e.g., shipworms)	SMALL. 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.	4.3.3/4-33
28. Entrainment of fish and shellfish in early life stages	SMALL. 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.	4.3.3/4-33
29. Impingement of fish and shellfish	SMALL. 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.	4.3.3/4-33
30. Heat shock	SMALL. 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.	4.3.3/4-33
Terrestrial Resources		
41. Cooling tower impacts on crops and ornamental vegetation	SMALL. 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.	4.3.4/4-34
42. Cooling pond impacts on terrestrial resources	SMALL. 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.	4.3.5.1/4-42
43. Bird collisions with cooling towers	SMALL. 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.	4.3.5.2/4-45
45. Power line right-of-way management (cutting and herbicide application)	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.	4.5.6.1/4-71
46. Bird collision with power lines	SMALL. Impacts are expected to be of small significance at all sites.	4.5.6.2/4-74

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

	Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	SMALL. 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.	4.5.6.3/4-77
48.	Floodplains and wetlands on power line right-of-way	SMALL. 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.	4.5.7/4-81
		Air Quality	
51.	Air quality effects of transmission lines	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.	4.5.2/4-62
		Land Use	
52.	Onsite land use	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.	3.2/3-1
53.	Power line right-of-way	SMALL. Ongoing use of power line rights-of-way would continue with no change in restrictions. The effects of these restrictions are of small significance.	4.5.3/4-62
		Human Health	
56.	Microbiological organisms (occupational health)	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.	4.3.6/4-48
58.	Noise	SMALL. 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.	4.3.7/4-49
60.	Electromagnetic fields, chronic effects	UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.	4.5.4.2/4-67

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
61. Radiation exposures to public (license renewal term)	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	SMALL. 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.	4.6.3/4-95
Socioeconomics		
64. Public services: public safety, social services, and tourism and recreation	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.	3.7.4/3-104 (renewal – public services) 3.7.4.3/3-18 (renewal – safety) 3.7.4.4/3-19 (renewal t – social) 3.7.4.6/3-20 (renewal – tourism, recreation) 4.7.3/4-104 (renewal – public services) 4.7.3.3/4-106 (renewal – safety) 4.7.3.4/4-107 (renewal - social) 4.7.3.6/4-107 (renewal – tourism, recreation)
67. Public services, education (license renewal term)	SMALL. Only impacts of small significance are expected.	4.7.3.1/4-106
73. Aesthetic impacts (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.7.6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.5.8/4-83

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
	Postulated Accidents	
75. Design basis accidents	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)
	Uranium Fuel Cycle and Waste Management	
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	SMALL. Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.	6.2/6-8
78. Offsite radiological impacts (collective effects)	The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste, and spent fuel disposal is calculated to be about 14,800 person rem, 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 dose projections 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 judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment 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	6.2.4/6-27

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
	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.	
79. Offsite radiological impacts (spent fuel and high-level waste disposal)	For the high-level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 310^{-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," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high-level waste	6.2.4/6-28.

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
	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. The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MTHM) repository. Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment 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. Note: This information from the regulation was accurate at the time it was promulgated.	

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
80. Nonradiological impacts of the uranium fuel cycle	SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical) 6.6/6-90 (conclusion)
81. Low-level waste storage and disposal	SMALL. 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.	6.4.2/6-36 ("low-level" definition) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects) 6.6/6-90 (conclusion)
82. Mixed waste storage and disposal	SMALL. 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 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.	6.4.5/6-63 6.6/6-91 (conclusion)
83. Onsite spent fuel	SMALL. 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.	6.4.6/6-70 6.6/6-91 (conclusion)

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
84. Nonradiological waste	SMALL. 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.	6.5/6-86 6.6/6-92 (conclusion)
85. Transportation	SMALL. 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 of 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.	Addendum 1
	Decommissioning	
86. Radiation doses	SMALL. Doses to the public will be well below applicable regulatory standards, regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.	7.3.1/7-15
87. Waste management	SMALL. 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.	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88. Air quality	SMALL. 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.	7.3.3/7-21 (air) 7.4/7-25 (conclusion)
89. Water quality	SMALL. 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.	7.3.4/7-21 (water) 7.4/7-25 (conclusion)
90. Ecological resources	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.	7.3.5/7-21 (ecological) 7.4/7-25 (conclusion)

Table 4-2. Category 1 and "NA" Issues That ARE APPLICABLE to Joseph M. Farley Nuclear Plant[a]. (Cont'd)

Issue	NRC Findings[b]	GEIS, Ref. NRC 1996b (Section/Page)
91. Socioeconomic impacts	SMALL. 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.	7.3.7/7-24 (socioeconomic) 7.4/7-25 (conclusion)
92. Environmental justice	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.	Not in GEIS

CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
GEIS = Generic Environmental Impact Statement (NRC 1996b)
Hz = Hertz
NA = Not applicable
NEPA = National Environmental Policy Act
NPDES = National Pollutant Discharge Elimination System
NRC = U.S. Nuclear Regulatory Commission

a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. SNC added issue numbers for expediency.
b. NRC has defined SMALL to mean that, for the issue, environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small. (10 CFR 51 Appendix B, Table B-1, Footnote 3).
c. NRC published, on September 3, 1999, a GEIS addendum in support of its rulemaking that re-categorized Issue 85 from 2 to 1.

Table 4-3. Results of Induced Current Analysis.

Transmission Line	Voltage (kV)	Limiting Case Peak Electric Field Strength (kV/meter)	Limiting Case Induced Current (milliamperes)
Pinckard	230	3.3	3.6
S. Bainbridge	230	3.5	3.5
Webb	230	3.9	4.6
Raccon Creek	500	5.2	4.8
Snowdoun	500	5.0	5.1

kV = kilovolt

Table 4-4. Summary of Detailed SAMA Analyses.

SAMA ID number	Averted offsite exposure cost	Averted offsite economic cost	Averted onsite exposure cost	Averted onsite cleanup cost	Averted replacement power cost	Total benefits	Cost of implementation	Net value of modifications
SAMA 7	$396	$6	$1,150	$35,757	$22,312	$59,621	$270,000/unit	($210,379/unit)
SAMA 11	$2,179	$39	$4,403	$136,952	$85,455	$229,028	$520,000/unit	($290,972/unit)
SAMA 24	$1,849	$456	$1,198	$37,264	$23,252	$64,019	$830,000/unit	($765,981/unit)
SAMA 89	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$425,000/unit	($387,500/unit)
SAMA 96	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$960,000/unit	($922,500/unit)
SAMA 101	$1,624	$24	$1,759	$54,697	$34,130	$92,233	$900,000/unit	($807,767/unit)
SAMA 117	$234	$5	$160	$4,972	$3,103	$8,474	$122,000/unit	($113,526/unit)
SAMA 118	$215	$4	$147	$4,558	$2,844	$7,768	$122,000/unit	($114,232/unit)
SAMA 119	$1,849	$456	$1,198	$37,264	$23,252	$64,019	$930,000/unit	($865,981/unit)
SAMA 120	$471	$10	$322	$10,004	$6,242	$17,049	$475,000/unit	($457,951/unit)
SAMA 123	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$330,000/unit	($292,500/unit)

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

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

Description of Process

The FNP Environmental Protection Plan (EPP) and SNC Environmental Services procedures govern review of environmental issues and serve as the bases for the process by which SNC identifies new and significant environmental information at FNP. Changes in plant design, operation, or tests and experiments with potential for environmental impact are reviewed in accordance with established procedures and responsibilities to ensure that such activities do not involve an unreviewed environmental question or changes to the EPP. The environmental impacts of license renewal, including new and significant information for FNP, were evaluated prior to submittal of the license application. Established procedures and responsibilities will ensure that any new and significant information related to renewal of the FNP licenses will be identified, reviewed, and addressed during the period of NRC review.

Review of Environmental Issues Prior to License Application Submittal

SNC Environmental Services performed an evaluation of environmental issues applicable to license renewal for FNP. This evaluation was performed on the Category 1 issues appearing in 10 CFR 51, subpart A, Appendix B, Table B-1 to verify that the conclusions of the GEIS remain valid with respect to FNP.

As a result of this review, SNC is not aware of any new and significant information regarding the Plant's environment or Plant operations that would make a generic conclusion codified by NRC for Category 1 issues not applicable to FNP, that would alter regulatory or GEIS statements regarding Category 2 issues, or that would suggest any other measure of license renewal environmental impact.

PAGE INTENTIONALLY LEFT BLANK

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

SNC has reviewed the environmental impacts of renewing the FNP operating licenses and has concluded that all impacts would be small and would not require mitigation. This environmental report documents the basis for SNC's conclusion. Chapter 4 incorporates by reference NRC findings for the 54 Category 1 issues that apply to FNP, all of which have impacts that are small (**Table 4-2**). The rest of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be small. **Table 6-1** identifies the impacts that FNP license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

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

"…The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

All impacts of FNP license renewal are small and would not require mitigation. Current operations include mitigation and monitoring activities that would continue during the license renewal term. SNC performs routine mitigation and monitoring activities to ensure the safety of workers, the public, and the environment. These activities include the radiological environmental monitoring program, continuous emissions monitoring, effluent chemistry monitoring, and effluent toxicity testing.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

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

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts. For Category 2 issues, SNC has followed NRC regulatory requirements, analyzed the issues and, where required, has addressed potential adverse effects (**Chapter 4**). For the applicable issues presented in Chapter 4, SNC has categorized all impacts as "small", based on NRC's impact significance definitions. NRC defines "small" as an effect that is either not detectable or so minor that it will neither destabilize nor noticeably alter any important attribute of the resource. Based on this definition, "small" impacts are not considered adverse and, therefore, no unavoidable adverse impacts have been identified.

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

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

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

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

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

NRC

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

The current balance between short-term use and long-term productivity at the FNP site was established when the Plant began operating in 1977. The FESs (**AEC 1972,** 1974) evaluated the impacts of constructing and operating FNP in rural Houston County, Alabama. Short-term use of natural resources would include use of land and water. The area surrounding the Plant site is chiefly rural and at least half is agricultural. Approximately 500 acres of the site are devoted to generating and support facilities. This includes the area occupied by buildings, structures, and landscaping around the FNP site proper and the 108-acre Service Water Storage Pond (**AEC 1974**). Transmission line construction required approximately 5,300 acres of forest, pasture, or cultivated land (including managed timber lands), and resulted in the alteration of natural wildlife habitats. Land areas disturbed during construction of the Plant, but not used, have been replanted with native grasses, trees, and shrubs (AEC 1974). The consumptive loss of water from Chattahoochee River due to the operation of the Plant is 0.3 percent of the most probable daily flow of the Chattahoochee River.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use (**NRC 1996b**), in this case, agricultural use and forestland. The extent of decommissioning will consider the intended new use of the site and balance health and safety considerations, salvage values and environmental impact. Decisions on the ultimate disposition of the site have not yet been made. Continued operation for an additional 20 years would not alter this conclusion.

Table 6-1. Environmental Impacts Related to License Renewal at FNP.

No.	Issue	Environmental Impact
		Surface Water Quality, Hydrology, and Use (for all plants)
13	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	**Small.** Evaporative losses from the Chattahoochee River would be approximately 0.3 percent of the upstream most probable daily flow and 1.0 percent of the 7Q10 flow which would have little or no effect on the Chattahoochee River and its riparian ecological communities.
		Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)
25	Entrainment of fish and shellfish in early life stages	**None.** This issue does not apply because FNP utilizes a cooling tower-based heat dissipation system.
26	Impingement of fish and shellfish	**None.** This issue does not apply because FNP utilizes a cooling tower-based heat dissipation system.
27	Heat shock	**None.** This issue does not apply because FNP utilizes a cooling tower-based heat dissipation system.
		Groundwater Use and Quality
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**Small.** From the end of the current license period to the end of the relicensing period, the incremental increase in drawdown is projected to be approximately 0.1 feet.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing make-up water from a small river)	**Small.** Evaporative losses from the Chattahoochee River would be approximately 1 percent of the 7Q10 and would not affect a significant aquifer.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because FNP does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** This issue does not apply because FNP does not use a cooling pond.
		Terrestrial Resources
40	Refurbishment impacts	**None.** No impacts are expected because FNP will not undertake refurbishment.
		Threatened or Endangered Species
49	Threatened or endangered species	**Small.** License renewal will not result in operational changes at FNP or on transmission corridors that would alter current natural resource management practices. Current vegetation management practices in transmission corridors could actually be beneficial for species that depend on open conditions (e.g., gopher tortoise).
		Air Quality
50	Air quality during refurbishment (nonattainment and maintenance areas)	**None.** No impacts are expected because FNP will not undertake refurbishment.
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**Small.** Given the circulating water system's discharge temperature and disinfection of the sewage treatment plant effluent, SNC does not expect plant operations to stimulate growth or reproduction of thermophilic microorganisms.

Table 6-1. Environmental Impacts Related to License Renewal at FNP. (Cont'd)

No.	Issue	Environmental Impact
59	Electric shock from transmission-line-induced current	**Small.** The largest modeled induced current under the FNP transmission lines would be 5.1 milliamperes (Farley-Snowdown Line). Because the NESC limit specifies only one significant digit (5 milliamperes), FNP transmission lines conform to NESC provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	**None.** SNC anticipates no additional employment.
65	Public services: public utilities	**None.** SNC anticipates no additional employment.
66	Public services: education (refurbishment)	**None.** No impacts are expected because FNP will not undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because FNP will not undertake refurbishment.
69	Offsite land use (license renewal term)	**Small.** No Plant-induced changes to offsite land use are expected from license renewal. Impacts from continued operation would be positive.
70	Public services: transportation	**None.** SNC anticipates no additional employment
71	Historic and archaeological resources	**Small.** Continued operation of FNP would not require construction at the site or new transmission lines. SNC is not currently aware of plant-related activities affecting archaeological or historic sites of significance within the area. Therefore, SNC concludes that license renewal would not adversely affect historic or archaeological resources.
		Postulated Accidents
76	Severe accidents	**None.** All candidate SAMAs had costs that exceeded any attainable benefit.

PAGE INTENTIONALLY LEFT BLANK

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

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

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

"…While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable.…" (NRC 1996b, Section 8.1, pg. 8-1).

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996g, Section II.H, page 66541, Column 3).

Chapter 7 addresses alternatives to FNP license renewal. The chapter evaluates what might happen if NRC did not renew the Plant operating licenses: what alternative actions might be undertaken; which alternatives are not reasonable and why; and, for reasonable alternatives, what the associated environmental impacts might be. Chapter 8 compares these impacts to those associated with license renewal.

In determining the level of detail and analysis that it should provide in Chapter 7, SNC relied on the NRC decision-making standard for license renewal:

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

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

7.1 NO-ACTION ALTERNATIVE

7.1.1 Decommissioning

Regardless of whether NRC renews the FNP operating licenses, and regardless of which alternatives are undertaken should NRC not renew the licenses, SNC must comply with NRC requirements for decommissioning a nuclear power plant.

The GEIS (**NRC 1996b,** pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement (DECON) and safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, SNC would continue operating FNP until the current license expires, and then initiate decommissioning activities in accordance with NRC requirements.

The GEIS describes decommissioning activities based on an evaluation of an example reactor (the "reference" pressurized-water reactor is the 1,175 MWe Trojan Nuclear Plant). This description is comparable to decommissioning activities that SNC would conduct at FNP, although SNC notes that the FNP units are smaller than the referenced reactor.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include occupational and public radiation dose, impacts of waste management, impacts to air and water quality, and ecological, economic, and socioeconomic impacts. In its GEIS on decommissioning, NRC indicated that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations (NRC 1988, Section 4). SNC adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

SNC notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. SNC will have to decommission FNP; license renewal would only postpone decommissioning for 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. SNC adopts by reference NRC findings (10 CFR 51 Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the license renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of options for replacing FNP capacity. **Section 7.2.2** analyzes the impacts from these options.

SNC concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (NRC 1996b) and in the decommissioning GEIS (**NRC 1988,** Section 4.4). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.1.2 Replacement Capacity

In 2000, FNP provided approximately 12.6 terawatt hours of electricity (**EIA 2001a**). (A terawatt hour is one billion kilowatt hours.) This is approximately 28 percent of the energy generated by nuclear power that Southern Company provides to its four million customers in Alabama, Georgia, Florida, and Mississippi (**SO 2001c**). SNC believes that any alternative would be unreasonable if it did not include replacing this capacity. Replacement could be accomplished by (1) building new generating capacity, (2) purchasing power from outside the SNC system, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

7.2.1 Alternatives Considered

7.2.1.1 Technology Choices

Although FNP is located in Alabama, much of the power generated by FNP is sold to SNC customers in Georgia, with a small portion going to Florida. Therefore, power generation in Alabama and Georgia is of interest for this evaluation. The current mix of power generation options in these states is one indicator of what have been considered to be feasible choices for electric generation technology within the SNC service area. SNC evaluated electric generation capacity and utilization characteristics for Alabama and Georgia. "Capacity" is how much of the various technology choices have been installed. "Utilization" is how much each choice is actually used.

In 1998, Alabama's electric utility industry had a total generating capacity of 21,292 MWe. As Figure 7-1 indicates, this capacity includes units fueled by coal (53.3 percent), nuclear (23.2 percent), oil (0.1 percent), gas (1.6 percent), dual (e.g., oil/gas)-fired (7.7 percent), and hydroelectric (14.1 percent). Approximately 1,080 MWe (4.8 percent of the state's generating capacity) were from non-utility sources (**EIA 2000a,** Table 4). Non-utility generators also use a variety of energy sources.

Georgia's electric utility industry had a total generating capacity of 23,391 MWe in 1998. As Figure 7-2 indicates, this capacity includes units fueled by coal (57.9 percent), nuclear (16.9 percent), oil (4.4 percent), gas (0.1 percent), dual (e.g., oil/gas)-fired (6.0 percent), and hydroelectric (14.8 percent). Approximately 1,692 MWe (6.7 percent of the State's generating capacity) were from non-utility sources (**EIA 2000b,** Table 4). Like Alabama, Georgia's non-utility generators use a variety of energy sources.

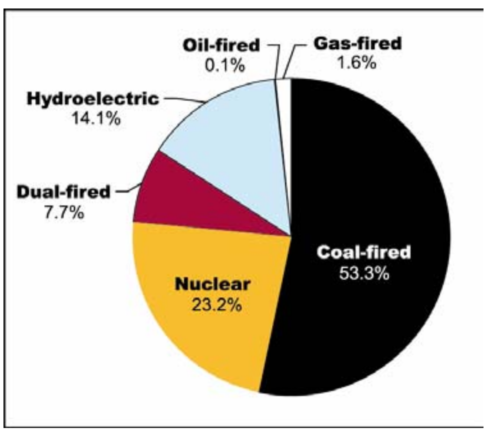


Figure 7-1. Alabama Utility Generating Capacity, 1998

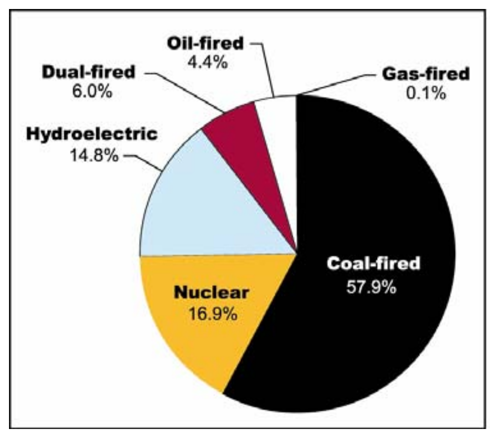


Figure 7-2. Georgia Utility Generating Capacity, 1998

Based on 1998 generation data, Alabama utility companies provided 113 terawatt hours of electricity. As Figure 7-3 depicts, utilities' generation utilization in Alabama was primarily from coal (63 percent), followed by nuclear (25.3 percent), hydroelectric (9.3 percent), gas (2.2 percent), and oil (0.2 percent). Approximately 6.6 terawatt hours of electricity (5.5 percent of the State's generation) were provided by non-utility sources (EIA 2000a, Table 5).

In 1998, utility companies in Georgia provided 109 terawatt hours of electricity. As Figure 7-4 depicts, utilities' generation utilization in Georgia was primarily from coal (64.3 percent), followed by nuclear (28.9 percent), hydroelectric (4.6 percent), gas (1.6 percent), and oil (0.6 percent). Non-utility sources provided approximately 6.6 terawatt hours of electricity (5.7 percent of the State's generation) (**EIA 2000b,** Table 5).

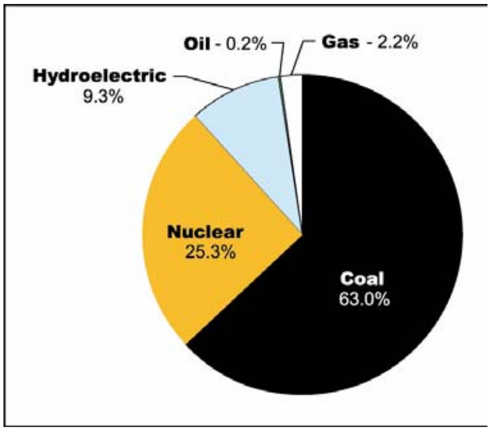


Figure 7-3. Alabama Utility Generation Utilization, 1998

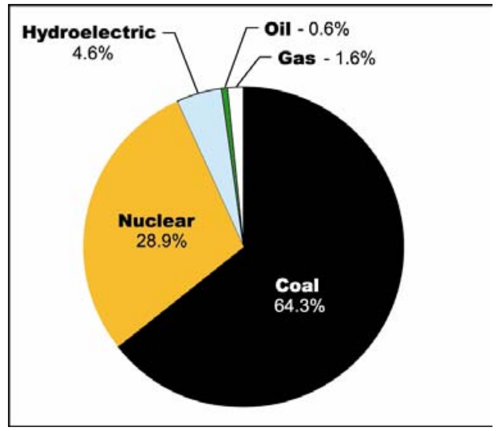


Figure 7-4. Georgia Utility Generation Utilization, 1998

The difference between capacity and utilization is the result of preferential usage. For example, in Georgia in 1998, nuclear energy represented 16.9 percent of utilities' installed capacity, but produced 28.9 percent of the electricity generated by utilities (EIA 2000b, Tables 4 and 5, respectively). This reflects Georgia's preference for reliance on nuclear energy as a base-load generating source. Alabama also has a preference for reliance on nuclear energy for base-load generation, but to a lesser extent.

7.2.1.2 <u>Effects of Deregulation</u>

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

Over the past few years, deregulation of the electric utility industry has received considerable attention at the state level. Twenty-four states and the District of Columbia have passed legislation or issued regulatory orders that will allow their consumers access to competitive electricity retail markets. The relatively high prices for electricity in these states was a primary driver for development of competitive retail markets for electric power generation. However, electric customers in the southeastern states enjoy relatively low prices for electricity, and do not feel an immediate need to restructure (EIA 2000c). Nevertheless, both Alabama and Georgia have been studying the issue of electric power industry restructuring, or deregulation.

Limited retail competition has been present in Georgia since the 1973 passage of the Georgia Territorial Electric Service Act. This Act provides to customers with loads of at least 900 kilowatts a choice in electric service suppliers. In January 1997, the Georgia Public Service Commission (GPSC) initiated a study to evaluate the advantages and disadvantages of expanding retail competition in Georgia's electric industry. On January 23, 1998, the GPSC published a report that identified issues that must be resolved if full retail competition is to come to the electric industry, and provided a set of guiding principles for continuing examination of electric industry restructuring. The GPSC report also concluded that Georgia's electric power industry would be restructured at some point in the future (**GPSC 1998**).

In October 2000, the Alabama Public Service Commission (APSC) completed a two-year study of electricity industry restructuring. The APSC study did not rule out the possibility that the electric power industry could be restructured in the future. However, it did conclude that restructuring of the electric utility industry in Alabama is not in the public interest at this time because safe, reliable, and efficient energy services at a reasonable price could not be guaranteed. Moreover, the APSC would not mandate retail competition or electric industry restructuring without enabling state legislation (**APSC 2000**).

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

It is not clear whether SNC or another supplier would construct new generating units to replace those at FNP, if its licenses were not renewed. However, regardless of which entities construct and operate the replacement power supply, certain environmental parameters would be constant among these alternative power sources. Therefore, Chapter 7 discusses the impacts of reasonable alternatives to FNP license renewal without regard to whether they would be implemented by SNC.

7.2.1.3 Mixture

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy, given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically feasible and commercially viable (**NRC 1996b,** pg. 8-1). Consistent with the NRC determination, SNC has not evaluated mixes of generating sources. The impacts from coal- and gas-fired generation presented in this chapter would bound the impacts from any generation mixture of the two technologies.

7.2.1.4 Fossil-Fuel-Fired Generation

SNC analyzed locating hypothetical new coal- and gas-fired units at the existing FNP site. Using an existing site could minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities such as transmission lines, roads and parking areas, office buildings, and the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal-and gas-fired units.

It must be emphasized that these are hypothetical scenarios. SNC does not have plans for such construction at the FNP site.

Coal-Fired Generation

NRC has evaluated coal-fired generation alternatives for the Oconee Nuclear Station (**NRC 1999c,** Section 8.2.1). For Oconee, NRC analyzed 2,500 MWe of coal-fired generation capacity. SNC has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed substantially more generating capacity than the 1,699 MWe (**EIA 2001a**) discussed in this analysis. In defining the FNP coal-fired alternative, SNC has used site- and Alabama-specific input and has scaled from the NRC (Oconee Nuclear Station) analysis, where appropriate.

SNC defined the FNP coal-fired alternative as consisting of two 800-MWe units. SNC chose this configuration to be equivalent to the gas-fired alternative described below. This equivalency makes impact characteristics most comparable, facilitating impact analysis.

Table 7-1 describes assumed basic operational characteristics of the coal-fired units. SNC based its emission control technology and percent-control assumptions on alternatives that the U.S. Environmental Protection Agency (EPA) has identified as being available for minimizing emissions (**EPA 1998**). For the purposes of analysis, SNC has assumed that coal and lime (calcium oxide) would be delivered by rail after upgrading the existing rail spur into FNP.

Gas-Fired Generation

SNC has chosen to evaluate gas-fired generation, using combined-cycle turbines, because it has determined that the technology is mature, economical, and feasible. A scenario, for example, of three units with a net capacity of 566 MWe each could be assumed to replace the 1,699-MWe FNP total net capacity. However, SNC's experience indicates that, although customized unit sizes can be built, using standardized sizes is more economical. Existing manufacturers' standard-sized units include a gas-fired combined-cycle plant of 800-MWe net capacity, consisting of three 184-MWe gas turbines and 248 MWe of heat recovery capacity (e.g., General Electric Frame 7FB).

SNC assumed two 800-MWe units, having a total capacity of 1,600 MWe, as the gas-fired alternative at the FNP site. Although this provides less capacity than the existing unit (1,600 MWe for this alternative versus 1,699 MWe for existing capacity), it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods, such as importing power. However, for the reasons discussed in Section 7.2.1.3, SNC did not analyze a mixture of these alternatives and imported power.

Table 7-2 describes assumed basic operational characteristics of the gas-fired units. As for the coal-fired alternative, SNC based its emission control technology and percent-control assumptions on alternatives that EPA has identified as being available for minimizing emissions (EPA 1998). For the purposes of analysis, SNC has assumed that it would ensure gas availability through its parent organization, Southern Company.

7.2.1.5 <u>Purchased Power</u>

SNC has evaluated conventional and prospective power supply options that could be reasonably implemented before the current FNP license expires. Southern Company has entered into long-term purchase contracts with several entities to provide firm capacity and energy. Because these contracts are part of SNC's current and future capacity, SNC does not consider these power purchases to be a feasible option for the purchased power alternative.

Alabama is a net exporter of power; in 1999, the State exported 103 gigawatt-hours of electricity (**EIA 2001b,** Table 17). On the other hand, Georgia (historically a net exporter of power) imported 1.8 gigawatt-hours of electricity in 1999 (EIA 2001b, Table 77). Therefore, in 1999, approximately 101 gigawatt-hours of electricity were exported from the two-state region. Some of the exported power may be the result of purchase contracts, which would prevent SNC from using this power to replace FNP generation. However, SNC cannot rule out the possibility that power would be available for purchase as an alternative to FNP license renewal. Therefore, SNC has analyzed purchased power as a reasonable alternative.

SNC assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, SNC is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative.

7.2.1.6 Demand-Side Management

SNC's parent company, Southern Company, has an extensive demand-side management (DSM) program that reduces generation needs through a combination of energy conservation, efficiency, and load management programs (**SO undated**). Southern Company's DSM programs fall into the following categories:

Conservation Programs

- Educational programs that encourage the wise use of energy.

Energy Efficiency Programs

- Discounted residential rates for Good Cents homes and homes that meet specific energy efficiency standards
- Incentive programs that encourage customers to replace old, inefficient appliances or equipment with new high-efficiency appliances or equipment
- Load-based pricing that encourages customers to use electricity more efficiently
- Government partnerships that assist federal facilities in meeting mandated energy efficiency goals through design and installation of high-efficiency lighting systems and computerized energy management.

Load Management Programs

- Standby Generator Program that encourages customers to let Southern Company switch loads to the customer's standby generators during periods of peak demand
- Interruptible Service Program that encourages customers to allow blocks of their loads to be interrupted during periods of peak demand
- Real-Time Pricing that encourages customers to reduce usage during specific times
- Time-of-Use Pricing that encourages customers to discontinue usage during periods of peak demand.

Southern Company annually projects both the summer and winter peak power (in megawatts [MW]), annual energy requirements (in gigawatt-hours), and impacts of DSM. Projections for future DSM show substantial decreases in DSM initiatives that were in effect during past years. Market conditions, which provided the initial support for utility-sponsored conservation and load management efforts during the late 1970s and early 1980s, can be broadly characterized by:

- Increasing long-term marginal prices for capacity and energy production resources
- Forecasts projecting increasing demand for electricity across the nation
- General agreement that conditions (1) and (2) would continue for the foreseeable future
- Limited competition in the generation of electricity
- Economies of scale in the generation of electricity, which supported the construction of large central power plants, and

- The use of average embedded cost as the basis for setting electricity prices within a regulated context.

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

1. A decline in generation costs, due primarily to technological advances that have reduced the cost of constructing new generating units (e.g., combustion turbines), and

2. National energy legislation, which has encouraged wholesale competition through open access to the transmission grid, as well as state legislation designed to facilitate retail competition.

Consistent with (1) and (2) above, the utility planning environment features lower capacity and lower energy prices than during earlier periods, shorter planning horizons, lower reserve margins, and increased reliance on market prices to direct utility resource planning. These have greatly reduced the number of cost-effective DSM alternatives.

Other significant changes include the following.

- The adoption of increasingly stringent national appliance standards for most major energy-using equipment and the adoption of energy efficiency requirements in state building codes. These mandates have further reduced the potential for cost-effective utility-sponsored measures.

- In states that are currently transitioning into deregulation, third parties are increasingly providing energy services and products in competitive markets at prices that reflect their value to the customer. Market conditions can be expected to continue this shift among providers of cost-effective load management.

For these reasons, SNC determined that the remaining DSM programs, which are primarily directed toward load management, are not an effective substitute for any of its large base-load units (such as FNP) that operate at high-capacity factors.

7.2.1.7 Other Alternatives

This section identifies alternatives that SNC has determined are not reasonable and the SNC basis for this determination. SNC accounted for the fact that FNP is a base-load generator and that any feasible alternative to FNP would also need to be able to generate base-load power. In performing this evaluation, SNC relied heavily upon NRC's GEIS (**NRC 1996b,** Section 8.3).

Wind

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

Wind power is not a technically feasible alternative in SNC's service area. According to the Wind Energy Resource Atlas of the United States (**NREL 1986**), areas suitable for wind energy applications must be wind power class 3 or higher. Alabama and Georgia do not have sufficient wind resources for wind energy applications (NREL 1986). More than 98 percent of the land area in Alabama has a wind power class of 1, with the remaining area rated as class 2. Nearly 94 percent of the land area in Georgia is less than wind power class 3. While some areas in Georgia are wind power class 3 or higher, these areas are confined to exposed ridge crests and mountain summits in the northeastern part of the State, which makes them unsuitable for utility-scale wind energy applications (**NREL 1986**).

The GEIS estimates a land-use requirement of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of FNP generating capacity with wind power, even assuming ideal wind conditions, would require dedication of about 400 square miles. Based on the lack of sufficient wind speeds and the amount of land needed to replace FNP, the wind alternative would require a large greenfield site, which could result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and kill birds.

SNC has concluded that, due to the lack of area in Alabama and Georgia having suitable wind speeds and the amount of land needed (approximately 400 square miles), wind power is not a reasonable alternative to FNP license renewal.

Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity. (**NRC 1996b,** Sections 8.3.2 and 8.3.3).

Solar power is not a technically feasible alternative for base-load capacity in SNC's service area. Alabama and Georgia receive about 4 kilowatt hours of solar radiation per square meter per day, compared with 5 to 7.2 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (NRC 1996b, Sections 8.3.2 and 8.3.3).

Finally, according to the GEIS, land requirements for solar plants are high, at 35,000 acres per 1,000 MWe for photovoltaic and 14,000 acres per 1,000 MWe for solar thermal systems. Therefore, replacement of FNP generating capacity with solar power would require dedication of about 97 square miles for photovoltaic and 40 square miles for solar thermal systems. Neither type of solar electric system would fit at the FNP site, and both would have large environmental impacts at a greenfield site.

SNC has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 40 to 97 square miles), solar power is not a reasonable alternative to FNP license renewal.

Hydropower

A portion (about 6,500 MW) of utility generating capacity in the two-state region is hydroelectric. As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity in the two-state region 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 Assessment for Alabama* (**INEL 1998a**), there are no remaining sites in Alabama that would be environmentally suitable for a large hydroelectric facility. Similarly, the *U.S. Hydropower Resource Assessment for Georgia* (**INEL 1998b**), indicates that there are no environmentally suitable sites remaining in Georgia that could be used for a large hydroelectric facility.

The GEIS (Section 8.3.4) estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of FNP generating capacity would require flooding more than 2,800 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

SNC has concluded that, due to the lack of suitable sites in the two-state region and the amount of land needed (approximately 2,800 square miles), hydropower is not a reasonable alternative to FNP license renewal.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. However, because there are no high-temperature geothermal sites in Alabama or Georgia, SNC concludes that geothermal is not a reasonable alternative to FNP license renewal.

Wood Energy

As discussed in the GEIS (**NRC 1996b**), 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. According to the U.S. Department of Energy, Alabama is also considered to have an excellent wood resource potential (**DOE 2001**). The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. However, the largest wood waste power plants are 40 to 50 MW in size.

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

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

Municipal Solid Waste

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

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of FNP license renewal.

SNC has concluded that, due to the high costs and burning municipal solid waste to generate electricity is not a reasonable alternative to FNP license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in Section 8.3.8 of the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as FNP.

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

SNC has concluded that, due to the high costs and burning other biomass-derived fuels is not a reasonable alternative to FNP license renewal.

Oil

Both Alabama and Georgia have several oil-fired power plants; however, they produce less than three percent of the two-state region's power generation. Oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. From 1998 to 1999, utilities reduced production of electricity by oil-fired plants by about 40 percent in Alabama and 2 percent in Georgia (**EIA 2000c,** Table A9).

Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

SNC has concluded that, due to the high costs oil-fired generation is not a reasonable alternative to FNP license renewal.

Fuel Cells

Phosphoric acid fuel cells are the most mature fuel cell technology, but they are only in the initial stages of commercialization. Two hundred turnkey plants have been installed in the United States, Europe, and Japan. Recent estimates suggest that a company would have to produce about 100 MW of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt. However, the current production capacity of all fuel cell manufacturers only totals about 75 MW per year. SNC believes that this technology has not matured sufficiently to support production for a facility the size of FNP. SNC has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to FNP license renewal.

Delayed Retirement

In its planning SNC considered the delayed retirement of older, less-efficient baseload plants. However, the cost of refurbishing these plants to make them more efficient and meet future emission limits would exceed the cost of building new plants. For this reason, SNC has determined that delayed retirement of other Southern Company generating units would not be a feasible alternative to FNP license renewal. SNC concludes that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives.

7.2.2 Environmental Impacts of Alternatives

This section evaluates the environmental impacts from what SNC has determined to be reasonable alternatives to FNP license renewal: coal-fired generation, gas-fired generation, and purchased power.

In characterizing environmental impacts from alternatives, SNC has used the same definitions of "small," "moderate," and "large" that are presented in the Chapter 4 Introduction.

7.2.2.1 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (**NRC 1996b,** Section 8.3.9) and concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative defined by SNC in **Section 7.2.1.4** would be located at FNP.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant would emit sulfur oxides (SO_x), nitrogen oxides (NO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. SNC has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal (see **Table 7-1**). SNC estimates the coal-fired alternative emissions to be as follows:

Sulfur oxides = 5,447 tons per year

Oxides of nitrogen = 1,419 tons per year

Carbon monoxide = 1,463 tons per year

Particulates:

Total suspended particulates = 275 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 63 tons per year

Table 7-3 shows how SNC calculated these emissions.

In 1998, emissions of oxides of sulfur and nitrogen from Alabama's generators ranked 10th and 12th nationally, respectively, while Georgia's generators emissions of oxides of sulfur and nitrogen ranked 9th and 11th nationally, respectively (**EIA 2000a** and **EIA 2000b**). The acid rain requirements of the Clean Air Act Amendments capped the nation's sulfur dioxide (SO_2) emissions from power plants. Each company having fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. To operate a fossil-fuel burning plant at FNP, SNC would have to purchase SO_2 allowances from the open market or shut down existing fossil-fired capacity and apply the credits from that plant to the new one.

In October 1998, EPA promulgated the NO_x State Implementation Plan (SIP) Call regulation that requires 22 states, including Alabama and Georgia, to reduce their NO_x emissions by more than 30 percent to address national ozone limits. Final SIPs were originally required by September 1999. However, in May 1999, the District of Columbia Circuit Court of Appeals issued an order staying the September 1999 SIP submittal deadline until "further action of the Court." In March 2000, the Court largely upheld the NO_x SIP

Call rule and cleared the way for EPA to implement the program. For Georgia, the rule was vacated and EPA was required to repropose the rule for the northern two-thirds of the State. EPA also agreed to exclude the southern third of Alabama and the southern third of Georgia because modeling results do not show an impact on any out-of-state nonattainment area from sources in these regions. The regulation imposes an NO_x "budget" to limit NO_x emissions from certain regions of each State. The District of Columbia Circuit Court of Appeals extended the actual implementation date from May 31, 2003, to May 31, 2004. Final state budgets, allocations, trading programs, and other details are still being developed (**SO 2000b**). Because their programs are under development, it is unclear how Alabama and Georgia will implement the new regulation. Although FNP is located in a federally exempted area, the State of Alabama may require SNC to obtain enough NO_x credits to cover annual emissions in order to operate a fossil-fuel-fired plant at the FNP site.

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

Waste Management

SNC concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant, using coal having an ash content of 9.4 percent, would annually consume approximately 5,850,000 tons of coal (**Table 7-3**). Particulate control equipment would collect most (99.9 percent) of this ash, approximately 549,000 tons per year. SO_2-control equipment, annually using about 179,000 tons of limestone (calcium carbonate), would generate another 213,000 tons per year of waste in the form of scrubber sludge. SNC estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 426 acres (approximately 4,300 × 4,300 feet). While only half this waste volume and land use would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact. **Table 7-4** shows how SNC calculated ash and scrubber waste volumes.

While adequate space within the site footprint would be available for ash and scrubber waste disposal, the waste pile would probably be located in a previously undisturbed area. This would result in a large impact on ecological resources due to the loss of natural habitat, but would not destabilize the ecology of the area. Cultural resource impacts could also be impacted, but impacts could be minimized through implementation of survey and recovery techniques. SNC believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any other resources. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, SNC believes that waste disposal for the coal-fired alternative would have moderate impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation would be unwarranted.

Other Impacts

Construction of the powerblock and coal storage area would impact approximately 300 acres of land and associated terrestrial habitat. Because most of this construction would be in previously disturbed areas, impacts would be minimal. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Construction debris from clearing and grubbing could be disposed of onsite and municipal waste disposal capacity would be available. Socioeconomic impacts from the construction workforce would be moderate because worker relocation would be expected, due to the site's remote location. Cultural resource impacts would be unlikely, due to the previously disturbed nature of the site, and could be minimized by survey and recovery techniques (if needed).

Impacts to aquatic resources and water quality would be minimized due to the Plant's use of the existing cooling water system. The new stacks, and boilers, and increased rail deliveries to the site would be a major aesthetic impact compared to the existing FNP structures and operations, visible from both State Road 95 and the Chattahoochee River. Coal delivery would add noise and transportation impacts associated with unit-train traffic. SNC estimates it would require 300 employees to operate the two-unit facility. Because a coal-fired plant would require fewer workers than the 830 permanent employees at FNP, socioeconomic impacts from workforce reduction would be moderate, due to the site's location in a rural area.

SNC believes that other construction and operation impacts would be small. In most cases, the impacts would be detectable, but they would not be clearly noticeable and would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation would not be warranted beyond that mentioned.

7.2.2.2 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. **Section 7.2.1.4** presents SNC's reasons for defining the gas-fired generation alternative as a combined-cycle plant on the FNP site. Land-use impacts from gas-fired units on the site would be less than those of the coal-fired alternative. Reduced land requirements, due to construction on the existing site and a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources as well. A smaller workforce could have adverse socioeconomic impacts. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generators.

The gas-fired alternative defined by SNC in Section 7.2.1.4 would be located at FNP.

Air Quality

Natural gas is a relatively clean-burning fossil fuel. Also, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient (56 percent vs. 33 percent for the coal-fired alternative). Therefore, the gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative. Control technology for gas-fired turbines focuses on NO_x emissions. SNC estimates the gas-fired alternative emissions to be as follows:

Sulfur oxides = 125 tons per year

Oxides of nitrogen = 401 tons per year

Carbon monoxide = 83 tons per year

Filterable Particulates = 70 tons per year (all particulates are PM_{10})

Table 7-5 shows how SNC calculated these emissions.

The **Section 7.2.2.1** discussion of regional air quality, Clean Air Act requirements, and the NO_x SIP Call is also applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. SNC concludes that emissions from a gas-fired alternative located at FNP would noticeably alter local air quality, but would not destabilize regional resources. Air quality impacts would therefore be moderate, but substantially smaller than those of coal-fired generation.

Waste Management

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

Other Impacts

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on the existing FNP site would reduce construction-related impacts.

To the extent practicable, SNC would route the gas pipeline along previously disturbed ROWs to minimize impacts. However, this would still be a costly (i.e., approximately $1 million/mile) and potentially controversial action, with ecological impacts from installation of approximately 100 miles of buried 24-inch-diameter gas pipeline to FNP. The pipeline could require an additional 500 acres for an easement. SNC would mitigate the political impacts through public hearings and apply best management practices during construction, such as minimizing soil loss and restoring vegetation immediately after an excavation is backfilled. Construction would result in the loss of some less mobile animals (e.g., frogs and turtles). Because these animals are common throughout the area, SNC expects negligible reduction in their populations as a result of construction. SNC does not expect that installation of a pipeline would create a long-term reduction in the local or regional diversity of plants and animals.

NRC estimated in the GEIS that 110 acres would be needed for a plant site; this much previously disturbed acreage is available at FNP, reducing loss of terrestrial habitat. Erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Aesthetic impacts would be small because turbines and stacks would have visual impacts similar to the existing FNP facilities. Socioeconomic impacts of construction would be minimal. However, the GEIS estimates a work force of 150 for gas operations. SNC would expect this number to be closer to 25 - 40 workers for a plant of this size. This reduction in the current workforce would result in adverse socioeconomic impacts. SNC believes these impacts would be moderate, due to the rural location of the site.

7.2.2.3 Purchased Power

As discussed in **Section 7.2.1.5,** SNC assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. SNC is also adopting by reference the NRC analysis of environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but would be located elsewhere within the State. SNC believes that out-of-state imports would not be required.

The purchased power alternative would include constructing up to 200 miles of high-voltage (i.e., 500-kV) transmission lines to get power from remote locations in Alabama to the SNC network. SNC believes most of the transmission lines could be routed along existing ROWs and assumes that the environmental impacts of transmission line construction would be moderate. Environmental impacts of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously undisturbed greenfield site would exceed those of a coal- or gas-fired alternative located on the FNP site.

Table 7-1. Coal-Fired Alternative.

Characteristic	Basis
Unit size = 800 MW ISO rating net[a]	Set to match capacity of gas-fired alternative
Unit size = 848 MW ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 2	Calculated to be $\leq$ FNP Units 1 & 2 total net capacity of 1,699 MW
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998, Table 1.1-3, pg. 1.1-17)
Fuel type = bituminous, pulverized coal	Typical for coal used in Alabama
Fuel heating value = 11,009 Btu/lb	1999 value for coal used in Alabama (EIA 2000d, Table 28)
Fuel ash content by weight = 9.4 percent	1999 value for coal used in Alabama (EIA 2000d, Table 28)
Fuel sulfur content by weight = 0.98 percent	1999 value for coal used in Alabama (EIA 2000d, Table 28)
Uncontrolled NO_x emission = 9.7 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, pre-NSPS with low - NO_x burner (EPA 1998, Table 1.1-3, pg. 1.1-17)
Heat rate = 10,200 Btu/kWh	Typical for coal-fired single-cycle steam turbines (EIA 2000d, pg. 108)
Capacity factor = 0.85	Typical for large coal-fired units (Southern Company experience)
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (EPA 1998, Table 1.1-2)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998, pp. 1.1-6 and -7)
SO_x control = Wet scrubber – limestone (95 percent removal efficiency)	Best available for minimizing SO_x emissions (EPA 1998, Table 1.1-1, pg. 1.1-13)

Btu = British thermal unit
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
NSPS = New Source Performance Standard
lb = pound
MW = megawatt
NO_x = nitrogen oxides
SO_x = sulfur oxides
a. The difference between "net" and "gross" is electricity consumed onsite.

Table 7-2. Gas-Fired Alternative.

Characteristic	Basis
Unit size = 800 MW ISO rating net:[a] Three 184-MW combustion turbines and a 248-MW heat recovery boiler	Manufacturer's standard size gas-fired combined cycle plant
Unit size = 572-MW ISO rating gross:[a] Three 191.4-MW combustion turbines 257.8-MW heat recovery boiler	Calculated based on 4 percent onsite power
Number of units = 2	Provides 1600 MWe $\leq$ FNP Units 1 & 2 net capacity of 1,669 MWe
Fuel type = natural gas	Assumed
Fuel heating value = 1,019 Btu/ft^3	1999 value for gas used in Alabama (EIA 2000d, Table 28)
Fuel sulfur content = 0.0034 lb/MMBtu	Used when sulfur content is not available (EPA 2000, Table 3.1-2a)
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions (EPA 2000, Table 3.1 Database
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas-fired units with water injection (EPA 2000, Table 3.1 Database)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas-fired units (EPA 2000, Table 3.1)
Heat rate = 5940 Btu/kWh	Manufacturer's listed heat rate for this unit.
Capacity factor = 0.85	Typical for large gas-fired base load units

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

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

Table 7-3. Air Emissions from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual coal consumption	$2\text{ units} \times \frac{848\ \text{MW}}{\text{unit}} \times \frac{10{,}200\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times \frac{\text{lb}}{11{,}009\ \text{Btu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times 0.85 \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{day}}{\text{yr}}$	5,850,206 tons of coal per year
SO_x[a,c]	$\frac{38 \times 0.98\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 95/100) \times \frac{5{,}850{,}206\ \text{tons}}{\text{yr}}$	5,447 tons SO_x per year
NO_x[b, c]	$\frac{9.7\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 95/100) \times \frac{5{,}850{,}206\ \text{tons}}{\text{yr}}$	1,419 tons NO_x per year
CO[c]	$\frac{0.5\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{6{,}884{,}077\ \text{tons}}{\text{yr}}$	1,463 tons CO per year
TSP[d]	$\frac{10 \times 9.4\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 99.9/100) \times \frac{5{,}850{,}206\ \text{tons}}{\text{yr}}$	275 tons TSP per year
PM_{10}[d]	$\frac{2.3 \times 9.4\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 99.9/100) \times \frac{5{,}850{,}206\ \text{tons}}{\text{yr}}$	63 tons PM_{10} per year

CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulates having diameter less than 10 microns
SO_2 = sulfur dioxide
TSP = total suspended particulates
a. EPA 1998, Table 1.1-1.
b. EPA 1998, Table 1.1-2.
c. EPA 1998, Table 1.1-3.
d. EPA 1998, Table 1.1-4.

Table 7-4. Solid Waste from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual SO_x generated[a]	$\frac{5{,}850{,}206 \text{ tons coal}}{\text{yr}} \times \frac{0.98 \text{ tons}}{100 \text{ tons coal}} \times \frac{64.1 \text{ tons } SO_2}{32.1 \text{ tons}}$	114,607 tons of SO_x per year
Annual SO_x removed	$\frac{114{,}607 \text{ tons } SO_2}{\text{yr}} \times (95/100)$	108,876 tons of SO_x per year
Annual ash generated	$\frac{5{,}850{,}206 \text{ tons coal}}{\text{yr}} \times \frac{9.4 \text{ tons ash}}{100 \text{ tons coal}} \times (99.9/100)$	549,369 tons of ash per year
Annual limestone consumption[b]	$\frac{114{,}607 \text{ tons } SO_2}{\text{yr}} \times \frac{100 \text{ tons } CaCO_3}{64.1 \text{ tons } SO_2}$	178,794 tons of $CaCO_3$ per year
Calcium sulfite[c]	$\frac{108{,}876 \text{ tons } SO_2}{\text{yr}} \times \frac{120 \text{ tons } CaSO_3}{64.1 \text{ tons } SO_2}$	203,825 tons of $CaSO_3$·per year
Annual scrubber waste[d]	$\frac{178{,}794 \text{ tons } CaCO_3}{\text{yr}} \times \frac{(100-95)}{100} + 203{,}825 \text{ tons } CaSO_3$	212,765 tons of scrubber waste per year
Total volume of scrubber waste[e]	$\frac{212{,}765 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{tons}} \times \frac{\text{ft}^3}{144.8 \text{ lb}}$	117,575,503 ft^3 of scrubber waste
Total volume of ash dispensed onsite[f,g]	$\frac{549{,}369 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{tons}} \times \frac{\text{ft}^3}{100 \text{ lb}}$	439,495,581 ft^3 of ash
Total volume of solid waste disposed onsite	$117{,}575{,}503 \text{ ft}^3 + 439{,}495{,}581 \text{ ft}^3$	557,071,084 ft^3 of solid waste
Waste pile area (acres)	$\frac{557{,}071{,}084 \text{ ft}^3}{30 \text{ ft}} \times \frac{\text{acre}}{43{,}560 \text{ ft}^2}$	426 acres of solid waste
Waste pile area (ft × ft square)	$\sqrt{(557{,}071{,}084 \text{ ft}^3/30\text{ft})}$	4,309 feet by 4,309 feet of solid waste

S = sulfur
SO_2 = sulfur dioxide
CaO = calcium oxide (lime)
$CaSO_4 \cdot 2H_2$ = calcium sulfate dihydrate

a. Calculations assume 100 percent combustion of coal.
b. Lime consumption is based on total SO_2 generated.
c. Calcium sulfate generation is based on total SO_2 removed.
d. Total scrubber waste includes scrubbing media carryover.
e. Density of $CaSO_4 \cdot 2H_2O$ is 144.8 lb/ft^3.
f. Density of coal bottom ash is 100 lb/ft^3 (FHA 1997).
g. Assumed 87 percent of ash is recycled.

Table 7-5. Air Emissions from Gas-Fired Alternative.

Parameter	Calculation	Result
Annual gas consumption	$2\,\text{unit} \times \frac{832\,\text{MW}}{\text{unit}} \times \frac{5{,}940\,\text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\,\text{kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1{,}019\,\text{Btu}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365\,\text{day}}{\text{yr}}$	72,225,176,997 ft^3 per year
Annual Btu input	$\frac{72{,}225{,}176{,}997\,\text{ft}^3}{\text{yr}} \times \frac{1{,}019\,\text{Btu}}{\text{ft}^3} \times \frac{\text{MMBtu}}{10^6\,\text{Btu}}$	73,597,455 MMBtu per year
SO_x[a]	$\frac{0.0034\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{73{,}597{,}455\,\text{MMBtu}}{\text{yr}}$	125 tons SO_x per year
NO_x[b]	$\frac{0.0109\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{73{,}597{,}455\,\text{MMBtu}}{\text{yr}}$	401 tons NO_x per year
CO[b]	$\frac{0.0023\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{73{,}597{,}455\,\text{MMBtu}}{\text{yr}}$	83 tons CO per year
TSP[a]	$\frac{0.0019\,\text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{73{,}597{,}455\,\text{MMBtu}}{\text{yr}}$	70 tons filterable TSP per year
PM_{10}[a]	$\frac{70\,\text{tons TSP}}{\text{yr}}$	70 tons filterable PM_{10} per year

Btu = British thermal units
CO = carbon monoxide
MM = million
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_2 = sulfur dioxide
TSP = total suspended particulates
a. EPA 2000, Table 3.1-1.
b. EPA 2000, Table 3.1-2.

8.0 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

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

Chapter 4 analyzes environmental impacts of FNP license renewal and Chapter 7 analyzes impacts from renewal alternatives. **Table 8-1** summarizes environmental impacts of the proposed action (license renewal) and the alternatives, so the reader can compare them. The environmental impacts compared in Table 8-1 are those that are either Category 2 issues for the proposed action, license renewal, or are issues that the GEIS (**NRC 1996b**) identified as major considerations in an alternatives analysis. For example, although NRC concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (**Section 7.2.2**). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. **Table 8-2** is a more detailed comparison of the alternatives.

Table 8-1. Impacts Comparison Summary

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

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource nor are points of distinction among the alternatives. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8-2. Impacts Comparison Detail.

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative: With Coal-Fired Generation	No Action Alternative: With Gas-Fired Generation	No Action Alternative: With Purchased Power
Alternative Descriptions				
FNP license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current FNP license. Adopting by reference, as bounding FNP decommissioning, GEIS description (NRC 1996b, Section 7.1)	New construction at the FNP site.	New construction at the FNP site.	Would involve construction of new generation capacity in the region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
			Construct 100 miles of gas pipeline in a 100-foot-wide corridor	
		Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Construct up to 200 miles of transmission lines
		Two 800-MW (net) tangentially-fired, dry bottom units; capacity factor 0.85	Two units, each with 800 MW of net power, consisting of three 184-MW combustion turbines and a 248-MW heat recovery boiler	
		Existing FNP intake/ discharge system	Existing FNP intake/ discharge system	
		Pulverized bituminous coal, 11,009 Btu/pound; 10,200 Btu/kWh; 9.4% ash; 0.98% sulfur; 9.7 lb/ton nitrogen oxides; 5,850,206 tons coal/yr	Natural gas, 1,019 Btu/ft^3; 5,940 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0109 lb NO_x/MMBtu; 72,225,176,997 ft^3 gas/yr	
		Low NO_x burners, overfire air and selective catalytic reduction (95% NO_x reduction efficiency).	Selective catalytic reduction with steam/water injection	
		Wet scrubber – lime/limestone desulfurization system (95% SO_x removal efficiency)		

Table 8-2. Impacts Comparison Detail (Cont'd).

		No Action Alternative		
Proposed Action (License Renewal)	Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Fabric filters (baghouse - 99.9% particulate removal efficiency)		
830 workers		300 workers (Section 7.2.2.1)	25-40 workers (Section 7.2.2.2)	
Land Use Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996b, Section 7.3)	SMALL – The powerblock and associated facilities could be constructed on previously disturbed land at the FNP site. Approximately 213 acres would be needed for ash and scrubber waste disposal over the 20 year license renewal term.	SMALL – 500 acres would be required for a new gas pipeline. The powerblock and associated facilities could be constructed on previously disturbed land at the FNP site.	MODERATE – Transmission lines could be constructed along existing transmission corridors. Adopting by reference GEIS description of land use impacts from alternate technologies (NRC 1996b, Section 8.2)
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings, (Table 4-2, Issues 3, 6-11). Category 2 groundwater issues not applicable, (Section 4.7, Issue 35; and Section 4.8, Issue 39). One Category 2 surface water issue applies (Section 4.1, Issue 13) and one Category 2 groundwater issue applies (Section 4.6, Issue 34)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 89.)	SMALL – Construction impacts minimized by use of best management practices. Operational impacts minimized by use of the existing cooling water system.	SMALL – Reduced cooling water demands, inherent in combined-cycle design	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996b, Section 8.2)

Table 8-2. Impacts Comparison Detail (Cont'd).

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative: With Coal-Fired Generation	No Action Alternative: With Gas-Fired Generation	No Action Alternative: With Purchased Power
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding, (Table 4-2, Issue 51). Category 2 issue not applicable, (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issue 88)	MODERATE – 5,447 tons SO_2/yr 1,419 tons NO_x/yr 1,463 tons CO/yr 275 tons TSP/yr 63 tons PM_{10}/yr	MODERATE – 125 tons SO_2/yr 401 tons NO_x/yr 83 tons CO/yr 70 tons PM_{10}/yr[a]	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996b, Section 8.2)
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings, (Table 4-2, Issues 15-24, 28-30, 41-43, 45-48). Four Category 2 issues not applicable, (Section 4.9, Issue 40; Section 4.2, Issue 25; Section 4.3, Issue 26; and Section 4.4, Issue 27).	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 90)	SMALL – 213 acres of forested land could be required for ash/sludge disposal over 20-year license renewal term.	SMALL – Construction of the pipeline could alter habitat.	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996b, Section 8.2)
Threatened or Endangered Species Impacts				
SMALL – No federally threatened or endangered species are known at the site or along the transmission corridors. (Section 2.6, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996b, Section 7.3)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats

Table 8-2. Impacts Comparison Detail (Cont'd).

		No Action Alternative		
Proposed Action (License Renewal)	Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Human Health Impacts				
SMALL – Adopting by reference, Category 1 issues, (Table 4-2, Issues 56, 58, 60, 61, 62). Risk due to transmission-line induced currents minimal due to conformance with consensus code, (Section 4.13, Issue 59) Small risk due to microbiological organisms (Section 4.12, Issue 57)	SMALL – Adopting by reference Category 1 issue finding, (Table 4-2, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996b, Section 8.3.9)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996b, Table 8.2)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996b, Section 8.2)
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings, (Table 4-2, Issues 64, 67). Two Category 2 issues are not applicable, (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Three Category 2 issues would experience no impacts because there would be no increase in employment during the license renewal term (Section 4.14 Issue 63; Section 4.15, Issue 65; Section 4.19, Issue 70). Plant contribution to county tax base is large, and continued plant operation would benefit county (Section 4.17.2, Issue 69).	SMALL – Adopting by reference Category 1 issue finding, (Table 4-2, Issue 91)	MODERATE – Reduction in permanent work force at FNP could adversely affect Houston and surrounding counties (Section 7.2.2.1).	MODERATE – Reduction in permanent work force at FNP could adversely affect Houston and surrounding counties (Section 7.2.2.2).	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996b, Section 8.2)

Table 8-2. Impacts Comparison Detail (Cont'd).

		No Action Alternative		
Proposed Action (License Renewal)	Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)				
		Waste Management Impacts		
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 87)	MODERATE – 549,369 tons of coal ash and 212,765 tons of scrubber sludge per year would require 213 acres over 20-year term. (Section 7.2.2.1)	SMALL – Almost no waste generation (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996b, Section 8.2)
		Aesthetic Impacts		
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996b, Section 7.3)	MODERATE – The coal-fired power block and the exhaust stack would be visible from Hwy 95 and from a moderate offsite distance (Section 7.2.2.1)	SMALL – Steam turbines and stacks would create visual impacts comparable to those from existing FNP facilities (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996b, Section 8.2)
		Cultural Resource Impacts		
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (NRC 1996b, Section 7.3)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site (Section 7.2.2.1)	SMALL – 100 miles of pipeline construction could affect some cultural resources (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996b, Section 8.2)

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_2 = sulfur dioxide
TSP = total suspended particulates
yr = year

PAGE INTENTIONALLY LEFT BLANK

9.0 STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

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

9.1.1 General

Table 9-1 lists environmental authorizations that SNC has obtained for current FNP operations. In this context, SNC uses "authorizations" to include any permits, licenses, approvals, or other entitlements, issued by state, county, or local governmental entities. SNC expects to continue renewing these authorizations during the current license period and through the NRC license renewal period. Based on the new and significant information identification process described in Chapter 5, SNC concludes that FNP is in compliance with applicable environmental standards and requirements.

Table 9-2 lists additional environmental authorizations and consultations that would be conditions precedent to NRC renewal of the FNP licenses to operate. As indicated, SNC anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 Threatened or Endangered Species

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required by federal law or NRC regulation, SNC has chosen to invite comment from federal and state agencies regarding potential effects that FNP license renewal might have. **Attachment C** includes copies of FNP correspondence with FWS, NMFS, the FDACS, the FFWCC, the ADCNR, and the GADNR. Based on the SNC submittals and other information, as discussed in detail in Section 4.10, the agencies concur with the SNC conclusion that FNP license renewal would not adversely affect threatened or endangered species or critical habitat.

9.1.3 Coastal Zone Management Program

The federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. Alabama's coastal area extends from the continuous 10-foot contour to the limits of the State's territorial waters (three miles offshore). FNP, located in Houston County, is not within the Alabama coastal zone (**Code of Alabama**

1975, Section 9-7-15). Coastal zone management requirements are not applicable to FNP license renewal.

Florida's Coastal Zone Management Program will not be consulted concerning the relicensing of FNP. Although the State of Florida's coastal zone encompasses the state's 67 counties, the state has limited its federal consistency review of federally licensed and permitted activities to the federal licenses of permits specified in Section 380.23(3)(c) requested for activities located in or seaward of one of the state's 35 coastal counties.

Section 380.23(3)(c) reads:

(3) Consistency review shall be limited to review of the following activities, uses, and projects to ensure that such activities and uses are conducted in accordance with the state's coastal management program:

(c) Federally licensed or permitted activities affecting land and water uses when such activities are in or seaward of the jurisdiction of local governments required to develop a coastal zone protection element as provided in s.380.24 and when such activities involve…

Because FNP is not located "in or seaward" of Florida's coastal zone, consultation with Florida's coastal zone management program is not necessary.

9.1.4 Historic Preservation

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for the State Historic Preservation Officer (SHPO) having a consultative roll (36 CFR 800.2). Although not required of an applicant by federal law or NRC regulation, SNC has chosen to invite comment by the Alabama, Florida, and Georgia SHPOs. **Attachment E** includes a copy of SNC correspondence with the SHPOs regarding potential effects that FNP license renewal might have on historic or cultural resources. Based on the SNC submittal and other information, the SHPOs concurred with SNC's conclusion that continued operation of FNP would have no effect on historic properties.

9.1.5 Water Quality (401) Certification

Federal Clean Water Act (CWA) Section 401 requires that applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency a certification from the state that the discharge will comply with applicable CWA requirements (33 USC 1341). NRC has indicated in its GEIS that issuance of an NPDES permit implies certification by the state (**NRC 1996b,** pg. 4-4). SNC is applying to NRC for license renewal to continue FNP operations. **Attachment B** contains excerpts of the FNP NPDES permit. Consistent with the GEIS, SNC is providing evidence of the FNP NPDES permit as evidence of state water quality (401) certification.

9.2 ALTERNATIVES

NRC

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

The coal, gas, and purchased power alternatives discussed in **Section 7.2.1** probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. SNC notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. SNC also notes that the EPA has revised requirements that could affect the design of cooling water intake structures for new facilities (**EPA 2001b**) and proposed requirements that could affect modifications at existing facilities (**EPA 2002**). As drafted, the requirements would probably necessitate construction of additional cooling towers for the coal-fired alternative.

Table 9-1. Environmental Authorizations for Current FNP Operations.

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal Requirements Applicable to License Renewal					
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License To Operate	NPF-5	Issued on 12/01/77 Expires on 06/05/17	Operation of Unit 1
			NPF-8	Issued on 07/30/81 Expires on 03/31/21	Operation of Unit 2
U.S. Department of Transportation (DOT) – Research and Special Programs Administration	49 USC 5108; 49 CFR Part 107, Subpart G	Hazardous Materials Certificate of Registration	061603001014L	Issued on 06/17/03 Expires on 06/30/04	Transportation of Hazardous Material
Department of the Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344)	Maintenance Dredging	AL01-02094-V	Issued on 02/01/02 Expires on 02/01/07	Maintenance Dredging of Intake Structure and Canal
State Requirements Applicable to License Renewal					
U.S. Environmental Protection Agency (EPA), Alabama Department of Environmental Management (ADEM) – Water Division	Federal Water Pollution Control Act (33 USC Sections 1251-1378); Alabama Water Pollution Control Act (Code of Alabama Sections 22-22-1 to 22-22-14); the Alabama Environmental Management Act (Code of Alabama Sections 22-22A-1 to 22-22A-15)	Individual Discharge Permit	AL0024619	Issued on 02/09/01 Expires on 02/28/06	Contains effluent limits for FNP discharges to the Chattahoochee River, an unnamed tributary to the Chattahoochee River, and Wilson Creek.
ADEM – Land Division	ADEM Administrative Code Rule 335-13-7	Medical Waste Management Plan	G-OTH00504	Notification received on 11/23/92 No expiration	Required for all medical waste generators
ADEM – Water Division	Code of Alabama 1975 Sections 22-36-3 and 22-36-4	Certificate of Registration	10146 069 010975	Issued on 01/30/98	Registration of 2 underground storage tanks

Table 9-1. Environmental Authorizations for Current FNP Operations. (Cont'd)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
ADEM – Water Division	Code of Alabama 1975 Sections 22-36-3 and 22-36-4	Certificate of Registration	10146 069 010982	Issued on 04/09/98	Registration of 9 aboveground storage tanks
ADEM – Water Division	Alabama Safe Drinking Water Act (Code of Alabama 1975, Sections 22-23-30 to 22-23-53); Alabama Environmental Management Act (Code of Alabama 1975 Sections 22-22A-1 to 22-22A-15)	Water Supply Permit	96-583	Issued on 08/15/96 Expires on 10/01/06	Permit to operate a public water system
State of Alabama – Alabama Department of Economic and Community Development	Alabama Water Resources Act (Code of Alabama 1975, Section 9-10B-19); Administrative Rules implementing the Alabama Water Use Reporting Program	Certificate of Use	OWR-0063	Issued on 08/23/94 Expires on 01/01/34	Permit to withdraw groundwater and surface water
ADEM – Land Division	Solid Waste Disposal Act (Code of Alabama Sections 22-27-1 to 22-27-27); the Alabama Environmental Management Act (Code of Alabama Sections 22-22A-1 to 22-22A-15)	Solid Waste Disposal Facility Permit	35-05	Issued on 12/16/02 Expires on 12/15/07	Establishes types and amount of waste approved for disposal in the FNP landfill
ADEM – Air Division	ADEM Air Regulations (ADEM Code 335-3-15-02-10)	Synthetic Minor Operating Permit		Issued on 12/10/96 Expires NA	Air Emissions
South Carolina Department of Health and Environmental Control - Division of Radioactive Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	South Carolina Radioactive Waste Transport Permit	0053-01-03-X	Issued on 11/12/02 Expires on 12/31/03	Transportation of radioactive waste into the state of South Carolina

Table 9-1. Environmental Authorizations for Current FNP Operations. (Cont'd)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Code TN Regulation 1200-2-10-.3(8)(d)	Transport of Radioactive Materials	T-AL003-L03	Issued on 11/12/02 Expires on 12/31/03	Transportation of radioactive waste into the state of Tennessee
Georgia Public Service Commission - Compliance and Safety Transportation Division	Rules of the GA Public Service Commission Chapter 1-15-1	Transport of Radioactive Materials	NA	Issued on 10/31/02 Expires on 12/31/03	Transportation of radioactive waste into the state of Georgia
State of Utah Department of Environmental Control Division of Radiological Control	Utah Radiation Controls Rules R313-26	Generator Site Access Permit	0112001241	Issued on 12/28/01 Expires on 12/31/02	Direct transport of radioactive waste to the Utah Envirocare Burial Site

ADEM = Alabama Department of Environmental Management
CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
FNP = Farley Nuclear Plant
USC = United States Code

Table 9-2. Environmental Authorizations for FNP License Renewal.

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with FWS (Attachment C)
State of Alabama Alabama Historical Commission Georgia Department of Natural Resources Historical Preservation Division Florida Department of State Division of Historical Resources	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPOs. SHPOs have concurred that license renewal will not affect any sites listed or eligible for listing (Attachment E)
ADEM – Industrial Section, Water Division	Clean Water Act Section 401 (33 USC 1341)	Certification of compliance with state water quality standards	Discharges during license renewal term

ADEM = Alabama Department of Environmental Management.

PAGE INTENTIONALLY LEFT BLANK

10.0 REFERENCES

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

ADOT (Alabama Department of Transportation). 1999. 1998 Alabama Traffic Flow Map. Bureau of Transportation Planning.

AEC (U.S. Atomic Energy Commission). 1972. *Final Environmental Statement related to the construction of Joseph M. Farley Nuclear Plant, Units 1 and 2*. Alabama Power Company. Docket Nos. 50-348 and 50-364. June.

AEC (U.S. Atomic Energy Commission). 1974. *Final Environmental Statement related to operation of Joseph M. Farley Nuclear Plant Units 1 and 2*. Alabama Power Company. Docket Nos. 50-348 and 50-364. December.

APC (Alabama Power Company). Undated. Field Logs of Chattahoochee River. Fish Sampling. 1983 – 1990.

APC (Alabama Power Company). 1971. *Environmental Report – Construction Permit Stage for the Joseph M. Farley Nuclear Plant*. September 9.

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

APSC (Alabama Public Service Commission). 2000. "Report on the Public Interest and Role of the Commission." October 2. Available online at http://www.psc.state.al.us/Electric%20Restruct/iifinal.doc. Accessed May 30, 2001.

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

CDC (Centers for Disease Control and Prevention). 2000. Surveillance for Waterborne-Disease Outbreaks-United States, 1997-1998. Volume 49, No. SS-4. Atlanta, GA. May 26.

CEQ (Council on Environmental Quality). 1997. "Environmental Justice: Guidance Under the National Environmental Policy Act." December 10.

Chapman, M. 2001. Facsimile transmission to E. N. Hill (Tetra Tech NUS). *Permitted Drinking Water Sources in Houston County*. Alabama Department of Environmental Management. June 22.

City of Dothan. 1999. *Future Land Use Plan*. Adopted 1999. City of Dothan Planning Office. Dothan, AL.

City of Dothan. 2001. *Dothan Utilities Water Production and Distribution*. Available online at http://www.dothan.org/depts/dothanutilities/utwaterdept2.htm. Accessed June 8, 2001.

Code of Alabama. 1975. "Coastal area board - Development of coastal area management program". Section 9-7-15. Available online at http://alisdb.legislature.state.al.us/acas/CodeOfAlabama/1975/9-7-15.htm. Accessed May 23, 2001.

DOE (U.S. Department of Energy). 2001. "Alabama Biomass Power Resources." Available online at http://www.eren.doe.gov/state_energy/tech_biomass.cfm?state=AL. Accessed July 26, 2001.

EIA (Energy Information Administration). 2000a. "State Electricity Profiles 2000 – Alabama." DOE/EIA-0629. June. Available online at http://www.eia.doe.gov/cneaf/electricity/st_profiles/alabama.pdf. Accessed May 29, 2001.

EIA (Energy Information Administration). 2000b. "State Electricity Profiles 2000 – Georgia. " DOE/EIA-0629. June. Available online at http://www.eia.doe.gov/cneaf/electricity/st_profiles/georgia.pdf. Accessed May 29, 2001.

EIA (Energy Information Administration). 2000c. "Electric Power Annual 1999, Volume I." DOE/EIA-0348(99)/1. August. Available online at http://www.eia.doe.gov/cneaf/electricity/epav1/epav1.pdf. Accessed May 29, 2001.

EIA (Energy Information Administration). 2000d. "Electric Power Annual 1999, Volume II." DOE/EIA-0348(99)/2. October. Available online at http://www.eia.doe.gov/cneaf/electricity/epav2/epav2.pdf. Accessed May 29, 2001.

EIA (Energy Information Administration). 2001a. "Nuclear Reactors Operating in the United States, 2000." Available online at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/states. html. Accessed May 30-31, 2001.

EIA (Energy Information Administration). 2001b. "State Energy Data Report 1999, Consumption Estimates." DOE/EIA-0214(99). May. Available online at http://www.eia.doe.gov/emeu/sedr/ contents.html. Accessed May 23, 2001.

EIA (Energy Information Administration). 2001c. "U.S. Nuclear Operators. Joseph M. Farley." Available online at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/farley. html. Accessed November 20.

EPA (U.S. Environmental Protection Agency). 1979. Pathogenic Naegleria-Distribution in Nature. Health Effects Research Laboratory. Cincinnati, OH. EPA-600/1-79-018. May.

EPA (U.S. Environmental Protection Agency). 1998. *Air Pollutant Emission Factors*, Vol. 1, *Stationary Point Sources and Area Sources*, Section 1.1, "Bituminous and Subbituminous Coal Combustion." AP-42. September 1998. Available online at http://www.epa.gov/ttn/chief/ap42/ch01/. Accessed June 6, 2001.

EPA (U.S. Environmental Protection Agency). 2000. *Air Pollutant Emission Factors*, Vol. 1, *Stationary Point Sources and Area Sources*, Section 3.1, "Stationary Gas Turbines." AP-42. April. Available online at http://www.epa.gov/ttn/chief/ap42/ch03/. Accessed June 6, 2001.

EPA (U.S. Environmental Protection Agency). 2001a. "Nonattainment Areas for All Criteria Pollutants". February. Available online at http://www.epa.gov/oar/oaqps/greenbk/ancl.html. Accessed May 23, 2001.

EPA (U.S. Environmental Protection Agency). 2001b. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule." *Federal Register*. Vol. 66, No. 243. December 18.

EPA (U.S. Environmental Protection Agency). 2002. "National Pollutant Discharge Elimination System – Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities; Proposed Rule." *Federal Register*. Vol. 67, No. 68. April 9.

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

FHA (Federal Highway Administration). 1997. *User Guidelines for Waste and Byproduct Materials in Pavement Construction*, FHWA-RD-97-148. Available online at http://tfhrc.gov/hnr20/recycle/waste/cbabs1.htm. Accessed May 29, 2001.

Floyd, W. Warner. 1974. Letter to Gordon Dicker (U.S. Atomic Energy Commission). Joseph M. Farley Nuclear Power Plant historical review. Alabama Historical Commission. Montgomery, AL. November 8.

Fretwell, Mark E. 1980. *This So Remote Frontier, The Chattahoochee Country of Alabama and Georgia*. Rose Printing Company. Tallahassee, FL.

Georgia Power. 2002. Draft License Application: Preliminary Draft Environmental Assessment Middle Chattahoochee Project (FERC No. 2177).

GDOT (Georgia Department of Transportation). 2000. "Coheelee Creek Covered Bridge Historical Marker". Available online at http://www.dot.state.ga.us/homeoffs/bridge_dsgn.www/covered/ coheelee/marker.htm. Accessed February 28, 2001.

GPSC (Georgia Public Service Commission). 1998. "Staff Report on Electric Industry Restructuring." Docket No. 7313-U. January. Available online at http://www.psc.state.ga.us/electricindust/. Accessed June 1, 2001.

GSA (Georgia Survey of Alabama). 1991. *Wells and Springs in Southeastern Alabama; To Accompany Map 201A*.

Heitshmidt, Dustin. 2000. Letter to District Conservationist, U.S. Department of Agriculture Natural Resources Conservation Service. December 15.

Historic Chattahoochee Commission. 1998. "Scenic Forks Tour." Available online at http://www.hcc-al-ga.org/scenictour.htm. Accessed February 28, 2001.

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

INEL (Idaho National Engineering Laboratory). 1998a. "U.S. Hydropower Resource Assessment for Alabama." DOE/ID-10430(AL). Available online at http://hydropower.inel.gov/state/al/al.pdf. Accessed May 22, 2001.

INEL (Idaho National Engineering Laboratory). 1998b. "U.S. Hydropower Resource Assessment for Georgia." DOE/ID-10430(GA). Available online at http://hydropower.inel.gov/state/ga/ga.pdf. Accessed May 22, 2001.

Joklik, W. K. and D. T. Smith, (Eds.). 1972. *Microbiology, 15th Edition*. Appleton-Century-Crofts. New York, NY.

JSU (Jacksonville State University). 2000. "ACT/ACF Tri-State Water Basin Compacts." Available online at http://www.jsu.edu/depart/epic/ACT.htm. Accessed July 27, 2001.

McGregory, Jerrilyn. 1997. *Wiregrass Country*. University Press of Mississippi. Jackson, MS.

Mettee, M. F., P. E. O'Neil, and J. M. Pierson. 1996. *Fishes of Alabama and the Mobile Basin*. Oxmoor House. Birmingham, AL.

Moss, A. 2001. Facsimile transmission to E. N. Hill, (Tetra Tech NUS). Ad Valorem Taxes for Houston County. Houston County Revenue Commissioner's Office. June 27.

National Park Service. 2001. National Register Information System. Available online at http://www.nr.nps.gov/ nrloc1.htm. Accessed June 8, 2001.

NEI (Nuclear Energy Institute). 2000. "Restructuring the U.S. Electric Power Industry." Available online at http://www.nei.org/doc.asp?catnum=3&catid=277. Accessed May 29, 2001.

NRC (U.S. Nuclear Regulatory Commission). 1988. *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*. NUREG-0586. Washington, DC. August.

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

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

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

NRC (U.S. Nuclear Regulatory Commission). 1996d. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, Supplementary Information to Final Rule." *Federal Register*. Vol. 61, No. 244. December 18.

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

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

NRC (U.S. Nuclear Regulatory Commission). 1996g. "Supplementary Information to Final Rule." *Federal Register*. Vol. 61, No. 244. December 18.

NRC (U.S. Nuclear Regulatory Commission). 1998. *Environmental Assessment and Finding of No Significant Impact: Regarding Electrical Power Uprate; Joseph M. Farley Nuclear Plants Units 1 and 2*. Docket Nos. 50-348 and 50-364. *Federal Register*. Vol. 63, No. 78. April 23.

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

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

NRC (U.S. Nuclear Regulatory Commission). 1999c. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Oconee Nuclear Station*, NUREG-1437. Supplement 2, Final. Office of Nuclear Reactor Regulations. Washington, DC. December.

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

NREL (National Renewable Energy Laboratory). 1986. "Wind Energy Resource Atlas of the United States." DOE/CH 10093-4. Available online at http://rredc.nrel.gov/wind/pubs/atlas/. Accessed May 22, 2001.

POLY (Polyengineering, Inc.) 2001. Long Range Plan for the Dothan Water System, 2001 Update. Dothan City Commission Resolution No. 2000-273. Dothan, AL.

Pool, R. 2001. *Megawatt Production of the Jim Woodruff, Walter F. George, and George W. Andrews Lock and Dam Systems on the Chattahoochee River.* Personal communication with E. N. Hill, TtNUS. November 20.

Robinson, J. (U.S. Geological Survey, Alabama). 2001. Aquifer data from Fort Rucker, Alabama. Teleconference with G. Gunter (Tetra Tech NUS). July 25.

SEARP & DC (Southeast Alabama Regional Planning and Development Commission). 1998. *Overall Economic Development Plan*. Available online at http://www.sanman.net/searpdc/iemain.htm. Accessed June 8, 2001.

SNC (Southern Nuclear Operating Company). 1997. Power Uprate Environmental Evaluation. January 15.

SNC (Southern Nuclear Operating Company). 2000a. *Joseph M. Farley Nuclear Plant Units 1 and 2. Final Safety Analysis Report Update*. Rev. 17. Birmingham, AL.

SNC (Southern Nuclear Operating Company). 2000b. Discharge Monitoring Report. July 2000.

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

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

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

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

SO (Southern Company). 2000b. "Environmental Compliance Strategy 2000 Review." Available online at ftp://www.psc.state.ga.us/13305/44524e.doc. Accessed May 30, 2001.

SO (Southern Company). 2001a. Farley Nuclear Plant Annual Water Use Report for 2000. ENV-01-062. Birmingham, Alabama. March 23.

SO (Southern Company). 2001b. "Southern Nuclear: Plant Farley." Available online at http://www.southernco.com/southernnuclear/farley.asp. Accessed July 6, 2001.

SO (Southern Company). 2001c. "Southern Company 2000 Annual Report." Available online at http://investor.southerncompany.com/annual.cfm. Accessed May 30, 2001.

SO (Southern Company). Undated. "Energy Solutions Optimize Your Energy Use." Available online at http://www.southerncompany.com/energysolutions. Accessed July 12, 2001.

Solomon, T. 2001. Southeast Alabama Regional Planning and Development Commission. *Future Land Use Trends in Southeastern Alabama*. Personal communication with E. N. Hill, TtNUS. July 30.

State of Georgia. 1997. "Georgia and Alabama Governors Sign Water Compacts." Office of the Governor, Press Advisory. Available online at http://www.state.ga.us/archive/governor/govoff/ pressrel/1997/d6.htm. Accessed July 27, 2001.

Tallahassee (FL) News Herald. 1997. "Tri-River agreement heads for Chiles' desk." Available online at http://www.newsherald.com/LOCAL/RIVER415.htm. Accessed July 27, 2001.

Tetra Tech NUS. 2001a. Population Projections for the FNP Region. Aiken, SC. June.

Tetra Tech NUS. 2001b. Calculation Package for Groundwater Drawdown. Aiken, SC. July 30.

Tetra Tech NUS. 2001c. "Calculation Package for Induced Current Analysis. Transmission Lines." Aiken, SC. July 3.

Tetra Tech NUS. 2002a. Threatened and Endangered Species Surveys: Joseph M. Farley Nuclear Plant and Associated Transmission Line Corridors, 2001-2002. Aiken, South Carolina. June 21.

Tetra Tech NUS. 2002b. Threatened and Endangered Species Survey: Sinai Cemetery Transmission Line Corridor, 2002. Aiken, South Carolina.

USACE (United States Army Corps of Engineers). 2000. *Apalachicola-Chattahoochee-Flint River System General Information.* Available online at http://www.sam.usace.army.mil/op/rec/act/ history.htm. Accessed September 11, 2002.

USACE (United States Army Corps of Engineers). 2002. *Lake Seminole Information.* Available online at http://www.sam.usace.army.mil/op/rec/. Accessed September 9, 2002.

USCB (U.S. Census Bureau). 1990. "1990 Census Data." Available online at http://venus.census.gov/ cdrom/lookup. Accessed July 31, 2001.

USCB (U.S. Census Bureau). 1995. *Alabama Population of Counties by Decennial Census: 1900 to 1990.* Available online at http://www.census.gov/population/cencounts/al190090.txt. Accessed June 8, 2001.

USCB (U.S. Census Bureau). 1996. *State Population Rankings Summary - Alabama's Population Projections: 1995-2025*. Available online at http://www.census.gov/population/projections/state/ 9525rank/alprsrel.txt. Accessed June 8, 2001.

USCB (U.S. Census Bureau). 2000a. *Summary File 1: Census 2000."* Available online at http://www.census.gov/PressRelease/www/2001/sumfile1.html. Accessed November 12, 2001.

USCB (U.S. Census Bureau). 2000b. American Factfinder. Census 2000 Redistricting Data (Public Law 94-171) Summary File. Alabama – County. Available online at http://factfinder.census.gov/. Accessed June 8, 2001.

USCB (U.S. Census Bureau). 2000c. American Factfinder. "HCT. Tenure by poverty status in 1999 by age of householder [43] – Universe: Occupied housing units: 1999. Data Set: Census 2000 Summary File 3 (SF3) – Sample Data." Available online at http://factfinder.census.gov/. Accessed October 24, 2002.

USCB (U.S. Census Bureau). 2002. "Summary File 3: Census 2000." Available online at http://www.census.gov/Press-Release/www/2002/sumfile3.html. Accessed October 24, 2002.

University of Alabama. 1999. Population Projections for Alabama Counties, 2000 to 2015. Available online at http://cber.cba.ua.edu/edata/est_prj/poppro99.prn. Accessed June 11, 2001.

University of Florida. 2000. "Water Wars: Water Allocation Law and the Apalachicola-Chattahoochee-Flint River Basin. Available online at http://edis.ifas.ufl.edu/BODY_FE208. Accessed July 26, 2001.

USGS (U.S. Geological Survey). 1996. *Geohydrology and Evaluation of Stream-Aquifer Relations in the Apalachicola-Chattahoochee-Flint River Basin, Southeaster Alabama, Northwestern Florida, and Southwestern Georgia*. Prepared in cooperation with the U. S. Army Corps of Engineers, the Alabama Department of Economic and Community Affairs, the Northwestern Florida Water Management District, and the Georgia Department of Natural Resources, Environmental Protection Division. United States Geological Survey Water-Supply Paper 2460.

USGS (U.S. Geological Survey). 1997. *Ground-Water Resources of the Lower-Middle Chattahoochee River Basin in Georgia and Alabama, and Middle Flint River Basin in Georgia – Subarea 3 of the Apalachicola-Chattahoochee-Flint and Alabam-Coos-Tallapoosa River Basins*. Prepared in cooperation with Alabama Department of Economic and Community Affairs Office of Water Resources, Georgia Department of Natural Resources Environmental Protection Division, Northwestern Florida Water Management District, and U. S. Army Corps of Engineers Mobile District. Open-File Report 96-483.

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

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

PAGE INTENTIONALLY LEFT BLANK

Attachment A

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Southern Nuclear Operating Company (SNC) has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act issues for license renewal of nuclear power plants. Table A-1 lists these 92 issues and identifies the section in which SNC addressed each issue in the environmental report. For expediency, SNC has assigned a number to each issue and uses the issue numbers throughout the environmental report.

Table A-1. Joseph M. Farley Nuclear Plant Environmental Report Discussion of License Renewal NEPA Issues[a].

	Issue	Category	Section of this Environmental Report
1.	Impacts of refurbishment on surface water quality	1	4.0
2.	Impacts of refurbishment on surface water use	1	4.0
3.	Altered current patterns at intake and discharge structures	1	4.0
4.	Altered salinity gradients	1	4.0
5.	Altered thermal stratification of lakes	1	4.0
6.	Temperature effects on sediment transport capacity	1	4.0
7.	Scouring caused by discharged cooling water	1	4.0
8.	Eutrophication	1	4.0
9.	Discharge of chlorine or other biocides	1	4.0
10.	Discharge of sanitary wastes and minor chemical spills	1	4.0
11.	Discharge of other metals in waste water	1	4.0
12.	Water use conflicts (plants with once-through cooling systems)	1	4.0
13.	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	4.1
14.	Refurbishment impacts to aquatic resources	1	4.0
15.	Accumulation of contaminants in sediments or biota	1	4.0
16.	Entrainment of phytoplankton and zooplankton	1	4.0
17.	Cold shock	1	4.0
18.	Thermal plume barrier to migrating fish	1	4.0
19.	Distribution of aquatic organisms	1	4.0
20.	Premature emergence of aquatic insects	1	4.0
21.	Gas supersaturation (gas bubble disease)	1	4.0
22.	Low dissolved oxygen in the discharge	1	4.0
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0
24.	Stimulation of nuisance organisms (e.g., shipworms)	1	4.0
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4
28.	Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	4.0
29.	Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	4.0
30.	Heat shock for plants with cooling-tower-based heat dissipation systems	1	4.0
31.	Impacts of refurbishment on groundwater use and quality	1	4.0

Table A-1. Joseph M. Farley Nuclear Plant Environmental Report Discussion of License Renewal NEPA Issues[a]. (Cont'd)

	Issue	Category	Section of this Environmental Report
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	4.0
33.	Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5
34.	Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	4.6
35.	Groundwater use conflicts (Ranney wells)	2	4.7
36.	Groundwater quality degradation (Ranney wells)	1	4.0
37.	Groundwater quality degradation (saltwater intrusion)	1	4.0
38.	Groundwater quality degradation (cooling ponds in salt marshes)	1	4.0
39.	Groundwater quality degradation (cooling ponds at inland sites)	2	4.8
40.	Refurbishment impacts to terrestrial resources	2	4.9
41.	Cooling tower impacts on crops and ornamental vegetation	1	4.0
42.	Cooling tower impacts on native plants	1	4.0
43.	Bird collisions with cooling towers	1	4.0
44.	Cooling pond impacts on terrestrial resources	1	4.0
45.	Power line right-of-way management (cutting and herbicide application)	1	4.0
46.	Bird collisions with power lines	1	4.0
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0
48.	Floodplains and wetlands on power line right-of-way	1	4.0
49.	Threatened or endangered species	2	4.10
50.	Air quality during refurbishment (non-attainment and maintenance areas)	2	4.11
51.	Air quality effects of transmission lines	1	4.0
52.	Onsite land use	1	4.0
53.	Power line right-of-way land use impacts	1	4.0
54.	Radiation exposures to the public during refurbishment	1	4.0
55.	Occupational radiation exposures during refurbishment	1	4.0
56.	Microbiological organisms (occupational health)	1	4.0
57.	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12
58.	Noise	1	4.0
59.	Electromagnetic fields, acute effects (electric shock)	2	4.13
60.	Electromagnetic fields, chronic effects	NA[b]	4.0
61.	Radiation exposures to public (license renewal term)	1	4.0
62.	Occupational radiation exposures (license renewal term)	1	4.0

Table A-1. Joseph M. Farley Nuclear Plant Environmental Report Discussion of License Renewal NEPA Issues[a]. (Cont'd)

	Issue	Category	Section of this Environmental Report
63.	Housing impacts	2	4.14
64.	Public services: public safety, social services, and tourism and recreation	1	4.0
65.	Public services: public utilities	2	4.15
66.	Public services: education (refurbishment)	2	4.16
67.	Public services: education (license renewal term)	1	4.0
68.	Offsite land use (refurbishment)	2	4.17.1
69.	Offsite land use (license renewal term)	2	4.17.2
70.	Public services: transportation	2	4.18
71.	Historic and archaeological resources	2	4.19
72.	Aesthetic impacts (refurbishment)	1	4.0
73.	Aesthetic impacts (license renewal term)	1	4.0
74.	Aesthetic impacts of transmission lines (license renewal term)	1	4.0
75.	Design basis accidents	1	4.0
76.	Severe accidents	2	4.20
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0
78.	Offsite radiological impacts (collective effects)	1	4.0
79.	Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0
80.	Nonradiological impacts of the uranium fuel cycle	1	4.0
81.	Low-level waste storage and disposal	1	4.0
82.	Mixed waste storage and disposal	1	4.0
83.	Onsite spent fuel	1	4.0
84.	Nonradiological waste	1	4.0
85.	Transportation	1	4.0
86.	Radiation doses (decommissioning)	1	4.0
87.	Waste management (decommissioning)	1	4.0
88.	Air quality (decommissioning)	1	4.0
89.	Water quality (decommissioning)	1	4.0
90.	Ecological resources (decommissioning)	1	4.0
91.	Socioeconomic impacts (decommissioning)	1	4.0
92.	Environmental justice	NA[b]	4.21

a. Source: 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Not applicable. Regulation does not categorize this issue.
NEPA = National Environmental Policy Act.

Attachment B

NPDES Permit

The National Pollutant Discharge Elimination System permit for the Joseph M. Farley Nuclear Plant is approximately 33 pages long. Only the cover page, providing the authority to discharge, is included here. No other pages are pertinent to any Category 2 issues.

PAGE INTENTIONALLY LEFT BLANK

ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

POST OFFICE BOX 301463 36130-1463 ♦ 1400 COLISEUM BLVD. 36110-2059
MONTGOMERY, ALABAMA
WWW.ADEM.STATE.AL.US
(334) 271-7700

JAMES W. WARR
DIRECTOR

DON SIEGELMAN
GOVERNOR

Facsimiles: (334)
Administration: 271-7950
General Counsel: 394-4332
Air: 279-3044
Land: 279-3050
Water: 279-3051
Groundwater: 270-5631
Field Operations: 272-8131
Laboratory: 277-6718
Mining: 394-4326
Education/Outreach: 394-4383

February 9, 2001

W C CARR
MANAGER ENVIRONMENTAL SERVICES
FARLEY NUCLEAR PLANT
P O BOX 1295
BIRMINGHAM AL 35201

'FEB 2001

RE: Final NPDES Permit
NPDES Permit Number AL0024619

Dear Mr. Carr:

Attached is the issued copy of the above referenced permit.

Your comments relating to temperature limitations were considered and the Department has determined that the proposed limitations should be included in the permit due to the potential for thermal pollution from this type of operation

We will look forward to receiving monitoring data in accordance with the conditions of your Permit. Please see PART I.C., Page 3 for your reporting requirements. In order to minimize the paperwork burden on both of us, we ask that when submitting the required Discharge Monitoring Reports (DMR's), please **do not submit** lab worksheets, logs, reports or other paperwork, not specifically required by the permit unless requested to do so by ADEM staff.

If there are questions or comments in reference to the permit or related monitoring requirements, please contact Jim Phillips of this office (334) 271-7828.

Sincerely,

Edgar K. Hughes, Chief
Industrial Section
Water Division

/ar

Enclosure: Final Permit

cc:	EPA Region IV:	Final Permit
	Mike McCary, P & S:	Final Permit
	John Chitwood, Montgomery Field Office:	Final Permit

Birmingham Branch
110 Vulcan Road
Birmingham, Alabama 35209-4702
(205) 942-6168
(205) 941-1603 [Fax]

Decatur Branch
2715 Sandlin Road, S.W.
Decatur, Alabama 35603-1333
(256) 353-1713
(256) 340-9359 [Fax]

Mobile Branch
2204 Perimeter Road
Mobile, Alabama 36615-1131
(334) 450-3400
(334) 479-2593 [Fax]

Mobile – Coastal
4171 Commanders Drive
Mobile, Alabama 36615-1421
(334) 432-6533
(334) 432-6598 [Fax]

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

PERMITTEE:	FARLEY NUCLEAR PLANT (FORMERLY SOUTHERN NUCLEAR OPERATING CO)
FACILITY LOCATION:	HOUSTON COUNTY HIGHWAY 95 SOUTH COLUMBIA, ALABAMA
PERMIT NUMBER:	AL0024619
RECEIVING WATERS:	CHATTAHOOCHEE RIVER UNNAMED TRIBUTARY TO CHATTAHOOCHEE RIVER WILSON CREEK

In accordance with and subject to the provisions of the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§1251-1378 (the "FWPCA"), the Alabama Water Pollution Control Act, as amended, ***Code of Alabama 1975****, §§ 22-22-1 to 22-22-14 (the "AWPCA"), the Alabama Environmental Management Act, as amended,* ***Code of Alabama 1975****, §§22-22A-1 to 22-22A-15, and rules and regulations adopted thereunder, and subject further to the terms and conditions set forth in this permit, the Permittee is hereby authorized to discharge into the above-named receiving waters.*

ISSUANCE DATE:	FEBRUARY 9, 2001
EFFECTIVE DATE:	MARCH 1, 2001
EXPIRATION DATE:	FEBRUARY 28, 2006

Alabama Department of Environmental Management

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT
TABLE OF CONTENTS

PAGE INTENTIONALLY LEFT BLANK

Attachment C

Special-Status Species Correspondence

PAGE INTENTIONALLY LEFT BLANK

Special-Status Species Correspondence

Letter | Page

PAGE INTENTIONALLY LEFT BLANK

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Mr. Larry Goldman
Field Supervisor
Daphne (AL) Field Office
U.S. Fish & Wildlife Service
1208-B Main Street
P.O. Drawer 1190
Daphne, AL 36526

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened and Endangered Species and Important Habitats

Dear Mr. Goldman:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will be communicating with your organization during the application review of FNP's environmental report. We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figures 2-1 and 2-2). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) carry electricity into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP, including maintenance of transmission lines by Alabama Power Company over the license renewal period (an additional 20 years), would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide us with any information you may have about any threatened or endangered species or ecologically significant habitats that may occur on the 1,850-acre FNP site or within/along associated transmission corridors that cross seven Alabama counties (Houston, Montgomery, Geneva, Dale, Pike, Barbour, and Henry). Please also indicate whether your office has any concerns regarding operation of the plant or these lines. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

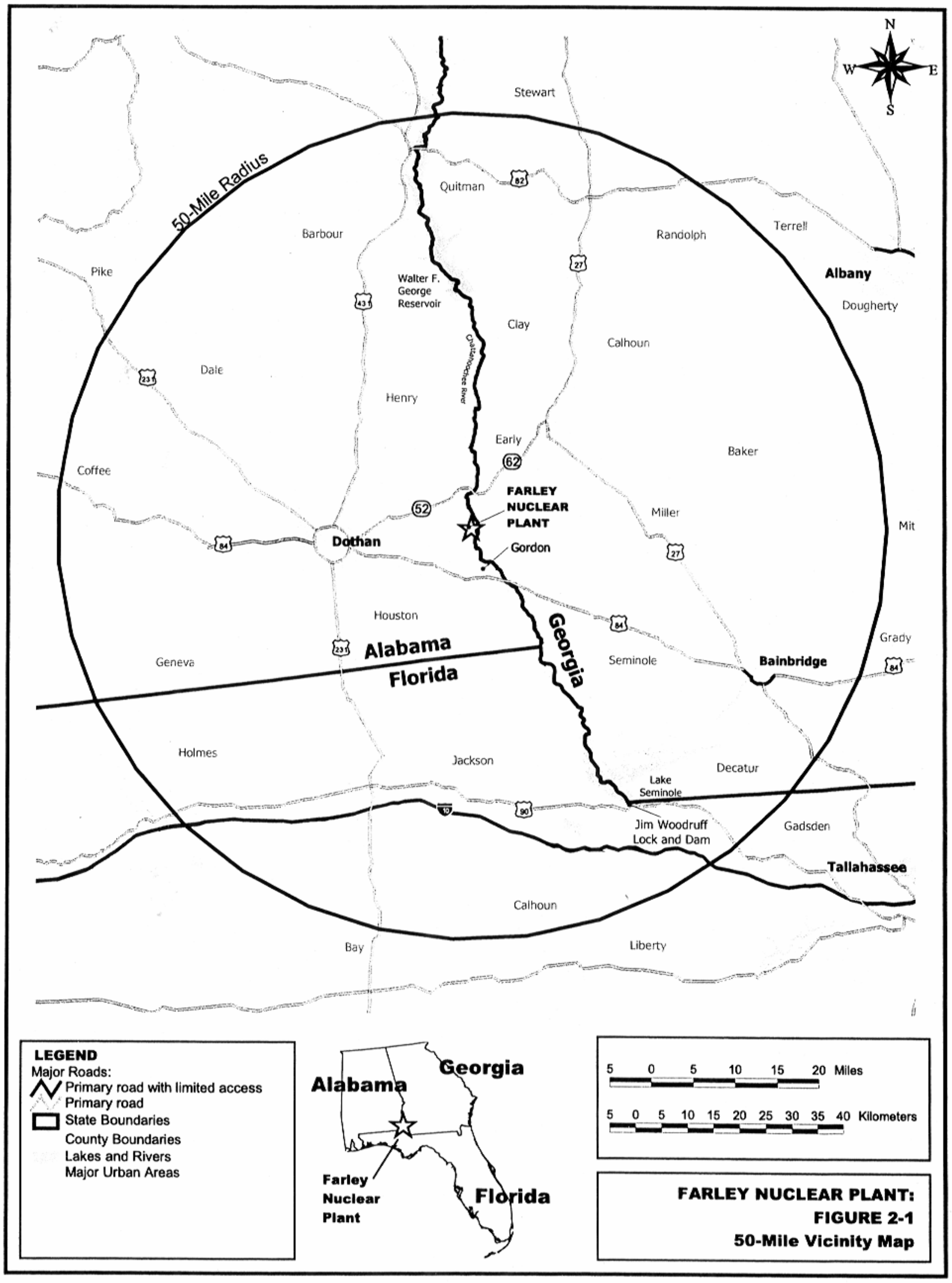
Sincerely,

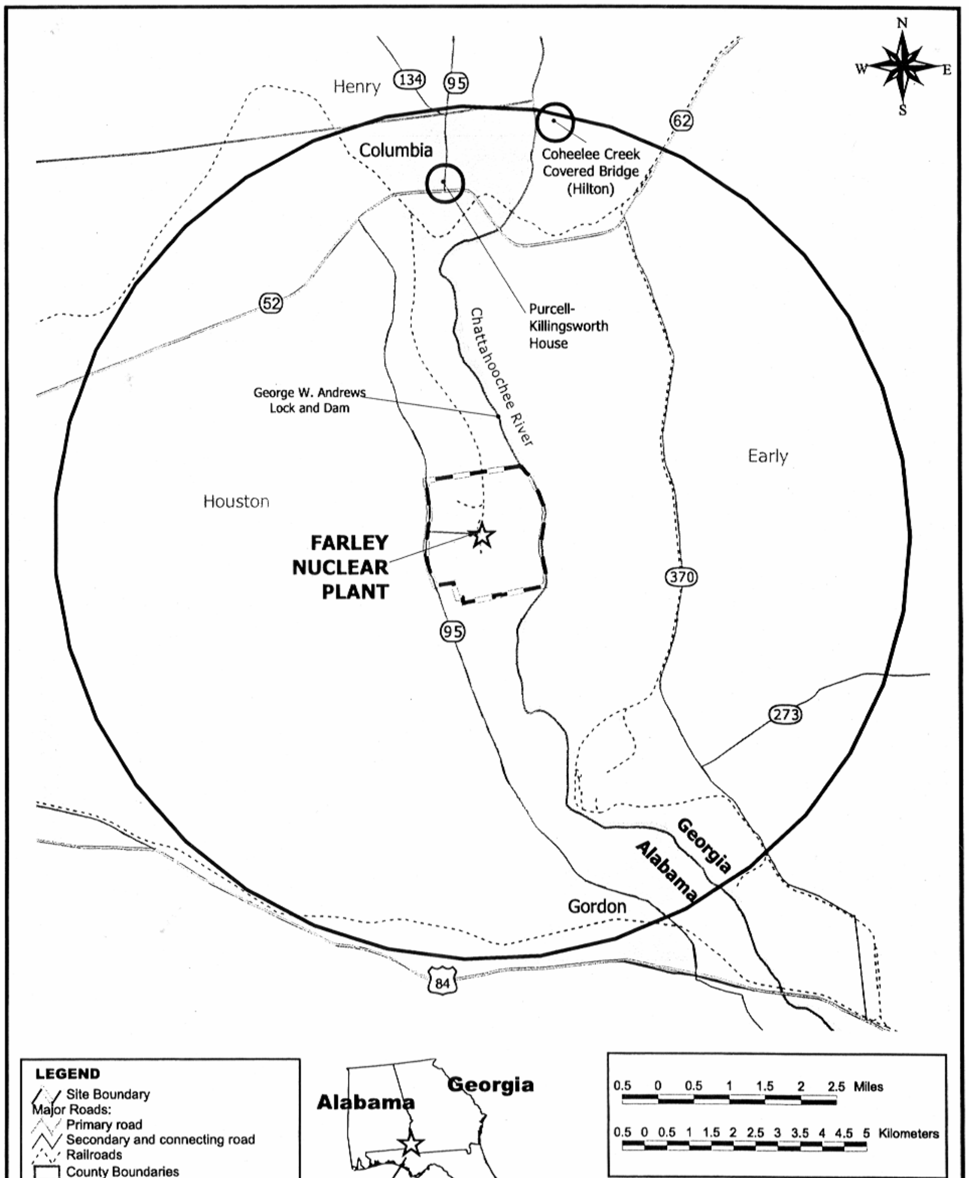
C. R. Pierce

C. R. Pierce
License Renewal Services Manager

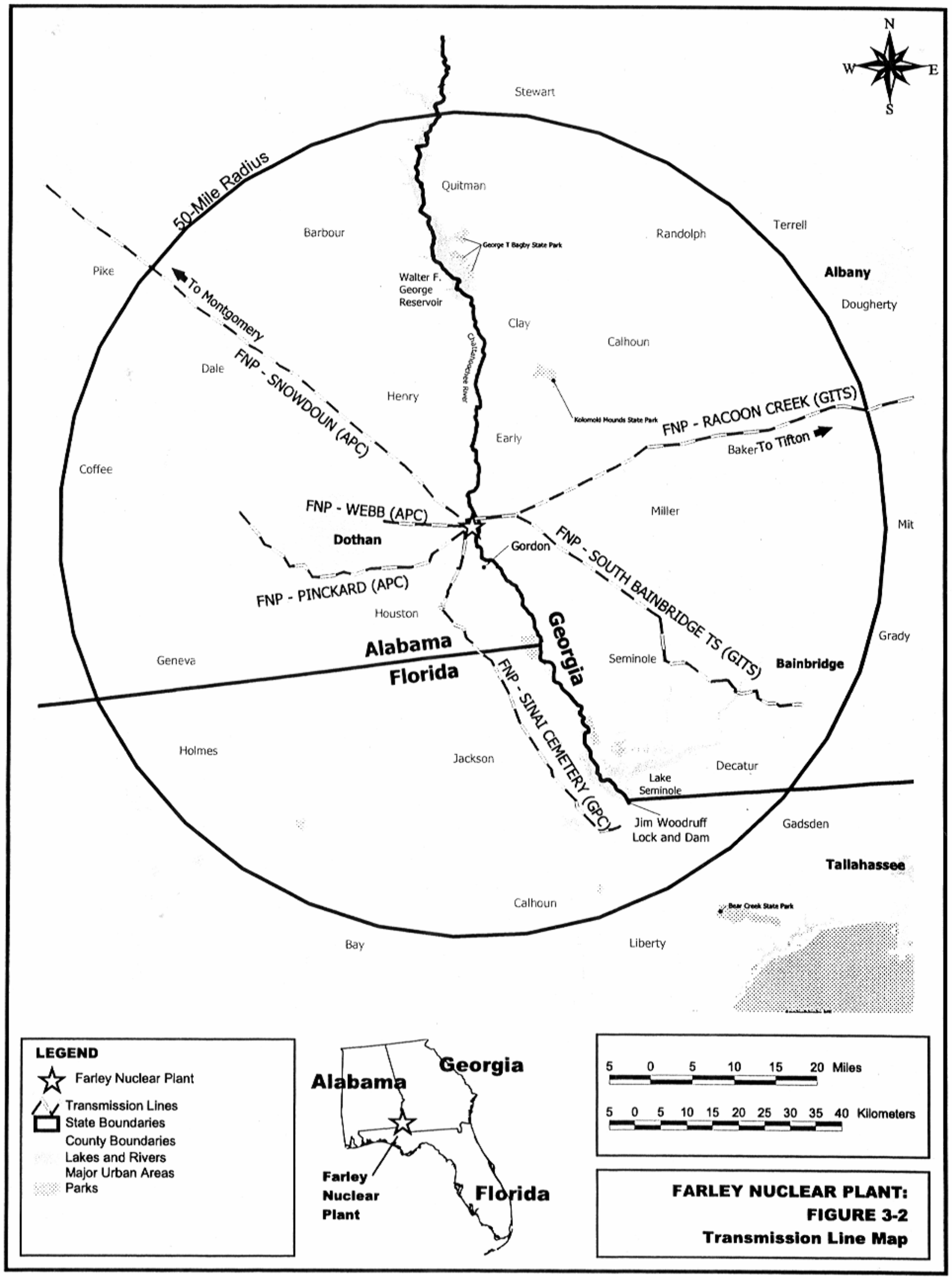
Enclosures: Figures 2-1, 2-2, and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Pike
Albany
Dougherty
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Chattahoochee River
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 2-2
6-Mile Vicinity Map


N
W
E
S
Stewart
50-Mile Radius
Quitman
Barbour
George T Bagby State Park
Randolph
Terrell
Pike
To Montgomery
Walter F. George Reservoir
Albany
Dougherty
Clay
Calhoun
Dale
FNP - SNOWDOUN (APC)
Henry
Chattahoochee River
Kolomoki Mounds State Park
FNP - RACOON CREEK (GITS)
Early
Baker
To Tifton
Coffee
FNP - WEBB (APC)
Miller
Mit
Dothan
Gordon
FNP - SOUTH BAINBRIDGE TS (GITS)
FNP - PINCKARD (APC)
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
FNP - SINAI CEMETERY (GPC)
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bear Creek State Park
Bay
Liberty
LEGEND
Farley Nuclear Plant
Transmission Lines
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Parks
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P. O. Drawer 1190
Daphne, Alabama 36526

IN REPLY REFER TO:
02-1034

July 9, 2002

C.R. Pierce, License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Dear Mr. Pierce:

Thank you for your letter of May 7, 2002, requesting comments on the proposed application for re-licensing of Joseph M. Farley Nuclear Plant Units 1 and 2 (FNP), located in Houston County, Alabama. We have reviewed the information you enclosed and are providing the following comments in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.) and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Endangered Species Act

From our data base we have determined that the following federally protected species of concern may be in your in your project area or impact zone:

Flatwoods salamander (*Phaeognathus cingulatum)* Threatened

This salamander is small and slender with a black to chocolate brown coloration and silvery gray lines that form a net-like or banded pattern across its body. Its native habitat is the longleaf pine flatwoods of the lower southeastern coastal plain. Threats to this species include habitat destruction due to agriculture, urban expansion, forestry practices and fire suppression.

Red-cockaded Woodpecker (*Picoides borealis*) Endangered.

Red-cockaded woodpeckers nest in pine stands greater than 60 years old. They forage in areas with pine stems greater than 10 inches DBH. If potential nesting habitat exists in the area that would be removed by this project, we recommend that red-cockaded woodpecker surveys be conducted.

We recommend that a habitat evaluation of the project area be conducted by a qualified biologist having knowledge of the above listed species, their required habitat and experience in

1

PHONE: 334-441-5181 www.fws.gov FAX: 334-441-6222
SHIPPING ADDRESS: 1208-B Main Street, Daphne, AL 36526

conducting surveys of them. Where it is determined that habitat associated with the these two species exists, we recommend that a survey for the species be conducted. We request that you provide us with a description of the habitat observed, as well as the survey report as appropriate, including survey methodology for our review. **If habitat for those species does not exist, then a survey is not necessary.**

The Service has a trust responsibility for the protection and conservation of migratory species as well as interest in the protection and conservation of recreational and commercial fisheries. The Chattahoochee River supports migratory fish species and significant recreational fisheries, including that of the species listed below:

*striped bass (*Morone saxatilis*)
hybrid striped bass (*M. chrysops x saxatilis*)
largemouth bass (*Micropterus salmoides*)
spotted bass (*Micropterus punctulatus*)
white bass (*Morone chrysops*)
yellow bullhead (*Ameiurus natalis*)
white catfish (*Ameiurus catus*)
brown bullhead (*Ameiurus nebulosus*)
spotted bullhead (*Ameiurus seuraeanthus*)
channel catfish (*Ictalurus punctatus*)
"shoal bass" (*Micropterus species*)
black crappie (*Pomoxis nigromaculatus*)
bream (*Lepomis spp.*)
*skipjack herring (*Alosa chrysochloris*)
gizzard shad (*Dorosoma cepedianum*)
threadfin shad (*Dorosoma cepedianum*)
*American eel (*Anguilla rostrata*)

* = migratory species

The Service has concern for the health of these species and the associated fisheries they support. Fish and most other aquatic biota are sensitive to thermal pollution and alteration of temperature regimes. Such alteration from that of ambient conditions can affect spawning, growth, reproduction and movements or migrations that are necessary for fish to complete their life cycles. There is potential during low flow conditions for water temperatures from power plant discharges, to greatly exceed that of instantaneous ambient stream temperature. This is particularly important during hydrologically stressed periods and during periods when ambient temperatures are most elevated. In such a case, sensitive fish species might either be eliminated from or avoid affected stream reaches as result of elevated temperatures or reduced dissolved oxygen concentrations. Elevated water temperature (above that of ambient) may serve to reduce dissolved oxygen concentrations to the point where fish and other aquatic biota are stressed, perhaps to a significant degree. The discharge plume may act as a barrier to fish migration.

Because fish occupy habitat where their temperature tolerances may be reached, they are susceptible to minor deviations beyond ambient temperatures. Therefore, the Service is concerned that the thermal discharge from the operation of the Joseph M. Farley Nuclear Power Plant may be having an adverse effect on the species listed above, as well as on other aquatic biota.

We do not have adequate information regarding ambient flows and maximum discharge rates from the Joseph M. Farley Nuclear Plant facility and its affect on water temperature and dissolved oxygen concentrations to determine whether fish and other aquatic biota of the Chattahoochee River are being adequately protected from the operation and discharge of the facility. If you have information refuting to the effects of the discharge on stream temperature and dissolved oxygen, we would appreciate receiving a copy for our further evaluation. If adequate information is not available to make such an assessment and determination, we recommend that appropriate studies be designed and implemented to provide such information.

The Service has particular concern for the health of the striped bass (*Morone saxatilis*) populations in the Chattahoochee River system. Although not listed as threatened or endangered, striped bass provide a significant recreational fishery. They prefer cooler water temperatures, have a low tolerance to warm water temperatures and are sensitive to abrupt changes in temperature and dissolved oxygen. Gizzard and threadfin shads are sensitive to abrupt changes in temperature and dissolved oxygen. (Mettee, O'Neil, and Pierson, 1996). Striped bass forage primarily on those shads. Elevated temperature and dissolved oxygen levels resulting from the thermal discharge from the Joseph M. Farley Nuclear Plant may also have an adverse effect on the macroninvertebrate community, the food source for migratory fish and recreational fisheries of the Chattahoochee River.

Our concerns include not only that for thermal discharges mentioned above but also that for radiation that may be released from the facility into the Chattahoochee River and the effects such releases might have on the health of fish and other aquatic biota. Such effects may include physiological, biological and mutagenic effects on overall aquatic ecosystem health, including but not limited to such things as reproduction, growth, behavior, diseases, ... etc. We request that you provide us a copy of data and reports you may have submitted to the Nuclear Regulatory Commission in most recent years that deal with exposure of fish and other aquatic biota to radiation. If adequate data and information (existing) is not available, we recommend appropriate study(ies) be directed at the possible effects on fish and other aquatic biota found in the Chattahoochee River and within the potential impact zone sufficient to make such a determination and assessment. Such studies should include collection of tissue samples of fish and other aquatic biota of the Chattahoochee River and measurements and determination of radiation levels and overall health of their health and condition, as they relate to levels of exposure to radiation.

We have the following comments, questions and requests for information:

1. We would like a copy of the existing Joseph M. Farley Nuclear Plant NPDES permit for our review.

2. We would like to review available data for the past two years (or for the most recent two year period) on the water temperature of in-stream flow of the river immediately below the point of discharge, as well as that immediately downstream and upstream of the point of discharge.

3. We would like to receive information collected on the effects of the thermal discharge on fish and other aquatic biota.

4. We would like to receive any dissolved oxygen data that has been collected on the Chattahoochee River both upstream and downstream of the point of discharge of the facility by the Southern Nuclear Operating Company, Inc. and/or consultants.

5. Please provide us with a copy of monthly operating reports on radioactive releases and contamination, including that of fish tissue sampling and analyses that were submitted to the Nuclear Regulatory Commission over the last two years or the most recent of such data.

6. Please list all radioactive pollutants, toxics and caustics discharged into the Chattahoochee River or to waste holding ponds.

7. Are biocides to be used in the operation? If so, how will those biocides be contained and prevented from being discharged into the Chattahoochee River?

8. Has there been any water quality sampling and monitoring (physical, chemical and biological) done on the Chattahoochee River by the Southern Nuclear Operating Company, Inc.? If so, we would like a copy of such information generated over the last three years for our review.

9. What is the 7Q10 and average monthly discharge rates (cfs) at the point of intake or withdrawal (withdrawal for cooling water) and discharge intake point? We ask that you calculate them from actual in-stream flow data rather than using runoff coefficients. Please provide us with the calculations used. If the Southern Nuclear Operating Company, Inc. has in-stream flow data (upstream or downstream), we ask that you submit it for our review. How would plant impacts be affected by implementation of the proposed water allocation formula for the Apalachicola, Chattahoochee, Flint River Basins currently being considered by the states of Alabama, Florida, and Georgia?

10. What are the average and maximum discharge rates (cfs) for thermal discharge into the Chattahoochee River? We would like a copy of discharge flow data generated over the last two years.

4

11. For any water withdrawals, we recommend suitable screening be provided over the intake structure to minimize entrainment/impingement of fish during water diversion. Please present the design specifications for any existing screening designs for the present intake structure. The velocity through the screen should not exceed one foot per second.

12. Please provide us with maps (USGS quadrangle level of detail) showing the layout of transmission lines.

13. Will there be any refurbishments made of the facility and system? If so please provide details of those plans.

As you can see, there are a number of outstanding questions concerning this project. If we receive the information requested above, we will be in better position to interact with you as your relicensing process goes forward.

Should you wish, data we have requested could be provided on diskette in J - peg format.

We appreciate the opportunity to provide this information. If you need additional information, please contact Mr. Bill Young of my staff, at (251) 441-5181 ext. 38.

Sincerely,

Larry E. Goldman
Field Supervisor

cc: Jon Hornsby, ADCNR

References:

Mettee, F. Maurice, O'Neil, Patrick E., and Pierson, J. Malcolm, 1996, Fishes of Alabama and the Mobile Basin, by State of Alabama, 820 pp

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295

Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Mr. Steve Parris
Supervisory Biologist
West Georgia Sub-Office
U.S. Fish & Wildlife Service
P.O. Box 52560
Ft. Benning, GA 31995-2560

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened or Endangered Species and Important Habitats

Dear Mr. Parris:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will be communicating with your organization during the application review of FNP's environmental report. We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC"s review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to- Racoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently

under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance is anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Georgia by Georgia Integrated Transmission System, would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the two Farley-connected transmission corridors (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) that cross eight Georgia counties (Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur). Please indicate whether your office has any concerns regarding operation of these lines. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

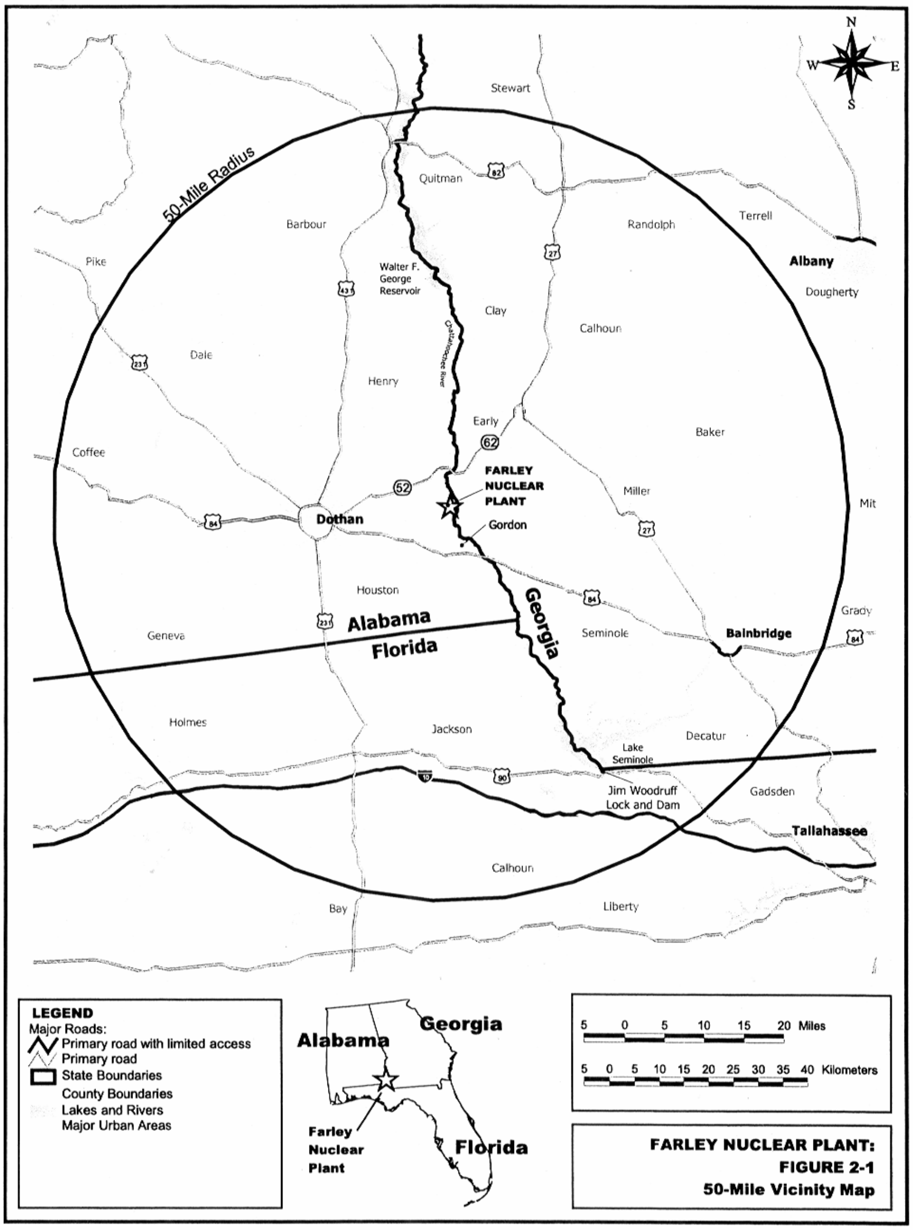
Sincerely,

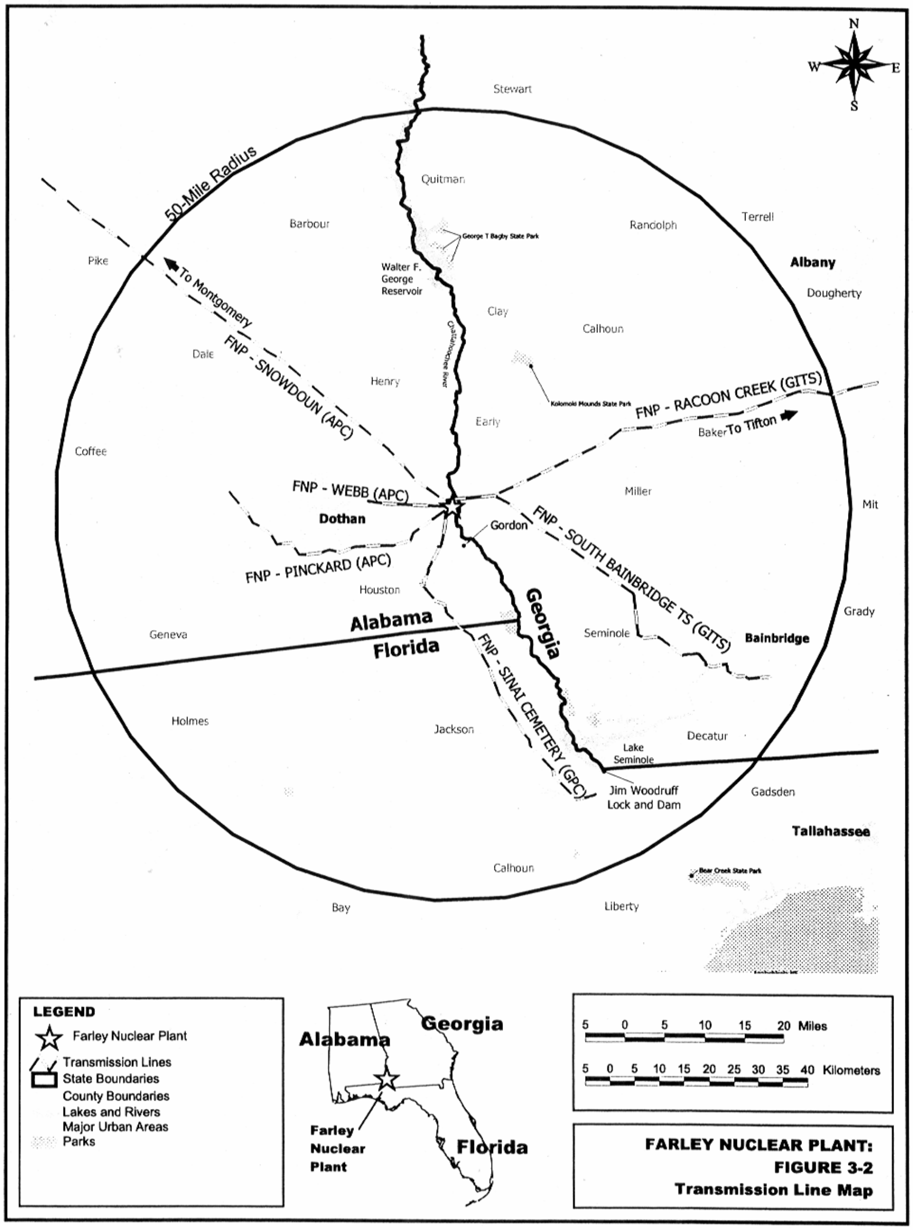
C R Pierce

C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


Stewart
Quitman
50-Mile Radius
Barbour
Randolph
Terrell
Albany
Dougherty
Pike
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

United States
Fish & Wildlife Service

Georgia Ecological Services

www.fws.gov/r4gafo

□ Coastal Georgia Suboffice
4270 Norwich Avenue
Brunswick, GA 31520
912-265-9336 Fax: 912-265-1061

□ North Georgia Field Office
247 South Milledge Avenue
Athens, GA 30605
706-613-9493 Fax: 706-613-6059

☒ West Georgia Suboffice
P.O. Box 52560
Ft. Benning, GA 31995-2560
706-544-6422 Fax: 706-544-6419

Fax Transmittal Sheet

To: Jim Davis, Southern Company

Fax Number: 205 992-5294

From: Steve Parris

Date: 1-22-03

Pages To Follow: 2

Subject: Farley Nuclear Plant License Renewal

JAN 22 2003 11:59AM USFWS WEST GA FT BENNING 706 544 6419 p.1

Southern Nuclear
Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

FWS Log No: 02-0628

RECEIVED
MAY 13 2002
W.GA.ES

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

U. S. Fish and Wildlife Service
247 S. Milledge Ave., Athens, Georgia 30605
Phone: (706) 613-9493 Fax: (706) 613-6059

FWS Log No. 02-0628

Based on the information provided, the proposed action is not expected to significantly imp[act] fish and wildlife resources under the U. S. Fish and Wildlife Service jurisdiction.

for Stephen D. Parris 1-22-03
Sandra S. Tucker, Field Supervisor — Date

Mr. Steve Parris
Supervisory Biologist
West Georgia Sub-Office
U.S. Fish & Wildlife Service
P.O. Box 52560
Ft. Benning, GA 31995-2560

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened or Endangered Species and Important Habitats

Dear Mr. Parris:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will be communicating with your organization during the application review of FNP's environmental report. We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC"s review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to- Racoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently

JAN 22 2003 11:59AM USFWS WEST GA FT BENNING 706 544 6419 p.2

under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance is anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Georgia by Georgia Integrated Transmission System, would not adversely affect any threatened or endangered species.

no comment

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the two Farley-connected transmission corridors (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) that cross eight Georgia counties (Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur). Please indicate whether your office has any concerns regarding operation of these lines. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

Sincerely,

C R Pierce

C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis

JAN 22 2003 11:59AM USFWS WEST GA FT BENNING 706 544 6419 P.3

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Ms. Gail Carmody
Project Leader
U.S. Fish & Wildlife Service
1601 Balboa Avenue
Panama City, FL 32405

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened or Endangered Species and Important Habitats

Dear Ms. Carmody:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will be communicating with your organization during the application review of FNP's environmental report. We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) carry electricity into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP, including maintenance of transmission lines by Alabama and Gulf Power Companies over the license renewal period (an additional 20 years), would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide any information you may have about any threatened or endangered species or ecologically significant habitats associated with the transmission corridor that crosses one Florida county (Jackson). Please also indicate whether your office has any concerns regarding the operation of this line. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

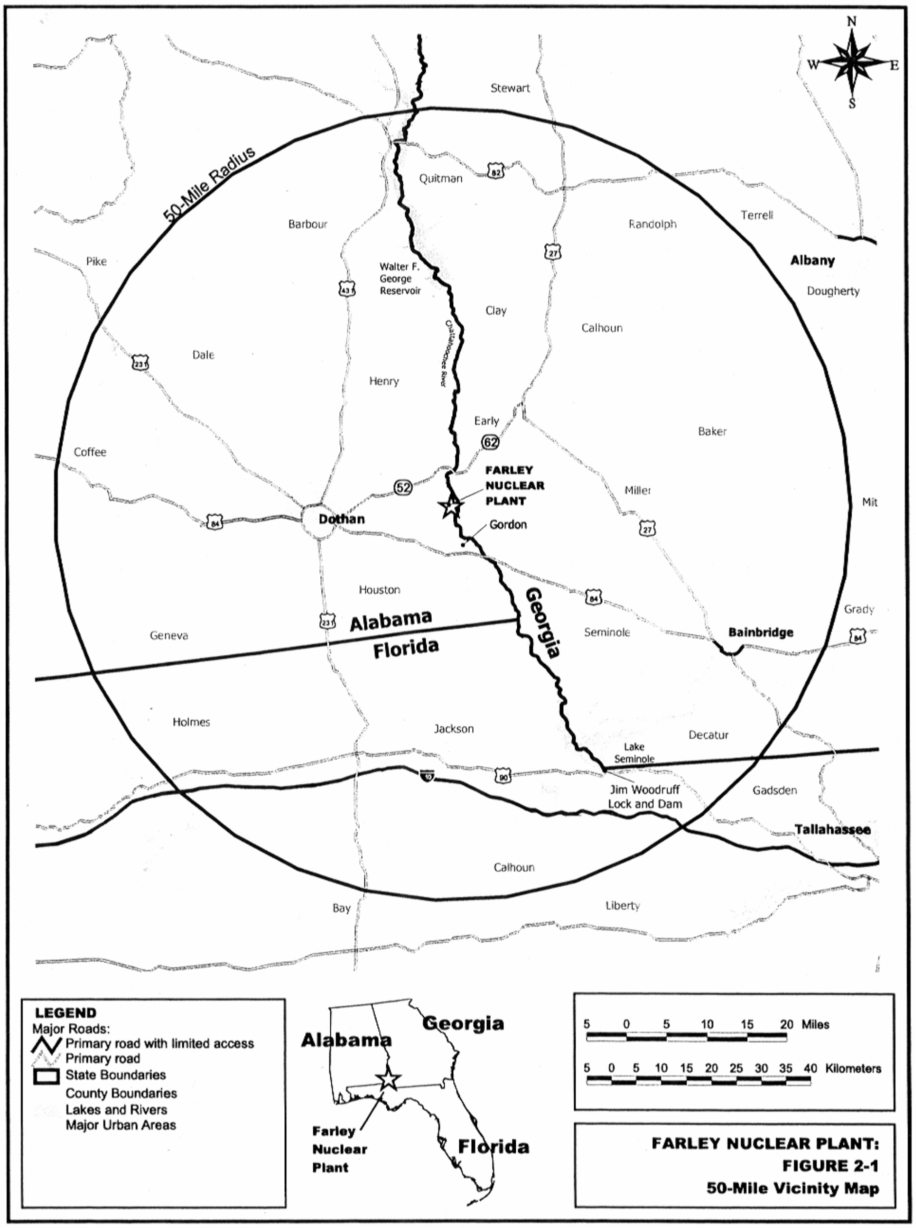
Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

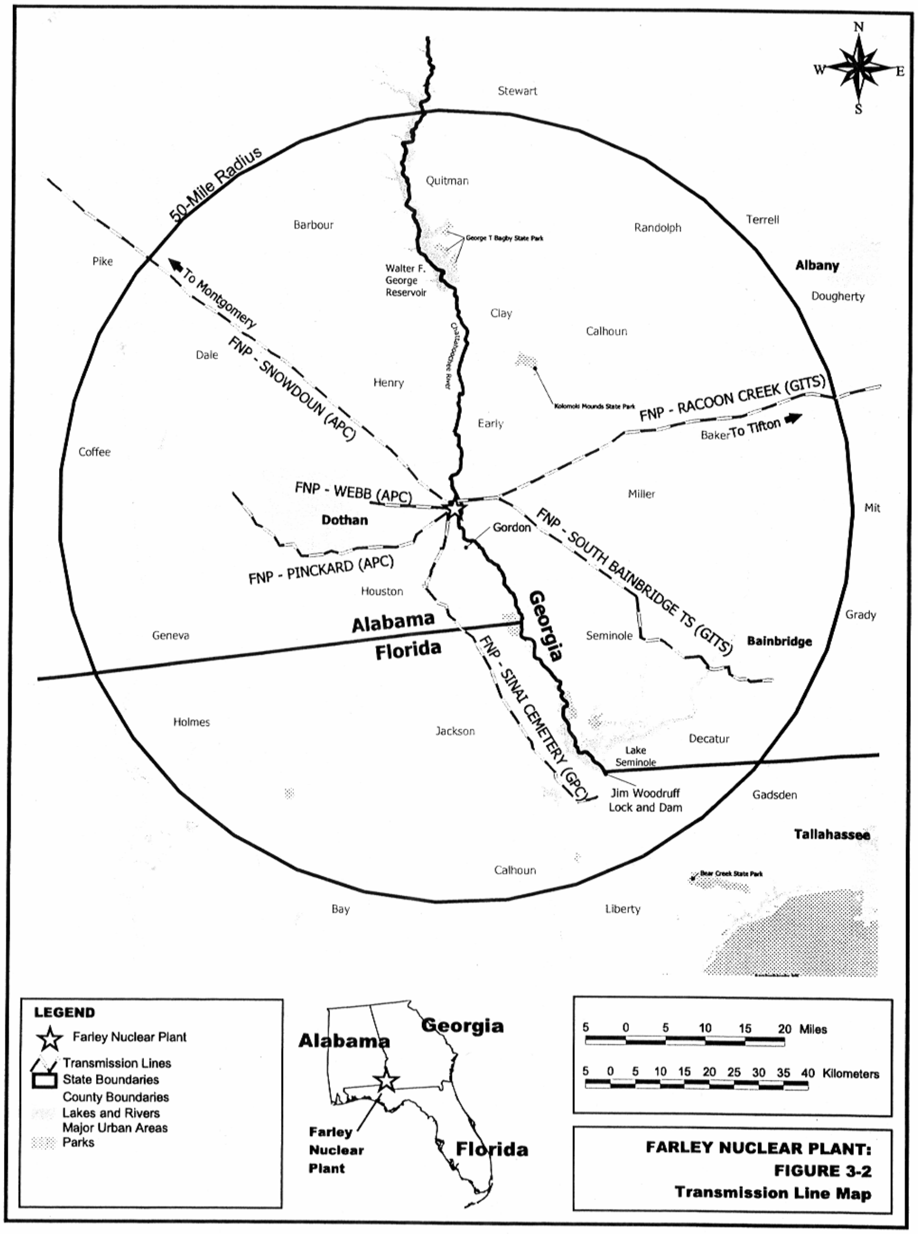
Sincerely,

C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Pike
Walter F. George Reservoir
Albany
Dougherty
Clay
Calhoun
Dale
Henry
Chattahoochee River
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Georgia
Alabama
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

IN REPLY REFER TO:

Tel: (850) 769-0552
Fax: (850) 763-2177

June 13, 2002

Mr. C.R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

Re: FWS No. 4-P-02-179
Farley Nuclear Plant License Renewal
Sinai Cemetery Transmission Line
Jackson County, Florida

Dear Mr. Pierce:

Thank you for your letter requesting information about any threatened or endangered species or ecologically significant habitats associated with the project referenced above. This response is provided pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

Southern Nuclear Operating company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the Farley Nuclear Plant (FNP) in Houston County, Alabama. Five transmission lines connecting FNP to a regional transmission system are associated with this project. Three lines lie entirely in Alabama and are owned and operated by Alabama Power. Two lines carry electricity into Georgia and are operated by Georgia Integrated Transmission System for most of their length. A sixth line located in Jackson County, Florida, is owned and maintained by Gulf Power. In your letter you indicated that this line "is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has been dismantled. Our comments apply to the Gulf Power line in Jackson County.

To assist you with your studies, we are enclosing a table of threatened, endangered, and other special status species and their habitats for Jackson County, Florida. The table is a combination of species occurrence and habitat information developed by the Florida Natural Areas Inventory (FNAI), and species status data compiled by the Florida Fish and Wildlife Conservation Commission (FWCC).

The FNAI is a statewide database housing extensive information on the occurrence and quality of rare and endangered species and high quality natural communities in Florida. The FNAI can be contacted at 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, (850) 224-8207. The FWCC may have additional information on State-listed species and important habitats. The FWCC Environmental Services Division is located at 620 South Meridian Street, Tallahassee, Florida 32399-1600, (850) 488-6661. Our office is not able to provide site-specific information. If more site-specific data is needed for project evaluation, we suggest coordinating with the FNAI and the FWCC.

Depending on levels of disturbance, location, soils and hydrologic regimes, existing vegetative communities and a host of other conditions, there is some potential for listed species to be found in, and along utility rights-of-way (ROW) corridors. For example, a listed plant might occur in a right-of-way because mowing or other activities have maintained suitable "open" habitat conditions. Another example might be a gopher tortoise burrow that is used by an eastern indigo snake. We are enclosing a table of rare and listed plants of the Florida panhandle that have the potential to occur within highway and utility rights-of-way. This table has been developed by botanists of FNAI.

Certain activities that cause soil disturbance or soil compaction in rights-of-way have some potential to affect listed species. Other activities occurring during a plant's flowering season or an animal's reproductive season may also impact listed species. Depending on management techniques, ROW maintenance has the potential to harm or benefit listed species. Along another transmission line in an adjacent county (Gadsden County, Florida), Gulf Power Corporation has been cooperative in implementing management that will protect and enhance habitat for the federally endangered fringed campion (*Silene polypetala*). Gulf Power has agreed to conduct mowing operations during a time of the year when the plant is not in "flower" to avoid adverse impacts. Along with consideration of application methods, timing of herbicide application has also been modified.

Opportunities exist elsewhere in utility ROWs in the Florida panhandle to undertake similar conservation efforts. We hope to work with Gulf Power and other utility companies to conserve and recover other listed species known to occur in utility ROWs.

The following is a brief explanation of an agency's responsibilities under the Endangered Species Act (Act): Section 7(a)(2) of the Act requires Federal agencies to ensure that their actions do not jeopardize the continued existence of listed species, or destroy or adversely modify critical habitat. The Federal agency (or its designee) responsible for authorizing, funding, or implementing an action is required to determine whether listed species, proposed species, critical habitat, or proposed critical habitat may be present in the area that would be influenced by that action. If such species or habitat may be present, the Federal agency is required to determine whether the action may directly, indirectly, and/or cumulatively affect such species or habitat.

To make such a determination, the following information should be considered and summarized in a biological information report:

1. The results of an on-site inspection of the areas affected by the action.

2. The views of recognized experts on the species at issue.

3. A review of the literature and other information.

4. An analysis of the effects of the action on the species and habitat, including consideration for the cumulative effects, and the results of any related studies.

5. An analysis of alternative actions considered by the Federal agency for the proposed action.

If the proposed action potentially involves listed species or critical habitat, the Federal agency must consult with the Fish and Wildlife Service (Service). Consultation can be informal or formal. It may be concluded informally if an action can be implemented in a way that is not likely to adversely affect listed species or critical habitat. Coordination with the Service to explore this possibility is encouraged.

If a determination is made that listed species or critical habitat may be adversely affected, the Federal agency must request, in writing, formal consultation with the Service. If the proposed action is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat, the Federal agency must confer with the Service.

Section 7(d) of the Act underscores the requirement that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable alternatives regarding their actions on listed species.

Thank you for giving us the opportunity to comment on FNP License Renewal. We hope you find this information helpful. Please feel free to contact this office if you have any questions or need additional information.

Sincerely yours,

for Gail A. Carmody
Project Leader

Enclosure:
Jackson County Species Table
Jackson County ROW Species

cc:
Sandy Tucker, North GA. ES FO, Athens, GA
Larry Goldman, Alabama ES FO, Daphne, AL.
Rachel Terry, Gulf Power Corp., Pensacola, FL (w/enclosures)

SS/kh/c:/stan4p02179

3

FLORIDA NATURAL AREAS INVENTORY
1018 Thomasville Road, Suite 200-C, Tallahassee, FL 32303 (850) 224-8207

October 2000
Page 1 of 2

Jackson County

Rare Plant Species
Species potentially occurring in rights-of-way underlined

Occurrence Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	Status†
VASCULAR PLANTS						
Agrimonia incisa	incised groove-bur	G3	S2	N	N	C
Andropogon arctatus	pine-woods bluestem	G3	S3	N	N	C
Aquilegia canadensis var australis	Marianna columbine	G5T1	S1	N	N	C
Arabis canadensis	sicklepod	G5	S1	N	LE	C
Aristida simpliciflora	southern three-awned grass	G2	S2	N	N	C
Arnoglossum diversifolium	variable-leaved Indian-plantain	G2	S2	N	LT	C
Asplenium x heteroresiliens	Wagner's spleenwort	HYB	S1S2	N	N	C
Aster fragilis var brachypholis	Apalachicola River aster	G4T2	S1	N	N	C
Baptisia megacarpa	Apalachicola wild indigo	G3	S2	N	LE	C
Botrychium lunarioides	winter grape-fern	G4?	S1	N	N	C
Brickellia cordifolia	Flyr's brickell-bush	G2G3	S2	N	LE	C
Calamintha dentata	toothed savory	G3	S3	N	N	C
Callirhoe papaver	poppy mallow	G5	S2	N	LE	C
Calycanthus floridus	sweet shrub	G5T4	S2	N	LE	C
Calystegia catesbiana	trailing bindweed	G3	S1	N	LE	C
Coreopsis integrifolia	Chipola dye-flower	G1G2	S1	N	N	C
Croton elliottii	Elliott's croton	G2G3	S2S3	N	N	C
Cryptotaenia canadensis	Canada honewort	G5	S2S3	N	LE	C
Cynoglossum virginianum	wild comphrey	G5	S2	N	N	C
Dirca palustris	eastern leatherwood	G4	S2	N	N	C
Euphorbia commutata	wood spurge	G5	S2?	N	N	C
Forestiera godfreyi	Godfrey's privet	G3	S2S3	N	LE	C
Hepatica nobilis	liverleaf	G5	S2	N	LE	C
Ilex amelanchier	serviceberry holly	G4	S2	N	N	C
Illicium floridanum	Florida anise	G5	S3	N	LT	C
Isopyrum biternatum	false rue-anemone	G5	S1	N	N	C
Kalmia latifolia	mountain laurel	G5	S3	N	LT	R
Lilium michauxii	Carolina lily	G4G5	S1S2	N	N	C
Lilium superbum	turk's cap lily	G5	S1	N	N	C
Linum westii	West's flax	G2	S2	N	LE	C
Macranthera flammea	hummingbird flower	G3	S2	N	LE	C
Magnolia ashei	Ashe's magnolia	G2	S2	N	LE	C
Magnolia pyramidata	pyramid magnolia	G4	S2	N	LE	C
Malaxis unifolia	green adder's-mouth	G5	S3	N	LE	C
Marshallia obovata	Barbara's buttons	G4G5	S1	N	LE	C
Matelea baldwyniana	Baldwyn's spiny-pod	G2G3	S1	N	LE	C
Matelea floridana	Florida spiny-pod	G2	S2	N	LE	R
Myriophyllum laxum	piedmont water-milfoil	G3	S2S3	N	N	C
Nuphar lutea ssp ulvacea	west Florida cowlily	G5T2	S2	N	N	C
Pachysandra procumbens	Allegheny spurge	G4G5	S1	N	LE	C
Physostegia leptophylla	slender-leaved dragon-head	G4?	S3S4	N	N	C
Platanthera integra	yellow fringeless orchid	G4	S3S4	N	LE	C

FLORIDA NATURAL AREAS INVENTORY
1018 Thomasville Road, Suite 200-C, Tallahassee, FL 32303 (850) 224-8207

October 2000
Page 2 of 2

Jackson County

Rare Plant Species
Species potentially occurring in rights-of-way underlined

Occurrence Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	Status†
Podophyllum peltatum	may apple	G5	S1	N	N	C
Polymnia laevigata	Tennessee leafcup	G3	S1?	N	N	C
Rhododendron austrinum	orange azalea	G3G4	S3	N	LE	C
Rudbeckia triloba var pinnatiloba	pinnate-lobed coneflower	G4T2?	S1	N	N	C
Ruellia noctiflora	white-flowered wild petunia	G2G3	S2	N	LE	C
Salix eriocephala	heart-leaved willow	G5	S1	N	LE	C
Salix floridana	Florida willow	G2	S2	N	LE	C
Salvia urticifolia	nettle-leaved sage	G5	S1	N	LE	C
Schisandra coccinea	schisandra	G4	S2	N	LE	C
Sideroxylon lycioides	gopherwood buckthorn	G5	S2	N	LE	C
Sideroxylon thornei	Thorne's buckthorn	G2	S1	N	LE	C
Silene polypetala	fringed campion	G2	S1	LE	LE	C
Sium floridanum	Florida water-parsnip	G1Q	S1	N	N	C
Spigelia gentianoides	gentian pinkroot	G2	S1	LE	LE	C
Torreya taxifolia	Florida torreya	G1	S1	LE	LE	C
Trillium lancifolium	narrow-leaved trillium	G3	S2	N	LE	C
Uvularia floridana	Florida merrybells	G3?	S1	N	N	C
Xyris scabrifolia	Harper's yellow-eyed grass	G3	S1	N	LT	C

* See attached *FNAI Rank Explanations* sheet for definitions of **Global and State Ranks**, and **State and Federal Status**

** See attached *FNAI Rank Explanations* sheet, ***Special Animal Listings - State and Federal Status*** section

† County Occurrence Status

Vertebrates and Invertebrates:

C = (Confirmed) Occurrence status derived from a documented record in the FNAI data base.
P = (Potential) Occurrence status derived from a reported occurrence for the county, or the occurrence lies within the published range of the taxon.
N = (Nesting) For sea turtles only; occurrence status derived from documented nesting occurrences.

Plants, Natural Communities, and Other:

C = (Confirmed) Occurrence status derived from a documented record in the FNAI data base or from a herbarium specimen.
R = (Reported) Occurrence status derived from published reports.

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
FISH:				
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	SSC	T	ESTUARINE: various MARINE: various habitats RIVERINE: alluvial and blackwater streams
Bluestripe shiner	*Cyprinella callitaenia*		ce	RIVERINE: alluvial stream
Shoal bass	*Micropterus sp. (undescribed)*	SSC		RIVERINE: alluvial stream
Bluenose shiner	*Pteronotropis welaka*	SSC		RIVERINE: blackwater, alluvial, and spring-run streams
AMPHIBIANS & REPTILES:				
American alligator	*Alligator mississippiensis*	SSC	T(s/a)	ESTUARINE: marshes, various habitats LACUSTRINE: marshes, swamps, various habitats PALUSTRINE: swamps, floodplains, marshes, various habitats RIVERINE: open water, shorelines, various habitats
Flatwoods salamander	*Ambystoma cingulatum*	SSC	T	PALUSTRINE: wet flatwoods, dome swamp, basin swamp, ruderal TERRESTRIAL: mesic flatwoods (reproduces in ephemeral wetlands within this community)
Eastern indigo snake	*Drymarchon corais couperi*	T	T	ESTUARINE: tidal swamp PALUSTRINE: hydric hammock, wet flatwoods TERRESTRIAL: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Gopher tortoise	*Gopherus polyphemus*	SSC	ce	TERRESTRIAL: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal
Barbour's map turtle	*Graptemys barbouri*	SSC	ce	PALUSTRINE: floodplain stream, floodplain swamp RIVERINE: alluvial stream
Georgia blind salamander	*Haideotriton wallacei*	SSC	ce	SUBTERRANEAN: aquatic cave

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

Page 1 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Alligator snapping turtle	*Macroclemys temminckii*	SSC	ce	ESTUARINE: tidal marsh LACUSTRINE: river floodplain lake, swamp lake RIVERINE: alluvial stream, blackwater stream
Florida pine snake	*Pituophis melanoleucus mugitus*	SSC	ce	LACUSTRINE: ruderal, sandhill upland lake TERRESTRIAL: sandhill, scrubby flatwoods, xeric hammock, ruderal
Suwannee cooter	*Pseudemys concinna suwanniensis*	SSC		RIVERINE: alluvial stream, blackwater stream, spring-fed stream
Gopher frog	*Rana capito*	SSC	ce	TERRESTRIAL: sandhill, scrub, scrubby flatwoods, xeric hammock (reproduces in ephemeral wetlands within these communities)
BIRDS:				
Bachman's sparrow	*Aimophila aestivalis*		ce	TERRESTRIAL: various, ruderal
Limpkin	*Aramus guarauna*	SSC		LACUSTRINE: various PALUSTRINE: various RIVERINE: various
Little blue heron	*Egretta caerulea*	SSC		ESTUARINE: marshes, shoreline PALUSTRINE: floodplains, swamps RIVERINE: shoreline
Snowy egret	*Egretta thula*	SSC		ESTUARINE: marshes, tidal swamps, shoreline LACUSTRINE: lake edges PALUSTRINE: swamp, floodplain, ruderal RIVERINE: shoreline
Tricolored heron	*Egretta tricolor*	SSC		ESTUARINE: marshes, tidal swamps, shoreline LACUSTRINE: lake edges PALUSTRINE: swamp, floodplain, ruderal RIVERINE: shoreline
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	ce	ESTUARINE: winters along coasts LACUSTRINE: various PALUSTRINE: various TERRESTRIAL: various, ruderal
Southeastern kestrel	*Falco sparverius paulus*	T	ce	ESTUARINE: various habitats PALUSTRINE: various habitats TERRESTRIAL: open pine forests, clearings, ruderal, various

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Bald eagle	*Haliaeetus leucocephalus*	T	T	ESTUARINE: marsh edges, tidal swamp, open water LACUSTRINE: swamp lakes, edges PALUSTRINE: swamp, floodplain RIVERINE: shoreline, open water TERRESTRIAL: pine and hardwood forests, clearings
Wood stork	*Mycteria americana*	E	E	ESTUARINE: marshes LACUSTRINE: floodplain lakes, marshes (feeding), various PALUSTRINE: marshes, swamps, various
Red-cockaded woodpecker	*Picoides borealis*	T	E	TERRESTRIAL: mature pine forests
Black Skimmer	*Rynchops niger*	SSC		ESTUARINE: various LACUSTRINE: various RIVERINE: various TERRESTRIAL: ocean beaches, beach dune, ruderal. Nests common on rooftops.
MAMMALS:				
Gray bat	*Myotis grisescens*	E	E	PALUSTRINE: caves, various TERRESTRIAL: caves, various
Indiana bat	*Myotis sodalis*	E	E	PALUSTRINE: various TERRESTRIAL: various
Southeastern big-eared bat	*Plecotus rafinesquii*		ce	PALUSTRINE: various, floodplains TERRESTRIAL: pine and hardwood forests, ruderal, various
INVERTEBRATES:				
Fat three-ridge (mussel)	*Amblema neislerii*		E	RIVERINE: main channels of small to large rivers; slow to moderate currents; various substrates (Panhandle watersheds: Apalachicola, Chipola)
Rayed creekshell (mussel)	*Anodontoides radiatus*		ce	RIVERINE: Small to medium sized creeks in substrates of mud, sandy mud, or sand and gravel (Panhandle watersheds: Apalachicola, Chipola, Escambia, Choctawhatchee)

T&e23.xls
Printed 9/9/02 10:35 AM

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

Page 3 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Chipola slabshell (mussel)	*Elliptio chipolaensis*		T	RIVERINE: main channel of the Chipola River and its larger tributaries; prefers muddy sand and sandy clay substrates, but also found in silty sand substrates (Panhandle watersheds: Chipola upstream of Dead Lake)
Purple bankclimber (mussel)	*Elliptoideus sloatianus*		T	RIVERINE: small to large rivers in slow to moderate currents over sand, sand mixed with mud, or gravel substrates (Panhandle watersheds: Apalachicola, Ochlockonee)
Shiny-rayed pocketbook (mussel)	*Lampsilis subangulata*		E	RIVERINE: medium-sized creeks to mainstem rivers; clean or silty sand substrates, in slow to moderate currents (Panhandle watersheds: Chipola, Ochlockonee upstream of Lake Talquin)
Gulf moccasinshell (mussel)	*Medionidus penicillatus*		E	RIVERINE: medium-sized creeks to large rivers with sand and gravel substrates in slow to moderate currents (Panhandle watersheds: Chipola, Econfina Creek)
Oval pigtoe (mussel)	*Pleurobema pyriforme*		E	RIVERINE: medium-sized creeks to small rivers; various substrates; slow to moderate currents (Panhandle watersheds: Chipola, Econfina Creek, Ochlockonee)
scupltured pigtoe (mussel)	*Quincuncina infucata*		ce	RIVERINE: small streams to large rivers in sandy, muddy sand, or fine gravel substrates, pools, and rocky areas with swift current, often under debris (Panhandle watersheds: Apalachicola, Chipola)
downy rainbow (mussel)	*Villosa villosa*		ce	RIVERINE: small streams to large rivers in sand or muddy sand substrates (Panhandle watersheds: Apalachicola, Chipola, Escambia, Choctawhatchee, Ochlockonee, Suwannee)

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

Page 4 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
PLANTS:				
Incised groove-bur	*Agrimonia incisa*		ce	TERRESTRIAL: sandhills, upland pine forest, upland hardwood forest edges
Marianna columbine	*Aquilegia canadensis var australis*	E	ce	PALUSTRINE: floodplain forest TERRESTRIAL: bluff; soil over limestone
Sicklepod	*Arabis canadensis*	E		TERRESTRIAL: upland mixed forest, limestone outcrops
Southern three-awned grass	*Aristida simpliciflora*		ce	PALUSTRINE: wet flatwoods TERRESTRIAL: sandhill, mesic flatwoods, old fields
Apalachicola wild indigo	*Baptisia megacarpa*	E		PALUSTRINE: floodplain forest TERRESTRIAL: upland mixed forest, slope forest
Flyr's brickell-bush	*Brickellia cordifolia*	E	ce	TERRESTRIAL: upland hardwood forest, near streams
Buckthorn	*Bumelia lycioides*	E		PALUSTRINE: bottomland forest, dome swamp, floodplain forest TERRESTRIAL: upland hardwood forest
Buckthorn	*Bumelia thornei*	E	ce	PALUSTRINE: hydric hammock, floodplain swamp
Toothed savory	*Calamintha dentata*		ce	TERRESTRIAL: sandhill, roadsides
Wood's poppy-mallow	*Callirhoe papaver*	E		TERRESTRIAL: upland mixed forest, roadsides; edge or understory
Sweet shrub	*Calycanthus floridus*	E		TERRESTRIAL: upland hardwood forest, slope forest, bluffs PALUSTRINE: bottomland forest, stream banks, floodplains
Canada honewort	*Cryptotaenia canadensis*	E		PALUSTRINE: floodplain forest, bottomland forest RIVERINE: alluvial stream bank
Florida anise	*Illicium floridanum*	T		PALUSTRINE: floodplain forest, baygall RIVERINE: seepage stream bank TERRESTRIAL: slope forest, seepage slope

E=endangered, T=threatened, P=proposed, C=candidate, s/a=Similarity of appearance, SSC=Species of Special Concern, ce=Consideration encouraged, CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

Page 5 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Mountain laurel	*Kalmia latifolia*	T		RIVERINE: seepage stream bank TERRESTRIAL: slope forest, seepage stream banks
Southern red lily	*Lilium catesbaei*	T		PALUSTRINE: wet prairie, wet flatwoods, seepage slope TERRESTRIAL: mesic flatwoods, seepage slope; usually with grasses
West's flax	*Linum westii*	E	ce	PALUSTRINE: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins
Hummingbird flower	*Macranthera flammea*	E		PALUSTRINE: seepage slope, dome swamp edges, floodplain swamps RIVERINE: seepage stream banks TERRESTRIAL: seepage slopes
Ashe's magnolia	*Magnolia ashei*	E		TERRESTRIAL: slope and upland hardwood forest, ravines
Pyramid magnolia	*Magnolia pyramidata*	E		TERRESTRIAL: slope forest
Green adder's-mouth	*Malaxis unifolia*	E		PALUSTRINE: floodplain forest TERRESTRIAL: slope forest, upland mixed forest
Barbara's buttons	*Marshallia obovata*	E		TERRESTRIAL: sandhill, upland mixed forest
Baldwyn's spiny-pod	*Matelea baldwyniana*	E	ce	TERRESTRIAL: bluff, upland mixed forest, bottomland forest, roadsides; calcareous soil
Florida spiny-pod	*Matelea floridana*	E	ce	TERRESTRIAL: upland mixed forest, upland hardwood forest
Piedmont water-milfoil	*Myriophyllum laxum*		ce	LACUSTRINE: sandhill upland lake, submersed PALUSTRINE: floodplain and dome swamp RIVERINE: blackwater stream, roadside ditches
West Florida cowlily	*Nuphar luteum ssp. ulvaceum*		ce	PALUSTRINE: floodplain swamp RIVERINE: seepage stream, blackwater stream, spring-run stream
Allegheny-spurge	*Pachysandra procumbens*	E		TERRESTRIAL: upland mixed forest, bluff; calcareous soil

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

Page 6 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Crystal Lake nailwort	*Paronychia chartacea minima*	E	T	TERRESTRIAL: Karst sandhill lake margins
Purple cliff brake	*Pellaea atropurpurea*	E		TERRESTRIAL: upland glade
Eastern ninebark	*Physocarpus opulifolius*	E		RIVERINE: seepage stream banks
Hairy fever tree	*Pinckneya bracteata*	T		PALUSTRINE: creek swamps, titi swamps, bogs
Chapman's butterwort	*Pinguicula planifolia*	T	ce	PALUSTRINE: wet flatwoods, seepage slopes, bog, dome swamp, ditches; in water
Yellow fringed orchid	*Platanthera ciliaris*	T		PALUSTRINE: bogs, wet flatwoods TERRESTRIAL: Bluff
Yellow fringeless orchid	*Platanthera integra*	E	ce	PALUSTRINE: wet prairie, seepage slope TERRESTRIAL: mesic flatwoods
Snowy orchid	*Platanthera nivea*	T		PALUSTRINE: bogs
Orange azalea	*Rhododendron austrinum*	E		PALUSTRINE: bottomland forest RIVERINE: seepage stream bank TERRESTRIAL: slope forest, upland mixed forest
Pinnate-lobed coneflower	*Rudbeckia triloba var pinnatiloba*		ce	TERRESTRIAL: upland mixed forest, fields and roadsides; calcareous soils
Heart-leaved willow	*Salix eriocephala*	E		PALUSTRINE: floodplain swamp, alluvial woodlands
Florida willow	*Salix floridana*	E	ce	PALUSTRINE: hydric hammock, bottomland forest RIVERINE: spring-run stream margins
Nettle-leaved sage	*Salvia urticifolia*	E		TERRESTRIAL: upland glade
Parrot pitcher plant	*Sarracenia psittacina*	T		PALUSTRINE: wet flatwoods, wet prairie, seepage slope
Decumbant pitcher plant	*Sarracenia purpurea*	T		PALUSTRINE: Bogs
Fringed campion	*Silene polypetala*	E	E	TERRESTRIAL: upland mixed forest, slope forest, and along utility corridors in appropriate habitats.
Florida water-parsnip	*Sium floridanum*		ce	PALUSTRINE: floodplain forest, strand swamp; growing in water
Gentian pinkroot	*Spigelia gentianoides*	E	E	TERRESTRIAL: mixed hardwood forest; rich humus

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

T&e23.xls
Printed 9/9/02 10:35 AM

Page 7 of 8

THREATENED, ENDANGERED, AND OTHER SPECIES OF CONCERN LIKELY TO OCCUR IN JACKSON COUNTY, FLORIDA
Compiled by U.S. Fish and Wildlife Service, January 2002

Common Name	Scientific Name	Status State	Status FWS	Natural Communities
Florida torreya	*Torreya taxifolia*	E	E	TERRESTRIAL: slope forest, upland mixed forest, and ravines.
Narrow-leaved trillium	*Trillium lancifolium*	E		PALUSTRINE: bottomland forest TERRESTRIAL: upland mixed forest, slope forest
Northern prickley ash	*Zanthoxylum americanum*	E		TERRESTRIAL: slope forest; calcareous soils

T&e23.xls
Printed 9/9/02 10:35 AM

E=endangered, T=threatened, P=proposed, C=candidate,s/a=Similarity of appearance,
SSC=Species of Special Concern,ce=Consideration encouraged,CH=Critical habitat

Page 8 of 8

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Ms. Jo Lewis
Database Manager
Alabama State Lands Division
Natural Heritage Section
Department of Conservation and Natural Resources
64 North Union Street
Montgomery, AL 36130

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened and Endangered Species and Important Habitats

Dear Ms. Lewis:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will consult with the U.S. Fish and Wildlife Service during the application environmental report review and may also seek your assistance in the identification of important species and habitats in the project area. We are contacting you early in the application process to identify any issues that need to be addressed or information required to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figures 2-1 and 2-2). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figures 3-1 and 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently under construction and crosses into the Florida pan-handle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Alabama by Alabama Power Company, would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the three Farley-connected transmission corridors (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) that cross seven Alabama counties (Houston, Montgomery, Geneva, Dale, Pike, Barbour, and Henry). Please also indicate whether your office has any concerns regarding the operation of the plant or lines. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Note that we are presently conducting surveys of the Farley-associated transmission corridors for threatened and endangered species (both state-listed and federally-listed). These surveys will be completed in the next couple of months. A copy of the final survey report will be provided to your office. This report will contain detailed information on occurrences of T&E species along the Alabama transmission corridors as well as "Observation/Collection Data Sheets" for incorporation into your database.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

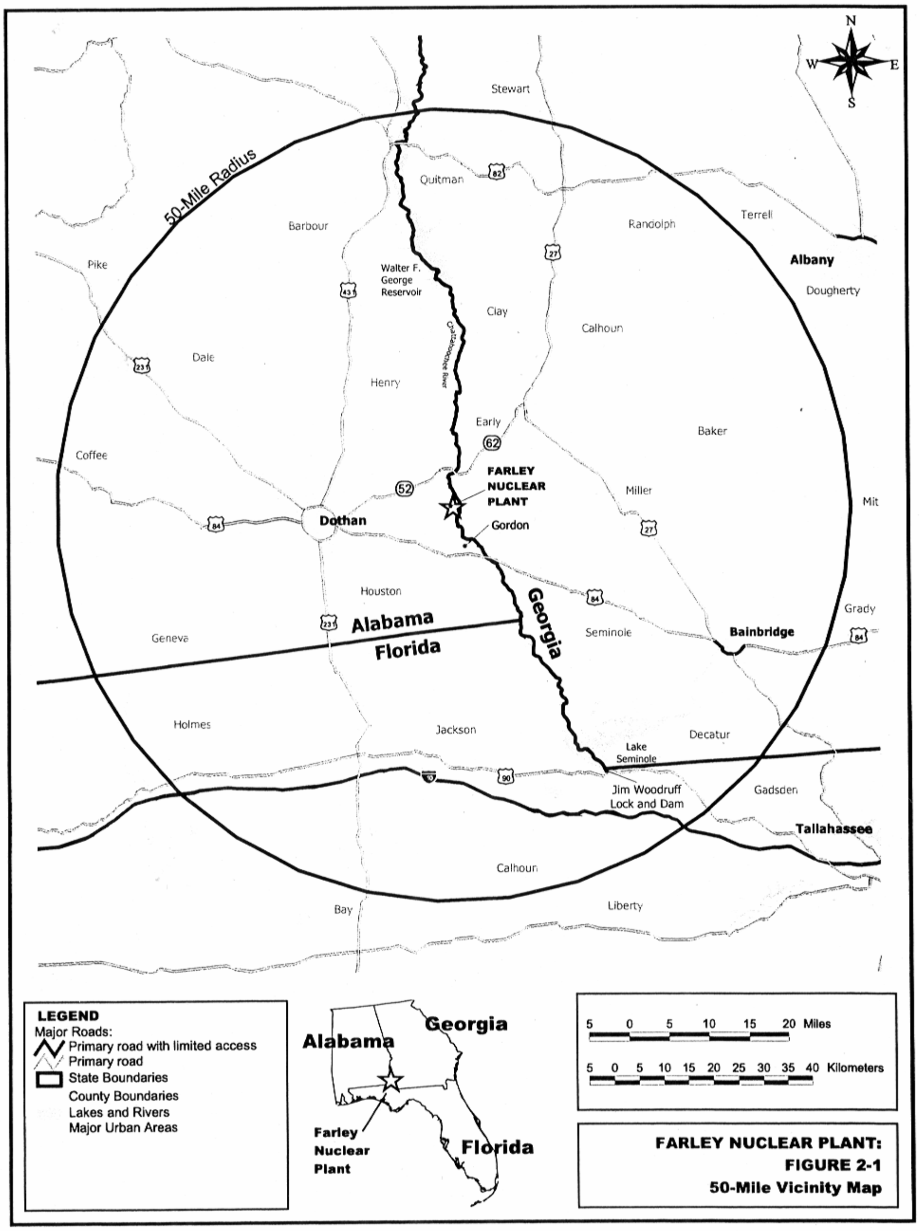
Sincerely,

C R Pierce

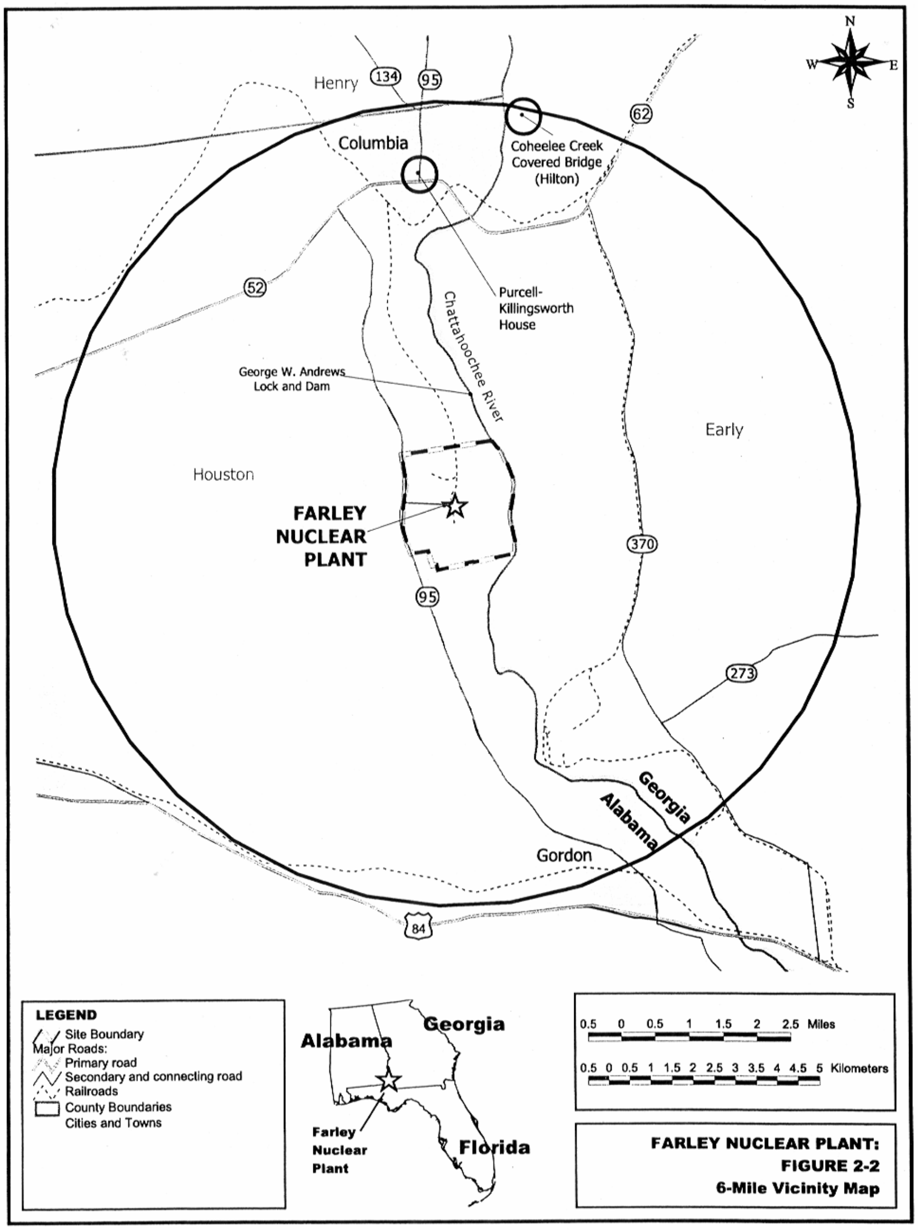
C. R. Pierce
License Renewal Services Manager

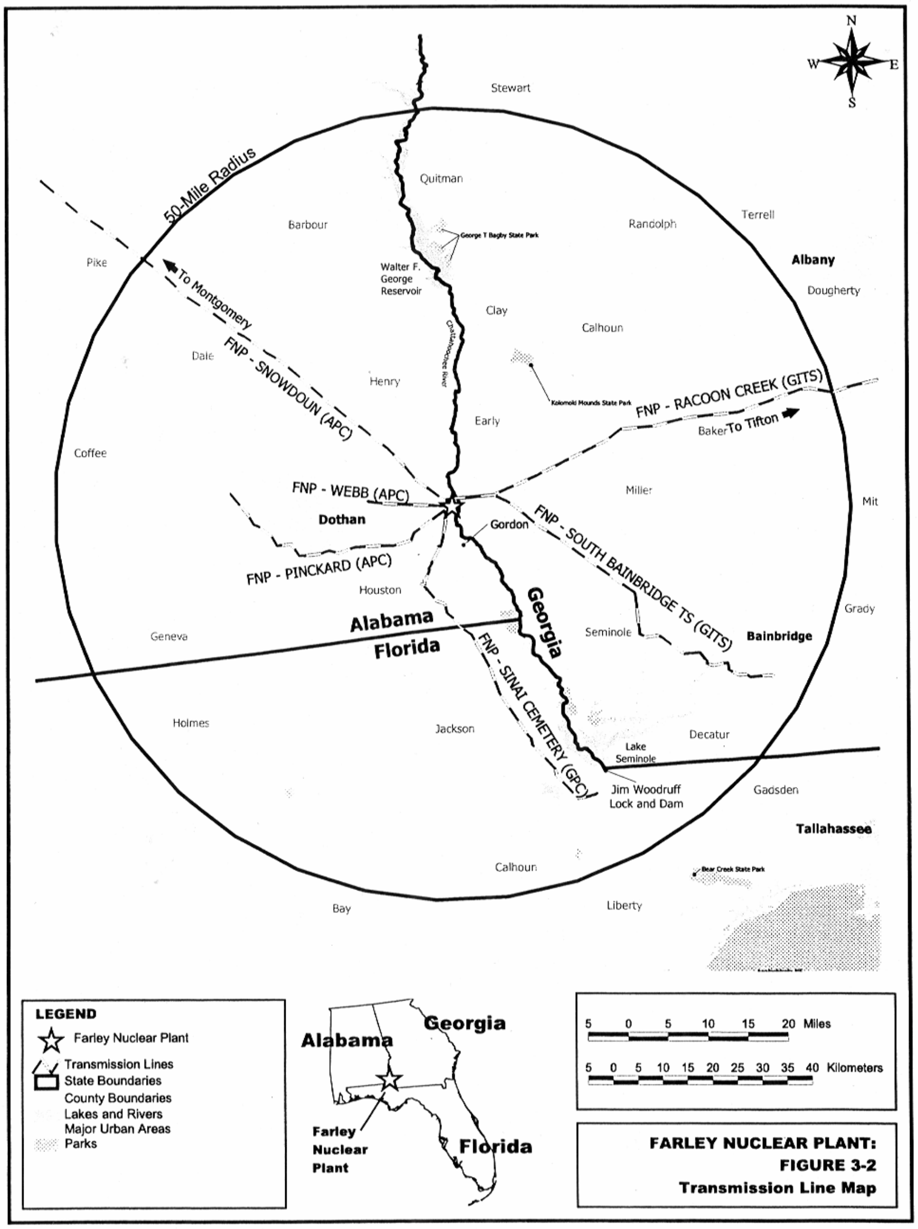
Enclosures: Figures 2-1, 2-2, and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis



FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map


Henry
134
95
62
Columbia
Coheelee Creek
Covered Bridge
(Hilton)
52
Purcell-
Killingsworth
House
Chattahoochee River
George W. Andrews
Lock and Dam
Early
Houston
FARLEY
NUCLEAR
PLANT
370
95
273
Georgia
Alabama
Gordon
84
LEGEND
Site Boundary
Major Roads:
Primary road
Secondary and connecting road
Railroads
County Boundaries
Cities and Towns
Georgia
Alabama
Farley
Nuclear
Plant
Florida
0.5 0 0.5 1 1.5 2 2.5 Miles
0.5 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-2
6-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

STATE OF ALABAMA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
64 NORTH UNION STREET
MONTGOMERY, ALABAMA 36130

DON SIEGELMAN
GOVERNOR

RILEY BOYKIN SMITH
COMMISSIONER

STATE LANDS DIVISION
JAMES H. GRIGGS, DIRECTOR

NATURAL HERITAGE SECTION
GREGORY M. LEIN, CHIEF
TELEPHONE (334) 242-3484
FAX NO. (334) 242-0999

May 21, 2002

C. R. Pierce
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham AL 35201-1295

Re: Sensitive Species Information Request
Project # Joseph M. Farley Nuclear Plant License Renewal

Dear Mr./ Ms. Pierce:

Our office received your request on May 10, 2002 and has since developed the following information pertaining to state protected, federally listed threatened and endangered species, and species that we believe to be sensitive to environmental perturbations. I have enclosed a list of sensitive species which the Natural Heritage Section Database or the U.S. Fish and Wildlife Service have indicated occur or have occurred in Houston and surrounding Alabama counties. Additionally, I have listed some potentially helpful and informative web sites at the end of this letter.

The Natural Heritage Section database contains numerous records of sensitive species in Houston, Barbour Coffee, Dale, Geneva, Henry, Montgomery and Pike Counties. Our database indicates the area of interest has not had sufficient biological survey wok performed at the delineated location, by our staff or any individuals referenced in our database. Therefore we can make no accurate assessment to the past or current inhabitancy of any federal or state protected species throughout this area. According to the data in our database the following species are known to have occurred within the 50 miles radius area delineate on the provided maps.

Relict Trillium	Trillium reiquum	Federally listed as ENDANGERED
Flatwoods Salamander	Ambystoma cingulatum	Federally listed as THREATENED
Dusky Gopher Frog	Rana capito sevosa	Protected by State Regulation
Pine Barren Treefrog	Hyla andersonii	Protected by State Regulation
Southern Sandshell	Lampsilis australis	Protected by State Regulation
Southeastern Pocket Gopher	Geomys pinetis	Protected by State Regulation
Gopher Tortoise	Gopherus polyphemus	Protected by State Regulation

I hope this information will be useful to you. The provided information is to help you in fulfilling your necessary legal obligations. The specific location of a sensitive species is considered confidential information by a State Lands Division Regulation and can be released only to individuals who enter into a confidentiality and indemnity contract with the State Lands Division.

The Natural Heritage Section provides this information as a service to the people of Alabama. The NHS acts as a clearing house for species distribution data. We happily accept any information environmental researchers are willing to donate. Sensitive species exact locations are kept confidential. If you would be willing to donate any information to this database, we will be better able to assist all individuals interested in environmental compliance.

Sincerely,
Jo Lewis

Jo Lewis
Database Manager

enclosures

Potentially helpful web sites

Information about federally listed species
http://www.pfmt.org/wildlife/endangered/

Daphne USFWS office by county federal list
http://southeast.fws.gov/daphne/specieslst.htm

Non-game species regulation starts on page 75
http://www.dcnr.state.al.us/agfd/2000-2001_regs.pdf

federal list of threatened and endangered species for Alabama
http://ecos.fws.gov/webpage/webpage_usa_lists.html?#AL

list of Alabama State Parks and links to more info
http://www.dcnr.state.al.us/parks/state_parks_index_1a.html

list of Forever Wild tracts minus about six.
http://www.dcnr.state.al.us/Forever%20Wild%20Administration.htm

http://bluegoose.arw.r9.fws.gov/
http://www.fws.gov/where/regfield.html

list of Refuges in AL with additional pages of refuge details
http://refuges.southeast.fws.gov//index.html

ALABAMA'S FEDERALLY LISTED AND STATE PROTECTED SPECIES (BY COUNTY)

This list is a combination of the June 2001 U.S.F.W. Service (Daphne field Office) federally listed species by county list and the Alabama State Lands Division's Natural Heritage Section Database of species distributions data. This list is continually being updated, and, therefore, it may be incomplete or inaccurate and is provided strictly for informational purposes. It does not constitute any form of Section 7 consultation. We recommend that the U.S.F.W. Service Field Office in Daphne be contacted for Section 7 consultations. Site specific information can be provided by the Alabama State Lands Division's Natural Heritage Section and/or the U.S.F.W. Service (Daphne field Office) prior to project activities. To be certain of occurrence, surveys should be conducted by qualified biologists to determine if a sensitive species occurs within a project area. Species not listed for a given county does not imply that they do not occur there, only that their occurrence there is as yet unrecorded by these two agencies.

Key to codes on list:	(P) - Historical Record and/ or Possible Occurrence in the County
Federal E - Endangered	C - Candidate Species
Federal T - Threatened	NEP - Nonessential Experimental Populations

BARBOUR

Protection Status	Common name	Scientific Name	State Regulation Applicable
Endangered	Wood Stork	Mycteria americana	220-2-.92 (1) (d)
Threatened	Bald Eagle	Haliaeetus leucocephalus	220-2-.92 (1) (d)
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Dusky Gopher Frog	Rana capito sevosa	220-2-.92 (1) (b)
State Protected	Eastern Coachwhip	Masticophis flagellum	220-2-.92 (1) (c)
State Protected	Southeastern Bat	Myotis austroriparius	220-2-.92 (1) (e)
State Protected	Southern Kidneyshell	Ptychobranchus jonesi	220-2-.98 (1) (a)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)

COFFEE

Protection Status	Common name	Scientific Name	State Regulation Applicable
Threatened	Gulf Sturgeon	Acipenser oxyrinchus desotoi	220-2-.92 (1) (f)
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)
State Protected	Common Ground-dove	Columbina passerina	220-2-.92 (1) (d)
State Protected	Dusky Gopher Frog	Rana capito sevosa	220-2-.92 (1) (b)

DALE

Protection Status	Common name	Scientific Name	State Regulation Applicable
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Gopher Tortoise	Gopherus polyphemus	220-2-.92 (1) (c)
State Protected	Southeastern Pocket Gopher	Geomys pinetis	220-2-.92 (1) (e)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)

GENEVA

Protection Status	Common name	Scientific Name	State Regulation Applicable
Endangered	Red-cockaded Woodpecker	Picoides borealis	220-2-.92 (1) (d)

Tuesday, May 21, 2002 Page 1 of 3

ALABAMA'S FEDERALLY LISTED AND STATE PROTECTED SPECIES (BY COUNTY)

GENEVA

Protection Status	Common name	Scientific Name	State Regulation Applicable
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
Threatened	Gulf Sturgeon	Acipenser oxyrinchus desotoi	220-2-.92 (1) (f)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)
State Protected	Pine Barrens Treefrog	Hyla andersonii	220-2-.92 (1) (b)

HENRY

Protection Status	Common name	Scientific Name	State Regulation Applicable
Endangered	Relict Trillium	Trillium reliquum	
Threatened	Bald Eagle	Haliaeetus leucocephalus	220-2-.92 (1) (d)
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Gopher Tortoise	Gopherus polyphemus	220-2-.92 (1) (c)
State Protected	Seal Salamander	Desmognathus monticola	220-2-.92 (1) (b)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)

HOUSTON

Protection Status	Common name	Scientific Name	State Regulation Applicable
Threatened	Flatwoods Salamander	Ambystoma cingulatum	220-2-.92 (1) (b)
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Southeastern Pocket Gopher	Geomys pinetis	220-2-.92 (1) (e)
State Protected	Barbour's Map Turtle	Graptemys barbouri	220-2-.92 (1) (c)
State Protected	Gopher Tortoise	Gopherus polyphemus	220-2-.92 (1) (c)

MONTGOMERY

Protection Status	Common name	Scientific Name	State Regulation Applicable
Endangered	Wood Stork	Mycteria americana	220-2-.92 (1) (d)
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Alabama Map Turtle	Graptemys pulchra	220-2-.92 (1) (c)
State Protected	Crystal Darter	Crystallaria asprella	220-2-.92 (1) (a)
State Protected	Osprey	Pandion haliaetus	220-2-.92 (1) (d)

PIKE

Protection Status	Common name	Scientific Name	State Regulation Applicable
Threatened	Eastern Indigo Snake	Drymarchon corais couperi	220-2-.92 (1) (c)
State Protected	Southern Sandshell	Lampsilis australis	220-2-.98 (1) (a)

ALABAMA'S FEDERALLY LISTED AND STATE PROTECTED SPECIES (BY COUNTY)

Notes:
- Bald eagle Haliaeetus leucocephalus, red-cockaded woodpecker Picoides borealis and the American peregrine falcon (Falco peregrinus anatum) may occur in any county, if habitat exists.
- Wood stork / July - October
- Bald eagle / Wintering birds possible in areas with reservoirs.
- Sea turtles / Only loggerhead is potential nester, the rest are in coastal waters.
- Black bear Ursus americanus sp. - known to exist in Mobile County, but not listed.

-Gulf moccasi nshell Mediondus penicillatus, oval pigtoe Pleurobema pyriforme, Chipola slabshell El liptio chipolaensis, and purple bankclimber Elliptoideus sloatianus, are freshwater mussels of the family Unionidae found only in eastern Gulf Slope streams draining the Apalachicolan Region, defined as streams from the Escambia to the Suwannee river systems, and occurring in southeast Alabama, southwest Georgia, and north Florida. All are listed as "Endangered".

- Fanshell Cyprogenia stegaria, Oyster mussel Epioblasma capsaeformis, Catspaw (purple cat's paw pearlymussel) Epioblasma obliquata obliquata, are historically known to be found in the Tennessee River system and drainage.

-Gentian pinkroot Spigelia gentianoides, has been historically found along the Alabama-Florida border.

-West Indian Manatee Trichechus manatus, have been known to move north along the gulf coast west

Tuesday, May 21, 2002 Page 3 of 3

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Mr. Greg Krakow
Data Manager
Georgia Department of Natural Resources
Wildlife Resources Division
Nongame Wildlife & Natural Heritage Section
Georgia Natural Heritage Program
2117 US Highway 278 SE
Social Circle, GA 30025

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened or Endangered Species and Important Habitats

Dear Mr. Krakow:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will consult with the U.S. Fish and Wildlife Service during the application environmental report review and may also seek your assistance in the identification of important species and habitats in the project area. We are contacting you early in the application process to identify any issues that need to be addressed or information required to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently

under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Georgia by Georgia Integrated Transmission System, would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide us with any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the two Farley-connected transmission corridors (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) that cross eight Georgia counties (Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur). Please also indicate whether your office has any concerns regarding the operation of these lines. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Note that we are presently conducting surveys of the Farley-associated transmission corridors for threatened and endangered species (both state-listed and federally-listed). These surveys will be completed in the next couple of months. A copy of the final survey report will be provided to your office. This report will contain detailed information on occurrences of T&E species along the Georgia transmission corridors as well as "Observation/Collection Data Sheets" for incorporation into your database.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

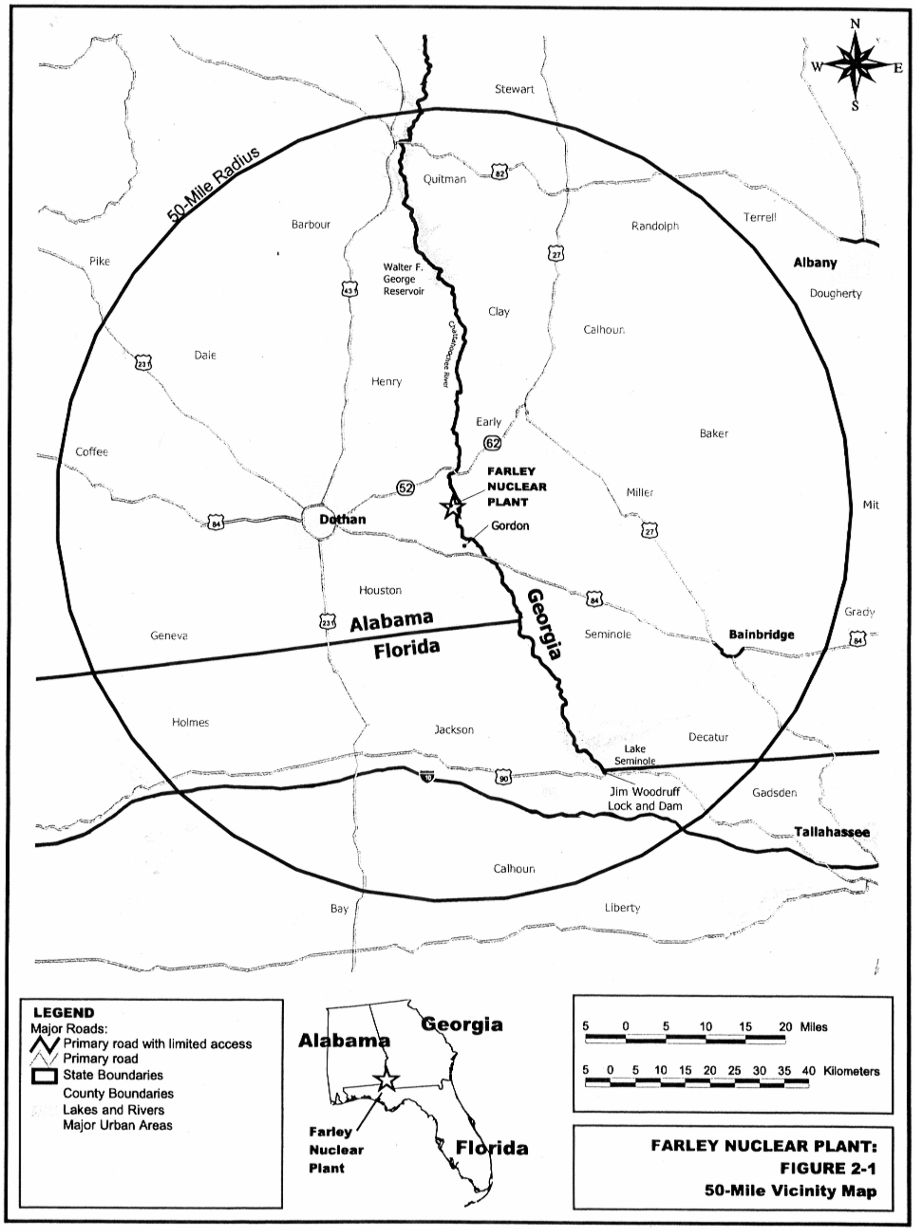
Sincerely,

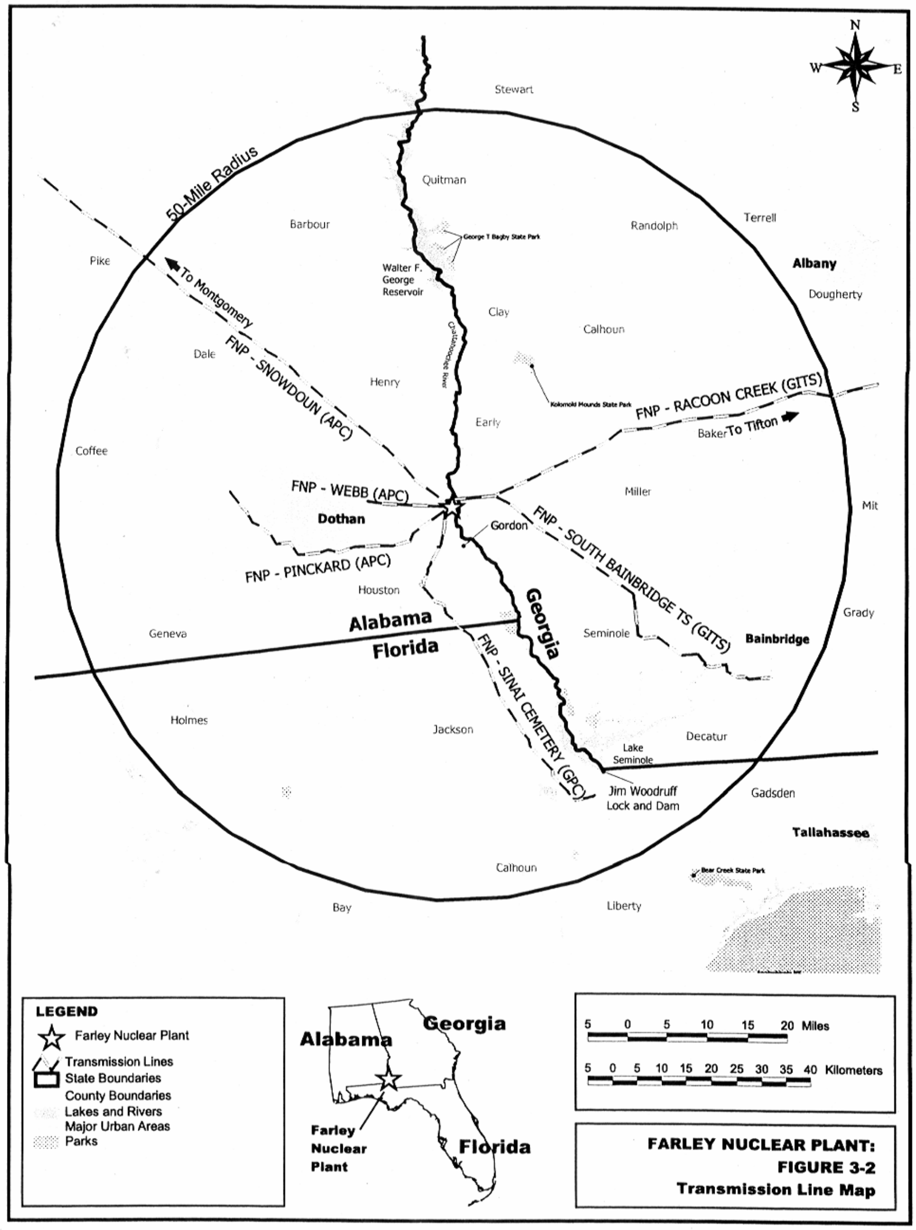
C. R. Pierce

C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Albany
Dougherty
Pike
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Alabama
Florida
Geneva
Seminole
Bainbridge
Grady
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map


Stewart
Quitman
50-Mile Radius
Barbour
Randolph
Terrell
Albany
Dougherty
Pike
To Montgomery
Walter F. George Reservoir
Clay
Calhoun
Dale
FNP - SNOWDOUN (APC)
Henry
Early
FNP - RACOON CREEK (GITS)
Baker
To Tifton
Coffee
FNP - WEBB (APC)
Miller
Dothan
Gordon
FNP - SOUTH BAINBRIDGE TS (GITS)
FNP - PINCKARD (APC)
Houston
Georgia
Alabama
Florida
Geneva
Seminole
Bainbridge
Grady
FNP - SINAI CEMETERY (GPC)
Holmes
Jackson
Lake Seminole
Decatur
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Farley Nuclear Plant
Transmission Lines
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Parks
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

Georgia Department of Natural Resources
Wildlife Resources Division

LONICE C. BARRETT, COMMISSIONER
DAVID WALLER, DIVISION DIRECTOR

Georgia Natural Heritage Program
2117 U.S. Hwy. 278 S.E., Social Circle, Georgia 30025-4714
(770) 918-6411, (706) 557-3032

June 13, 2002

C. R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Subject: **Known or Potential Occurrences of Special Concern Plant and Animal Species on or near Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia**

Dear Mr. Pierce:

This is in response to your request of May 7, 2002. Enclosed is a list of special concern species records in our database within a three mile radius of the project site and eight maps showing the location of special concern species within 0.25 mile of the project corridor. Also provided are lists that should aid in assessing the potential for rare species occurrences within the area of concern. Although lists of plant and animal species potentially occurring in many southwest Georgia counties have not been generated, provided are the lists of plant and animal species potentially occurring in the southwest Georgia Regional Development Commission counties combined, lists of plant and animal species potentially occurring in Tift and Dougherty counties, lists of plant species potentially occurring in Decatur County, and lists of animal species potentially occurring in Grady County.

Please keep in mind the limitations of our database. The data collected by the Georgia Natural Heritage Program comes from a variety of sources, including museum and herbarium records, literature, and reports from individuals and organizations, as well as field surveys by our staff biologists. In most cases the information is not the result of a recent on-site survey by our staff. Many areas of Georgia have never been surveyed thoroughly. Therefore, the Georgia Natural Heritage Program can only occasionally provide definitive information on the presence or absence of rare species on a given site. Our files are updated constantly as new information is received. **Thus, information provided by our program represents the existing data in our files at the time of the request and should not be considered a final statement on the species or area under consideration.**

If you know the location of populations of special concern species that are not in our database, please fill out the appropriate data collection form and send it to our office. Forms can be obtained through our web site (http://www.dnr.state.ga.us/dnr/wild/natural.html) or by contacting our office. If I can be of further assistance, please let me know.

Sincerely,

Sarah Beckman
for

Greg Krakow
Data Manager

enclosures

UR 8472

Page Number 1 of 6 Report Generated 13 June 2002

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Project Site at Chattahoochee River (-85.09999, 31.23470; NAD27):

Arnoglossum sulcatum (Grooved-stem Indian-plantain) approx. 2.5 mi. S of site
Carex dasycarpa (Velvet Sedge) approx. 2.5 mi. S of site
Salix floridana (Florida Willow) approx. 2.5 mi. S of site
Shackleford-Williams Bluff Preserve approx. 1.5 mi. S of site

Project Site at SR 370/Chattahoochee Industrial (-85.06801, 31.23377; NAD27):

Haliaeetus leucocephalus (Bald Eagle) approx. 1.5 mi. S of site
Macranthera flammea (Flame Flower) approx. 1.0 mi. N of site
Peltandra sagittifolia (Arrow Arum) approx. 1.0 mi. W of site (see Map 1)
Pinguicula primuliflora (Clearwater Butterwort) approx. 1.0 mi. N of site
Ponthieva racemosa (Shadow-witch Orchid) approx. 1.0 mi. N of site
Salix floridana (Florida Willow) approx. 1.0 mi. N of site
Salix floridana (Florida Willow) approx. 1.0 mi. W of site (see Map 1)
Sarracenia psittacina (Parrot Pitcherplant) approx. 1.0 mi. S of site
Sarracenia rubra (Sweet Pitcherplant) approx. 1.0 mi. N of site

Project Site at N-S Split Point (-85.02240, 31.23296; NAD27):

Salix floridana (Florida Willow) approx. 2.5 mi. S of site

FNP-TO-RACCOON CREEK:

Project Site at CR 201 (-84.86034, 31.27988; NAD27):

Heterodon simus (Southern Hognose Snake) approx. 2.5 mi. NW of site

Project Site at Spring Creek (-84.75072, 31.31757; NAD27):

Arnoglossum diversifolium (Variable-leaf Indian-plantain) approx. 0.5 mi. S of site
Arnoglossum diversifolium (Variable-leaf Indian-plantain) approx. 2.5 mi. NW of site
Pteronotropis welaka (Bluenose Shiner) approx. 1.0 mi. S of site
Sideroxylon thornei (Swamp Buckthorn) approx. 0.5 mi. S of site

 Report Generated 13 June 2002

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Project Site at CR 111 (-84.68158, 31.32290; NAD27):

Carex dasycarpa (Velvet Sedge) approx. 2.0 mi. NE of site
Epidendrum conopseum (Green-fly Orchid) approx. 2.0 mi. NE of site
Fundulus escambiae (Eastern Starhead Topminnow) approx. 1.0 mi. NE of site, in Big Cypress Pond at outlet
Sarracenia minor (Hooded Pitcherplant) approx. 2.5 mi. N of site

Project Site at Early/Baker County Line (-84.63717, 31.32546; NAD27):

Epidendrum conopseum (Green-fly Orchid) approx. 3.0 mi. S of site

Project Site at Bainbridge Highway (-84.52581, 31.32917; NAD27):

Gopherus polyphemus (Gopher Tortoise) approx. 0.5 mi. N of site

Project Site at Ichawaynochaway Creek (-84.49813, 31.32874; NAD27):

Elliptoideus sloatianus (Purple Bankclimber) less than 0.1 mi. S of site, in Ichawaynochaway Creek (see Map 2)
Medionidus penicillatus (Gulf Moccasinshell) less than 0.1 mi. S of site, in Ichawaynochaway Creek (see Map 2)
Pleurobema pyriforme (Oval Pigtoe) less than 0.1 mi. S of site, in Ichawaynochaway Creek (see Map 2)

Project Site at Chickasawhatchee Creek (-84.48505, 31.32912; NAD27):

Croton elliottii (Elliott Croton) approx. 2.0 mi. SE of site
Croton elliottii (Elliott Croton) approx. 2.5 mi. S of site
Croton elliottii (Elliott Croton) approx. 2.5 mi. SE of site
Epidendrum conopseum (Green-fly Orchid) approx. 2.5 mi. SE of site
Fimbristylis perpusilla (Harper Fimbry) approx. 2.0 mi. SE of site
Fimbristylis perpusilla (Harper Fimbry) approx. 2.5 mi. SE of site
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 0.5 mi. NE of site, in Chickasawhatchee Creek
Notropis harperi (Redeye Chub) approx. 1.5 mi. N of site, in Chickasawhatchee Creek
Rhexia aristosa (Awned Meadowbeauty) approx. 2.5 mi. NE of site
Joseph Jones Ecological Research Center approx. 1.0 mi. SE of site
Elmodel Wildlife Management Area on site

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Project Site at SR 37 (-84.42823, 31.34065; NAD27):

Croton elliottii (Elliott Croton) approx. 2.0 mi. S of site
Croton elliottii (Elliott Croton) approx. 2.5 mi. S of site
Croton elliottii (Elliott Croton) approx. 2.5 mi. SW of site
Echinodorus parvulus (Dwarf Burhead) approx. 2.5 mi. S of site
Ludwigia spathulata (Creeping Smallflower Seedbox) approx. 2.5 mi. S of site
Nerodia floridana (Florida Green Water Snake) 0.4 mi. S of site
Nerodia floridana (Florida Green Water Snake) less than 0.1 mi. SE of site (see Map 3)
Rhynchospora thornei (Thorne's Beakrush) approx. 2.5 mi. S of site
Scirpus hallii (Hall Bulrush) less than 0.1 mi. NW of site (see Map 3)

Project site at Tarva Road (-84.33188, 31.35509; NAD27):

Crataegus brachyacantha (Blueberry Hawthorn) approx. 1.0 mi. N of site
Elimia albanyensis (Black-crest Elimia) approx. 3.0 mi. S of site, in the Flint River
Elliptio arctata (Delicate Spike) approx. 1.5 mi. S of site, in Cooleewahee Creek
Elliptio nigella (Winged Spike) approx. 1.5 mi. S of site, in Cooleewahee Creek
Elliptoideus sloatianus (Purple Bankclimber) approx. 3.0 mi. S of site, in the Flint River
Graptemys barbouri (Barbour's Map Turtle) approx. 3.0 mi. S of site, in the Flint River
Haliaeetus leucocephalus (Bald Eagle) approx. 2.0 mi. SE of site
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 1.5 mi. S of site, in Cooleewahee Creek
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 2.0 mi. S of site, in Cooleewahee Creek
Medionidus penicillatus (Gulf Moccasinshell) approx. 3.0 mi. S of site, in the Flint River
Notropis harperi (Redeye Chub) approx. 1.5 mi. S of site, in Cooleewahee Creek
Physostegia angustifolia (Narrowleaf Obedient Plant) approx. 1.5 mi. SE of site
Pleurobema pyriforme (Oval Pigtoe) approx. 1.5 mi. S of site, in Cooleewahee Creek

Project Site at Point 3.5 miles West of Baker/Mitchell County Line (-84.28386, 31.34208; NAD27):

Elliptoideus sloatianus (Purple Bankclimber) approx. 1.0 mi. S of site, in the Flint River

Project Site North of Horseshoe Bend (-84.24458, 31.34912; NAD27):

Schwalbea americana (Chaffseed) approx. 3.0 mi. N of site

 Report Generated 13 June 2002

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Project Site at Walton Spring (-84.20030, 31.35371; NAD27):

Elliptoideus sloatianus (Purple Bankclimber) 0.2 mi. N of site, in the Flint River (see Map 4)
Elliptoideus sloatianus (Purple Bankclimber) approx. 3.0 mi. N of site, in the Flint River

Project Site at SR 93 (-84.07461, 31.37637; NAD27):

Evolvulus sericeus var. *sericeus* (Creeping Morning-glory) approx. 1.5 mi. S of site

Project Site at SR 133 (-83.94009, 31.39474; NAD27):

Angelica dentata (Sandhill Angelica), an imprecise location, approx. 1.0 mi. N of site

Project Site at SR 33 (-83.84458, 31.40576; NAD27):

Balduina atropurpurea (Purple Honeycomb Head) approx. 1.0 mi. SW of site
Drosera tracyi (Tracy's Dew-threads, Tracy's Threadleaf Sundew) approx. 2.0 mi. S of site
Picoides borealis (Red-cockaded Woodpecker) approx. 0.5 mi. S of site
Picoides borealis (Red-cockaded Woodpecker) approx. 2.0 mi. NW of site
Sarracenia flava (Yellow Flytrap) approx. 1.0 mi. S of site
Sarracenia psittacina (Parrot Pitcherplant) approx. 1.0 mi. S of site
Sarracenia psittacina (Parrot Pitcherplant) approx. 3.0 mi. S of site
Xyris scabrifolia (Harper Yellow-eyed Grass) approx. 2.5 mi. S of site

Project Site at Little River (-83.58118, 31.46446; NAD27):

Elyonurus tripsacoides (Pan-american Balsamscale) approx. 2.0 mi. SE of site
Sarracenia flava (Yellow Flytrap), an imprecise location, S of site
Sarracenia minor (Hooded Pitcherplant), an imprecise location, S of site

East End of FNP-to-Raccoon Creek (-83.55038, 31.47911; NAD27):

Balduina atropurpurea (Purple Honeycomb Head), an imprecise location, N of site
Oxypolis ternata (Savanna Cowbane), an imprecise location, N of site
Rhynchospora solitaria (Autumn Beakrush), an imprecise location, N of site

 Report Generated 13 June 2002

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

FNP-TO-SOUTH BAINBRIDGE:

Project Site at SR 39 (-84.94094, 31.16870; NAD27):

Schwalbea americana (Chaffseed), an imprecise location, SW of site

Project Site at SR 91 (-84.85303, 31.10305; NAD27):

Lobelia boykinii (Boykin Lobelia) approx. 2.0 mi. SW of site
Schwalbea americana (Chaffseed) approx. 2.5 mi. SW of site

Project Site at CR 16 (-84.77645, 31.04148; NAD27):

Sideroxylon thornei (Swamp Buckthorn) 0.3 mi. W of site (see Map 5)

Project Site at the Northern End of the Stretch of Corridor that Runs along the Seminole/Decatur County Line (-84.75367, 31.02321; NAD27):

Coreopsis integrifolia (Tickseed) approx. 1.0 mi. NE of site
Epidendrum conopseum (Green-fly Orchid) approx. 1.0 mi. NE of site
Litsea aestivalis (Pondspice) approx. 1.0 mi. NE of site

Project Site along Seminole/Decatur County Line NW of Brinson (-84.75449, 30.98823; NAD27):

Elliptio purpurella (Inflated Spike) approx. 1.0 mi. SE of site, in Spring Creek
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 1.0 mi. SE of site, in Spring Creek
Lythrum curtissii (Curtiss Loosestrife) approx. 1.5 mi. S of site (see Map 6)
Macrochelys temminckii (Alligator Snapping Turtle) approx. 0.5 mi. NE of site, in Spring Creek (see Map 6)
Notropis harperi (Redeye Chub) approx. 0.5 mi. SE of site, in Spring Creek (see Map 6)
Sideroxylon thornei (Swamp Buckthorn) approx. 1.5 mi. SE of site
Villosa villosa (Downy Rainbow) approx. 1.0 mi. SE of site, in Spring Creek

Special Concern Species Locations in Our Database, and Conservation Lands, within a Three Mile Radius of Joseph M. Farley Nuclear Plant Transmission Lines for License Renewal Application, Early, Baker, Mitchell, Tift, Worth, Miller, Seminole, and Decatur Counties, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Project Site at Spring Creek (-84.74502, 30.94185; NAD27):

Elliptio purpurella (Inflated Spike) approx. 2.0 mi. S of site, in Lake Seminole
Graptemys barbouri (Barbour's Map Turtle) less than 0.1 mi. N of site, in Spring Creek (see Map 7)
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 2.0 mi. S of site, in Lake Seminole
Macrochelys temminckii (Alligator Snapping Turtle) less than 0.1 mi. N of site, in Spring Creek (see Map 7)
Medionidus penicillatus (Gulf Moccasinshell) approx. 1.0 mi. N of site, in Spring Creek
Micromeria brownei var. *pilosiuscula* (Savory) approx. 0.5 mi. N of site
Pleurobema pyriforme (Oval Pigtoe) approx. 1.0 mi. N of site, in Spring Creek
Cave approx. 1.0 mi. S of site

Project Site at SR 253 (-84.62664, 30.88798; NAD27):

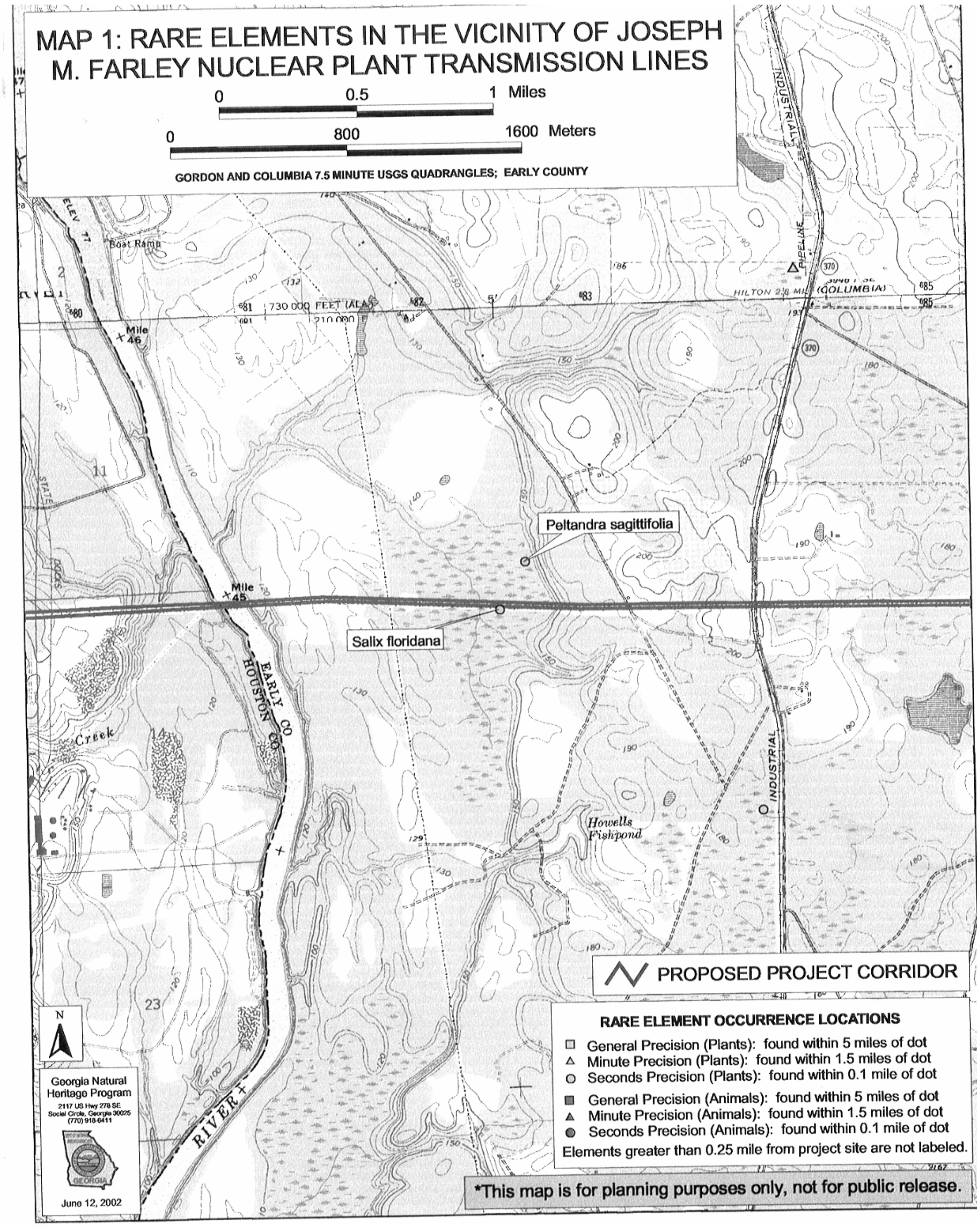
Graptemys barbouri (Barbour's Map Turtle) approx. 2.0 mi. NE of site, in the Flint River
Haliaeetus leucocephalus (Bald Eagle) approx. 2.0 mi. SW of site
Lake Seminole Wildlife Management Area approx. 0.5 mi. E of site

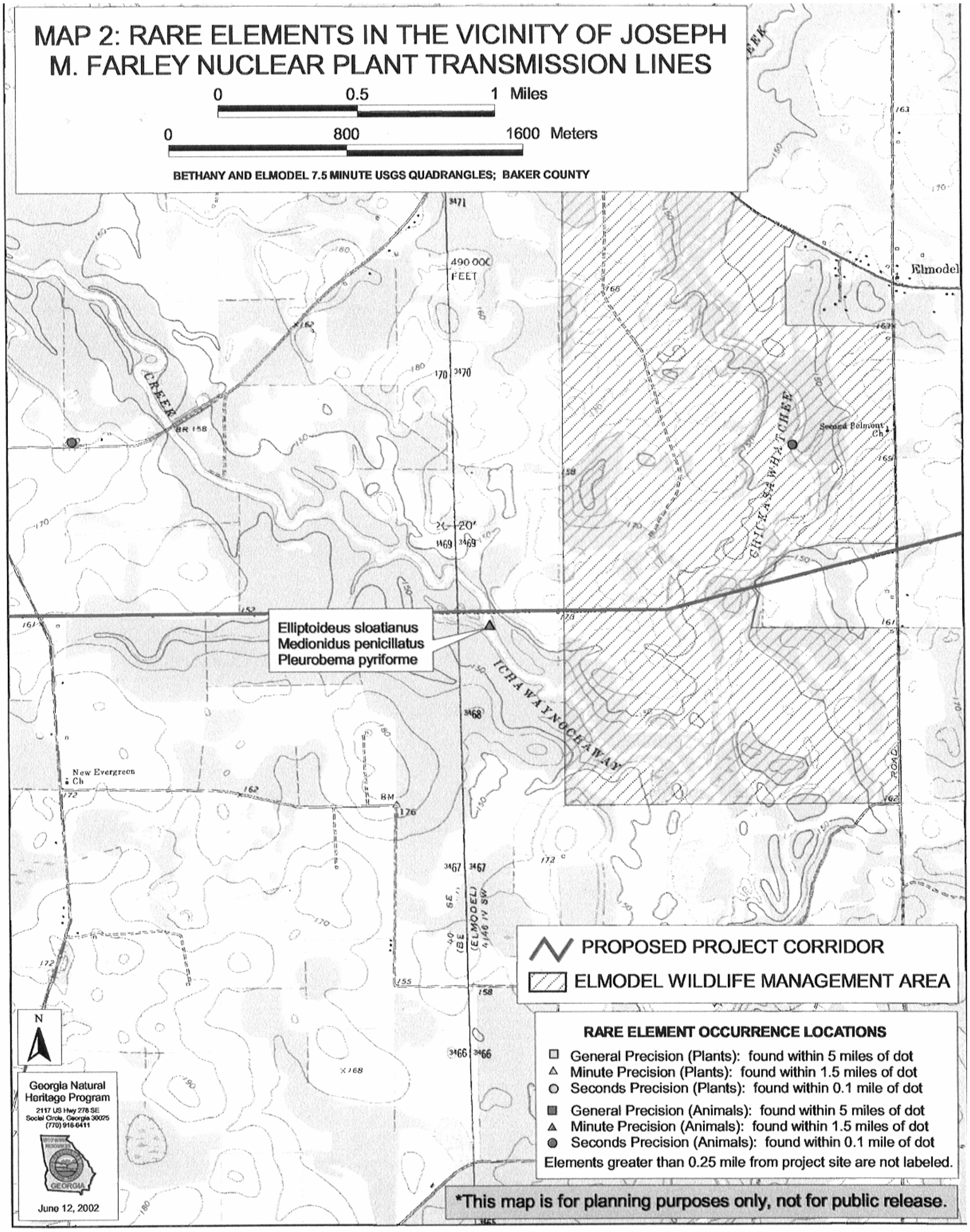
Project Site at SR 97 (-84.60174, 30.87446; NAD27):

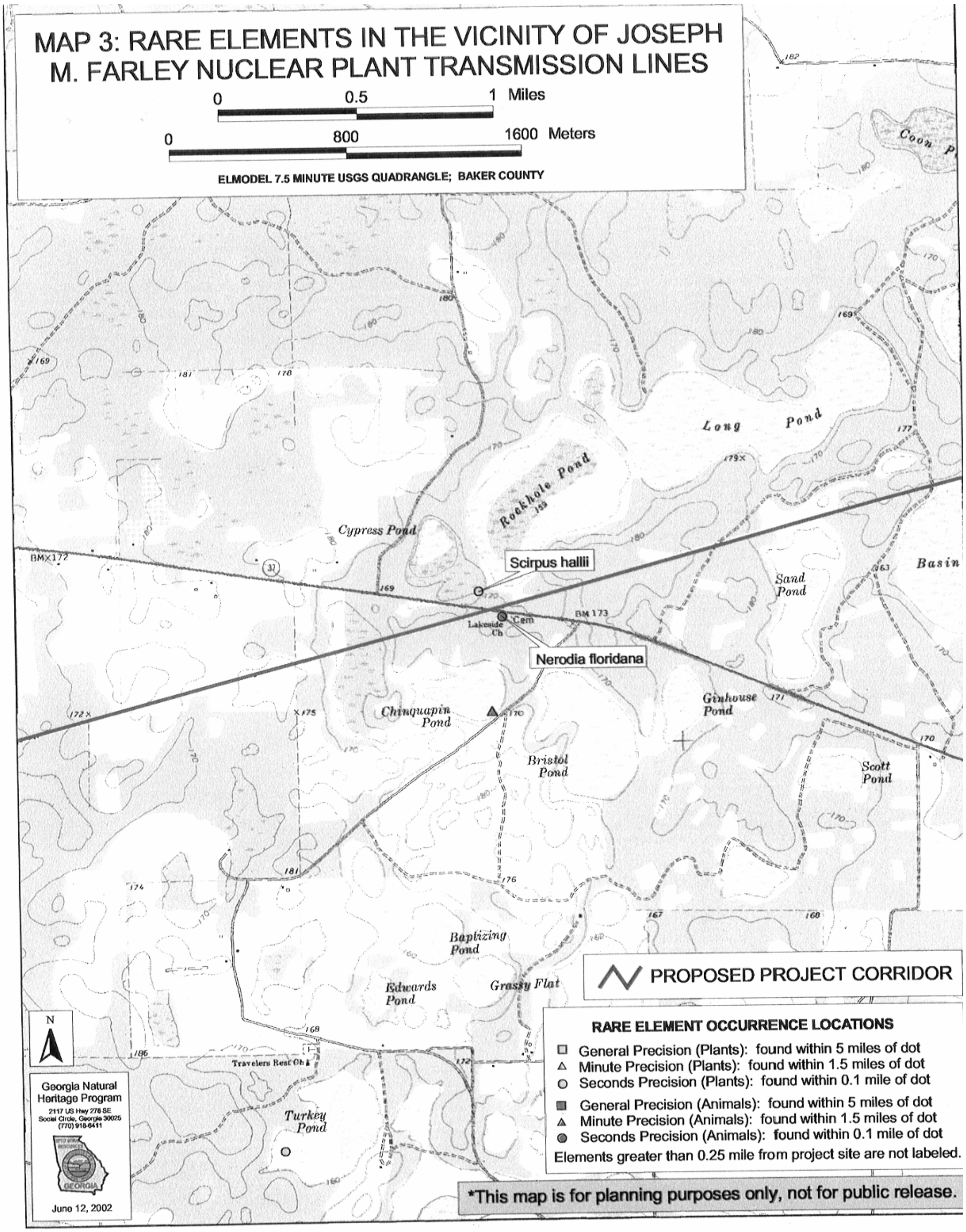
Alasmidonta triangulata (Southern Elktoe) approx. 2.5 mi. NE of site, in the Flint River
Elliptoideus sloatianus (Purple Bankclimber) approx. 2.5 mi. NE of site, in the Flint River
Elliptoideus sloatianus (Purple Bankclimber) approx. 3.0 mi. NE of site, in the Flint River
Lampsilis subangulata (Shinyrayed Pocketbook) approx. 2.5 mi. NE of site, in the Flint River
Macrochelys temminckii (Alligator Snapping Turtle) approx. 1.5 mi. N of site, in the Flint River
Medionidus penicillatus (Gulf Moccasinshell) approx. 2.5 mi. NE of site, in the Flint River
Utterbackia peggyae (Florida Floater) approx. 1.5 mi. SW of site, in Fourmile Creek
Utterbackia peggyae (Florida Floater) approx. 2.5 mi. N of site, in the Flint River
Villosa villosa (Downy Rainbow) approx. 1.5 mi. SW of site, in Fourmile Creek
Lake Seminole WMA approx. 1.0 mi. SW of site

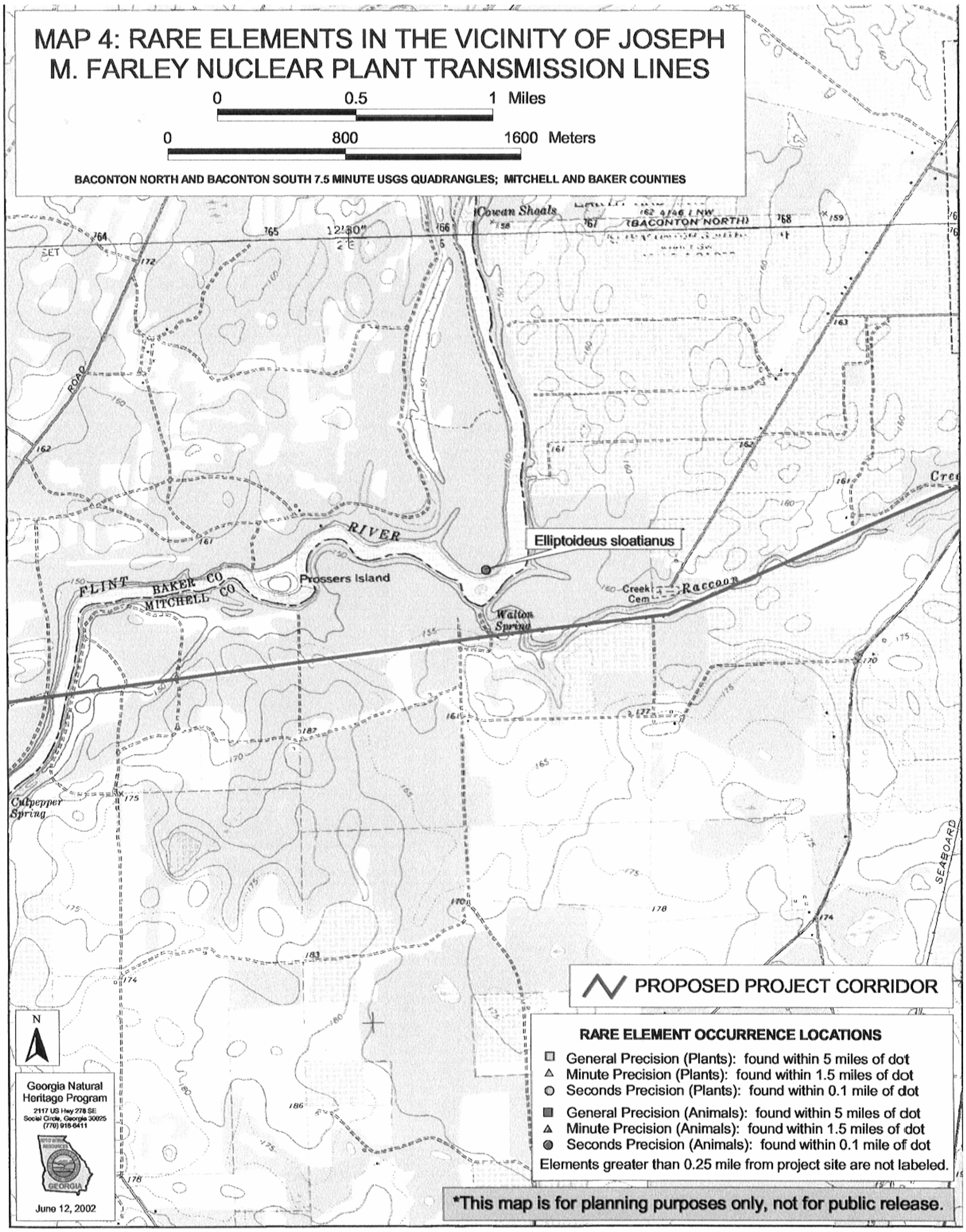
Project Site at SR 309 (-84.56805, 30.85591; NAD27):

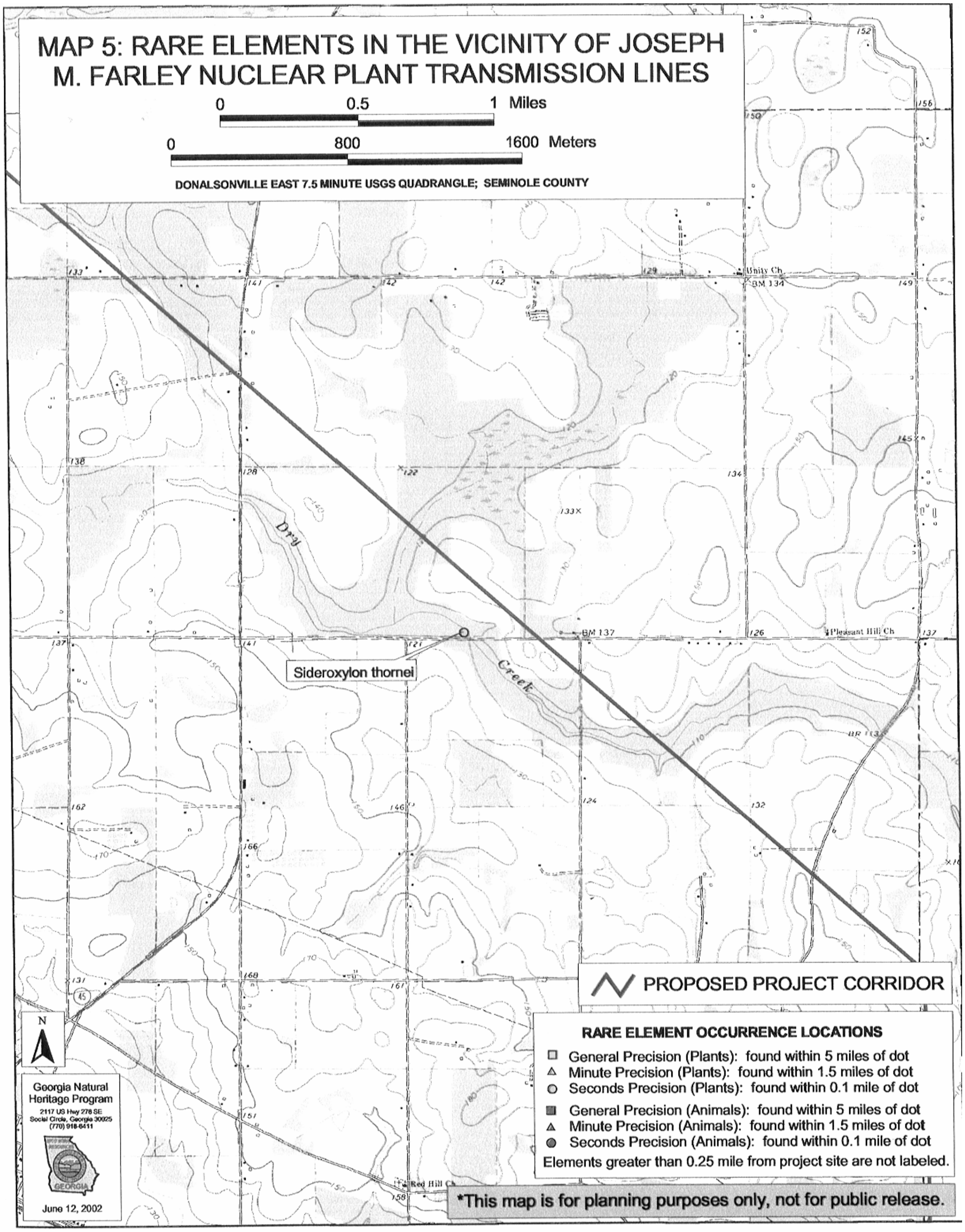
Elliptio arctata (Delicate Spike) less than 0.1 mi. W of site, in Fourmile Creek (see Map 8)
Scirpus erismanae (Bulrush) approx. 2.5 mi. NE of site
Utterbackia peggyae (Florida Floater) less than 0.1 mi. W of site, in Fourmile Creek (see Map 8)

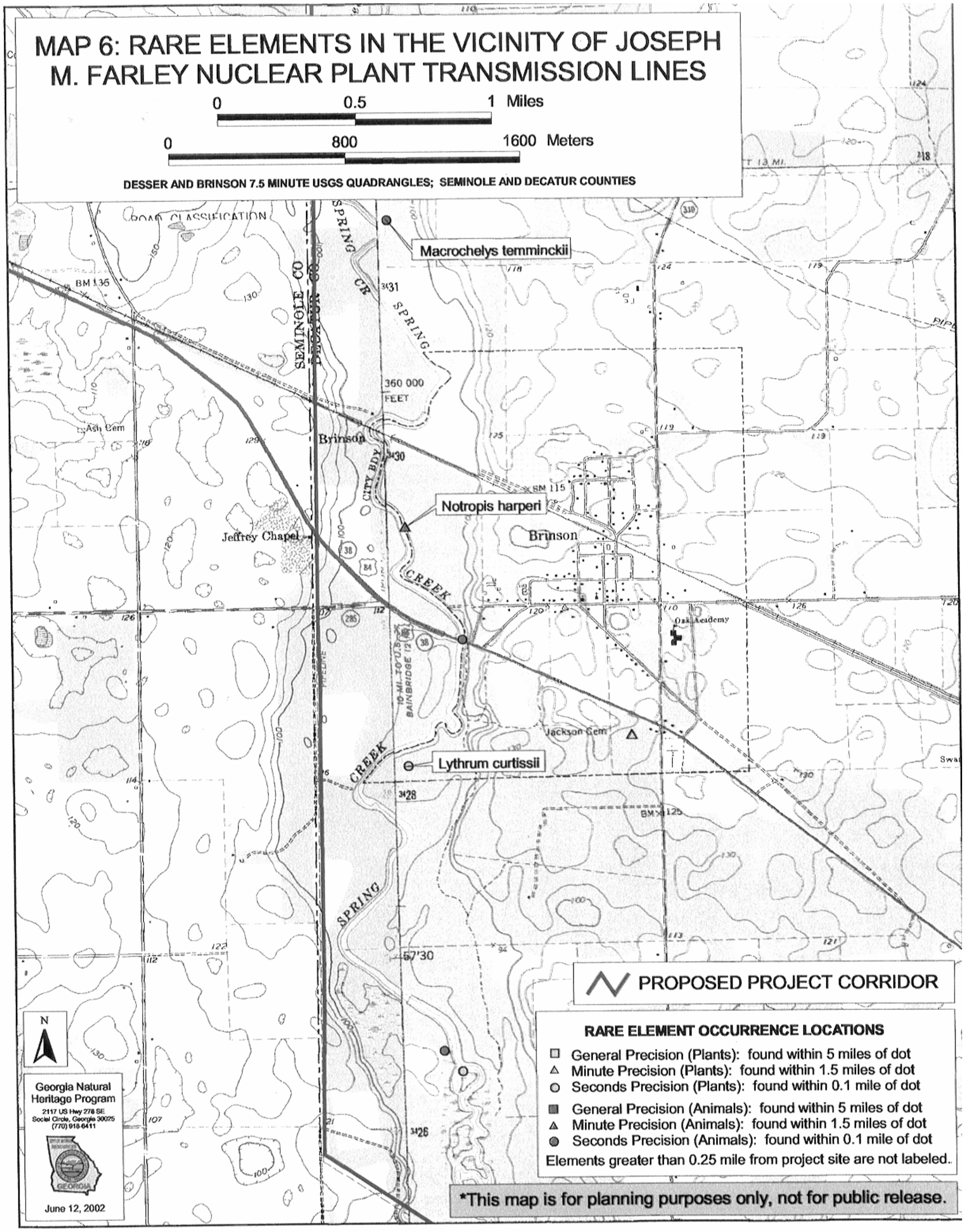

MAP 1: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0
0.5
1 Miles
0
800
1600 Meters
GORDON AND COLUMBIA 7.5 MINUTE USGS QUADRANGLES; EARLY COUNTY
Peltandra sagittifolia
Salix floridana
Howells Fishpond
EARLY CO
HOUSTON CO
RIVER
INDUSTRIAL
PIPELINE
Boat Ramp
Mile 46
Mile 45
Creek
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002

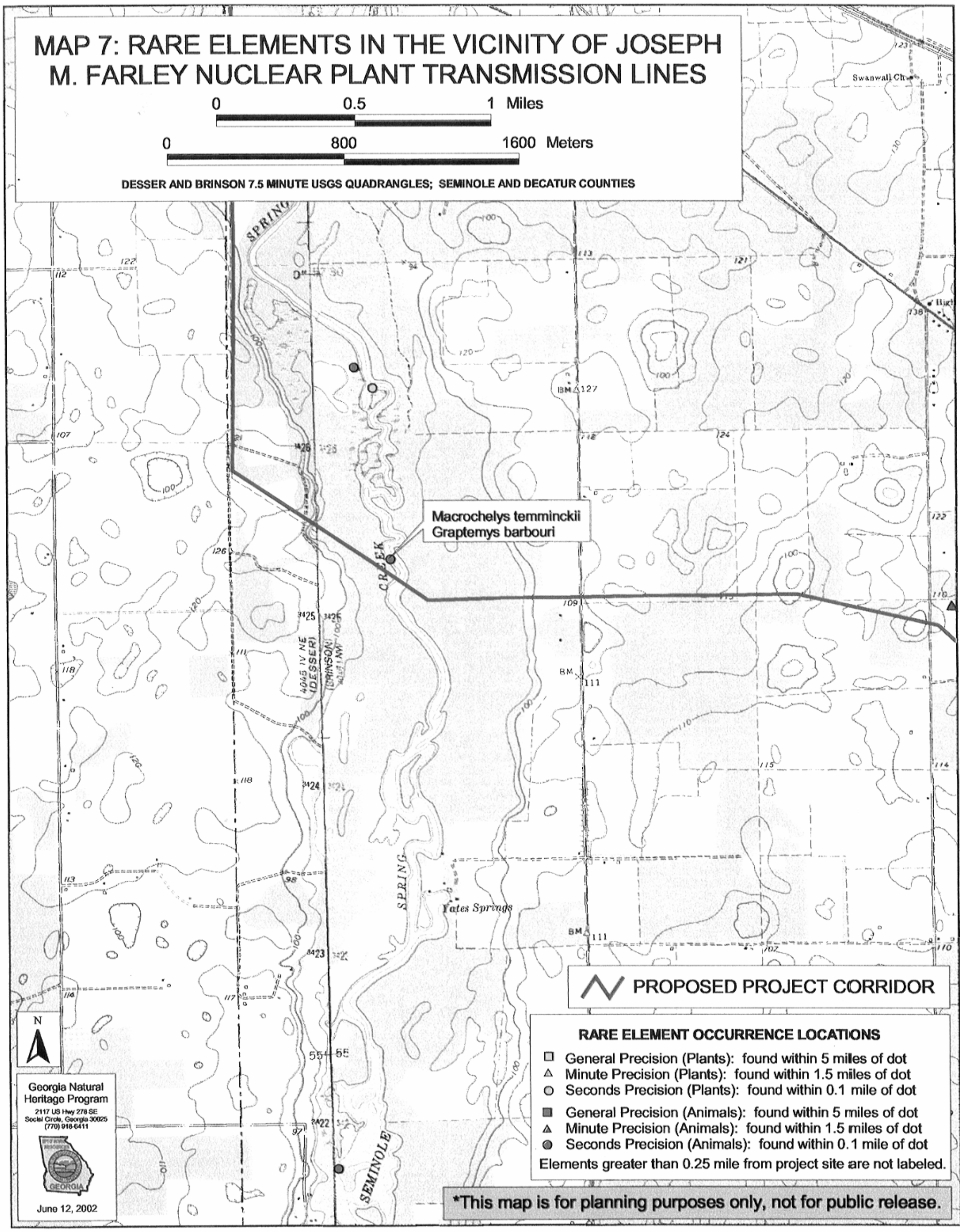

MAP 2: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0
0.5
1 Miles
0
800
1600 Meters
BETHANY AND ELMODEL 7.5 MINUTE USGS QUADRANGLES; BAKER COUNTY
Elmodel
CREEK
ICHAWAYNOCHAWAY
CHICKASAWHATCHEE
New Evergreen Ch
Elliptoideus sloatianus
Medionidus penicillatus
Pleurobema pyriforme
PROPOSED PROJECT CORRIDOR
ELMODEL WILDLIFE MANAGEMENT AREA
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002
*This map is for planning purposes only, not for public release.

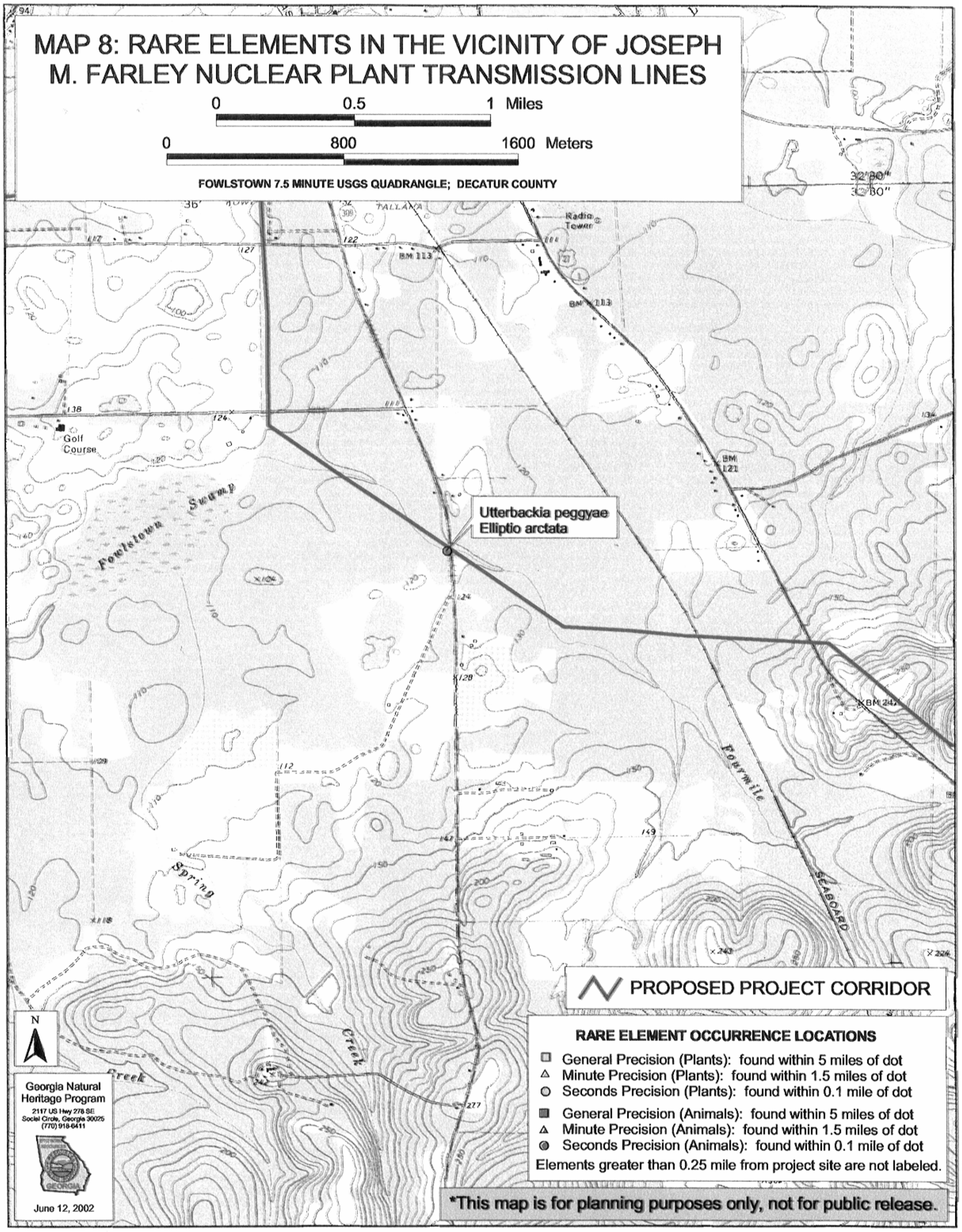

MAP 3: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0 0.5 1 Miles
0 800 1600 Meters
ELMODEL 7.5 MINUTE USGS QUADRANGLE; BAKER COUNTY
Long Pond
Rockhole Pond
Cypress Pond
Scirpus hallii
Nerodia floridana
Sand Pond
Basin
Chinquapin Pond
Ginhouse Pond
Bristol Pond
Scott Pond
Baptizing Pond
Edwards Pond
Grassy Flat
Turkey Pond
Travelers Rest Ch
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002


MAP 4: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0 0.5 1 Miles
0 800 1600 Meters
BACONTON NORTH AND BACONTON SOUTH 7.5 MINUTE USGS QUADRANGLES; MITCHELL AND BAKER COUNTIES
Cowan Shoals
FLINT RIVER
BAKER CO
MITCHELL CO
Prossers Island
Elliptoideus sloatianus
Walton Spring
Raccoon
Culpepper Spring
SEABOARD
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
June 12, 2002


MAP 5: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0 0.5 1 Miles
0 800 1600 Meters
DONALSONVILLE EAST 7.5 MINUTE USGS QUADRANGLE; SEMINOLE COUNTY
Sideroxylon thornei
Dry Creek
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002


MAP 6: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0
0.5
1 Miles
0
800
1600 Meters
DESSER AND BRINSON 7.5 MINUTE USGS QUADRANGLES; SEMINOLE AND DECATUR COUNTIES
Macrochelys temminckii
Notropis harperi
Lythrum curtissii
Brinson
Jeffrey Chapel
Oak Academy
Jackson Cem
SEMINOLE CO
DECATUR CO
SPRING CREEK
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002


MAP 7: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0
0.5
1 Miles
0
800
1600 Meters
DESSER AND BRINSON 7.5 MINUTE USGS QUADRANGLES; SEMINOLE AND DECATUR COUNTIES
Macrochelys temminckii
Graptemys barbouri
SPRING
CREEK
SEMINOLE
Yates Springs
Swanwall Ch
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
*This map is for planning purposes only, not for public release.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
GEORGIA
June 12, 2002


MAP 8: RARE ELEMENTS IN THE VICINITY OF JOSEPH M. FARLEY NUCLEAR PLANT TRANSMISSION LINES
0 0.5 1 Miles
0 800 1600 Meters
FOWLSTOWN 7.5 MINUTE USGS QUADRANGLE; DECATUR COUNTY
Utterbackia peggyae
Elliptio arctata
Golf Course
Fowlstown Swamp
Spring
Creek
Fourmile
SEABOARD
Radio Tower
PROPOSED PROJECT CORRIDOR
RARE ELEMENT OCCURRENCE LOCATIONS
General Precision (Plants): found within 5 miles of dot
Minute Precision (Plants): found within 1.5 miles of dot
Seconds Precision (Plants): found within 0.1 mile of dot
General Precision (Animals): found within 5 miles of dot
Minute Precision (Animals): found within 1.5 miles of dot
Seconds Precision (Animals): found within 0.1 mile of dot
Elements greater than 0.25 mile from project site are not labeled.
N
Georgia Natural Heritage Program
2117 US Hwy 278 SE
Social Circle, Georgia 30025
(770) 918-6411
June 12, 2002
*This map is for planning purposes only, not for public release.

Page Number 1 of 2 Report Generated 13 January 1998

Special Concern Animals Potentially Occurring in Tift County 30 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Acantharchus pomotis MUD SUNFISH	G5	S3			Blackwater streams; bays; cypress/gum ponds
Aimophila aestivalis BACHMAN'S SPARROW	G3	S3		R	Open pine or oak woods; old fields; brushy areas
Alosa alabamae ALABAMA SHAD	G4	S1		U	Brownwater & blackwater streams
Ambystoma cingulatum FLATWOODS SALAMANDER	G2G3	S3		R	Pine flatwoods; moist savannas; cypress/gum ponds
Ameiurus serracanthus SPOTTED BULLHEAD	G3	S2		R	Blackwater & brownwater streams; reservoirs
Ammodramus henslowii HENSLOW'S SPARROW	G3G4	S3			Fields; meadows
Cyprinella leedsi BANNERFIN SHINER	G3	S3S4			Blackwater & brownwater streams
Drymarchon corais couperi EASTERN INDIGO SNAKE	G4T3	S3	LT	T	Sandhills; pine flatwoods; dry hammocks
Elanoides forficatus AMERICAN SWALLOW-TAILED KITE	G5	S2		R	River swamps; marshes
Enneacanthus chaetodon BLACKBANDED SUNFISH	G5	S1S2		R	Blackwater streams; bays; cypress/gum ponds
Etheostoma edwini BROWN DARTER	G5	S3			Blackwater & brownwater streams; springs
Etheostoma parvipinne GOLDSTRIPE DARTER	G4G5	S2		R	Blackwater & brownwater streams; springs
Eumeces egregius MOLE SKINK	G4	S3			Coastal dunes; longleaf pine-turkey oak woods; dry hammocks
Farancia erytrogramma RAINBOW SNAKE	G5	S3			River swamps; springs; sandy fields near water
Gopherus polyphemus GOPHER TORTOISE	G3	S3		T	Sandhills; dry hammocks; longleaf pine-turkey oak woods
Heterodon simus SOUTHERN HOGNOSE SNAKE	G4G5	S3			Open, sandy woods; fields; floodplains
Kinosternon baurii STRIPED MUD TURTLE	G5	S3			River swamps; sloughs; ponds; marshes
Lasiurus intermedius NORTHERN YELLOW BAT	G4G5	S2S3			Wooded areas near open water or fields
Micrurus fulvius EASTERN CORAL SNAKE	G5	S3			Hardwood forests; pine flatwoods; dry hammocks; marshes
Mycteria americana WOOD STORK	G4	S2	LENL	E	Cypress/gum ponds; marshes; river swamps; bays
Notophthalmus perstriatus STRIPED NEWT	G2G3	S2		R	Pine flatwoods; ponds; ditches
Nyctanassa violacea YELLOW-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds

Page Number 2 of 2

Report Generated 13 January 1998

Special Concern Animals Potentially Occurring in Tift County

30 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

GEORGIA

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Nycticorax nycticorax BLACK-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds
Ophisaurus mimicus MIMIC GLASS LIZARD	G3	S2			Pine flatwoods
Pandion haliaetus OSPREY	G5	S3			Lakes; rivers; seacoasts
Picoides borealis RED-COCKADED WOODPECKER	G3	S2	LE	E	Open pine woods; pine savannas
Pituophis melanoleucus mugitus FLORIDA PINE SNAKE	G5T3?	S3			Upland forests; grasslands; floodplains; old field
Pseudotriton montanus MUD SALAMANDER	G5	S3			Swamps; muddy seeps; springs
Pteronotropis hypselopterus SAILFIN SHINER	G5	S3			Blackwater & brownwater streams
Rana capito GOPHER FROG	G4	S?	C		Floodplains; wet meadows; pastures; ponds

Page Number 1 of 3 Report Generated 14 January 1998

Special Concern Plants Potentially Occurring in Tift County 59 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Agalinis aphylla SCALE-LEAF PURPLE FOXGLOVE	G3G4	S2S3?			Longleaf pine-wiregrass savannas; pine flatwoods
Agalinis filicaulis SPINDLY PURPLE FOXGLOVE	G3G4	S2?			Seasonally wet, longleaf pine-wiregrass savannas; grassy pine barrens
Agrimonia incisa CUTLEAF AGRIMONY; CUTLEAF HARVEST LICE	G3	S3			Mixed oak-hickory forests, pine savannas, mesic hardwood forests
Amphicarpum muehlenbergianum BLUE MAIDENCANE, FLORIDA GOOBER GRASS	G4	S3?			Pine flatwoods
Andropogon mohrii BOG BLUESTEM	G4?	S2?			Longleaf pine-wiregrass savannas; pine-cypress savannas
Apteria aphylla NODDING NIXIE	G4	S3			Mesic hardwoods or magnolia-beech bluff forests
Asplenium heteroresiliens WAGNER SPLEENWORT	G2Q	S1		T	Limestone outcrops; marl
Balduina atropurpurea PURPLE HONEYCOMB HEAD	G2G3	S2		R	Wet savannas, pitcherplant bogs
Callirhoe papaver WOODS POPPY-MALLOW	G5	S2S3			Openings in oak-pine forests
Carex dasycarpa VELVET SEDGE	G4?	S3		R	Evergreen hammocks; mesic hardwood forests
Croton elliottii ELLIOTT CROTON	G2G3	S2S3			Pond margins and wet savannas
Delphinium carolinianum CAROLINA LARKSPUR	G5	S3			Granite outcrops; rocky, calcareous oak forests; Altamaha Grit outcrops
Elliottia racemosa GEORGIA PLUME	G2G3	S2S3		T	Scrub forests; Altamaha Grit outcrops; open forests over ultramafic rock
Epidendrum conopseum GREEN-FLY ORCHID	G3G4	S3		U	Epiphytic in bottomland hardwoods and magnolia-beech bluff forests, also Altamaha Grit outcrops
Eriocaulon texense TEXAS PIPEWORT	G4	S2?			Altamaha grit outcrops; wet pine savannas
Evolvulus sericeus var. sericeus CREEPING MORNING-GLORY	G5T?	S1		E	Altamaha Grit outcrops; open calcareous uplands
Fimbristylis perpusilla HARPER FIMBRY	G2G3	S1		E	Exposed muddy margins of pineland ponds
Habenaria quinqueseta var. quinqueseta MICHAUX ORCHID	G4G5T?	S1			Moist shade, Altamaha Grit outcrops; open pine woods
Ilex amelanchier SERVICEBERRY HOLLY	G4	S2			Wet, sandy thickets; cypress-gum swamps
Isoetes boomii BOOM QUILLWORT	G1Q	S1			Shallow water (one foot deep) of slow moving streams

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:58; Page 8/15

Page Number 2 of 3
Report Generated 14 January 1998
59 Taxa in List

Special Concern Plants Potentially Occurring in Tift County

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Isoetes georgiana GEORGIA QUILLWORT	G1Q	S2S3?			In floodplain woods on seasonally wet or inundated margins of braided streams
Krameria lanceolata SANDBUR	G5	S3?			Longleaf pine-wiregrass sandridges
Leitneria floridana CORKWOOD	G2G3	S1			Swamps; sawgrass-cabbage palmetto marshes
Lindera melissifolia PONDBERRY	G2	S1	LE	E	Pond margins and wet savannas
Litsea aestivalis PONDSPICE	G3	S2		T	Cypress ponds; swamp margins
Lobelia boykinii BOYKIN LOBELIA	G2	S2S3			Cypress ponds and wet savannas
Macbridea caroliniana CAROLINA BOGMINT	G2G3	S1?			Bogs; marshes; alluvial woods
Macranthera flammea FLAME FLOWER	G3	S2?			Wet, sandy thickets; pitcherplant bogs
Marshallia ramosa PINELAND MARSHALLIA	G2	S2		R	Altamaha Grit outcrops; open forests over ultramafic rock
Myrica inodora ODORLESS BAYBERRY	G4	S2?			Bayheads, titi swamps
Myriophyllum laxum LAX WATER-MILFOIL	G3	S2		T	Bluehole spring runs; shallow, sandy, swift-flowing creeks; clear, cool ponds
Oxypolis ternata TERNATE COWBANE	G3	S2			Wet pine savannas and bogs
Paronychia rugelii var. interior RUGEL NAILWORT	G2?T2?Q	S2?			Longleaf pine-turkey oak scrub, mostly Alapaha River drainage
Penstemon dissectus GRIT BEARDTONGUE	G2?	S2		R	Altamaha Grit outcrops and adjacent pine savannas; rarely sandridges
Pieris phillyreifolia CLIMBING HEATH	G3?	S3			Cypress ponds; epiphytic on cypress bark
Platanthera integra YELLOW FRINGELESS ORCHID	G4	S2			Wet savannas, pitcherplant bogs
Platanthera nivea SNOWY ORCHID	G5	S3			Wet savannas, pitcherplant bogs
Rhexia aristosa AWNED MEADOWBEAUTY	G3	S2			Pond margins and wet savannas
Rhododendron austrinum FLORIDA AZALEA	G3G4	S3			Hardwood-spruce pine forests; low woods
Rhynchospora macra SOUTHERN WHITE BEAKRUSH	G3G4	S1?			Seepage slopes; wet savannas
Rhynchospora oligantha FEATHER-BRISTLE BEAKRUSH	G4	S1?			Bogs
Rhynchospora punctata PINELAND BEAKRUSH	G1?	S1?			Wet savannas, pitcherplant bogs
Rhynchospora solitaria AUTUMN BEAKRUSH	G1	S1			Wet, sandy, peaty depressions

Page Number 3 of 3 Report Generated 14 January 1998

Special Concern Plants Potentially Occurring in Tift County 59 Taxa in List

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Rudbeckia nitida var. nitida YELLOW CONEFLOWER	G3?T1T3	S3?			Wet savannas, pitcherplant bogs; cypress ponds
Sarracenia flava YELLOW FLYTRAP	G4G5	S3S4		U	Wet savannas, pitcherplant bogs
Sarracenia leucophylla WHITETOP PITCHERPLANT	G3	SH		E	Wet savannas, pitcherplant bogs
Sarracenia minor HOODED PITCHERPLANT	G4	S4		U	Wet savannas, pitcherplant bogs
Sarracenia psittacina PARROT PITCHERPLANT	G4	S2S3		T	Wet savannas, pitcherplant bogs
Schizachyrium stoloniferum BLUESTEM	G3G4Q	S2?			Longleaf pine-wiregrass savannas
Schwalbea americana CHAFFSEED	G2	S1	LE	E	Ponds margins and wet savannas; upland ridge forests
Sideroxylon thornei SWAMP BUCKTHORN	G2	S2		E	Forested limesink depressions; calcareous swamps
Sporobolus teretifolius WIRE-LEAF DROPSEED	G1G2	S2?			Longleaf pine-wiregrass savannas, pitcherplant bogs
Stewartia malacodendron SILKY CAMELLIA	G4	S2		R	Steepheads, bayheads; edges of swamps
Stokesia laevis STOKES ASTER	G5	S1			Pitcherplant bogs
Thalictrum cooleyi COOLEY MEADOWRUE	G1	S1Q	LE	E	Pond margins and wet savannas
Trillium reliquum RELICT TRILLIUM	G2	S2	LE	E	Mesic hardwood forests; limesink forests
Uvularia floridana FLORIDA BELLWORT	G3?	S3?			Mixed oak-hickory forests; mesic hardwoods or magnolia-beech bluff forests
Xyris drummondii DRUMMOND YELLOW-EYED GRASS	G3	S1			Pine flatwoods
Xyris scabrifolia HARPER YELLOW-EYED GRASS	G3	S1			Sedge bogs; pitcherplant bogs; pine flatwoods

Page Number 1 of 2 Report Generated 16 November 2000

Special Concern Animals Potentially Occurring in Grady County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Acantharchus pomotis MUD SUNFISH	G5	S3			Blackwater lentic and lotic habitats with mud, silt, or detritus substrate
Aimophila aestivalis BACHMAN'S SPARROW	G3	S3		R	Open pine or oak woods; old fields; brushy areas
Alosa alabamae ALABAMA SHAD	G3	S1	C	U	Saltwater; coastal rivers in moderate current
Ambystoma cingulatum FLATWOODS SALAMANDER	G2G3	S3	LT	T	Pine flatwoods; moist savannas; cypress/gum ponds
Ameiurus serracanthus SPOTTED BULLHEAD	G3	S2		R	Large streams and rivers with moderate current and rock-sand substrate
Ammodramus henslowii HENSLOW'S SPARROW	G4	S3			Wet shrubby fields and weedy meadows
Amphiuma pholeter ONE-TOED AMPHIUMA	G3	S1		R	Organic mucky/muddy, shallow creeks; temporary pools and streams
Cyprinella leedsi BANNERFIN SHINER	G4	S3S4			Medium to large rivers in flowing water over sandy to rocky substrate
Elanoides forficatus SWALLOW-TAILED KITE	G5	S2		R	River swamps; marshes
Etheostoma edwini BROWN DARTER	G5	S3			Small to moderate sized flowing streams in root masses or aquatic vegetation
Etheostoma parvipinne GOLDSTRIPE DARTER	G4G5	S2		R	Small sluggish streams and spring seepage areas in woody debris, leaf material, mud, and silt
Etheostoma swaini GULF DARTER	G5	S3			Small to medium streams with moderate current over substrates of sand and detritus
Eumeces egregius MOLE SKINK	G4	S3	(PS)		Coastal dunes; longleaf pine-turkey oak woods; dry hammocks
Falco sparverius paulus SOUTHEASTERN AMERICAN KESTREL	G5T4	S3			Pine forests; pine savannas
Farancia erytrogramma RAINBOW SNAKE	G5	S3			River swamps; springs; sandy fields near water
Fundulus auroguttatus BANDED TOPMINNOW	G4	S3		R	Blackwater streams; ponds; bays; freshwater marshes
Fundulus chrysotus GOLDEN TOPMINNOW	G5	S3			Blackwater streams, ponds, bays, brackish streams with extensive aquatic vegetation
Fundulus escambiae EASTERN STARHEAD TOPMINNOW	G4	S3			Vegetated areas of sluggish streams, backwaters, and swamps
Gopherus polyphemus GOPHER TORTOISE	G3	S3	(PS:LT)	T	Sandhills; dry hammocks; longleaf pine-turkey oak woods
Haideotriton wallacei GEORGIA BLIND SALAMANDER	G2	S1		T	Caves & underground streams
Heterodon simus SOUTHERN HOGNOSE SNAKE	G2	S2			Open, sandy woods; fields; floodplains

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:59; Page 9/15

Page Number 2 of 2 Report Generated 16 November 2000

Special Concern Animals Potentially Occurring in Grady County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

GEORGIA

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Ichthyomyzon gagei SOUTHERN BROOK LAMPREY	G5	S3			Creeks to small rivers with sand or sand and gravel substrate
Kinosternon baurii STRIPED MUD TURTLE	G5	S3			River swamps; sloughs; ponds; marshes
Lasiurus intermedius NORTHERN YELLOW BAT	G4G5	S2S3			Wooded areas near open water or fields
Lepisosteus oculatus SPOTTED GAR	G5	S1			Weedy areas of clear backwaters and oxbow lakes
Lucania parva RAINWATER KILLIFISH	G5	S1			Fresh to brackish estuarine areas in vegetation
Macroclemys temminckii ALLIGATOR SNAPPING TURTLE	G3G4	S3		T	Rivers; lakes; large ponds near streams, swamps
Micropterus notius SUWANNEE BASS	G3	S1		R	Flowing water over rocky shoals or large springs and spring runs
Micrurus fulvius fulvius EASTERN CORAL SNAKE	G5T5	S3			Hardwood forests; pine flatwoods; dry hammocks; marshes
Mycteria americana WOOD STORK	G4	S2	(PS LE)	E	Cypress/gum ponds; marshes; river swamps, bays
Myotis austroriparius SOUTHEASTERN MYOTIS	G3G4	S3			Caves & buildings near water
Necturus sp. cf. beyeri GULF COAST WATERDOG	G4	S3			Habitat data is not available
Nerodia floridana FLORIDA GREEN WATER SNAKE	G5	S2			Swamps; marshes; limesink ponds; bays
Nyctanassa violacea YELLOW-CROWNED NIGHT-HERON	G5	S3S4			River swamps, marshes, cypress/gum ponds
Nycticorax nycticorax BLACK-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes, cypress/gum ponds
Pandion haliaetus OSPREY	G5	S3			Lakes; rivers; seacoasts
Picoides borealis RED-COCKADED WOODPECKER	G3	S2	LE	E	Open pine woods; pine savannas
Pseudobranchus striatus DWARF SIREN	G5	S3			Swamps; marshes, limesink ponds, bays
Pseudotriton montanus MUD SALAMANDER	G5	S4			Swamps; muddy seeps; springs
Pteronotropis hypselopterus SAILFIN SHINER	G5	S3			Flowing areas of small clear streams over sand substrate; often associated with woody debris or vege
Pteronotropis welaka BLUENOSE SHINER	G3G4	S1		R	Quiet backwaters and vegetated pools of streams and rivers
Seminatrix pygaea BLACK SWAMP SNAKE	G5	S3			Swamps, ponds; marshes, lakes

Page Number 1 of 2 Report Generated 16 November 2000

Special Concern Plants Potentially Occurring in Dougherty County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Agrimonia incisa CUTLEAF AGRIMONY; CUTLEAF HARVEST LICE	G3	S3			Mixed oak-hickory forests, pine savannas, mesic hardwood forests
Armoracia lacustris LAKE-CRESS	G4?	S1?			Shallow water of swamps and lake margins
Asplenium heteroresiliens WAGNER SPLEENWORT	G2Q	S1		T	Limestone and marl outcrops; tabby ruins
Callirhoe papaver WOODS POPPY-MALLOW	G5	S2S3			Openings in oak-pine forests
Carex dasycarpa VELVET SEDGE	G4?	S3		R	Evergreen hammocks; mesic hardwood forests
Ceanothus microphyllus SANDHILL CEANOTHUS	G4G5	S3			Longleaf pine-wiregrass savannas
Croton elliottii ELLIOTT CROTON	G2G3	S2S3			Pond margins and wet savannas
Epidendrum conopseum GREEN-FLY ORCHID	G4	S3		U	Epiphytic on limbs of evergreen hardwoods; also in crevices of Altamaha Grit outcrops
Fimbristylis perpusilla HARPER FIMBRY	G2	S1		E	Exposed muddy margins of pineland ponds
Leitneria floridana CORKWOOD	G3	S1			Swamps; sawgrass-cabbage palmetto marshes
Lindera melissifolia PONDBERRY	G2	S1	LE	E	Pond margins and wet savannas
Litsea aestivalis PONDSPICE	G3	S2		T	Cypress ponds; swamp margins
Lobelia boykinii BOYKIN LOBELIA	G2G3	S2S3			Cypress ponds and wet savannas
Oxypolis canbyi CANBY DROPWORT	G2	S2	LE	E	Cypress ponds and sloughs; wet savannas
Panicum hirstii HIRST PANIC GRASS	G1	SH	C	E	Cypress ponds, wet savannas and sloughs
Plantago sparsiflora PINELAND PLANTAIN	G3	S2			Open, wet pine savannas; shallow ditches
Pteroglossaspis ecristata WILD COCO	G2	S1			Grassy saw palmetto barrens; longleaf pine grasslands, sometimes with Schwalbea americana
Rhexia aristosa AWNED MEADOWBEAUTY	G3	S2			Pond margins and wet savannas
Rhododendron austrinum FLORIDA AZALEA	G3	S3			Hardwood-spruce pine forests; low woods
Sarracenia flava YELLOW FLYTRAP	G5?	S3S4		U	Wet savannas, pitcherplant bogs
Sarracenia leucophylla WHITETOP PITCHERPLANT	G3	SH		E	Wet savannas, pitcherplant bogs
Sarracenia minor HOODED PITCHERPLANT	G4	S4		U	Wet savannas, pitcherplant bogs

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:59; Page 10/15

Page Number 2 of 2 Report Generated 16 November 2000

Special Concern Plants Potentially Occurring in Dougherty County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Sarracenia psittacina PARROT PITCHERPLANT	G4	S2S3		T	Wet savannas, pitcherplant bogs
Schwalbea americana CHAFFSEED	G2	S1	LE	E	Ponds margins and wet savannas; upland ridge forests
Scirpus hallii HALL BULRUSH	G2	SH			Pond shores in peaty sands
Sideroxylon thornei SWAMP BUCKTHORN	G2	S2		E	Forested limesink depressions, calcareous swamps
Sium floridanum FLORIDA WATER-PARSNIP	G1Q	S1?			Calcareous swamps; floodplains
Stewartia malacodendron SILKY CAMELLIA	G4	S2		R	Steepheads, bayheads, edges of swamps
Stylisma pickeringii var. pickeringii PICKERING MORNING-GLORY	G4T2T3	S2		T	Open, dry, oak scrub of sandhills
Thalictrum cooleyi COOLEY MEADOWRUE	G1	S1	LE	E	Pond margins and wet savannas
Trillium reliquum RELICT TRILLIUM	G2	S2	LE	E	Mesic hardwood forests, limesink forests
Uvularia floridana FLORIDA BELLWORT	G3	S3?			Mixed oak-hickory forests; mesic hardwoods or magnolia-beech bluff forests
Xyris scabrifolia HARPER YELLOW-EYED GRASS	G3	S1			Sedge bogs, pitcherplant bogs; pine flatwoods
Zanthoxylum americanum NORTHERN PRICKLY-ASH	G5	S1?			Rocky, openly wooded slopes; river banks and terraces

Page Number 1 of 3 Report Generated 16 November 2000

Special Concern Animals Potentially Occurring in Dougherty County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Aimophila aestivalis BACHMAN'S SPARROW	G3	S3		R	Open pine or oak woods; old fields; brushy areas
Alosa alabamae ALABAMA SHAD	G3	S1	C	U	Saltwater; coastal rivers in moderate current
Amblema neislerii FAT THREERIDGE	G1	SX	LE	E	Small to large rivers with moderate current and muddy sand substrate
Ambystoma cingulatum FLATWOODS SALAMANDER	G2G3	S3	LT	T	Pine flatwoods; moist savannas; cypress/gum ponds
Ameiurus serracanthus SPOTTED BULLHEAD	G3	S2		R	Large streams and rivers with moderate current and rock-sand substrate
Ammodramus henslowii HENSLOW'S SPARROW	G4	S3			Wet shrubby fields and weedy meadows
Cyprinella callitaenia BLUESTRIPE SHINER	G2G3	S2		T	Flowing areas in large creeks and medium-sized rivers over rocky substrates
Elanoides forficatus SWALLOW-TAILED KITE	G5	S2		R	River swamps; marshes
Elimia albanyensis BLACK-CREST ELIMIA	G5	SH			Slackwater habitats in medium-sized rivers
Elliptio arctata DELICATE SPIKE	G4Q	S3			Large rivers and creeks with some current in sand and sand and limestone rock substrates
Elliptio fraterna BROTHER SPIKE	G1G2Q	S1			Sandy substrates of river channels with swift current
Elliptio nigella WINGED SPIKE	GH	SX			Spring influenced streams with substrate of sand and limestone rock
Elliptio purpurella INFLATED SPIKE	G3	S2			Sand and limestone rock substrates
Elliptoideus sloatianus PURPLE BANKCLIMBER	G2	S2	LT	T	Small to large rivers with moderate current and substrate of sand, fine gravel, or muddy sand
Etheostoma edwini BROWN DARTER	G5	S3			Small to moderate sized flowing streams in root masses or aquatic vegetation
Etheostoma parvipinne GOLDSTRIPE DARTER	G4G5	S2		R	Small sluggish streams and spring seepage areas in woody debris, leaf material, mud, and silt
Eumeces egregius MOLE SKINK	G4	S3	(PS)		Coastal dunes; longleaf pine-turkey oak woods; dry hammocks
Farancia erytrogramma RAINBOW SNAKE	G5	S3			River swamps; springs; sandy fields near water
Fundulus chrysotus GOLDEN TOPMINNOW	G5	S3			Blackwater streams, ponds, bays, brackish streams with extensive aquatic vegetation
Fundulus escambiae EASTERN STARHEAD TOPMINNOW	G4	S3			Vegetated areas of sluggish streams, backwaters, and swamps
Gopherus polyphemus GOPHER TORTOISE	G3	S3	(PS:LT)	T	Sandhills; dry hammocks; longleaf pine-turkey oak woods

 Report Generated 16 November 2000

Special Concern Animals Potentially Occurring in Dougherty County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Graptemys barbouri BARBOUR'S MAP TURTLE	G2	S2		T	Rivers & creeks Apalachicola River drainage
Haideotriton wallacei GEORGIA BLIND SALAMANDER	G2	S1		T	Caves & underground streams
Heterodon simus SOUTHERN HOGNOSE SNAKE	G2	S2			Open, sandy woods, fields; floodplains
Kinosternon baurii STRIPED MUD TURTLE	G5	S3			River swamps; sloughs; ponds; marshes
Lampsilis subangulata SHINYRAYED POCKETBOOK	G2	S2	LE	E	Sandy/rocky medium-sized rivers & creeks
Lasiurus intermedius NORTHERN YELLOW BAT	G4G5	S2S3			Wooded areas near open water or fields
Lepisosteus oculatus SPOTTED GAR	G5	S1			Weedy areas of clear backwaters and oxbow lakes
Macroclemys temminckii ALLIGATOR SNAPPING TURTLE	G3G4	S3		T	Rivers; lakes, large ponds near streams; swamps
Medionidus penicillatus GULF MOCCASINSHELL	G2	S2	LE	E	Sandy/rocky medium-sized rivers & creeks
Micrurus fulvius fulvius EASTERN CORAL SNAKE	G5T5	S3			Hardwood forests, pine flatwoods: dry hammocks, marshes
Mycteria americana WOOD STORK	G4	S2	(PS.LE)	E	Cypress/gum ponds; marshes, river swamps; bays
Necturus sp. cf. beyeri GULF COAST WATERDOG	G4	S3			Habitat data is not available
Nerodia floridana FLORIDA GREEN WATER SNAKE	G5	S2			Swamps; marshes, limesink ponds; bays
Notropis harperi REDEYE CHUB	G4	S2		R	Springs and spring influenced creeks over sand or rocky substrates
Nyctanassa violacea YELLOW-CROWNED NIGHT-HERON	G5	S3S4			River swamps, marshes; cypress/gum ponds
Nycticorax nycticorax BLACK-CROWNED NIGHT-HERON	G5	S3S4			River swamps, marshes, cypress/gum ponds
Pandion haliaetus OSPREY	G5	S3			Lakes; rivers; seacoasts
Picoides borealis RED-COCKADED WOODPECKER	G3	S2	LE	E	Open pine woods; pine savannas
Pleurobema pyriforme OVAL PIGTOE	G2	S2	LE	E	Sandy, medium-sized rivers & creeks
Pseudobranchus striatus DWARF SIREN	G5	S3			Swamps, marshes; limesink ponds; bays
Pseudotriton montanus MUD SALAMANDER	G5	S4			Swamps, muddy seeps; springs
Pteronotropis hypselopterus SAILFIN SHINER	G5	S3			Flowing areas of small clear streams over sand substrate; often associated with woody debris or vege

Page Number 3 of 3

Report Generated 16 November 2000

Special Concern Animals Potentially Occurring in Dougherty County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Pteronotropis welaka BLUENOSE SHINER	G3G4	S1		R	Quiet backwaters and vegetated pools of streams and rivers
Seminatrix pygaea BLACK SWAMP SNAKE	G5	S3			Swamps; ponds; marshes; lakes

Page Number 1 of 8

Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Agalinis aphylla SCALE-LEAF PURPLE FOXGLOVE	G3G4	S3?			Longleaf pine-wiregrass savannas; pine flatwoods
Agalinis divaricata PINELAND PURPLE FOXGLOVE	G3?	S1?			Dry, grassy, pine-scrub oak ridges; extreme SW Georgia
Agalinis filicaulis SPINDLY PURPLE FOXGLOVE	G3G4	S2?			Seasonally wet, longleaf pine-wiregrass savannas; grassy pine barrens
Agalinis georgiana GEORGIA PURPLE FOXGLOVE; SPOTLESS PURPLE FOXGLOVE	G?	SU			Dry, grassy, pine-scrub oak ridges
Agrimonia incisa CUTLEAF AGRIMONY; CUTLEAF HARVEST LICE	G3	S3			Mixed oak-hickory forests, pine savannas, mesic hardwood forests
Andropogon mohrii BOG BLUESTEM	G4?	S2?			Longleaf pine-wiregrass savannas; pine-cypress savannas
Apteria aphylla NODDING NIXIE	G4	S3			Mesic hardwoods or magnolia-beech bluff forests
Aristida simpliciflora CHAPMAN THREE-AWN GRASS	G2	SH			Longleaf pine-wiregrass savannas
Arnoglossum sulcatum GROOVED-STEM INDIAN-PLANTAIN	G2G3	S1			Bottomland forests
Asclepias pedicellata SAVANNA MILKWEED	G4	S2?			Longleaf pine flatwoods; sandy pinelands with longleaf pine-saw palmetto-myrtle oak (Sapelo Island)
Asclepias rubra RED MILKWEED	G4G5	SH			Bogs, wet savannas
Asplenium heteroresiliens WAGNER SPLEENWORT	G2Q	S1		T	Limestone and marl outcrops; tabby ruins
Aster eryngiifolius SNAKEROOT-LEAF ASTER	G3G4	S1			Moist pinelands
Aster praealtus WILLOW-LEAF ASTER	G5	S1?			Lowland forests over limestone
Aster sericeus var. microphyllus SILKY ASTER	G5T4	S1			Limestone glades
Balduina atropurpurea PURPLE HONEYCOMB HEAD	G2G3	S2		R	Wet savannas, pitcherplant bogs
Baptisia lecontei LECONTE WILD INDIGO	G4?	S1			Pineland scrub
Baptisia megacarpa BIGPOD WILD INDIGO	G2	S1			Floodplain forests
Brickellia cordifolia FLYR'S NEMESIS	G2G3	S1			Mesic hardwood forests
Callirhoe triangulata CLUSTERED POPPY-MALLOW, WINECUP	G3	S2			Sandy scrub
Calopogon multiflorus MANY-FLOWERED GRASS-PINK	G2G3	SH			Wet savannas; pitcherplant bogs

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:59; Page 12/15

Page Number 2 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Calystegia catesbiana ssp catesbiana CATESBY BINDWEED	G3T2?	S1?			Longleaf pine- wiregrass savannas
Carex baltzellii BALTZELL SEDGE	G3	S1		E	Beech-magnolia slope forests
Carex dasycarpa VELVET SEDGE	G4?	S3		R	Evergreen hammocks: mesic hardwood forests
Carex decomposita CYPRESS-KNEE SEDGE	G3	S2?			Swamps and lake margins on floating logs
Carphephorus pseudoliatris LAVENDER LADY	G4G5	SH			Pine flatwoods
Ceanothus microphyllus SANDHILL CEANOTHUS	G4G5	S3			Longleaf pine-wiregrass savannas
Chamaecrista deeringiana FLORIDA SENNA	G1G2	S1?			Sandhill scrub, longleaf pine-wiregrass savannas
Coreopsis integrifolia TICKSEED	G1G2	S1S2			Floodplain forests, streambanks
Croomia pauciflora CROOMIA	G3	S1		T	Mesic hardwood forests, usually with Fagus and Tilia
Croton elliottii ELLIOTT CROTON	G2G3	S2S3			Pond margins and wet savannas
Dalea carnea var gracilis SPRAWLING WHITE-TASSELS	G5T3T4	SH			Wet pine savannas, Southwest Georgia
Drosera filiformis THREAD-LEAF SUNDEW; DEW-THREADS	G5	S1?			Pitcherplant bogs, wet savannas
Eleocharis atropurpurea SPIKERUSH	G4G5	S1S3			Limesink pond margins
Eleocharis melanocarpa BLACKFRUIT SPIKERUSH	G4	S3			Limesink pond margins
Eleocharis montana var nodulosa SPIKERUSH	G5T?	SH			Limesink ponds and sloughs
Elyonurus tripsacoides PAN-AMERICAN BALSAMSCALE	G5?	SH			Pine savannas
Epidendrum conopseum GREEN-FLY ORCHID	G4	S3		U	Epiphytic on limbs of evergreen hardwoods; also in crevices of Altamaha Grit outcrops
Eryngium aromaticum FRAGRANT SNAKEROOT	G5	S3?			Dry pinelands; longleaf pine-wiregrass savannas
Fimbristylis decipiens SOUTHERN FIMBRY	G4	S3?			Wet pine savannas; sandy seeps on Altamaha grit outcrops
Fimbristylis perpusilla HARPER FIMBRY	G2	S1		E	Exposed muddy margins of pineland ponds
Fimbristylis tomentosa WOOLY FIMBRY	G?	SE?			Bogs, Granite outcrops
Fothergilla gardenii DWARF WITCH-ALDER	G3G4	S2		T	Openings in low woods; swamps

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Fuirena scirpoidea SOUTHERN UMBRELLA-SEDGE	G5	S1?			Pineland depressions, wet savannas with Toxicodendron vernix; often in maintained rights-of-way
Habenaria quinqueseta var. quinqueseta MICHAUX ORCHID	G4G5T?	S1			Moist shade, Altamaha Grit outcrops; open pine woods
Helianthus agrestis SOUTHEASTERN SUNFLOWER	G4?	SH			Mucky, wet soils in open flatwoods
Helianthus heterophyllus WETLAND SUNFLOWER	G4	S1			Bogs; wet pine savannas
Ilex amelanchier SERVICEBERRY HOLLY	G4	S2			Wet, sandy thickets; cypress-gum swamps
Illicium floridanum FLORIDA ANISE-TREE	G5	S1		E	Steepheads, floodplain forests
Ipomoea macrorhiza LARGE-STEM MORNING-GLORY	G3G5	S1?			Exposed sandy soils
Krameria lanceolata SANDBUR	G5	S3?			Longleaf pine-wiregrass sandridges
Lachnocaulon beyrichianum SOUTHERN BOG-BUTTON	G2G3	S1			Flatwoods
Lechea deckertii DECKERT PINWEED	G4G5	S1?			Scrub
Lechea torreyi TORREY PINWEED	G4G5	SU			Flatwoods; pond margins; pocosins
Leitneria floridana CORKWOOD	G3	S1			Swamps; sawgrass-cabbage palmetto marshes
Liatris chapmanii CHAPMAN GAY-FEATHER	G5	SH			Scrub
Lindera melissifolia PONDBERRY	G2	S1	LE	E	Pond margins and wet savannas
Linum sulcatum var. harperi HARPER GROOVED FLAX	G5T2	SH			Dry pinelands
Linum westii WEST FLAX	G2	SP			Bogs, cypress pond margins
Listera australis SOUTHERN TWAYBLADE	G4	S2			Poorly drained circumneutral soils
Litsea aestivalis PONDSPICE	G3	S2		T	Cypress ponds; swamp margins
Lobelia boykinii BOYKIN LOBELIA	G2G3	S2S3			Cypress ponds and wet savannas
Lophiola aurea GOLDCREST	G4	S1?			Pine flatwoods, bogs
Lythrum curtissii CURTISS LOOSESTRIFE	G1	S1		T	Openings in calcareous swamps
Macbridea caroliniana CAROLINA BOGMINT	G2G3	S1?			Bogs; marshes; alluvial woods
Macranthera flammea FLAME FLOWER	G3	S1?			Wet, sandy thickets; pitcherplant bogs

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 16:00; Page 13/15

Page Number 4 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Magnolia pyramidata PYRAMID MAGNOLIA	G4	S3			Bluff and ravine forests
Malaxis spicata FLORIDA ADDERS-MOUTH	G4?	S1			Low hammocks; spring-fed river swamps
Matelea alabamensis ALABAMA MILKVINE	G2	S1		T	Open bluff forests, mesic margins of longleaf pine sandridges
Matelea flavidula YELLOW MILKVINE	G3?	S3?			Open bluff forests; floodplain forests
Melanthium woodii OZARK BUNCHFLOWER	G5	S2		R	Mesic hardwood forests over basic soils
Micromeria brownei var. pilosiuscula SAVORY	G5T?	S1?			Floodplain forests; muddy banks
Mimosa strigillosa POWDER-PUFF MIMOSA	G4G5	S3?			Floodplain forests; wet, grassy openings
Myrica inodora ODORLESS BAYBERRY	G4	S2?			Bayheads, titi swamps
Myriophyllum laxum LAX WATER-MILFOIL	G3	S2		T	Bluehole spring runs; shallow, sandy, swift-flowing creeks; clear, cool ponds
Najas filifolia NARROWLEAF NAIAD	G1	S1			Lakes
Oldenlandia boscii BLUETS	G5	S3?			Cypress pond margins; exposed pond bottoms in limesinks; sag pond margins; sometimes ditches
Pachysandra procumbens ALLEGHENY-SPURGE	G4G5	S1S2			Mesic hardwood forests over basic soils
Palafoxia integrifolia PALAFOXIA	G3G4	S2?			Sandy pine-oak scrub
Panax quinquefolius AMERICAN GINSENG	G3G4	S3			Mesic hardwood forests, cove hardwood forests
Panicum tenerum PANIC GRASS	G4	S1			Wet pine savannas near the coast
Peltandra sagittifolia ARROW ARUM	G3G4	S2?			Swamps; wet hammocks on pristine sphagnum mats
Pentodon pentandrus PENTODON	G5?	S1?			Wet meadows; pond edges
Phaseolus polystachios var. sinuatus TRAILING BEAN-VINE	G4T3?	S2?			Sandhills: dry pinelands and hammocks
Phlebodium aureum GOLDFOOT FERN	G5	S1			Exposed calcareous soil; also epiphytic on live oak and sabal palmetto (cabbage palm)
Physostegia leptophylla TIDAL MARSH OBEDIENT PLANT, NARROWLEAF DRAGONHEAD	G4?	S2S3		T	Freshwater tidal marshes; disjunct in wet savannas of extreme SW Georgia
Pieris phillyreifolia CLIMBING HEATH	G3	S3			Cypress ponds, epiphytic on cypress bark, abundant in Okefenokee Swamp
Pinguicula primuliflora CLEARWATER BUTTERWORT	G3G4	S1		T	In shallow, sandy, clearwater streams and seeps; Atlantic whitecedar swamps

Page Number 5 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Plantago sparsiflora PINELAND PLANTAIN	G3	S2			Open, wet pine savannas; shallow ditches
Platanthera integra YELLOW FRINGELESS ORCHID	G3G4	S2			Wet savannas, pitcherplant bogs
Platanthera nivea SNOWY ORCHID	G5	S3			Wet savannas, pitcherplant bogs
Polygala balduinii WHITE MILKWORT	G4	S1?			Wet pine savannas
Polygala leptostachys GEORGIA MILKWORT	G3G4	S1			Oak-pine scrub
Ponthieva racemosa SHADOW-WITCH ORCHID	G4G5	S2?			Calcareous swamps; marly outcrops
Psilotum nudum WHISK FERN	G5	S1			Swamp forests and hammocks, near Okefenokee Swamp; usually epiphytic on tree trunks, on barrier isla
Pteroglossaspis ecristata WILD COCO	G2	S1			Grassy saw palmetto barrens; longleaf pine grasslands, sometimes with Schwalbea americana
Ptilimnium nodosum MOCK BISHOP-WEED	G2	S1	LE	E	Granite outcrops; limesink depressions
Quercus austrina BLUFF WHITE OAK	G5	S3?			Bluff forests; floodplain hammocks
Quercus breviloba SHALLOW-LOBED OAK	G5T5	SR			Upland scrub
Quercus sinuata BASTARD OAK, DURAND OAK	G5	S1S2			Bluff forests
Rhexia aristosa AWNED MEADOWBEAUTY	G3	S2			Pond margins and wet savannas
Rhexia nuttallii NUTTALL MEADOWBEAUTY	G4?	S1?			Pine flatwoods; bogs
Rhexia parviflora SMALL-FLOWERED WHITE MEADOWBEAUTY	G2	SH			Limesink pond margins, perhaps in openings under pond-cypress
Rhododendron austrinum FLORIDA AZALEA	G3	S3			Hardwood-spruce pine forests; low woods
Rhynchospora breviseta SHORT-BRISTLE BEAKSEDGE	G3G4	SU			Bogs; flatwoods
Rhynchospora careyana CAREY'S HORNED BEAKSEDGE	G4?Q	S3S4			Sag ponds; cypress ponds; pine flatwoods
Rhynchospora culixa GEORGIA BEAKSEDGE	GH	S1			Pine savannas; flatwoods
Rhynchospora decurrens SWAMP-FOREST BEAKSEDGE	G3G4	S1?			Swamps
Rhynchospora harperi HARPER'S BEAKSEDGE	G4?	S1S2			Cypress pond margins and wet savannas; limesink depression ponds (dolines)
Rhynchospora macra SOUTHERN WHITE BEAKSEDGE	G3	S1?			Peaty, sandhill seepage slopes; streamhead pocosins

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 16:00; Page 14/15

Page Number 6 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Rhynchospora oligantha FEATHER-BRISTLE BEAKSEDGE	G4	S1?			Bogs; sea-level fens, wet savannas
Rhynchospora pleiantha COASTAL BEAKSEDGE	G2	SH			Margins of limesink depression ponds (dolines)
Rhynchospora punctata PINELAND BEAKSEDGE	G1?	S1?			Wet savannas, pitcherplant bogs
Rhynchospora scirpoides LONG-BEAK BALDRUSH	G4	S2?			Floating mats in ponds, pond margins
Rhynchospora solitaria AUTUMN BEAKRUSH	G1	S1			Wet, sandy, peaty depressions
Rhynchospora stenophylla CHAPMAN'S BEAKRUSH	G4	S2			Wet, sandy, peaty depressions; Chamaecyparis seeps
Rhynchospora thornei THORNE'S BEAKRUSH	G1G2	S2			Margins of limesink ponds, moist limestone barrens, wet priaries
Rhynchospora torreyana TORREY BEAKRUSH	G4	S1?			Bogs, wet savannas
Rudbeckia nitida var nitida YELLOW CONEFLOWER	G3?T2T3	S3			Wet savannas, openings in pineland flatwoods; seepage bogs, sometimes with pitcherplants
Sageretia minutiflora TINY-LEAF BUCKTHORN	G4	S1		T	Calcareous bluff forests; maritime forests over shell mounds
Sagittaria isoetiformis ARROWHEAD	G4?	SU			Sandy ponds and bogs; seasonal ponds over Grady soils?
Salix floridana FLORIDA WILLOW	G2	S1		E	Spring runs, seepy, sphagnous wetlands with Eleocharis tortilis, Itea, Alnus, Orontium, Arnoglossum
Sarracenia flava YELLOW FLYTRAP	G5?	S3S4		U	Wet savannas, pitcherplant bogs
Sarracenia leucophylla WHITETOP PITCHERPLANT	G3	SH		E	Wet savannas, pitcherplant bogs
Sarracenia minor HOODED PITCHERPLANT	G4	S4		U	Wet savannas, pitcherplant bogs
Sarracenia psittacina PARROT PITCHERPLANT	G4	S2S3		T	Wet savannas, pitcherplant bogs
Schisandra glabra BAY STARVINE	G3	S2		T	Rich woods on stream terraces and lower slopes
Schizachyrium stoloniferum BLUESTEM	G3G4Q	S2S3			Longleaf pine-wiregrass savannas
Schwalbea americana CHAFFSEED	G2	S1	LE	E	Ponds margins and wet savannas; upland ridge forests
Scirpus erismanae BULRUSH	G?Q	S1?			Pond shores in peaty sands
Scirpus etuberculatus CLUB-RUSH	G3G4	S1S2			Marshes, shallow ponds, peaty swamps, as Okefenokee Swamp and Atlantic whitecedar swamps
Scirpus hallii HALL BULRUSH	G2	SH			Pond shores in peaty sands

Page Number 7 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Scutellaria saxatilis ROCK SKULLCAP	G3	S1			Mesic hardwood ravine forests
Selaginella ludoviciana LOUISIANA SPIKEMOSS	G3	S1?			Swamp margins; wet meadows
Sideroxylon thornei SWAMP BUCKTHORN	G2	S2		E	Forested limesink depressions; calcareous swamps
Silene ovata MOUNTAIN CATCHFLY	G2G3	S1			Mesic deciduous forests over limestone; high elevation oak forests
Silene polypetala FRINGED CAMPION	G2	S2	LE	E	Mesic deciduous forests
Sium floridanum FLORIDA WATER-PARSNIP	G1Q	S1?			Calcareous swamps; floodplains
Smilax lasioneuron CARRION-FLOWER	G5	S2?			Pine-oak-hickory forests; bluff forests
Spiranthes brevilabris SHORT-LIP LADIES-TRESSES	G3G4	S1?			Open pinelands; meadows
Spiranthes longilabris GIANT SPIRAL LADIES-TRESSES	G3	S1			Wet pinelands and prairies
Sporobolus teretifolius WIRE-LEAF DROPSEED	G2?	S2?			Longleaf pine-wiregrass savannas, pitcherplant bogs
Stewartia malacodendron SILKY CAMELLIA	G4	S2		R	Steepheads, bayheads; edges of swamps
Stokesia laevis STOKES ASTER	G3G4	S1			Pitcherplant bogs
Tephrosia chrysophylla SPRAWLING GOATS RUE	G4G5	S1			Dry, sandy scrub
Tephrosia mohrii DWARF GOATS RUE	G3	S1?			Scrub; longleaf pine-wiregrass savannas
Thalictrum cooleyi COOLEY MEADOWRUE	G1	S1	LE	E	Pond margins and wet savannas
Thelypteris ovata OVATE MAIDEN FERN	G3G5	S2S3			Calcareous hammocks; limesinks; mesic hardwood forests
Torreya taxifolia FLORIDA TORREYA	G1	S1	LE	E	Rich ravines in extreme Southwest Georgia
Tragia cordata HEARTLEAF NETTLE VINE	G4	S2?			Dry, usually rocky, calcareous woods; also relict prairie openings on the Fort Valley Plateau
Trepocarpus aethusae TREPOCARPUS	G4G5	S2?			Floodplain forests
Tridens carolinianus CAROLINA REDTOP	G3	S1?			Dry, open mixed oak-pine forests of the Fall Line Sandhills
Trillium decipiens MIMIC TRILLIUM	G3	S3?			Mesic hardwood forests; limesink forests
Trillium lancifolium LANCELEAF TRILLIUM	G3	S2S3			Floodplain forests; also lower rocky slopes over basic soils
Trillium reliquum RELICT TRILLIUM	G2	S2	LE	E	Mesic hardwood forests; limesink forests; usually with Fagus and Tilia

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 16:00; Page 15/15

Page Number 8 of 8 Report Generated 10 August 2001

Special Concern Plants Potentially Occurring in Decatur County, Georgia

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30025, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Trillium underwoodii DWARF MIMIC TRILLIUM	G4?	S3?			Mesic hardwood forests
Utricularia olivacea LEAFLESS DWARF BLADDERWORT	G4	S1?			Shallow ponds, especially limesink ponds or dolines of Southwest Georgia
Uvularia floridana FLORIDA BELLWORT	G3	S3?			Mixed oak-hickory forests, mesic hardwoods or magnolia-beech bluff forests
Vitis palmata CATBIRD GRAPE	G4	SH			Floodplain forests; river banks
Vitis rotundifolia var. munsoniana MUNSON GRAPE	G5T4?	S1			Floodplain forests, blackwater streamsides
Xyris drummondii DRUMMOND YELLOW-EYED GRASS	G3	S1			Pine flatwoods
Xyris scabrifolia HARPER YELLOW-EYED GRASS	G3	S1			Sedge bogs; pitcherplant bogs; pine flatwoods
Xyris serotina YELLOW-EYED GRASS	G3G4	S3S4			Sandy pinelands; acid swamps
Xyris stricta YELLOW-EYED GRASS	G3G4	S4?			Acidic swamps
Zephyranthes simpsonii SIMPSON RAIN LILY	G2G3	S1			Pine flatwoods; edges of sloughs on southcentral coastal plain
Zigadenus leimanthoides DEATH-CAMUS	G4Q	S1			Sandhill bogs; pine flatwoods

Page Number 1 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Aesculus parviflora BOTTLEBRUSH BUCKEYE	G3?	S2S3			Mesic bluff and ravine forests
Agalinis aphylla SCALE-LEAF PURPLE FOXGLOVE	G3G4	S2S3?			Longleaf pine-wiregrass savannas; pine flatwoods
Agalinis divaricata PINELAND PURPLE FOXGLOVE	G3	S1?			Dry, grassy, pine-scrub oak ridges; extreme SW Georgia
Agalinis filicaulis SPINDLY PURPLE FOXGLOVE	G3G4	S2?			Seasonally wet, longleaf pine-wiregrass savannas; grassy pine barrens
Agrimonia incisa CUTLEAF AGRIMONY; CUTLEAF HARVEST LICE	G3	S3			Mixed oak-hickory forests, pine savannas, mesic hardwood forests
Amphicarpum muehlenbergianum BLUE MAIDENCANE, FLORIDA GOOBER GRASS	G4	S3?			Pine flatwoods
Andropogon mohrii BOG BLUESTEM	G4?	S2?			Longleaf pine-wiregrass savannas; pine-cypress savannas
Anemone caroliniana CAROLINA WINDFLOWER	G5	S1?			Upland seepage swamp openings over Iredell soils; wet meadows
Apteria aphylla NODDING NIXIE	G4	S3			Mesic hardwoods or magnolia-beech bluff forests
Arabis georgiana GEORGIA ROCKCRESS	G2	S1		T	Rocky or sandy river bluffs and banks, in circumneutral soil
Aristida condensata SANDHILL THREE-AWN GRASS	G4?	S3?			Sandridges
Aristida simpliciflora CHAPMAN THREE-AWN GRASS	G2	SH			Longleaf pine-wiregrass savannas
Arnoglossum diversifolium VARIABLE-LEAF INDIAN-PLANTAIN	G2	S2		T	Calcareous swamps
Arnoglossum sulcatum GROOVED-STEM INDIAN-PLANTAIN	G3G4	S1			Bottomland forests
Asclepias pedicellata SAVANNA MILKWEED	G3?	S2			Bogs, wet savannas
Asplenium heteroresiliens WAGNER SPLEENWORT	G2Q	S1		T	Limestone outcrops; marl
Aster eryngiifolius SNAKEROOT-LEAF ASTER	G3?	S1			Moist pinelands
Aster georgianus GEORGIA ASTER	G2G3	S2			Upland oak-hickory-pine forests
Aster sericeus var. microphyllus SILKY ASTER	G5T4	S1			Limestone glades

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:57; Page 3

Page Number 2 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

GEORGIA

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Balduina atropurpurea PURPLE HONEYCOMB HEAD	G2G3	S2		R	Wet savannas, pitcherplant bogs
Baptisia lecontei LECONTE WILD INDIGO	G4?	S1			Pineland scrub
Baptisia megacarpa BIGPOD WILD INDIGO	G3	S1			Floodplain forests
Brickellia cordifolia FLYR'S NEMESIS	G2G3	S1			Mesic hardwood forests
Callirhoe papaver WOODS POPPY-MALLOW	G5	S2S3			Openings in oak-pine forests
Callirhoe triangulata CLUSTERED POPPY-MALLOW, WINECUP	G3G5	S2			Sandy scrub
Calopogon multiflorus MANY-FLOWERED GRASS-PINK	G4	SH			Wet savannas, pitcherplant bogs
Carex baltzellii BALTZELL SEDGE	G2	S1		E	Beech-magnolia slope forests
Carex dasycarpa VELVET SEDGE	G4?	S3		R	Evergreen hammocks; mesic hardwood forests
Carex decomposita CYPRESS-KNEE SEDGE	G4	S2?			Swamps and lake margins on floating logs
Carex fissa var. aristata SEDGE	G2QT?	S1			Wet savannas
Carphephorus pseudoliatris LAVENDER LADY	G4G5	SH			Pine flatwoods
Chamaecrista deeringiana FLORIDA SENNA	G2G3	S1?			Sandhill scrub, longleaf pine-wiregrass savannas
Collinsonia tuberosa STONEROOT	G3G4	S3			Mesic woods over basic rock
Coreopsis integrifolia TICKSEED	G1G2	S1S2			Floodplain forests, streambanks
Corydalis flavula YELLOW CORYDALIS	G5	S3?			Rocky floodplain forests and hardwood ravines
Crataegus brachyacantha BLUEBERRY HAWTHORN	G4	SH			Open pinelands
Croomia pauciflora CROOMIA	G3	S1		T	Mesic hardwood forests
Croton elliottii ELLIOTT CROTON	G2G3	S2S3			Pond margins and wet savannas
Delphinium carolinianum CAROLINA LARKSPUR	G5	S3			Granite outcrops, rocky, calcareous oak forests; Altamaha Grit outcrops
Dodecatheon meadia SHOOTING-STAR	G5	S3			Mesic hardwood forests over basic soils

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 3 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Drosera filiformis var. tracyi TRACY THREADLEAF SUNDEW	G5T3T4	S1?			Pitcherplant bogs
Eleocharis atropurpurea SPIKERUSH	G4G5	S1?			Limesink pond margins
Eleocharis melanocarpa BLACKFRUIT SPIKERUSH	G4	SU			Limesink pond margins
Eleocharis montana var. nodulosa SPIKERUSH	G5T?	SH			Limesink ponds and sloughs
Eleocharis robbinsii SPIKERUSH	G4G5	SU			Pine savanna ponds
Elyonurus tripsacoides PAN-AMERICAN BALSAMSCALE	G5?	SH			Pine savannas
Epidendrum conopseum GREEN-FLY ORCHID	G3G4	S3		U	Epiphytic in bottomland hardwoods and magnolia-beech bluff forests, also Altamaha Grit outcrops
Evolvulus sericeus var. sericeus CREEPING MORNING-GLORY	G5T?	S1		E	Altamaha Grit outcrops; open calcareous uplands
Fimbristylis decipiens SOUTHERN FIMBRY	G4	S1?			Wet pine savannas; sandy swales
Fimbristylis perpusilla HARPER FIMBRY	G2G3	S1		E	Exposed muddy margins of pineland ponds
Glyceria septentrionalis FLOATING MANNA-GRASS	G5	SH			Cypress ponds
Habenaria quinqueseta var. quinqueseta MICHAUX ORCHID	G4G5T?	S1			Moist shade, Altamaha Grit outcrops; open pine woods
Helianthus agrestis SOUTHEASTERN SUNFLOWER	G2G3	SH			Mucky, wet soils in open flatwoods
Helianthus heterophyllus WETLAND SUNFLOWER	G3G4	S1			Bogs; wet pine savannas
Hexastylis shuttleworthii var. harperi HARPER HEARTLEAF	G4T2	S2?		U	Low terraces in floodplain forests; edges of bogs
Hygrophila lacustris HYGROPHILA	G5?	S1?			Shallow water of marshy shores
Hypericum adpressum BOG ST. JOHNSWORT	G2G3	S2?			Swamps
Ilex amelanchier SERVICEBERRY HOLLY	G4	S2			Wet, sandy thickets; cypress-gum swamps
Illicium floridanum FLORIDA ANISE-TREE	G5	S1		E	Steepheads, floodplain forests
Isoetes georgiana GEORGIA QUILLWORT	G1Q	S2S3?			In floodplain woods on seasonally wet or inundated margins of braided streams

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:57; Page 4

Page Number 4 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Isoetes hyemalis QUILLWORT	G2G3	S1			In blackwater streams, also emergent on sandy creek banks in deciduous swamps
Krameria lanceolata SANDBUR	G5	S3?			Longleaf pine-wiregrass sandridges
Lachnocaulon beyrichianum SOUTHERN BOG-BUTTON	G2G3	S1			Flatwoods
Leitneria floridana CORKWOOD	G2G3	S1			Swamps, sawgrass-cabbage palmetto marshes
Liatris chapmanii CHAPMAN GAY-FEATHER	G5	SH			Scrub
Lindera melissifolia PONDBERRY	G2	S1	LE	E	Pond margins and wet savannas
Linum sulcatum var. harperi HARPER GROOVED FLAX	G5TU	SH			Dry pinelands
Listera australis SOUTHERN TWAYBLADE	G4	S2			Poorly drained circumneutral soils
Litsea aestivalis PONDSPICE	G3	S2		T	Cypress ponds; swamp margins
Lobelia boykinii BOYKIN LOBELIA	G2	S2S3			Cypress ponds and wet savannas
Lophiola aurea GOLDCREST	G4	S1?			Pine flatwoods, bogs
Lythrum curtissii CURTISS LOOSESTRIFE	G1	S1		T	Openings in calcareous swamps
Macranthera flammea FLAME FLOWER	G3	S2?			Wet, sandy thickets; pitcherplant bogs
Magnolia pyramidata PYRAMID MAGNOLIA	G4	S3			Bluff and ravine forests
Marshallia ramosa PINELAND BARBARA BUTTONS	G2	S2		R	Altamaha Grit outcrops, open forests over ultramafic rock
Matelea alabamensis ALABAMA MILKVINE	G1	S1		T	Open bluff forests
Matelea flavidula YELLOW MILKVINE	G3	SU			Open bluff forests; floodplain forests
Micromeria brownei var pilosiuscula SAVORY	G5T?	S1?			Floodplain forests, muddy banks
Mimosa strigillosa POWDER-PUFF MIMOSA	G4G5	S3?			Floodplain forests, wet, grassy openings
Muhlenbergia torreyana TORREY DROPSEED	G3	SH			Seasonally inundated pond shores, swales and savannas
Myrica inodora ODORLESS BAYBERRY	G4	S2?			Bayheads, titi swamps

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 5 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Myriophyllum laxum LAX WATER-MILFOIL	G3	S2		T	Bluehole spring runs; shallow, sandy, swift-flowing creeks; clear, cool ponds
Najas filifolia NARROWLEAF NAIAD	G1	S1			Lakes
Oldenlandia boscii BLUETS	G5	S1?			Cypress pond margins; exposed pond bottoms
Oxypolis canbyi CANBY DROPWORT	G2	S2	LE	E	Cypress ponds and sloughs; wet savannas
Oxypolis ternata TERNATE COWBANE	G3	S2			Wet pine savannas and bogs
Panax quinquefolius AMERICAN GINSENG	G4	S3			Mesic hardwood forests; cove hardwood forests
Panicum hirstii HIRST PANIC GRASS	G1	SH		E	Cypress ponds, wet savannas and sloughs
Panicum tenerum PANIC GRASS	G4	S1			Wet pine savannas near the coast
Parietaria pensylvanica PENNSYLVANIA PELLITORY, HAMMERWORT	G5	S1?			Dry, open, calcareous soil
Paronychia rugelii var. interior RUGEL NAILWORT	G2?T2?Q	S2?			Longleaf pine-turkey oak scrub, mostly Alapaha River drainage
Penstemon dissectus GRIT BEARDTONGUE	G2?	S2		R	Altamaha Grit outcrops and adjacent pine savannas; rarely sandridges
Pentodon pentandrus PENTODON	G5?	S1?			Wet meadows; pond edges
Phaseolus polystachios var. sinuatus TRAILING BEAN-VINE	G4T3	S2?			Sandhills; dry pinelands and hammocks
Physostegia leptophylla NARROWLEAF OBEDIENT PLANT	G4G5	S2?		T	Wet savannas; bogs; freshwater tidal marshes
Pieris phillyreifolia CLIMBING HEATH	G3?	S3			Cypress ponds; epiphytic on cypress bark
Pinguicula primuliflora CLEARWATER BUTTERWORT	G4	S1		T	Sandy, clearwater streams and seeps; Atlantic white cedar swamps
Plantago sparsiflora PINELAND PLANTAIN	G2	S2			Open, wet pine savannas; shallow ditches
Platanthera integra YELLOW FRINGELESS ORCHID	G4	S2			Wet savannas, pitcherplant bogs
Platanthera nivea SNOWY ORCHID	G5	S3			Wet savannas, pitcherplant bogs
Polygala balduinii WHITE MILKWORT	G2G4	S1?			Wet pine savannas
Polygala boykinii BOYKIN MILKWORT	G3G4	S3			Openings in calcareous soil

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:57; Page 5

Page Number 6 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Polygala leptostachys GEORGIA MILKWORT	G2G4	S1			Oak-pine scrub
Ponthieva racemosa SHADOW-WITCH ORCHID	G4G5	S2?			Calcareous swamps; marly outcrops
Pteroglossaspis ecristata WILD COCO	G2G3	S1			Grassy saw palmetto barrens; longleaf pine grasslands
Ptilimnium nodosum MOCK BISHOP-WEED	G2	S1	LE	E	Granite outcrops, limesink depressions
Pycnanthemum floridanum FLORIDA MOUNTAIN-MINT	G3	S1?			Pine savannas, flatwoods
Quercus arkansana ARKANSAS OAK	G3	S2S3			Sandy upper ravine slopes
Quercus austrina BLUFF WHITE OAK	G5	S3?			Bluff forests; floodplain hammocks
Quercus breviloba SHALLOW-LOBED OAK	G5T5	SR			Upland scrub
Quercus sinuata BASTARD OAK	G5	S1S2?			Bluff forests
Rhexia aristosa AWNED MEADOWBEAUTY	G3	S2			Pond margins and wet savannas
Rhexia parviflora MEADOWBEAUTY	G2	SR			Limesink pond margins
Rhododendron austrinum FLORIDA AZALEA	G3G4	S3			Hardwood-spruce pine forests, low woods
Rhododendron prunifolium PLUMLEAF AZALEA	G3	S3		T	Mesic hardwood forests in ravines
Rhynchospora breviseta SHORT-BRISTLE BEAKRUSH	G3G4	SU			Bogs; flatwoods
Rhynchospora culixa GEORGIA BEAKRUSH	G1	SH			Pine savannas, flatwoods
Rhynchospora decurrens SWAMP FOREST BEAKRUSH	G3G4	S1?			Swamps
Rhynchospora harperi HARPER BEAKRUSH	G3	S1?			Cypress pond margins and wet savannas
Rhynchospora macra SOUTHERN WHITE BEAKRUSH	G3G4	S1?			Seepage slopes, wet savannas
Rhynchospora oligantha FEATHER-BRISTLE BEAKRUSH	G4	S1?			Bogs
Rhynchospora pleiantha COASTAL BEAKRUSH	G3	SH			Pond margins; wet savannas
Rhynchospora punctata PINELAND BEAKRUSH	G1?	S1?			Wet savannas, pitcherplant bogs

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 7 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Rhynchospora scirpoides LONG-BEAK BALDRUSH	G4	S2?			Floating mats in ponds and pond margins
Rhynchospora solitaria AUTUMN BEAKRUSH	G1	S1			Wet, sandy, peaty depressions
Rhynchospora stenophylla LITTLELEAF BEAKRUSH	G4	S2			Wet, sandy, peaty depression
Rhynchospora thornei THORNE BEAKRUSH	G1G2	S2			Margins of limesink ponds; moist limestone barrens
Rhynchospora torreyana TORREY BEAKRUSH	G4	S1?			Bogs; wet savannas
Rudbeckia nitida var. nitida YELLOW CONEFLOWER	G3?T1T3	S3?			Wet savannas, pitcherplant bogs; cypress ponds
Sageretia minutiflora TINY-LEAF BUCKTHORN	G4	S1		T	Calcareous bluff forests; shell mound forests
Sagittaria isoetiformis ARROWHEAD	G3G4	SU			Sandy ponds and bogs
Salix floridana FLORIDA WILLOW	G2	SH		E	Spring runs; seepy thickets
Sarracenia flava YELLOW FLYTRAP	G4G5	S3S4		U	Wet savannas, pitcherplant bogs
Sarracenia leucophylla WHITETOP PITCHERPLANT	G3	SH		E	Wet savannas, pitcherplant bogs
Sarracenia minor HOODED PITCHERPLANT	G4	S4		U	Wet savannas, pitcherplant bogs
Sarracenia psittacina PARROT PITCHERPLANT	G4	S2S3		T	Wet savannas, pitcherplant bogs
Sarracenia purpurea PURPLE PITCHERPLANT	G5	S1		E	Swamps, wet rhododendron thickets
Schisandra glabra BAY STARVINE	G4	S2		T	Stream terraces
Schizachyrium sanguineum var. hirtiflorum SANDHILL BLUESTEM	G5?T?	S1S3?			Dry, open sands with turkey oak; inland sand dunes (Albany Fossil Dunes)
Schizachyrium stoloniferum BLUESTEM	G3G4Q	S2?			Longleaf pine-wiregrass savannas
Schwalbea americana CHAFFSEED	G2	S1	LE	E	Ponds margins and wet savannas; upland ridge forests
Scirpus erismanae BULRUSH	G?	S1?			Pond shores in peaty sands
Scirpus etuberculatus CLUB-RUSH	G3G4	SH			Marshes; shallow ponds
Scirpus hallii HALL BULRUSH	G2	SH			Pond shores in peaty sands

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:58; Page 6

Page Number 8 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species / Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Scutellaria saxatilis ROCK SKULLCAP	G4?	S1			Mesic hardwood ravine forests
Selaginella ludoviciana LOUISIANA SPIKEMOSS	G3G4	S1?			Swamp margins; wet meadows
Sideroxylon thornei SWAMP BUCKTHORN	G2	S2		E	Forested limesink depressions; calcareous swamps
Silene ovata MOUNTAIN CATCHFLY	G3	S1			Mesic deciduous forests; high elevation oak forests
Silene polypetala FRINGED CAMPION	G2	S2	LE	E	Mesic deciduous forests
Silene regia ROYAL CATCHFLY	G3	S1		R	Limestone barrens, remnant prairies
Smilax lasioneuron CARRION-FLOWER	G5	S2?			Pine-oak-hickory forests; bluff forests
Solidago tarda GOLDENROD	G?	SU			Sandy upland forests
Spiranthes brevilabris var. floridana LADIES-TRESSES	G3G4T?	S1			Wet savannas, mowed grassy openings in Okefenokee area
Spiranthes longilabris GIANT SPIRAL LADIES-TRESSES	G3	S1			Wet pinelands and prairies
Spiranthes ovalis OVAL LADIES-TRESSES	G5	S3?			Moist hammocks, swamp margins; wet thickets over basic soils
Sporobolus teretifolius WIRE-LEAF DROPSEED	G1G2	S2?			Longleaf pine-wiregrass savannas, pitcherplant bogs
Stewartia malacodendron SILKY CAMELLIA	G4	S2		R	Steepheads, bayheads; edges of swamps
Stokesia laevis STOKES ASTER	G5	S1			Pitcherplant bogs
Stylisma pickeringii var. pickeringii PICKERING MORNING-GLORY	G4?T2T3	S2		T	Open, dry, oak scrub of sandhills
Tephrosia chrysophylla SPRAWLING GOATS RUE	G4G5	S1			Dry, sandy scrub
Tephrosia mohrii DWARF GOATS RUE	G2?Q	S1?			Scrub; longleaf pine-wiregrass savannas
Thalictrum cooleyi COOLEY MEADOWRUE	G1	S1Q	LE	E	Pond margins and wet savannas
Thelypteris ovata OVATE MAIDEN FERN	G3G5	S2S3?			Calcareous hammocks, limesinks, mesic hardwood forests
Torreya taxifolia FLORIDA TORREYA	G1	S1	LE	E	Rich ravines in extreme Southwest Georgia
Trepocarpus aethusae TREPOCARPUS	G4G5	S2?			Floodplain forests

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 9 of 9 Report Generated 30 October 1997

Special Concern Plants Potentially Occurring in Southwest Georgia RDC Counties*

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Trillium decipiens MIMIC TRILLIUM	G3	S3?			Mesic hardwood forests; limesink forests
Trillium lancifolium LANCELEAF TRILLIUM (COASTAL PLAIN SITES)	G3	S3			Floodplain forests, rocky slopes over basic soils
Trillium reliquum RELICT TRILLIUM	G2	S2	LE	E	Mesic hardwood forests; limesink forests
Trillium underwoodii DWARF MIMIC TRILLIUM	G4?	S3?			Mesic hardwood forests
Utricularia olivacea DWARF BLADDERWORT	G4	S1?			Shallow ponds
Uvularia floridana FLORIDA BELLWORT	G3?	S3?			Mixed oak-hickory forests; mesic hardwoods or magnolia-beech bluff forests
Veratrum woodii OZARK BUNCHFLOWER	G5	S2		R	Mesic hardwood forests over basic soils
Vigna luteola WILD YELLOW COWPEA	G5	S2?			Open swamps; maritime beaches and tidal flats
Viola conspersa AMERICAN DOG VIOLET	G5	S3			Sandy streamsides
Vitis palmata CATBIRD GRAPE	G4	SH			Floodplain forests; river banks
Vitis rotundifolia var. munsoniana MUNSON GRAPE	G5T4?	S1			Floodplain forests; blackwater streamsides
Warea sessilifolia SANDHILL-CRESS	G2G4	S1			Sandhills scrub
Xyris drummondii DRUMMOND YELLOW-EYED GRASS	G3	S1			Pine flatwoods
Xyris scabrifolia HARPER YELLOW-EYED GRASS	G3	S1			Sedge bogs; pitcherplant bogs; pine flatwoods
Zephyranthes simpsonii SIMPSON RAIN LILY	G2G3	S1			Pine flatwoods; edges of sloughs on southcentral coastal plain
Zigadenus leimanthoides DEATH-CAMUS	G4Q	S1			Sandhill bogs; pine flatwoods

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 1 of 3 Report Generated 4 November 1997

Special Concern Animals Potentially Occurring in Southwest RDC Counties

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Acantharchus pomotis MUD SUNFISH	G5	S3			Blackwater streams; bays; cypress/gum ponds
Aimophila aestivalis BACHMAN'S SPARROW	G3	S3		R	Open pine or oak woods; old fields; brushy areas
Alosa alabamae ALABAMA SHAD	G4	S1		U	Brownwater & blackwater streams
Alosa chrysochloris SKIPJACK HERRING	G5	S2?			Brownwater rivers
Ambystoma cingulatum FLATWOODS SALAMANDER	G2G3	S3		R	Pine flatwoods; moist savannas; cypress/gum ponds
Ameiurus serracanthus SPOTTED BULLHEAD	G3	S2		R	Blackwater & brownwater streams; reservoirs
Ammodramus henslowii HENSLOW'S SPARROW	G3G4	S3			Fields; meadows
Amphiuma pholeter ONE-TOED AMPHIUMA	G3	S1		R	Organic mucky/muddy, shallow creeks; temporary pools and streams
Botaurus lentiginosus AMERICAN BITTERN	G4	S3?			Marshes; lakes
Cyprinella callitaenia BLUESTRIPE SHINER	G2	S1		T	Brownwater streams
Cyprinella leedsi BANNERFIN SHINER	G3	S3S4			Blackwater & brownwater streams
Drymarchon corais couperi EASTERN INDIGO SNAKE	G4T3	S3	LT	T	Sandhills; pine flatwoods; dry hammocks
Elanoides forficatus AMERICAN SWALLOW-TAILED KITE	G5	S2		R	River swamps; marshes
Etheostoma edwini BROWN DARTER	G5	S3			Blackwater & brownwater streams; springs
Etheostoma parvipinne GOLDSTRIPE DARTER	G4G5	S2		R	Blackwater & brownwater streams; springs
Etheostoma swaini GULF DARTER	G5	S3			Brownwater & blackwater streams
Eumeces anthracinus COAL SKINK	G5	S1			Moist woods near streams, springs or bogs
Eumeces egregius MOLE SKINK	G4	S3			Coastal dunes; longleaf pine-turkey oak woods; dry hammocks
Falco sparverius paulus SOUTHEASTERN AMERICAN KESTREL	G5T3T4	S3			Pine forests; pine savannas
Farancia erytrogramma RAINBOW SNAKE	G5	S3			River swamps; springs; sandy fields near water
Fundulus auroguttatus BANDED TOPMINNOW	G4	S3		R	Blackwater streams; ponds; bays; freshwater marshes

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Sent By: GA-DNR, Wildlife Resources Divi; 706 557 3033; Sep-9-02 15:56; Page 2

Page Number 2 of 3 Report Generated 4 November 1997

Special Concern Animals Potentially Occurring in Southwest RDC Counties

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Fundulus chrysotus GOLDEN TOPMINNOW	G5	S3			Blackwater streams; ponds; bays; brackish streams
Fundulus escambiae EASTERN STARHEAD TOPMINNOW	G3G4	S3			Blackwater streams; ponds bays
Gopherus polyphemus GOPHER TORTOISE	G3	S3		T	Sandhills; dry hammocks; longleaf pine-turkey oak woods
Graptemys barbouri BARBOUR'S MAP TURTLE	G2	S2		T	Rivers & creeks Apalachicola River drainage
Haldeotriton wallacei GEORGIA BLIND SALAMANDER	G2	S1		T	Caves & underground streams; limesink ponds
Haliaeetus leucocephalus BALD EAGLE	G4	S2	LTNL	E	Edges of lakes & large rivers; seacoasts
Heterodon simus SOUTHERN HOGNOSE SNAKE	G4G5	S3			Open, sandy woods; fields; floodplains
Ichthyomyzon gagei SOUTHERN BROOK LAMPREY	G5	S3			Brownwater & blackwater streams
Kinosternon baurii STRIPED MUD TURTLE	G5	S3			River swamps, sloughs; ponds; marshes
Lampsilis subangulata SHINY-RAYED POCKETBOOK	G2	S2	PE		sandy/rocky medium-sized rivers & creeks
Lanius ludovicianus migrans MIGRANT LOGGERHEAD SHRIKE	G4G5T3	S?			Open woods; field edges
Lasiurus intermedius NORTHERN YELLOW BAT	G4G5	S2S3			Wooded areas near open water or fields
Lepisosteus oculatus SPOTTED GAR	G5	S1			Brownwater streams; reservoirs
Lucania parva RAINWATER KILLIFISH	G5	S1			Ponds; creeks
Macroclemys temminckii ALLIGATOR SNAPPING TURTLE	G3G4	S3		T	Rivers: lakes; large ponds near streams, swamps
Medionidus penicillatus GULF MOCCASINSHELL	G2	S2	PE		Sandy/rocky medium-sized rivers & creeks
Micropterus notius SUWANNEE BASS	G2G3	S1		R	Springs; rocky shoals, blackwater streams
Micrurus fulvius EASTERN CORAL SNAKE	G5	S3			Hardwood forests; pine flatwoods; dry hammocks; marshes
Mycteria americana heronry WOOD STORK	G4	S2	LENL	E	Cypress/gum ponds; marshes, river swamps; bays
Myotis austroriparius SOUTHEASTERN MYOTIS	G4	S3S4			Caves & buildings near water
Nerodia floridana FLORIDA GREEN WATER SNAKE	G5	S2			Swamps; marshes; limesink ponds; bays

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Page Number 3 of 3 Report Generated 4 November 1997

Special Concern Animals Potentially Occurring in Southwest RDC Counties

Georgia Natural Heritage Program, 2117 US Hwy 278 SE, Social Circle, GA 30279, (770) 918-6411

Species Common Name	Global Rank	State Rank	Federal Status	State Status	Habitat
Notophthalmus perstriatus STRIPED NEWT	G2G3	S2		R	Pine flatwoods; ponds; ditches
Notropis harperi REDEYE CHUB	G4	S1		R	Springs & small streams
Nyctanassa violacea YELLOW-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds
Nycticorax nycticorax BLACK-CROWNED NIGHT-HERON	G5	S3S4			River swamps; marshes; cypress/gum ponds
Picoides borealis RED-COCKADED WOODPECKER	G3	S2	LE	E	Open pine woods; pine savannas
Pituophis melanoleucus mugitus FLORIDA PINE SNAKE	G5T3?	S3			Upland forests; grasslands; floodplains; old field
Pleurobema pyriforme OVAL PIGTOE	G2	S2	PE		Sandy, medium-sized rivers & creeks
Pseudobranchus striatus DWARF SIREN	G5	S3			Swamps; marshes; limesink ponds; bays
Pseudotriton montanus MUD SALAMANDER	G5	S4			Swamps; muddy seeps; springs
Pteronotropis euryzonus BROADSTRIPE SHINER	G3	S1		R	Gravelly streams
Pteronotropis hypselopterus SAILFIN SHINER	G5	S3			Blackwater & brownwater streams
Pteronotropis welaka BLUENOSE SHINER	G4	S1		R	Blackwater & brownwater streams
Rana capito GOPHER FROG	G4	S?	C		Floodplains; wet meadows; pastures; ponds
Scartomyzon lachneri GREATER JUMPROCK	G3	S3			Brownwater streams
Seminatrix pygaea BLACK SWAMP SNAKE	G5	S3			Swamps; ponds; marshes; lakes
Umbra pygmaea EASTERN MUDMINNOW	G5	S3			Muddy streams & ponds

* Southwest Georgia RDC Counties are: Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, and Worth

Edition date: November 26, 2000

GEORGIA NATURAL HERITAGE PROGRAM

EXPLANATION OF CODES

FOR RARITY RANK AND LEGAL STATUS

The "State Rank" and "Global Rank" codes indicate relative rarity of species statewide and range-wide, respectively. An explanation of these codes follows. For further information please see www.natureserve.org/ranking.

STATE [GLOBAL] RANK

S1[G1]	Critically imperiled in state [globally] because of extreme rarity (5 or fewer occurrences).
S2[G2]	Imperiled in state [globally] because of rarity (6 to 20 occurrences).
S3[G3]	Rare or uncommon in state [rare and local throughout range or in a special habitat or narrowly endemic] (on the order of 21 to 100 occurrences).
S4[G4]	Apparently secure in state [globally] (of no immediate conservation concern).
S5[G5]	Demonstrably secure in state [globally].
SA	Accidental in state, including migratory or wide-ranging species recorded only once or twice or at very great intervals.
SN	Regularly occurring, usually migratory and typically nonbreeding species.
SR	Reported from the state, but without persuasive documentation (no precise site records and no verification of taxonomy).
SU[GU]	Possibly in peril in state [range-wide] but status uncertain; need more information on threats or distribution.
SX[GX]	Apparently extirpated from state [extinct throughout range]. GXC is known only in cultivation/captivity.
SE	An exotic established in state. May be native elsewhere in North America. Sometimes difficult to determine if native (**SE?**).
SH[GH]	Of historical occurrence in the state [throughout its range], perhaps not verified in the past 20 years, but suspected to be still extant.
[T]	Taxonomic subdivision (trinomial, either a subspecies or variety), used in a global rank, for example "G2T2."
Q	Denotes a taxonomic question - either the taxon is not generally recognized as valid, or there is reasonable concern about its validity or identity globally or at the state level.
?	Denotes questionable rank; best guess given whenever possible (e.g. **S3?**).

FEDERAL STATUS (US Fish and Wildlife Service, USFWS)

The following abbreviations are used to indicate the legal status of federally-protected plants and animals or those proposed for listing. For further information please see www.natureserve.org/status.

LE	Listed as endangered. The most critically imperiled species. A species that may become extinct or disappear from a significant part of its range if not immediately protected.
LT	Listed as threatened. The next most critical level of threatened species. A species that may become endangered if not protected.
PE or PT	Candidate species currently proposed for listing as endangered or threatened.
C	Candidate species presently under status review for federal listing for which adequate information exists on biological vulnerability and threats to list the taxa as endangered or threatened.
PDL	Proposed for delisting.
E(S/A) or T(S/A)	Listed as endangered or threatened because of similarity of appearance.
(PS)	Indicates "partial status" - status in only a portion of the species' range. Typically indicated in a "full" species record where an infraspecific taxon or population has U.S. ESA status, but the entire species does not.

STATE STATUS (Georgia Department of Natural Resources, GA-DNR)

The following abbreviations are used to indicate the status of state-protected plants and animals or those proposed for state-protection in Georgia.

E	Listed as endangered. A species which is in danger of extinction throughout all or part of its range
T	Listed as threatened. A species which is likely to become an endangered species in the foreseeable future throughout all or parts of its range.
R	Listed as rare. A species which may not be endangered or threatened but which should be protected because of its scarcity.
U	Listed as unusual (and thus deserving of special consideration). Uncommon plants subject to commercial exploitation would have this status.

NOTE:
This is a working list and is constantly revised. For the latest changes, acknowledgment of numerous sources, interpretation of data, or other information connected with this list, please contact:

Greg Krakow, Data Manager
Georgia Department of Natural Resources
Wildlife Resources Division
Georgia Natural Heritage Program
2117 U.S. Highway 278 S.E.
Social Circle, Georgia 30025-4714
Phone: 770-918-6411
Fax: 706-557-3033
E-mail: greg_krakow@mail.dnr.state.ga.us

The proper citation for this list is:

Georgia Natural Heritage Program. [Edition date from top right corner]. [Title from top center]. Georgia Department of Natural Resources, Social Circle.

GEORGIA NATURAL HERITAGE PROGRAM DATABASE

Georgia rare species and natural community occurrence information is now available on our web site at

www.dnr.state.ga.us/dnr/wild/natural.html

It is presented as both a web page (HTML) and a GIS file (ESRI Shape File). The HTML format can be used directly from your browser. The Shape File can be downloaded and used with any program that supports ESRI Shape Files. The database file associated with this Shape File can be brought into a spreadsheet, database, or word processor and queried by county, quad, and quarter quad.

Locations are at the precision of one quarter (1/4) of a USGS 7.5 minute quadrangle map (quarter quad). Quarter quads are named using the USGS map name with a suffix (NW, SW, NE, and SE).

This information is for known locations only. To obtain lists of rare species potentially occurring in a given county, please contact our office. Also, you will still need to contact our office for more precise locations of rare species in the vicinity of projects you are working with.

Please continue to keep in mind that many areas of the state have not been surveyed for rare species (see full disclaimer on our web page).

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Dr Dennis Hardin
Forest Ecologist
Division of Forestry
Florida Department of Agriculture and Consumer Services
3125 Conner Boulevard
Tallahassee, FL 32399-1650

RE: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened and Endangered Species and Important Habitats

Dear Dr. Hardin:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will consult with the U.S. Fish and Wildlife Service during the application environmental report review and may also seek your assistance in the identification of important species and habitats in the project area. We are contacting you early in the application process to identify any issues that need to be addressed or information required to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), owned and maintained by Gulf Power, is presently under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Florida by Gulf Power Company, would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide us with any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the Farley-connected transmission corridor (FNP-to-Sinai Cemetery) that crosses one Florida County (Jackson). Please also indicate whether your office has any concerns regarding the operation of this line. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

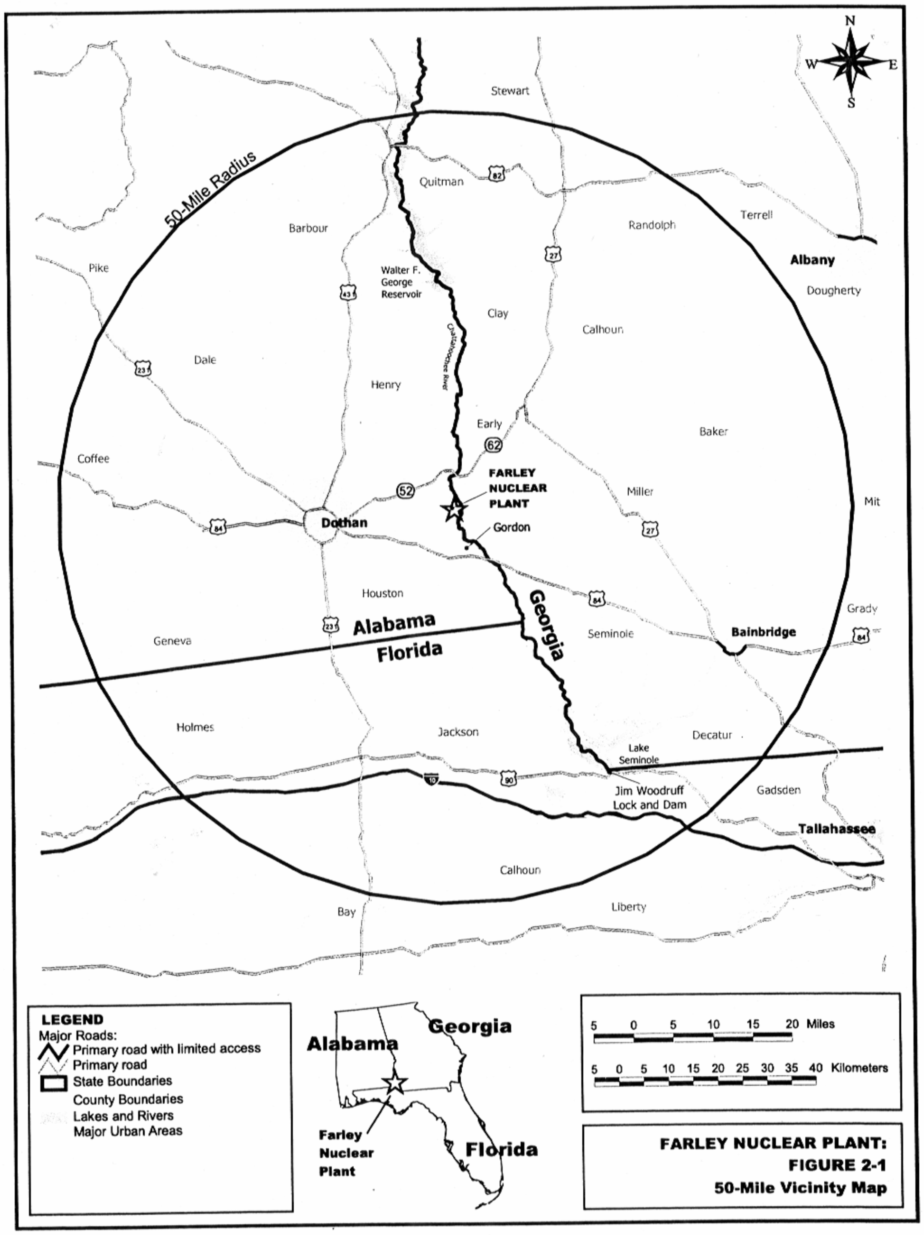
Sincerely,

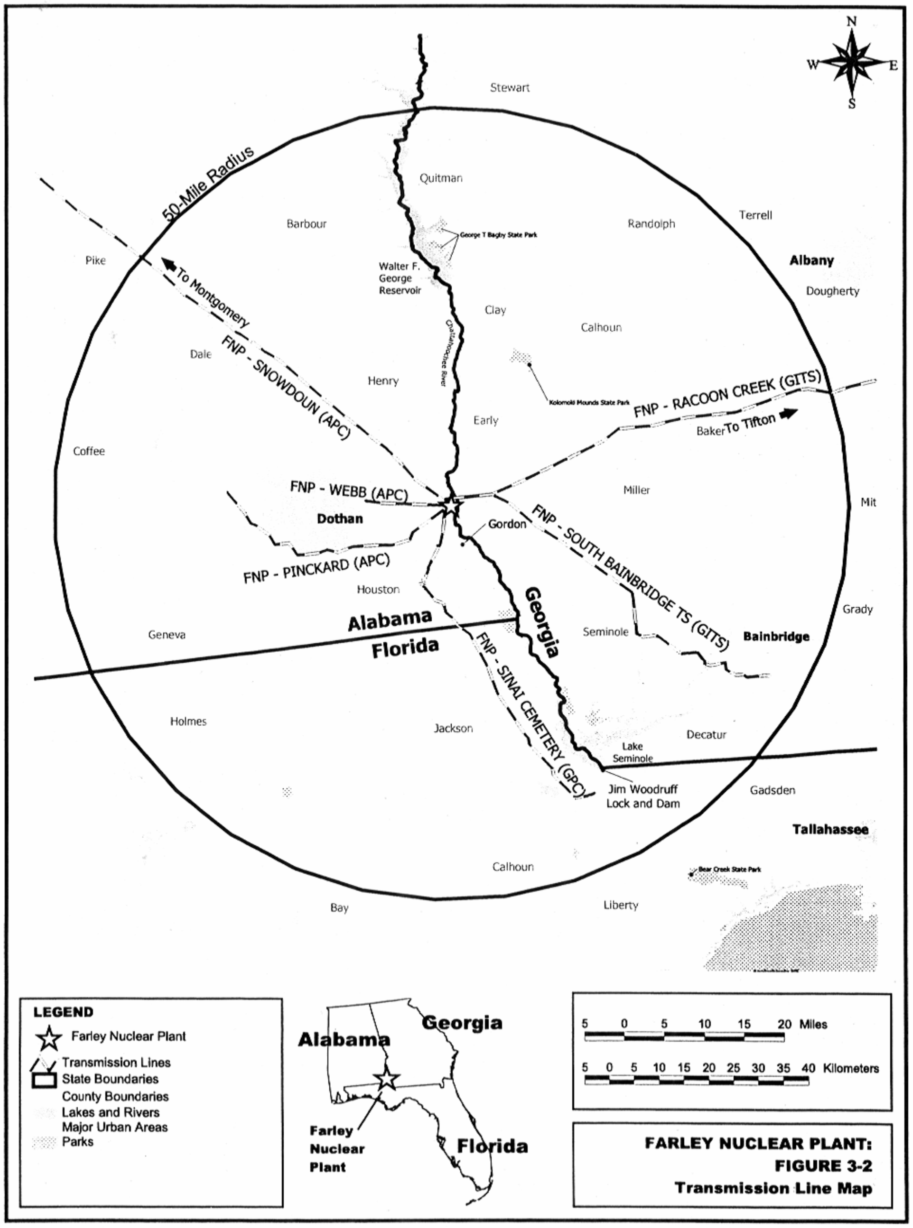
C. R. Pierce

C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


Stewart
Quitman
50-Mile Radius
Barbour
Randolph
Terrell
Albany
Dougherty
Pike
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Grady
Alabama
Florida
Seminole
Bainbridge
Geneva
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map


Stewart
Quitman
Barbour
Randolph
Terrell
Albany
Dougherty
50-Mile Radius
Pike
To Montgomery
Walter F. George Reservoir
Clay
Calhoun
Dale
FNP - SNOWDOUN (APC)
Henry
Early
FNP - RACOON CREEK (GITS)
Baker
To Tifton
Coffee
Miller
FNP - WEBB (APC)
Dothan
Gordon
FNP - SOUTH BAINBRIDGE TS (GITS)
Mit
FNP - PINCKARD (APC)
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
FNP - SINAI CEMETERY (GPC)
Holmes
Jackson
Lake Seminole
Decatur
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Farley Nuclear Plant
Transmission Lines
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Parks
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

Florida Department of Agriculture and Consumer Services
CHARLES H. BRONSON, Commissioner
The Capitol • Tallahassee, FL 32399-0800

Please Respond to:

FM
STATE LANDS
GENERAL

Division of Forestry
Forest Management Bureau
3125 Conner Blvd. C-25
Tallahassee, FL 32399-1650
Telephone: (850) 488-6611
FAX: (850) 921-6724

May 23, 2002

Mr. C. R. Pierce
License Renewal Services Manager
Southern Nuclear Operation Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

Dear Mr. Pierce:

This is in response to your letter of May 7, 2002, requesting any information we may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the Farley-connected transmission corridor that crosses Jackson County, Florida. The Division of Forestry does not maintain a database for threatened or endangered species, or of ecologically significant habitats, that do not occur on the State Forests we manage. We currently have no State Forests in Jackson County. The Division depends on the Florida Natural Areas Inventory to collect, maintain and make available such data. If you have not already done so, I strongly suggest that you contact them at 850/224-8207 and speak to their data manager, Glenn Woodsum, or visit their website at http://www.fnai.org/index.htm.

The above being the case, I know of no comments or concerns at this time.

Sincerely,

CHARLES H. BRONSON
COMMISSIONER OF AGRICULTURE

E. Dennis Hardin

Dr. E. Dennis Hardin
Forest Ecologist
850/414-8293

Fresh Florida.

Florida Agriculture and Forest Products
$53 Billion for Florida's Economy

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295

Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Mr. Bradley J. Hartman
Director of Office of Environmental Services
Florida Fish and Wildlife Conservation Commission
Wildlife Resources Division
620 South Meridian Street
Tallahassee, FL 32399-1600

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Threatened and Endangered Species and Important Habitats

Dear Mr. Hartman:

Southern Nuclear Operating Company is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will consult with the U.S. Fish and Wildlife Service during the application environmental report review and may also seek your assistance in the identification of important species and habitats in the project area. We are contacting you early in the application process to identify any issues that need to be addressed or information required to expedite the NRC's review.

FNP lies on the west bank of the Chattahoochee River in Houston County, Alabama, approximately 17 miles east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see attached Figure 2-1). The FNP site proper encompasses approximately 1,850 acres, roughly two-thirds of which (1,300 acres) are undeveloped (old fields, forests, and wetlands) and managed as a wildlife preserve.

Five transmission lines were built in the 1970s to connect FNP to the regional transmission system (see attached Figure 3-2). These transmission lines originate at FNP and extend to the west and east. Three transmission lines (FNP-to-Snowdoun, FNP-to-Webb, and FNP-to-Pinckard) lie entirely in Alabama and are owned and maintained by Alabama Power. Two lines (FNP-to-Raccoon Creek and FNP-to-South Bainbridge) cross the Chattahoochee River into Georgia and are owned and maintained by Georgia Integrated Transmission System for most of their length. The total length of the five FNP lines is approximately 305 miles. The associated transmission corridors occupy approximately 5,300 acres. A sixth transmission line (Farley-to-Sinai Cemetery), the majority of which is owned and maintained by Gulf Power, is presently

under construction and crosses into the Florida panhandle. The line is approximately 48 miles in length and occupies 582 acres. It is being constructed in an existing corridor that was originally dedicated to a 115 kV line that has now been dismantled.

Southern Nuclear Operating Company does not have any plans to alter current plant operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. There is no expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. As a consequence, we believe that operation of FNP over the license renewal term (an additional 20 years), including maintenance of the transmission lines in Florida by Gulf Power Company, would not adversely affect any threatened or endangered species.

We would appreciate your providing us with a response to this letter by June 16, 2002. Please provide us with any information you may have about any threatened or endangered species or ecologically significant habitats that may occur within/along the Farley-connected transmission corridor (FNP-to-Sinai Cemetery) that crosses one Florida county (Jackson). Please also indicate whether your office has any concerns regarding the operation of this line. We will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

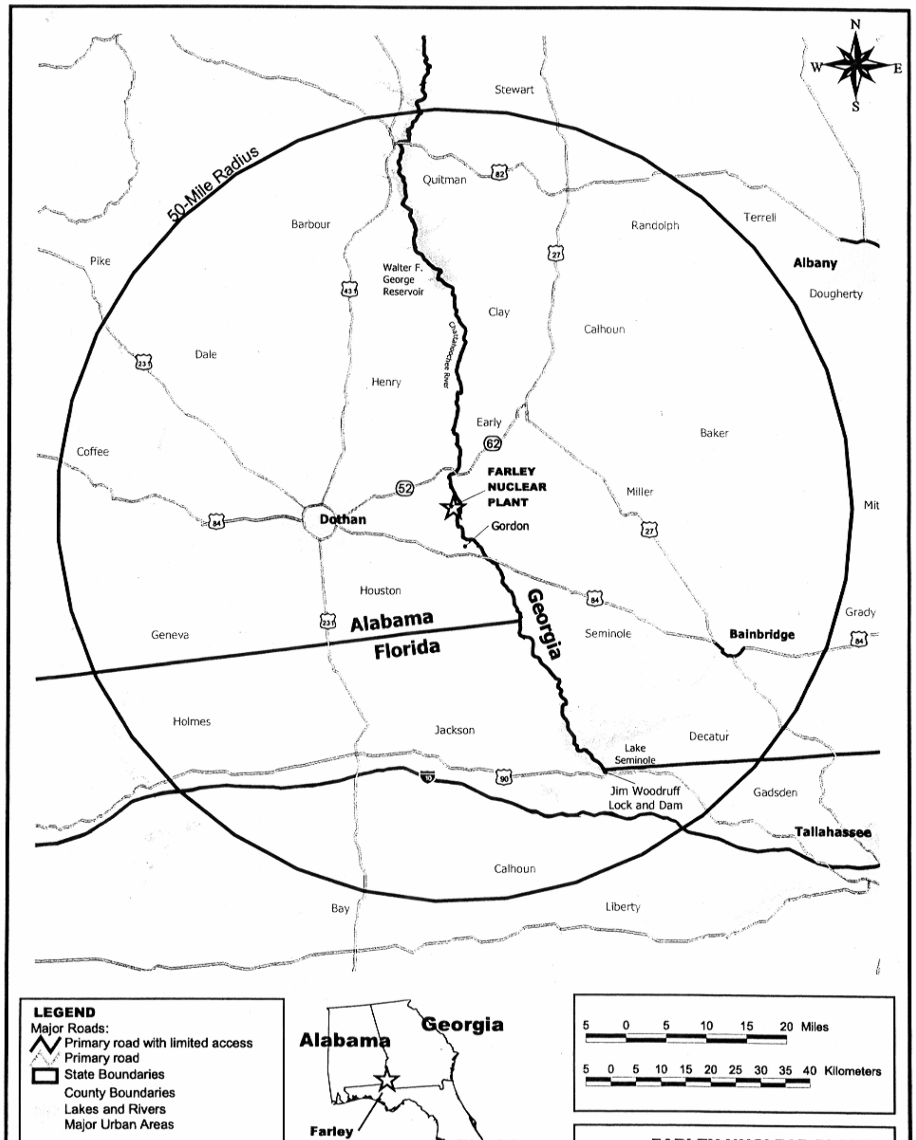
Sincerely,

C. R. Pierce

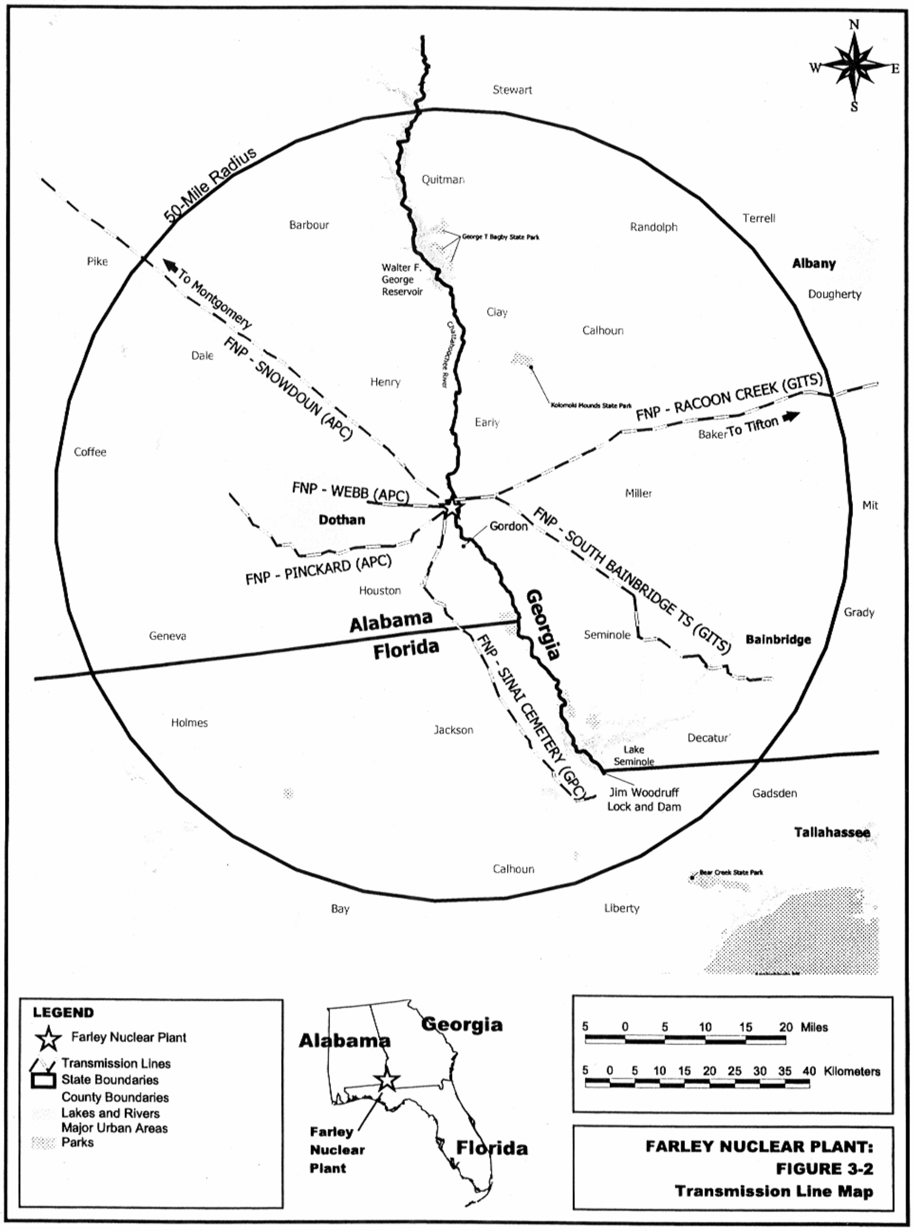
C. R. Pierce
License Renewal Services Manager

Enclosures: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis



FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map


Stewart
Quitman
Barbour
Randolph
Terrell
Albany
Dougherty
50-Mile Radius
Pike
To Montgomery
FNP - SNOWDOUN (APC)
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Early
FNP - RACOON CREEK (GITS)
Baker
To Tifton
Coffee
FNP - WEBB (APC)
Dothan
Gordon
Miller
Mit
FNP - SOUTH BAINBRIDGE TS (GITS)
FNP - PINCKARD (APC)
Houston
Alabama
Florida
Georgia
Geneva
Seminole
Bainbridge
Grady
FNP - SINAI CEMETERY (GPC)
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Farley Nuclear Plant
Transmission Lines
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Parks
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

BRADLEY J. HARTMAN, DIRECTOR
OFFICE OF ENVIRONMENTAL SERVICES
(850)488-6661 TDD (850)488-9542
FAX (850)922-5679

May 28, 2002

Mr. C.R. Pierce
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

Dear Mr. Pierce:

This letter is in response to your request received on 14 May 2002 for listed species occurrence records and critical habitats at (Farley Nuclear Plant) located in Jackson, Holmes, Calhoun, Bay and Washington Counties, Florida. Records from The Office of Environmental Service's database were located within the project area. Enclosed are 8.5 x 11 maps showing the location of listed species relative to this site, SHCA's, biodiversity hotspots and priority wetlands for listed species. A land cover map also was included.

Please note that our database does not necessarily contain records of all listed species that may occur in a given area. Our data is limited to sites that we surveyed or sites that others have surveyed and provided us with their data. Also, data on certain species, such as gopher tortoises, are not entered into our database on a site-specific basis. **Therefore, one should not assume that an absence of occurrences in our database indicates that species of significance do not occur in the area.**

If your investigation of this area yields additional listed species occurrences, we would appreciate your sending us records of your findings so that we can add the information to our database. The Florida Natural Areas Inventory (FNAI) maintains a separate database of listed plant and wildlife species, please contact FNAI directly for specific information on the location of element occurrences within the project area. Because FNAI is funded to provide information to public agencies only, you may be required to pay a fee for this information.

Please credit the Florida Fish and Wildlife Conservation Commission in any publication or presentation of this data. If you have any questions or further requests, please contact me at (850) 488-6661 or moultrg@gfc.state.fl.us.

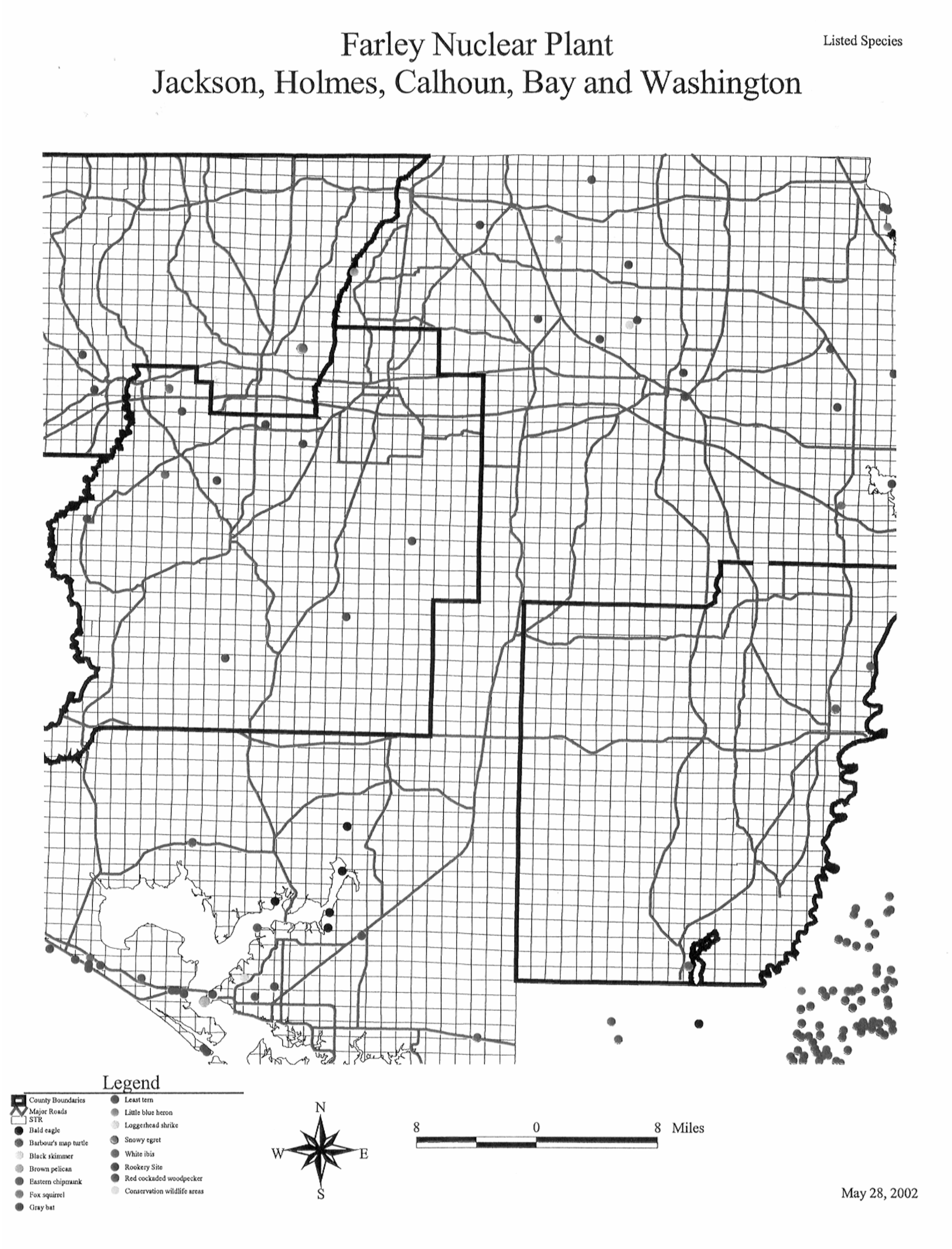
Sincerely,

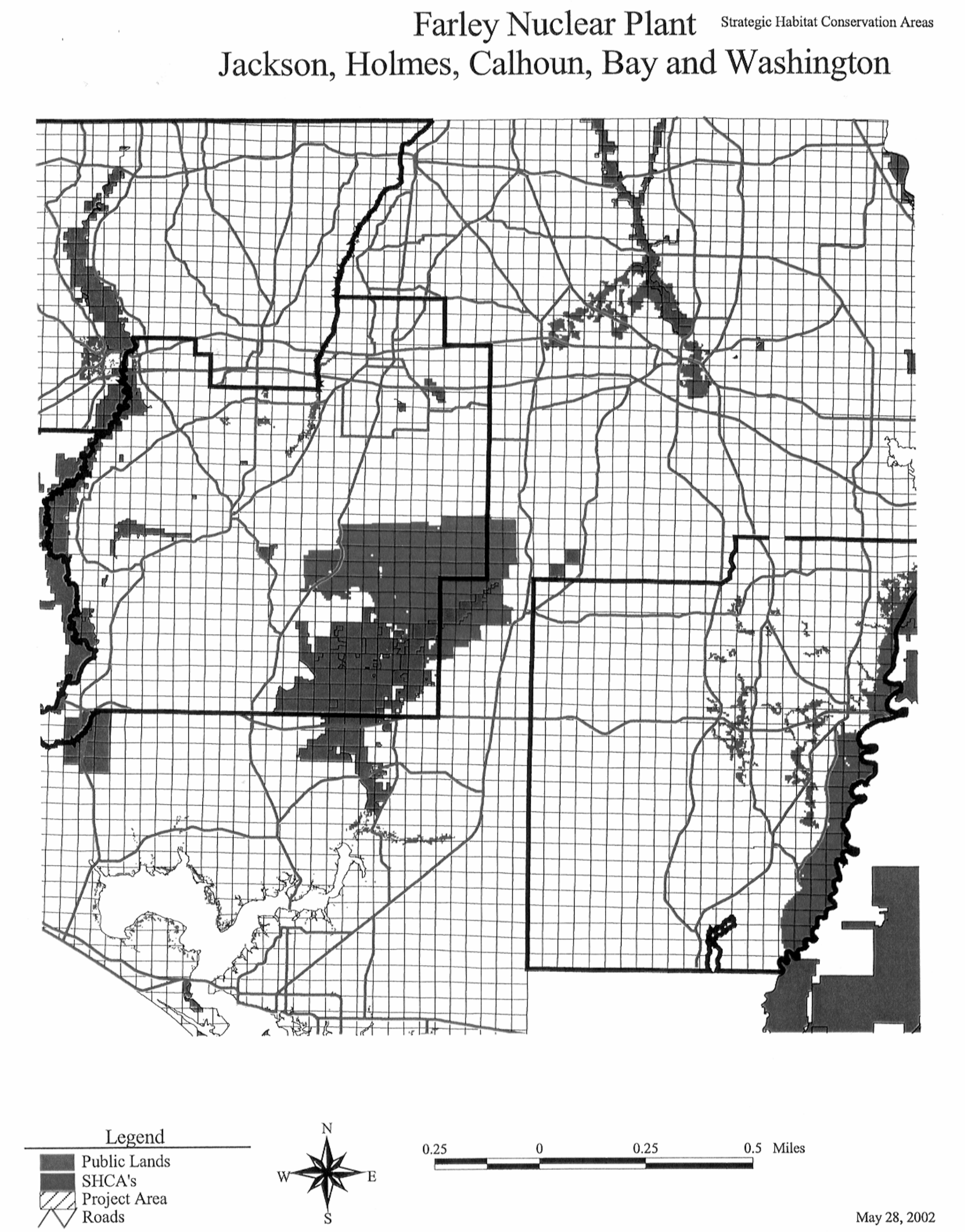
Gina Moultrie

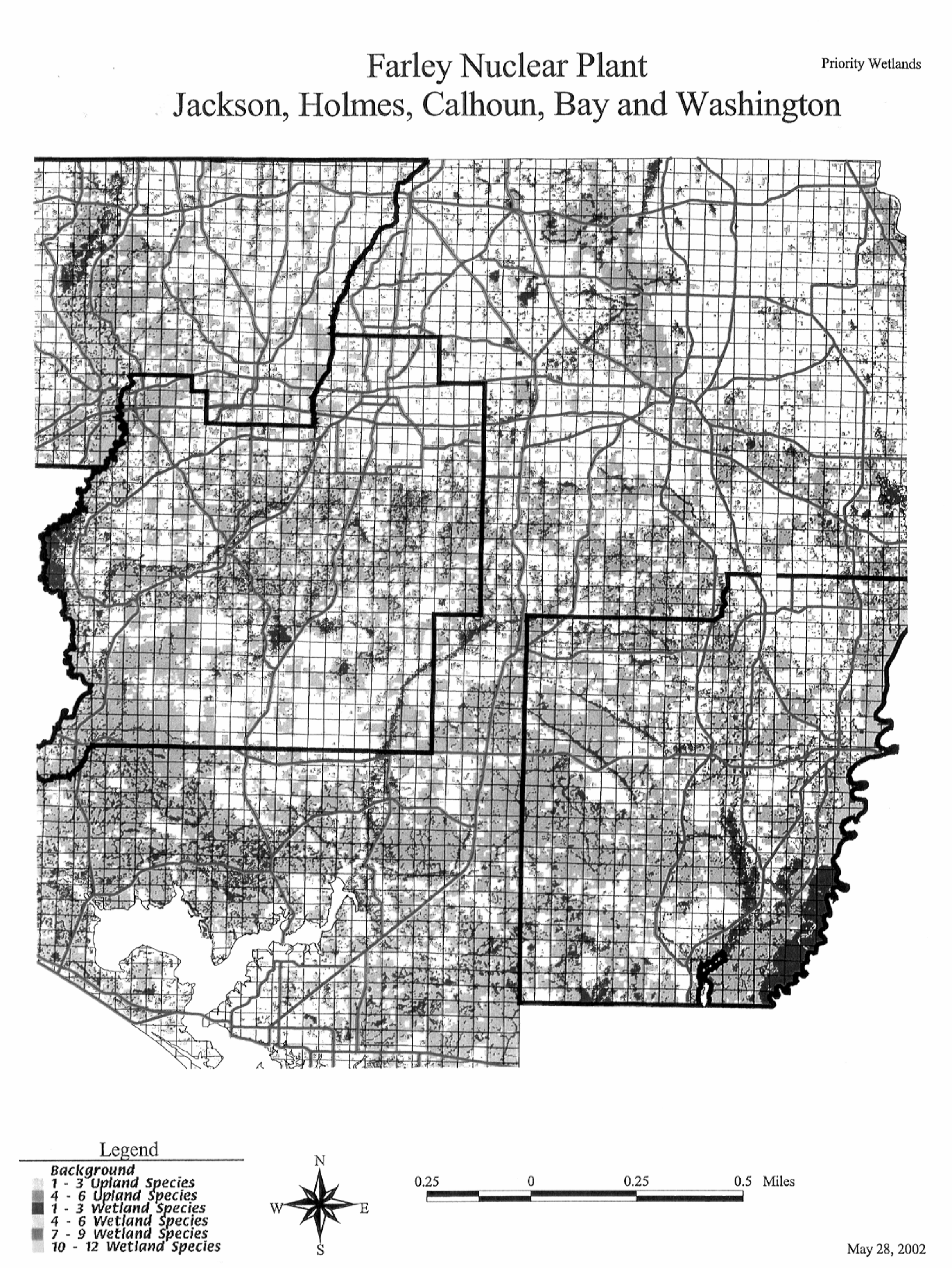
Gina C. Moultrie
Records Technician

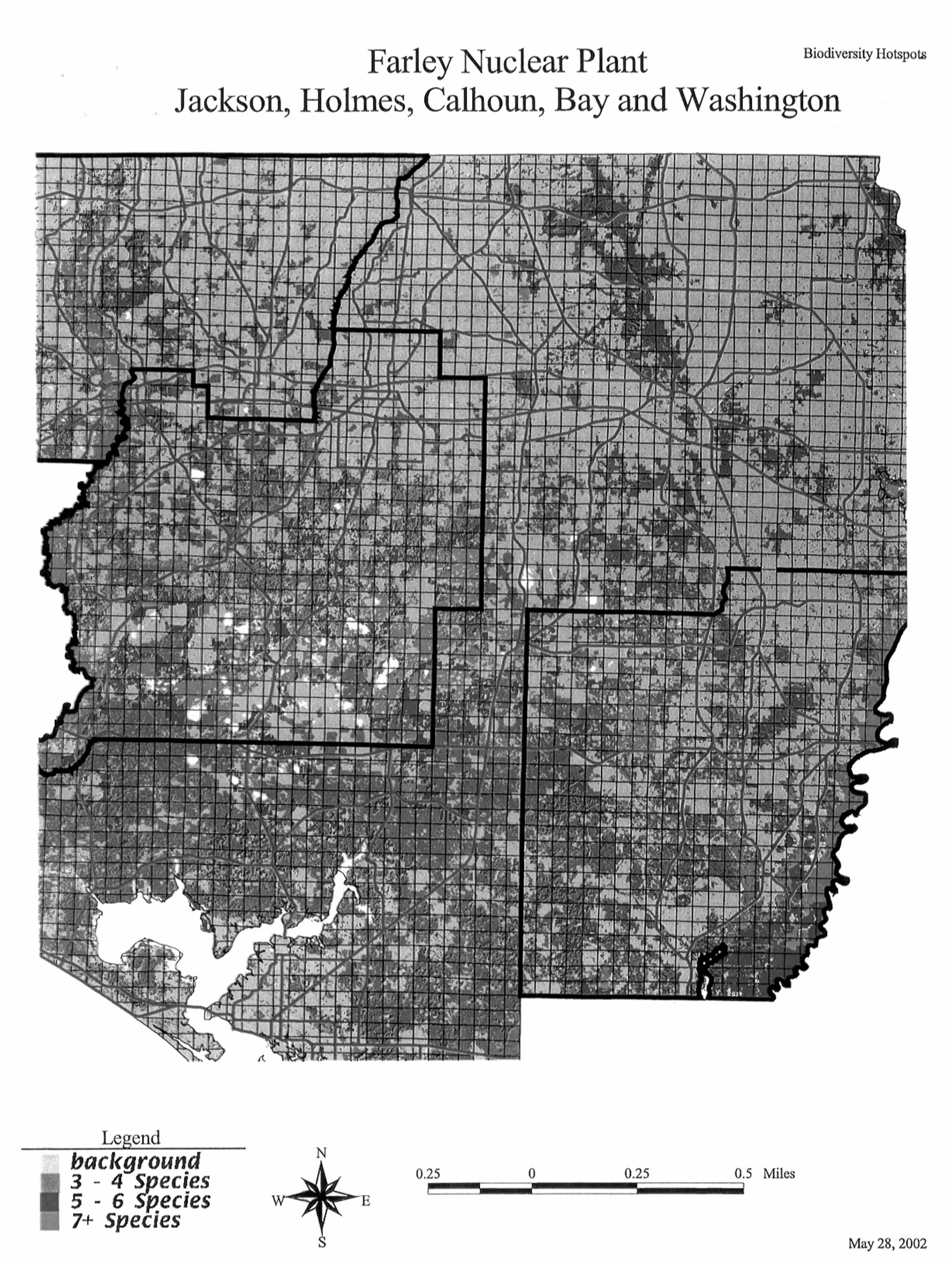
GCM
ENV 8-7/8
Correspondence/request/Hague1
Enclosures

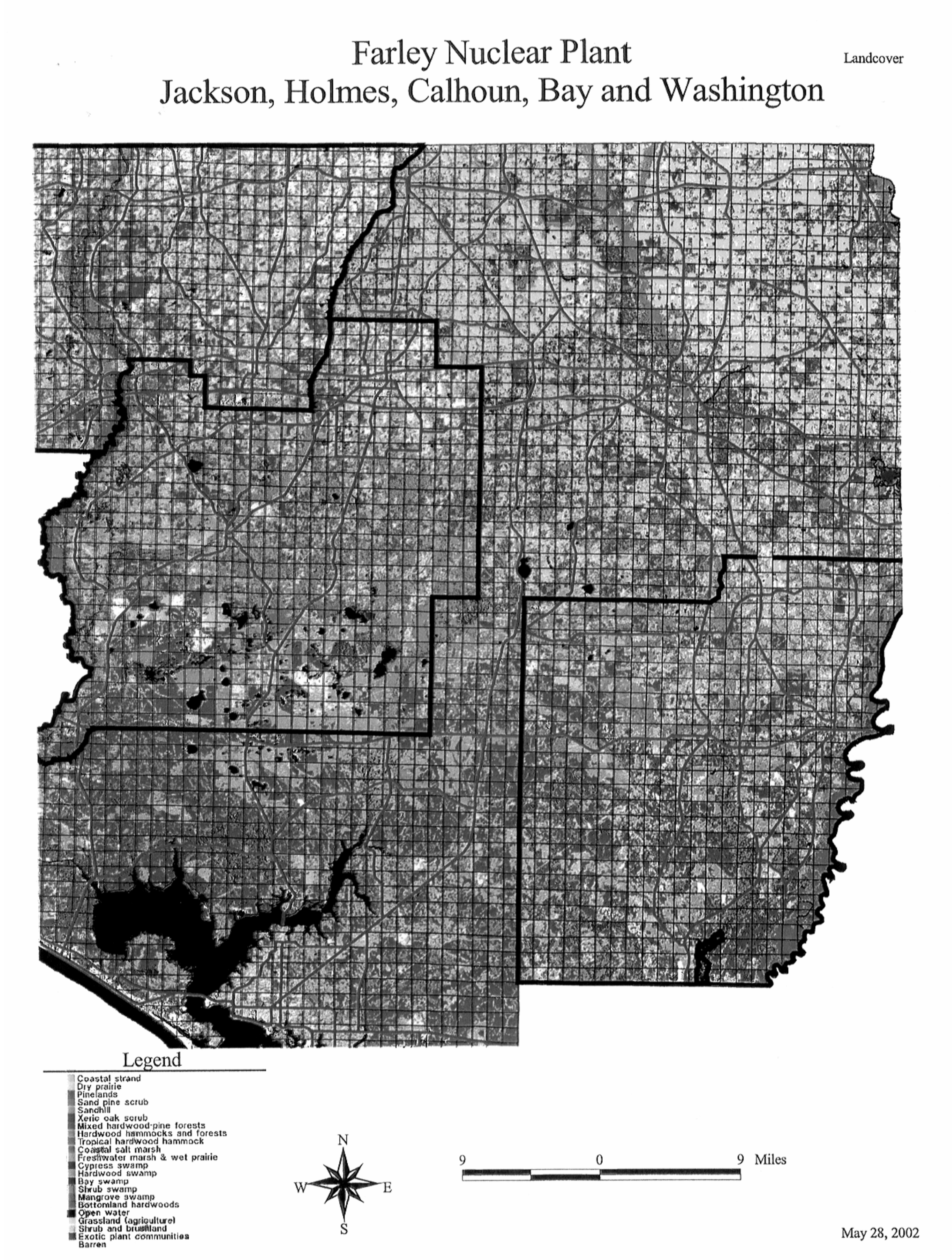
620 South Meridian Street • Tallahassee • FL • 32399-1600
www.floridaconservation.org


Farley Nuclear Plant
Jackson, Holmes, Calhoun, Bay and Washington
Listed Species
Legend
County Boundaries
Major Roads
STR
Bald eagle
Barbour's map turtle
Black skimmer
Brown pelican
Eastern chipmunk
Fox squirrel
Gray bat
Least tern
Little blue heron
Loggerhead shrike
Snowy egret
White ibis
Rookery Site
Red cockaded woodpecker
Conservation wildlife areas
N
W
E
S
8
0
8 Miles
May 28, 2002


Farley Nuclear Plant
Strategic Habitat Conservation Areas
Jackson, Holmes, Calhoun, Bay and Washington
Legend
Public Lands
SHCA's
Project Area
Roads
N
W
E
S
0.25
0
0.25
0.5 Miles
May 28, 2002


Farley Nuclear Plant
Jackson, Holmes, Calhoun, Bay and Washington
Priority Wetlands
Legend
Background
1 - 3 Upland Species
4 - 6 Upland Species
1 - 3 Wetland Species
4 - 6 Wetland Species
7 - 9 Wetland Species
10 - 12 Wetland Species
N
W
E
S
0.25
0
0.25
0.5 Miles
May 28, 2002


Farley Nuclear Plant
Jackson, Holmes, Calhoun, Bay and Washington
Biodiversity Hotspots
Legend
background
3 - 4 Species
5 - 6 Species
7+ Species
N
W
E
S
0.25
0
0.25
0.5 Miles
May 28, 2002


Farley Nuclear Plant
Jackson, Holmes, Calhoun, Bay and Washington
Landcover
Legend
Coastal strand
Dry prairie
Pinelands
Sand pine scrub
Sandhill
Xeric oak scrub
Mixed hardwood-pine forests
Hardwood hammocks and forests
Tropical hardwood hammock
Coastal salt marsh
Freshwater marsh & wet prairie
Cypress swamp
Hardwood swamp
Bay swamp
Shrub swamp
Mangrove swamp
Bottomland hardwoods
Open water
Grassland (agriculture)
Shrub and brushland
Exotic plant communities
Barren
N
W
E
S
9
0
9 Miles
May 28, 2002

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Mr. Charles Oravetz
Chief, Protected Species Branch
National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702

Re: Joseph M. Farley Nuclear Plant
Request for Information on Threatened or Endangered Species

Dear Mr. Oravetz:

Southern Nuclear Operating Company (SNC) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Farley Nuclear Plant Units 1 and 2 (FNP). The current operating licenses for Units 1 and 2 expire in 2017 and 2021, respectively. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10CFR51.53). The NRC will be communicating with your organization during the application review of FNP's environmental report. We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC's review.

Flows in the lower Chattahoochee River (the portion of the river between Walter F. George Reservoir and the Chattahoochee-Flint confluence) are influenced by a series of locks and dams built in the 1950s for flow regulation, hydroelectric power generation, and improved navigation. 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, via a 9-foot-deep and 100-foot-wide channel maintained by the U.S. Army Corps of Engineers.

The construction of locks and dams along the lower Chattahoochee in the 1950s severely reduced or eliminated surviving runs of most anadromous fishes native to the river system, including the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), Alabama shad (*Alosa alabamae*), and Gulf Coast striped bass (*Morone saxatilis*). Gulf sturgeon were abundant in the Chattahoochee before European settlement in the 19th century, ascending the river as far as the Fall Line. Habitat destruction and overfishing in the late-19th and early 20th century decimated the Chattahoochee River population, and completion of the Jim Woodruff Lock and Dam in 1957 effectively eliminated it. Alabama shad still migrate from the Gulf of Mexico into the Apalachicola River below Jim Woodruff Dam, but are blocked from moving upstream into the Chattahoochee River.

A landlocked population of striped bass occurs in the Chattahoochee River above Jim Woodruff Dam, but there is little or no movement to and from the Gulf of Mexico. Some Chattahoochee River striped bass do move downstream and pass the Jim Woodruff Lock and Dam when river flows are unusually high, but the Jim Woodruff Dam prevents upstream movement, so these fish are unable to return to the Chattahoochee River to spawn. Large numbers of striped bass (800,000) are stocked annually in the Apalachicola-Chattahoochee-Flint river system, including Lake Seminole and Walter F. George Reservoir. Striped bass are not plentiful in the Chattahoochee River adjacent to FNP, but they are occasionally caught by anglers pursuing the more common white and hybrid bass up- and downstream of George W. Andrews Lock and Dam.

In more than 25 years of monitoring the fish populations of the lower Chattahoochee River, Alabama Power and its contractors have never collected a listed anadromous species.

SNC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed marine species. SNC does not have any plans to alter current operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously-disturbed areas. There is expansion of existing facilities planned, and there is no additional land disturbance anticipated in support of license renewal. We therefore request your concurrence with our determination that license renewal would have no effect on threatened or endangered anadromous species (including candidate species and species proposed for listing) and that formal consultation is not necessary. After your review, we would appreciate your sending a letter to us detailing any concerns you may have about any listed species in the area or confirming SNC's conclusion that operation of FNP over the license renewal term would have no effect on any threatened or endangered species under the jurisdiction of the National Marine Fisheries Service. SNC will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the FNP license renewal application.

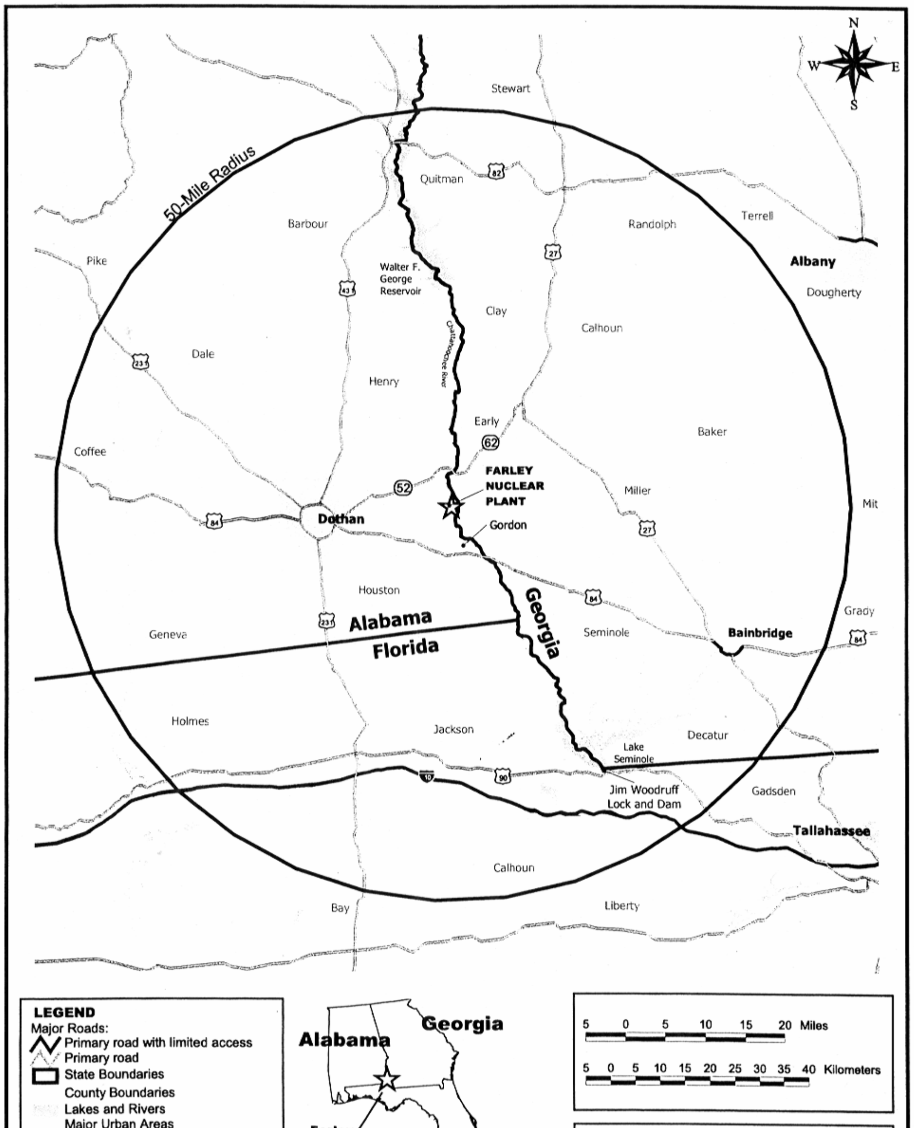
Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information.

Sincerely,

C. R. Pierce
License Renewal Services Manager

Enclosure: Figure 2-1

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis



FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Dr. N.
St. Petersburg, FL 33702
(727) 570-5312, FAX 570-5517
http://caldera.sero.nmfs.gov

F/SER3:SKB

JUN 21 2002

Mr. C.R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201- 1295

Dear Mr. Pierce:

This is in response to your May 7, 2002, letter regarding the renewal of the operating licenses for the Farley Nuclear Plant (FNP) Units 1 and 2. Thank you for giving us the opportunity to comment on the project so early in the application process. We have considered the project and submit the following with respect to possible effects on the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), listed September 30, 1991 under the Endangered Species Act (ESA).

The FNP is located on the Chattahoochee River which is a part of the Apalachicola-Chattahoochee-Flint river system. The Chattahoochee and the Flint rivers join near the Florida/Georgia state borders and form Lake Seminole which then drains through the Jim Woodruff Lock and Dam (JWLD) into the Apalachicola River. Although there are numerous reports of Gulf sturgeon in the Chattahoochee and Flint rivers prior to the construction of the JWLD, no evidence exists that Gulf sturgeon pass through the JWLD system. Therefore it is likely that the JWLD precludes any passage of the Gulf sturgeon from the Apalachicola River into Lake Seminole and contiguous rivers.

Critical habitat was proposed for the Gulf sturgeon on June 6, 2002, (67 FR 39105). The Apalachicola River (from its mainstem beginning at the JWLD downstream to its discharge at Apalachicola Bay, Florida, including all Apalachicola River distributaries) was included in the proposed Gulf sturgeon critical habitat designation. This inclusion as proposed critical habitat demonstrates the Apalachicola's essential role in the conservation of the Gulf sturgeon.

Riverine spawning sites were identified as a constituent element (essential for conservation) in the proposed Gulf sturgeon critical habitat designation. Gulf sturgeon require specific substrate suitable for egg deposition and development such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone or hard clay. Because the Gulf sturgeon were abundant in the Chattahoochee prior to construction of the JWLD, suitable habitat was evidently available in the river. Currently the distribution and availability of appropriate Gulf sturgeon spawning habitat in the Chattahoochee River is unknown.

We recommend FNP initiate a reconnaissance study to investigate the availability and distribution of appropriate Gulf sturgeon spawning habitat in the lower Chattahoochee River. NMFS would be happy to participate in the design of such a study and the results would immediately assist in our efforts to conserve the Gulf sturgeon.

NMFS also recommends that you contract the U.S. Fish and Wildlife Service (FWS) for their concurrence with your determination that license renewal would not effect listed species, and that formal consultation in the license renewal application would not be necessary. Although the Gulf sturgeon is jointly managed by FWS and NMFS, division of jurisdictional responsibilities was proposed in the June 6 critical habitat designation. In the proposed rule (67 FR 39105, June 6, 2002), consultation coordination was proposed as follows: FWS is responsible for all riverine actions, consultations for estuarine activities are to be directed to either FWS or NMFS based on action agency, and NMFS is responsible for all consultations in marine areas. Therefore, because of location, section 7 consultation for the FNP is likely to fall within FWS jurisdiction.

We look forward to working with the Southern Nuclear Operating Company, Inc. and the FNP in conserving our endangered and threatened resources. If you have any questions, please contact Dr. Stephania Bolden, fishery biologist, at (727) 570 - 5312 or by e-mail at stephania.bolden @noaa.gov.

Sincerely yours,

Georgia Cranmore
Assistant Regional Administrator
for Protected Resources

cc: F/PR3
FWS - Panama City

Ref: I/SER/2002/00498
o:\section7\informal\sturgeon\farleynuclear.wpd
File: 1514-22.o. (NRC)

2

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

BRADLEY J. HARTMAN, DIRECTOR
OFFICE OF ENVIRONMENTAL SERVICES
(850)488-6661 TDD (850)488-9542
FAX (850)922-5679

September 13, 2002

Mr. Mike Whitten
Tetratech, Inc.
900 Trail Ridge Road
Aiken, SC 29803

Dear Mr. Whitten:

Per your request, enclosed are 8 X 11" maps showing land cover, SHCA's, priority wetlands for wetland dependent listed species, biodiversity hotspots, and locations for critical habitat/listed species for Jackson County, Florida. If you have any questions or require additional data, please contact me at (850) 488-6661 or kawular@fwc.state.fl.us.

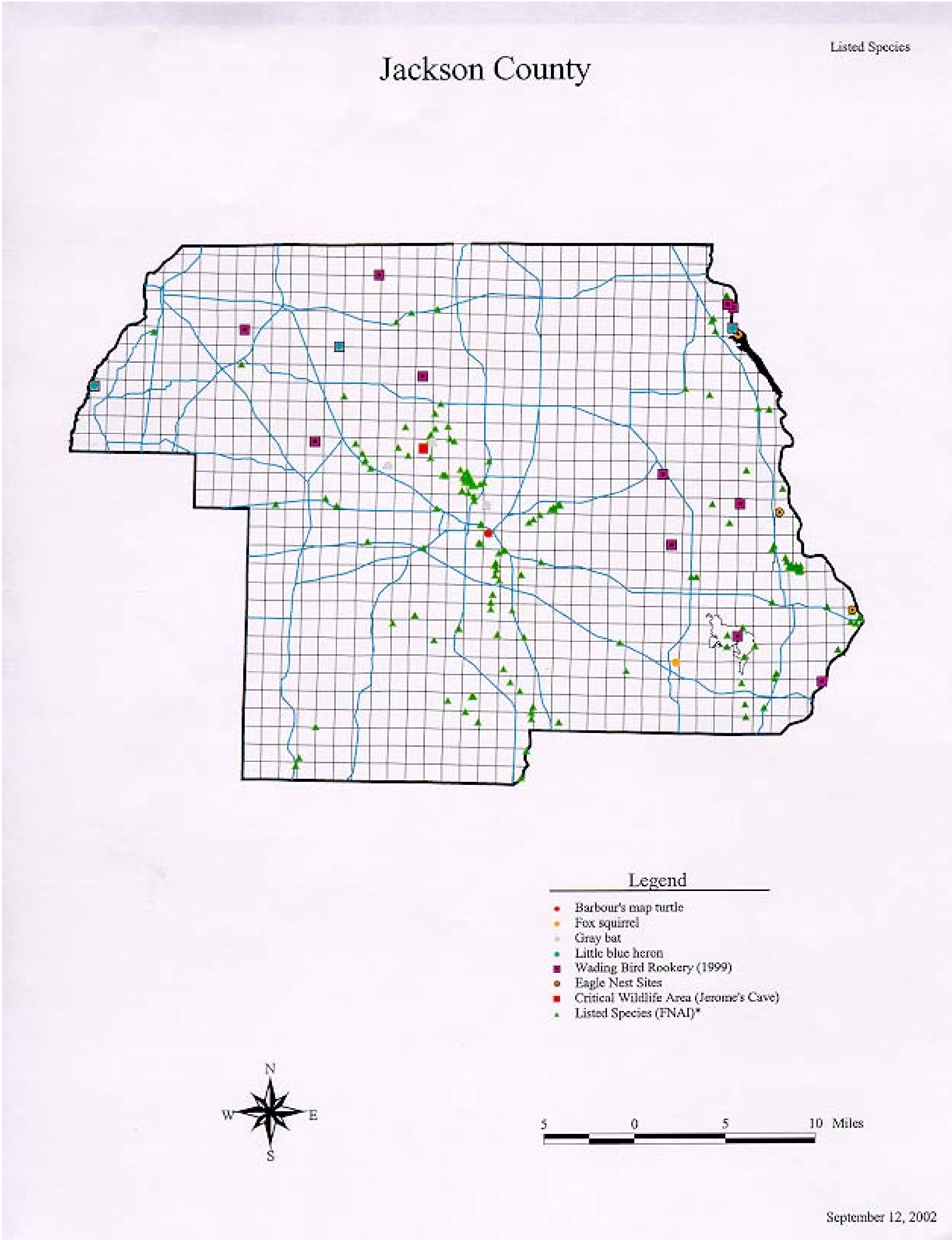
Sincerely,

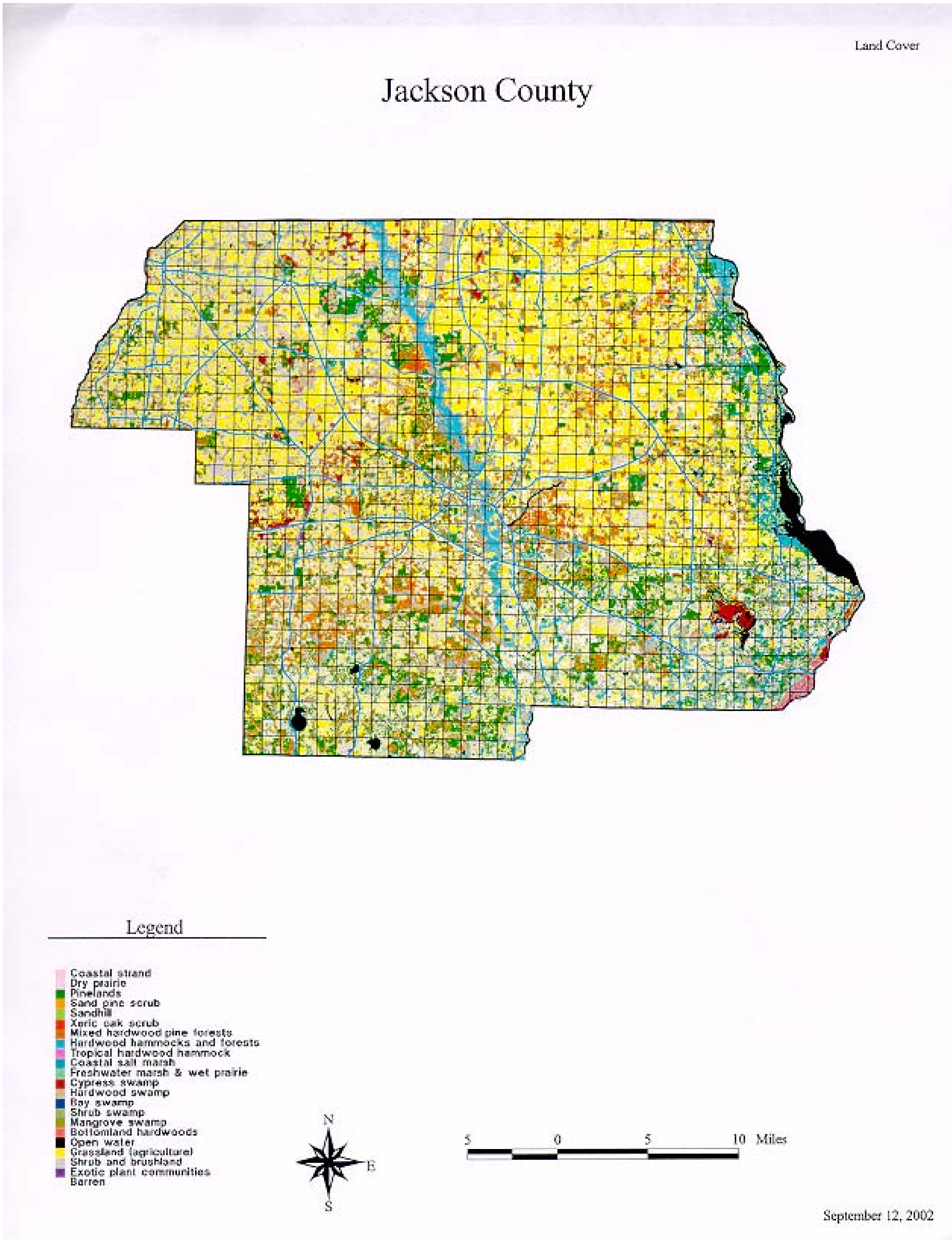
Robert J. Kawula, Ph.D.
Biological Scientist

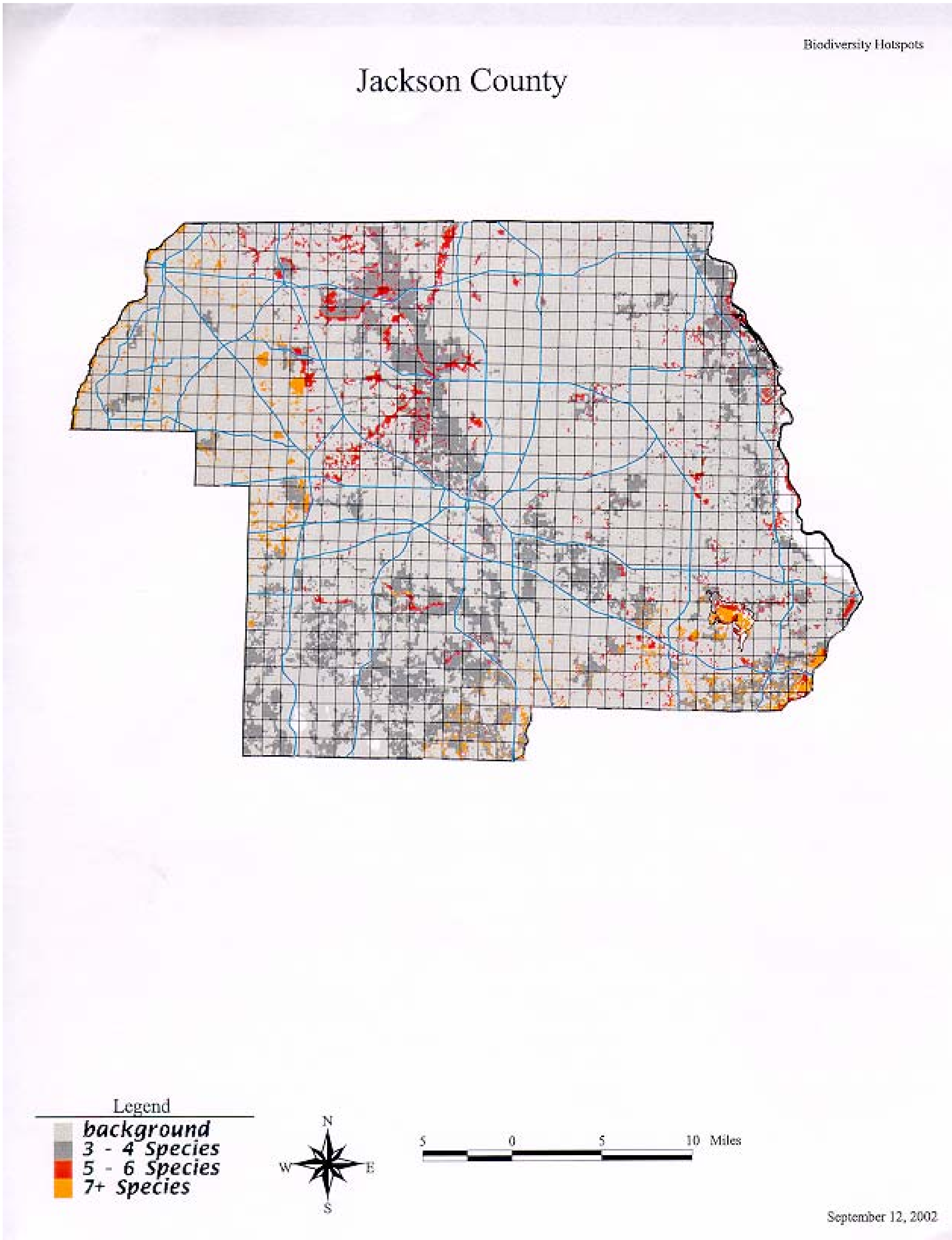
Enclosure

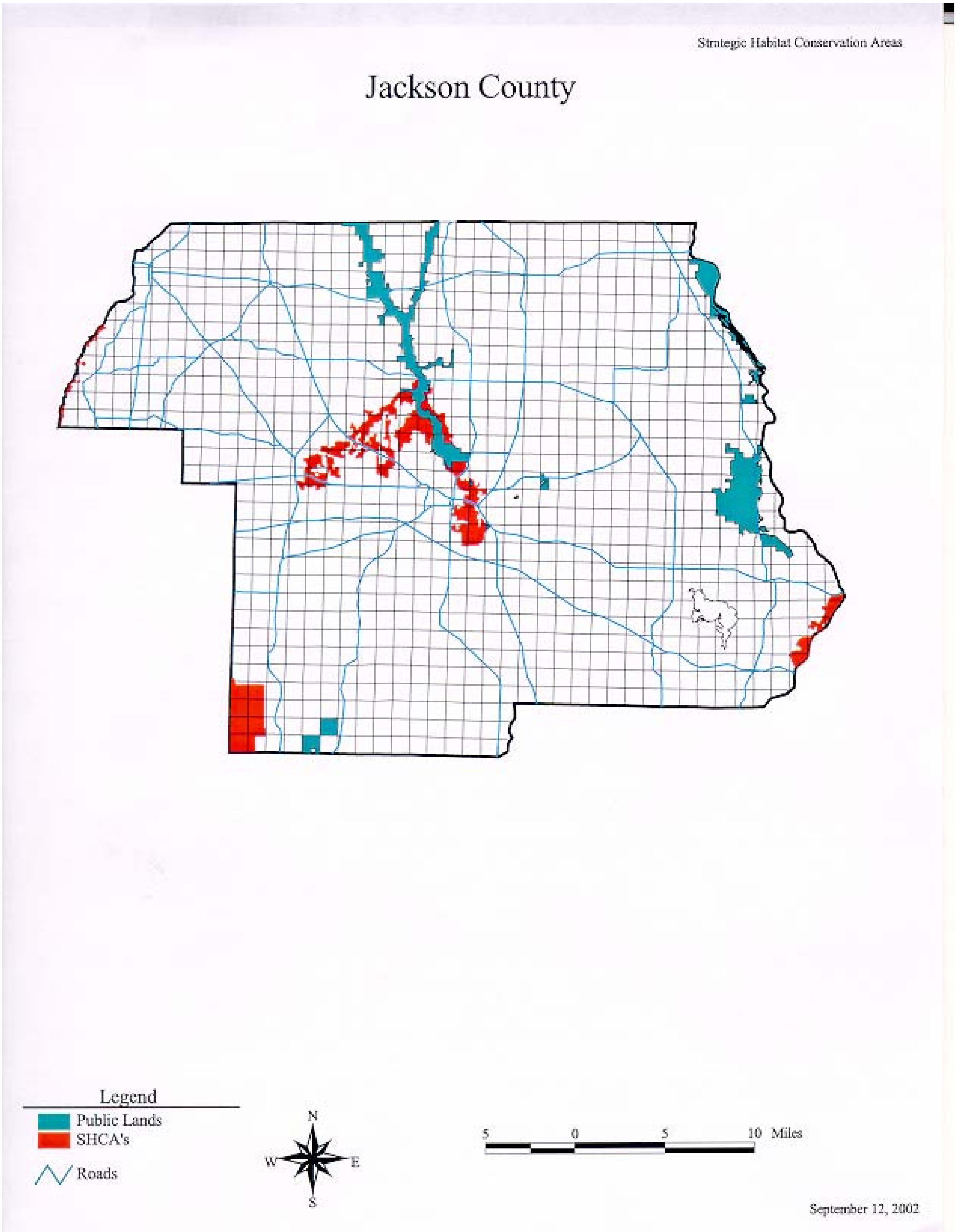
RJK
ENV 8-7/8
rkawula/correspondence/whitten1.doc

620 South Meridian Street • Tallahassee • FL • 32399-1600
www.floridaconservation.org


Listed Species
Jackson County
Legend
Barbour's map turtle
Fox squirrel
Gray bat
Little blue heron
Wading Bird Rookery (1999)
Eagle Nest Sites
Critical Wildlife Area (Jerome's Cave)
Listed Species (FNAI)*
N
W
E
S
5
0
5
10 Miles
September 12, 2002


Land Cover
Jackson County
Legend
Coastal strand
Dry prairie
Pinelands
Sand pine scrub
Sandhill
Xeric oak scrub
Mixed hardwood pine forests
Hardwood hammocks and forests
Tropical hardwood hammock
Coastal salt marsh
Freshwater marsh & wet prairie
Cypress swamp
Hardwood swamp
Bay swamp
Shrub swamp
Mangrove swamp
Bottomland hardwoods
Open water
Grassland (agriculture)
Shrub and brushland
Exotic plant communities
Barren
N
E
S
5
0
5
10 Miles
September 12, 2002


Biodiversity Hotspots
Jackson County
Legend
background
3 - 4 Species
5 - 6 Species
7+ Species
N
W
E
S
5
0
5
10 Miles
September 12, 2002


Strategic Habitat Conservation Areas
Jackson County
Legend
Public Lands
SHCA's
Roads
N
W
E
S
5
0
5
10 Miles
September 12, 2002


Priority Wetlands
Jackson County
Legend
Background
1 - 3 Upland Species
4 - 6 Upland Species
1 - 3 Wetland Species
4 - 6 Wetland Species
7 - 9 Wetland Species
10 - 12 Wetland Species
N
W
E
S
5
0
5
10 Miles
September 12, 2002

Attachment D

Microbiological Organisms Correspondence

PAGE INTENTIONALLY LEFT BLANK

PAGE INTENTIONALLY LEFT BLANK

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

James W. Warr
Director
Watershed Planning and Monitoring Program
Environmental Protection Division
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on *Naegleria fowleri* in the Chattahoochee River

Dear Mr. Warr:

Southern Nuclear Operating Company (SNC) is consulting with your office to determine whether there is any concern about the potential existence or concentration of the free-living amoebae *Naegleria fowleri* in the Chattahoochee River at the Joseph M. Farley Nuclear Plant (FNP) location.

SNC is preparing an application to the Nuclear Regulatory Commission (NRC) for renewal of the FNP operating licenses. License renewal would authorize an additional 20 years of operation beyond the current license expiration dates in 2017 (Unit 1) and 2021 (Unit 2). NRC requires license renewal applicants to "assess the impact of the proposed action (i.e., license renewal) on public health from thermophilic organisms in the affected water" (10 CFR 51.53). NRC license renewal guidance and supporting documentation focus on *N. fowleri* and suggest consulting with the cognizant State agency.

FNP is located in the southeastern corner of Alabama, on the west side of the Chattahoochee River in Houston County, 16.5 miles directly east of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (Figure 2-1). The plant discharges into the Chattahoochee River. Discharge limits and monitoring requirements for FNP are set forth in its National Pollutant Discharge Elimination System permit, AL0024619, and FNP discharge temperatures do not exceed 97 °F. SNC does not expect plant operations and cooling systems to change significantly over the license renewal term and SNC has no plans to increase the discharge temperature.

SNC understands that FNP discharge temperatures are less than those known to be optimal for growth and survival of thermophilic human pathogens such as *N. fowleri*. SNC is not aware of any information that suggests any concern about *N. fowleri* concentrations in the river. In accordance with NRC guidance, however, we are consulting with your office for any information that it has on the topic. Please indicate back to us whether your office has any concerns regarding the operation of the plant.

Please feel free to contact Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information. We would appreciate your input by June 16, 2002 to enable us to meet our application deadline.

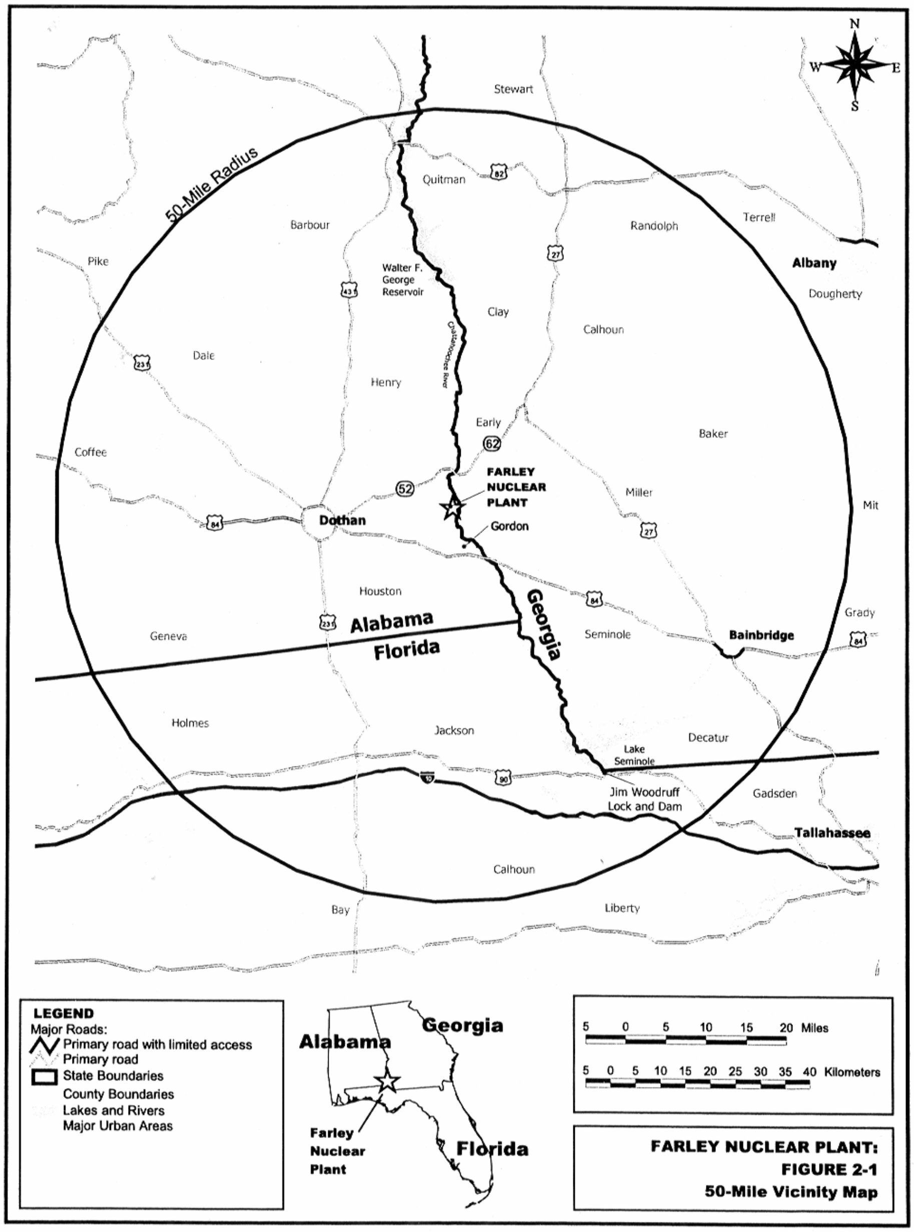
Sincerely,

C R Pierce

C. R. Pierce
License Renewal Services Manager

Enclosure: Figure 2-1

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis


50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Albany
Dougherty
Pike
Walter F. George Reservoir
Clay
Calhoun
Dale
Henry
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Dothan
Gordon
Mit
Houston
Georgia
Alabama
Florida
Geneva
Seminole
Bainbridge
Grady
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map

ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
POST OFFICE BOX 301463 36130-1463 ♦ 1400 COLISEUM BLVD. 36110-2059
MONTGOMERY, ALABAMA
WWW.ADEM.STATE.AL.US
(334) 271-7700

JAMES W. WARR
DIRECTOR

DON SIEGELMAN
GOVERNOR

Facsimiles: (334)
Administration: 271-7950
General Counsel: 394-4332
Air: 279-3044
Land: 279-3050
Water: 279-3051
Groundwater: 270-5631
Field Operations: 272-8131
Laboratory: 277-6718
Mining: 394-4326
Education/Outreach: 394-4383

August 21, 2002

Mr. C. R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Dear Mr. Pierce:

This is in response to your letter of May 7, 2002, requesting information or concerns that the Alabama Department of Environmental Management may have regarding the possible existence of the free-living amoebae *Naegleria fowleri* in the Chattahoochee River at the Farley Nuclear Plant. We have no information regarding the existence or concentration of *N. fowleri* in the Chattahoochee River, and suggest that you contact the Alabama Department of Public Health (if you have not done so).

If you have additional questions or need additional information, please contact Mr. Lynn Sisk at (334) 271-7826.

Sincerely,

James McIndoe

James McIndoe, Deputy Chief
Water Division

JM/LS/nf

Birmingham Branch
110 Vulcan Road
Birmingham, Alabama 35209-4702
(205) 942-6168
(205) 941-1603 [Fax]

Decatur Branch
2715 Sandlin Road, S.W.
Decatur, Alabama 35603-1333
(256) 353-1713
(256) 340-9359 [Fax]

Mobile Branch
2204 Perimeter Road
Mobile, Alabama 36615-1131
(334) 450-3400
(334) 479-2593 [Fax]

Mobile – Coastal
4171 Commanders Drive
Mobile, Alabama 36615-1421
(334) 432-6533
(334) 432-6598 [Fax]

Davis, James T.

From:	Davis, James T.
Sent:	Wednesday, January 22, 2003 11:32 AM
To:	'NSass@ADPH.state.al.us'
Subject:	Naegleris fowleri in Chattahoochee River

Mr. Neal Sass
Alabama Department of Public Health

As we discussed in our phone conversation Southern Nuclear is requesting any information or concerns that the Alabama Department of Public Health may have regarding the possible existence of the free-living amoebae Naegleria fowleri in the Chattahoochee River at the Farley Nuclear Plant. Please review and respond.

Thank You,

Jim Davis

Davis, James T.

From: nsass@adph.state.al.us
Sent: Wednesday, January 22, 2003 12:42 PM
To: Davis, James T.
Subject: Re: Naegleris fowleri in Chattahoochee River

Mr. Davis:

The Alabama Department of Public Health does not routinely collect water samples for the purpose of identifying bacterial, viral, or protozoon organisms in that water. Therefore, we would have no way of determining the presence of Naegleria fowleri in the Chattahoochee River.

Neil L. Sass, Ph.D.
State Toxicologist and
Counterterrorism Coordinator

```
|---------+---------------------------->
|         |           "Davis, James T."|
|         |           <JTDAVIS@southern|
|         |           co.com>          |
|         |                            |
|         |           01/22/2003 11:31 |
|         |           AM               |
|         |                            |
|---------+---------------------------->

>------------------------------------------------------------------------------------------
-----------------------------------------|
  |
|
  |       To:       <NSass@ADPH.state.al.us>
|
  |       cc:
|
  |       Subject:  Naegleris fowleri in Chattahoochee River
|

>------------------------------------------------------------------------------------------
-----------------------------------------|
```

Mr. Neal Sass
Alabama Department of Public Health

As we discussed in our phone conversation Southern Nuclear is requesting any information or concerns that the Alabama Department of Public Health may have regarding the possible existence of the free-living amoebae Naegleria fowleri in the Chattahoochee River at the Farley Nuclear Plant. Please review and respond.

Thank You,

Jim Davis

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Allan Hallum
Chief
Water Protection Branch
Environmental Protection Division
Georgia Department of Natural Resources
4220 International Parkway
Suite 101
Atlanta, GA 30354

Re: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on *Naegleria fowleri* in the Chattahoochee River.

Dear Mr. Hallum:

Southern Nuclear Operating Company (SNC) is consulting with your office to determine whether there is any concern about the potential existence or concentration of the free-living amoebae *Naegleria fowleri* in the Chattahoochee River at the Joseph M. Farley Nuclear Plant (FNP) location.

SNC is preparing an application to the Nuclear Regulatory Commission (NRC) for renewal of the FNP operating licenses. License renewal would authorize an additional 20 years of operation beyond the current license expiration dates in 2017 (Unit 1) and 2021 (Unit 2). NRC requires license renewal applicants to "assess the impact of the proposed action (i.e., license renewal) on public health from thermophilic organisms in the affected water" (10 CFR 51.53). NRC license renewal guidance and supporting documentation focus on *N. fowleri* and suggest consulting with the cognizant State agency.

FNP is located in the southeastern corner of Alabama, on the west side of the Chattahoochee River in Houston County, 16.5 miles directly east of Dothan (Figure 2-1). The plant discharges into the Chattahoochee River. Discharge limits and monitoring requirements for FNP are set forth in its National Pollutant Discharge Elimination System permit, AL0024619, and FNP discharge temperatures do not exceed 97 °F. SNC does not expect plant operations and cooling systems to change significantly over the license renewal term. SNC has no plans to increase the discharge temperature.

SNC understands that FNP discharge temperatures are less than those known to be optimal for growth and survival of thermophilic human pathogens such as *N. fowleri*. SNC is not aware of anyinformation that suggests any concern about *N. fowleri* concentrations in the river. In accordance with NRC guidance, however, we are consulting with your office for any information that it has on the topic. Please indicate back to us whether your office has any concerns regarding the operation of the plant.

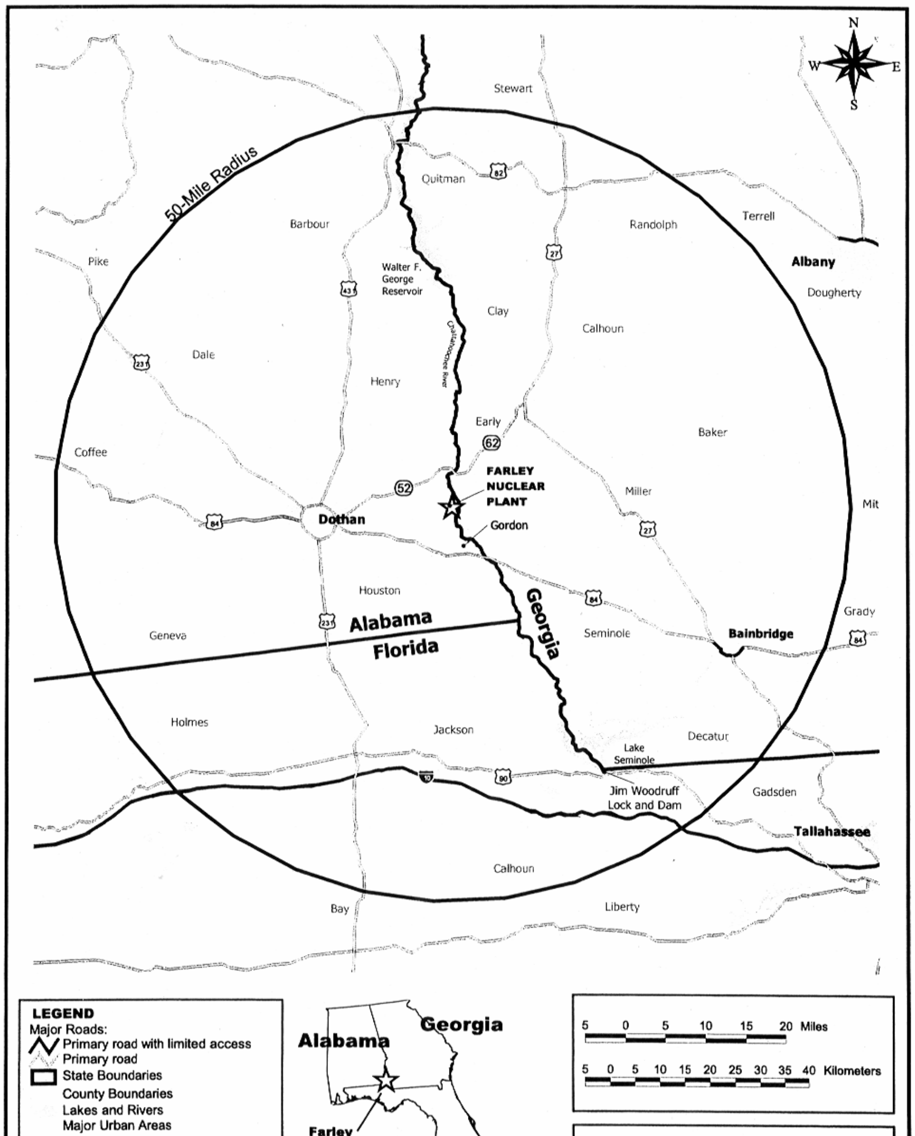
Please feel free to contact Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information. We would appreciate your input by June 16, 2002 to enable us to meet our application deadline.

Sincerely,

C. R. Pierce
License Renewal Services Manager

Enclosure: Figure 2-1

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis



FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map

Georgia Department of Natural Resources
Environmental Protection Division, Water Protection Branch
4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Alan W. Hallum, Branch Chief
404/675-6232
FAX: 404/675-6247

September 11, 2002

Mr. C. R. Pierce
License Renewal Services Manager
Southern Nuclear Operating Company, Inc.
P. O. Box 1295
Birmingham, AL 35201-1295

RE: J. M. Farley Nuclear Plant License Renewal
Request for Information on *Naegleria fowleri*
In The Chattahoochee River

Dear Mr. Pierce:

The Georgia Environmental Protection Division has never conducted any water quality monitoring to determine if *Naegleria fowleri* is present in Georgia waters. Following the death of a young boy due to infection with this organism on September 2, 2002, questions on the occurrence and risk of infection with *Naegleria fowleri* following water contact activities in Georgia have been raised. According to the Georgia Department of Human Resources, this recent death was the fourth documented case of infection in Georgia, with the suspected source of the exposure being the Oconee River near Dublin, Georgia. Based on these 4 cases, published literature documenting its common occurrence worldwide, implied documentation of its occurrence by disease cases, and field collections from various media in southern states indicates to us the probability that it is a common species in many of our waters.

Review of web-posted fact sheets from the Centers for Disease Control (CDC), and from the Florida Department of Health (copies attached), indicate that *Naegleria fowleri* is a free-living amoeba that is found worldwide, most commonly in the soil and in warm, stagnant bodies of freshwater, particularly where the temperature exceeds 86° F. The attached fact sheets indicate that cases of infection with this species from swimming in surface waters are rare. The attached fact sheets and recent news articles covering the recent case of infection in Georgia may provide information useful to your review. Should you have any further questions, please feel free to call Linda Harn of our Watershed Planning and Monitoring Program at 404/675-1647.

Sincerely,

Alan W. Hallum

Alan W. Hallum, Chief
Water Protection Branch

AWH/lmh
Attachments

Attachment E

State Historic Preservation Officer Correspondence

PAGE INTENTIONALLY LEFT BLANK

PAGE INTENTIONALLY LEFT BLANK

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Dr. Lee Warner
Alabama Historical Commission
468 South Perry St.
Montgomery, AL 36130-0900

SUBJECT: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Historic and Archaeological Resources

Dear Dr. Warner:

Southern Nuclear Operating Company (SNC) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Joseph M. Farley Nuclear Plant (FNP), which expire in June 2017 for Unit 1 and March 2021 for Unit 2. As part of the license renewal process, NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." NRC may also request an informal consultation with your office at a later date under Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and Federal Advisory Council on Historic Preservation regulations (36 CFR 800). By contacting you early in the application process, we hope to identify any issues that need to be addressed or any information your office may need to expedite the NRC consultation.

SNC has operated FNP since 1977. FNP is in Houston County, Alabama, approximately 16 miles east of the City of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see Figures 2-1 and 2-2). The Plant lies on the west shoreline of the Chattahoochee River, which serves as its makeup water source for the service water pond onsite that provides cooling water for the Plant. An exclusion area, defined as the area approximately one mile around the reactor buildings, is posted and access to the land portions is controlled. The FNP property includes approximately 1,850 acres.

Alabama Power Company, owner of the Plant, built five transmission lines for the specific purpose of connecting FNP to the regional transmission system (see Figure 3-2). Beginning at the FNP site, two transmission lines continue easterly into Georgia, two proceed westerly to the Dothan, Alabama area, and the fifth line runs northwesterly toward Montgomery, Alabama. There is a sixth line, which is currently under construction, that runs south into the Florida panhandle.

The *Final Environmental Statement for Joseph M. Farley Nuclear Plant Units 1 and 2,* prepared in 1974 by the U. S. Atomic Energy Commission, contains a copy of a November 8, 1974 letter from the State of Alabama Historical Commission that stated "... the operation of this generation facility will not impair, encroach upon or destroy any significant, historical and archeological landmark in Houston County, Alabama."

Using the National Register Information System (NRIS) online database, we have compiled a list of sites on the National Register of Historic Places within a six-mile radius of the FNP property. One site, the Purcell-Killingsworth House, is located in Columbia, Alabama north of FNP. The second, the Coheelee Creek Covered Bridge, is located in Hilton, Georgia approximately 5.5 miles northeast of FNP. We will provide all of this information to the NRC to aid in its evaluation of the license application.

SNC does not expect FNP operation through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area because SNC does not have any plans to alter current operations over the license renewal period. 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 repairs.

We would appreciate your sending us a letter by June 16, 2002 detailing any concerns you may have about historic/archaeological properties in the area of FNP or confirming SNC's conclusion that operation of FNP over the license renewal term would have no effect on any historic or archaeological properties in Alabama. This will enable us to meet our application preparation schedule. SNC will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information to review the proposed action.

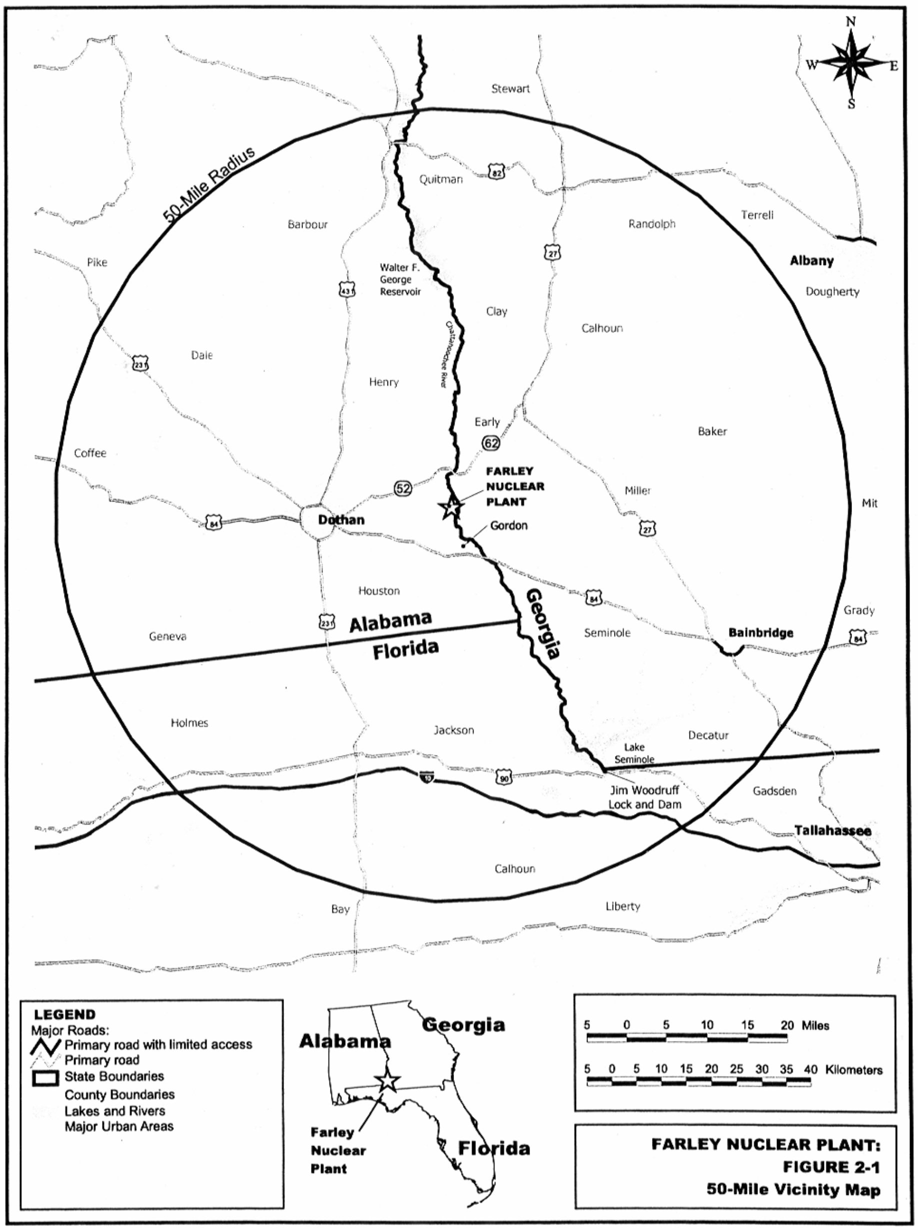
Sincerely,

C R Pierce

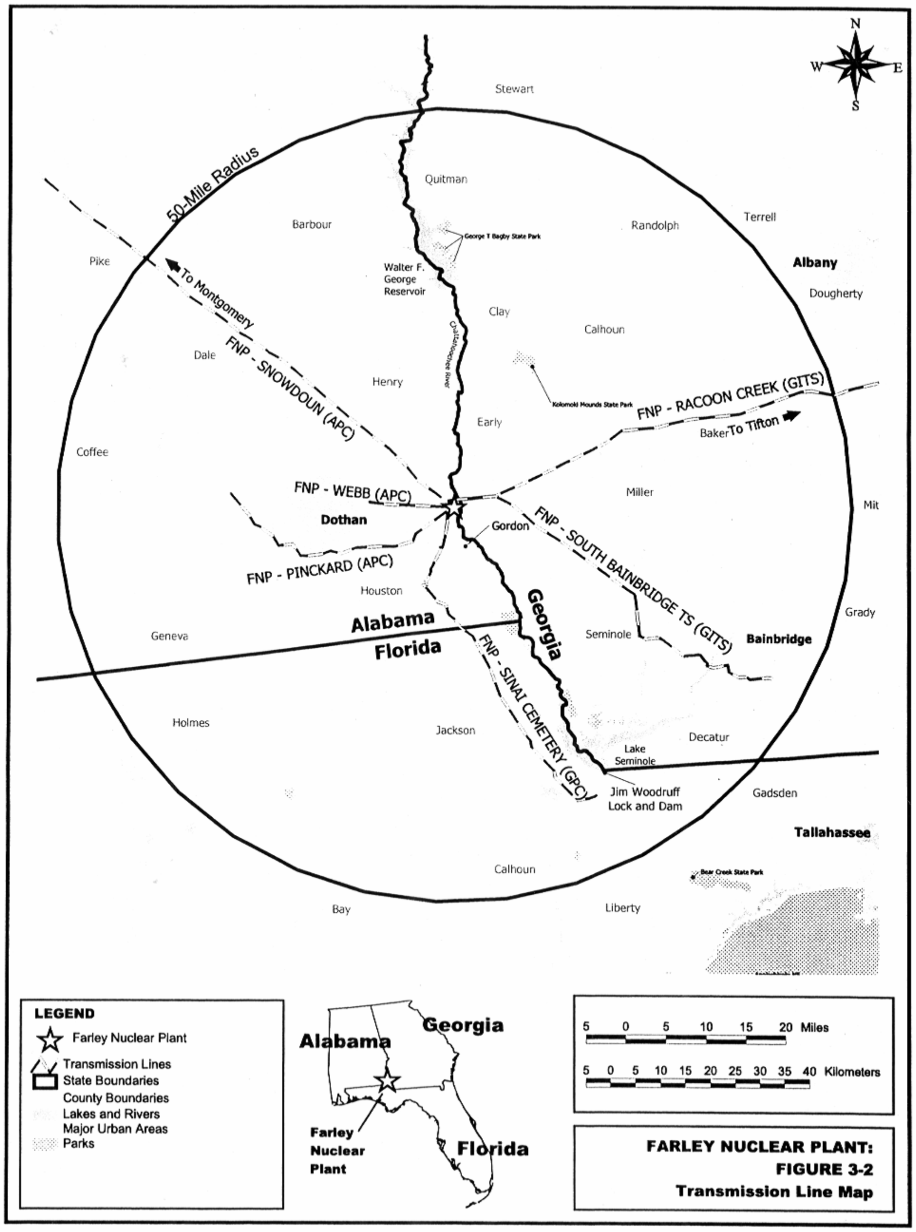
C. R. Pierce
License Renewal Services Manager

Enclosure: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis



FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

LEE H. WARNER
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

June 11, 2002

Mr. C. R. Pierce
Southern Company
P. O. Box 1295
Birmingha, AL 35201-1295

Re: AHC 02-0940
License Renewal
Joseph M. Farley Nuclear Plant
Houston County, AL

Dear Mr. Pierce:

Upon review of the proposed project, the Alabama Historical Commission has determined that the project activities will have no effect on any known cultural resources listed on or eligible for the National Register of Historic Places. Therefore, our office can concur with the proposed activities.

However, should any archaeological cultural resources be encountered during project activities, work shall cease and our office shall be consulted immediately. This stipulation shall be placed on the construction plans to insure contractors are aware of it.

We appreciate your efforts on this issue. If we may be of further service or if you have any questions or comments, please contact Stacye Hathorn of our office and be sure to **include the project number referenced above**.

Sincerely,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

THE STATE HISTORIC PRESERVATION OFFICE
www.preserveala.org

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295
Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Dr. Ray Luce
Historical Preservation Division
Georgia Department of Natural Resources
156 Trinity Ave., SW, Suite 101
Atlanta, GA 30303

RE: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Historic and Archaeological Resources

Dear Dr. Luce:

Southern Nuclear Operating Company (SNC) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Joseph M. Farley Nuclear Plant (FNP), which expire in June 2017 for Unit 1 and March 2021 for Unit 2. As part of the license renewal process, NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." NRC may also request an informal consultation with your office at a later date under Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and Federal Advisory Council on Historic Preservation regulations (36 CFR 800). We are contacting you early in the application process, to identify any issues that need to be addressed or any information your office may need to expedite the NRC's consultation.

SNC has operated FNP since 1977. FNP is in Houston County, Alabama, approximately 16 miles east of the City of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see Figure 2-1). The Plant lies on the west shoreline of the Chattahoochee River, which serves as its makeup water source for the service water pond onsite that provides cooling water for the Plant. An exclusion area, defined as the area approximately one mile around the reactor buildings, is posted and access to the land portions is controlled. The FNP property includes approximately 1,850 acres.

Alabama Power Company, owner of the Plant, built five transmission lines for the specific purpose of connecting FNP to the regional transmission system (see Figure 3-2). Beginning at the FNP site, two transmission lines continue easterly into Georgia, two proceed westerly to the Dothan, Alabama area, and the fifth line runs northwesterly toward Montgomery, Alabama. There is a sixth line, which is currently under construction, that runs south into the Florida panhandle.

Using the National Register Information System (NRIS) on-line database, we have compiled a list of sites on the National Register of Historic Places within a six-mile radius of the FNP property. The Coheelee Creek Covered Bridge is located in Hilton, Georgia, approximately 5.5 miles northeast of FNP. We will provide this information to the NRC to aid in its evaluation of the license application.

SNC does not expect FNP operation through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area because SNC has no plans to alter current operations over the license renewal period. There is no expansion of existing facilities planned, and there are no major structural modifications identified for the purpose of supporting license renewal. No land-disturbing activities are anticipated beyond those required for routine maintenance and repairs.

We would appreciate your sending a letter to us by June 16, 2002 detailing any concerns you may have about historic/archaeological properties in the area of FNP or confirming SNC's conclusion that operation of FNP over the license renewal term would have no effect on any historic or archaeological properties in Georgia. This will enable us to meet our application preparation schedule. SNC will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information to review the proposed action.

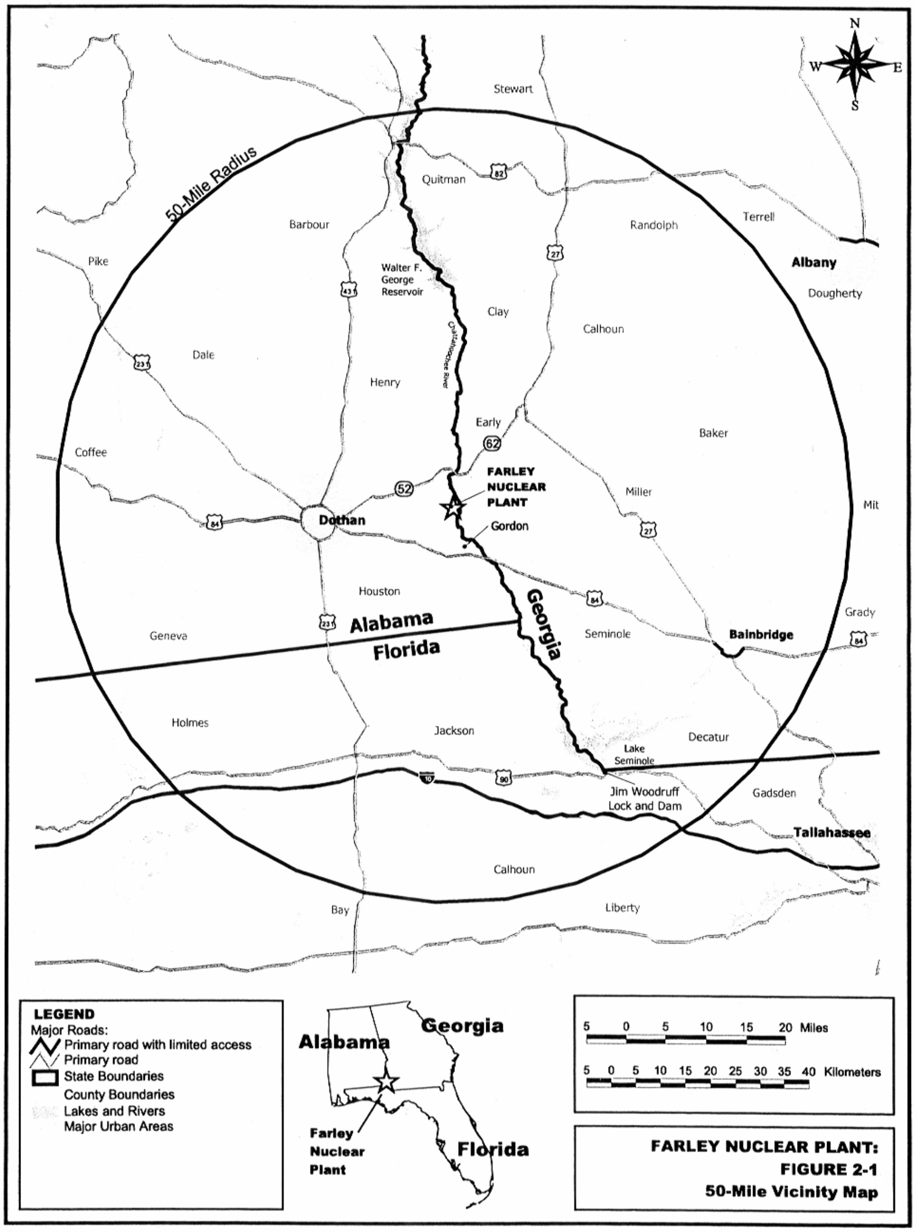
Sincerely,

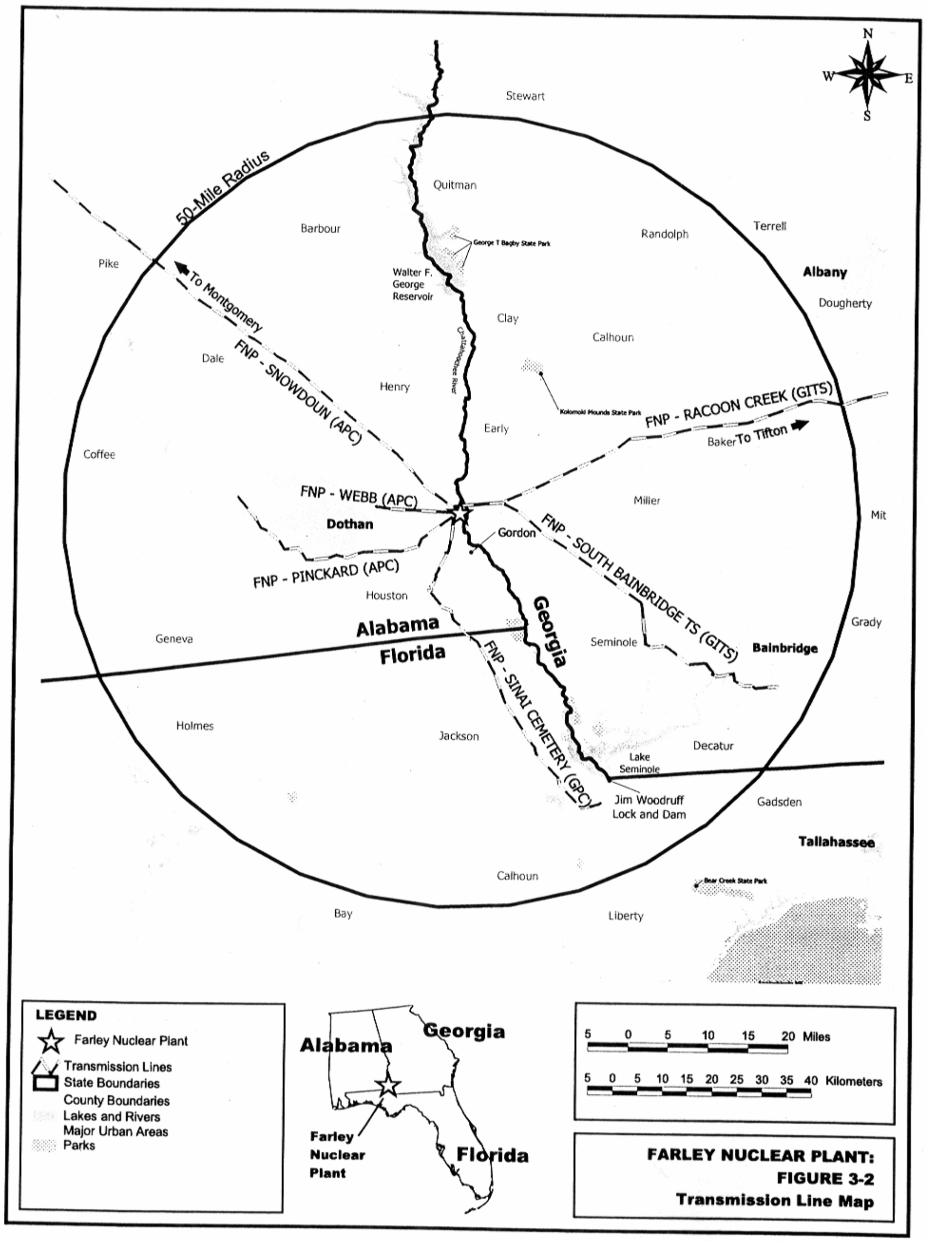
C. R. Pierce
License Renewal Services Manager

Enclosure: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis

900 Trail Ridge Road, Aiken, South Carolina 29803


N
W
E
S
50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Pike
Walter F.
George
Reservoir
Albany
Dougherty
Clay
Calhoun
Dale
Henry
Early
Baker
Coffee
FARLEY
NUCLEAR
PLANT
Miller
Dothan
Gordon
Mit
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
Holmes
Jackson
Decatur
Lake
Seminole
Jim Woodruff
Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley
Nuclear
Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map


Stewart
50-Mile Radius
Quitman
Barbour
Randolph
Terrell
Pike
George T Bagby State Park
Walter F. George Reservoir
Albany
Dougherty
To Montgomery
Clay
Calhoun
Dale
FNP - SNOWDOUN (APC)
Henry
Kolomoki Mounds State Park
FNP - RACOON CREEK (GITS)
Early
Baker
To Tifton
Coffee
Miller
FNP - WEBB (APC)
Mit
Dothan
Gordon
FNP - SOUTH BAINBRIDGE TS (GITS)
FNP - PINCKARD (APC)
Houston
Georgia
Grady
Alabama
Geneva
Seminole
Bainbridge
Florida
FNP - SINAI CEMETERY (GPC)
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bear Creek State Park
Bay
Liberty
LEGEND
Farley Nuclear Plant
Transmission Lines
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Parks
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

Georgia Department of Natural Resources
Historic Preservation Division
Lonice C. Barrett, Commissioner
W. Ray Luce, Division Director and Deputy State Historic Preservation Officer
156 Trinity Avenue, S.W., Suite 101, Atlanta, Georgia 30303-3600
Telephone (404) 656-2840 Fax (404) 657-1040 http://www.gashpo.org

MEMORANDUM

TO: C.R. Pierce
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

FROM: Serena G. Bellew SGB
Environmental Review Coordinator
Historic Preservation Division

RE: Finding of "No Historic Properties Affected"

PROJECT: Joseph M. Farley Nuclear Plant License Renewal

COUNTY: Early County, Georgia

HP-020513-004

DATE: June 14, 2002

The Historic Preservation Division has reviewed the information received concerning the above-mentioned project. Our comments are offered to assist federal agencies and project applicants in complying with the provisions of Section 106 of the National Historic Preservation Act.

Based on the information submitted, HPD has determined that no historic properties or archaeological resources that are listed in or eligible for listing in the National Register of Historic Places will be affected by this undertaking. Please note that historic and/or archaeological resources may be located within the project's area of potential effect (APE), however, at this time it has been determined that they will not be impacted by the above-referenced project. Furthermore, any changes to this project as proposed will require further review by our office for compliance with the Section 106 process.

If we may be of further assistance contact me at (404) 651-6624. Please refer to the project number assigned above in any future correspondence regarding this project.

SGB:lek

cc: Alex MacDonald, Southwest Georgia RDC

Southern Nuclear
Operating Company, Inc.
P. O. Box 1295
Birmingham, Alabama 35201-1295

Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

May 7, 2002

Dr. Janet Mathews
Division Director/Deputy State Historic Preservation Officer
Florida Bureau of Historic Preservation
500 South Bronough Street
Tallahassee, FL 32399

RE: Joseph M. Farley Nuclear Plant License Renewal
Request for Information on Historic and Archaeological Resources

Dear Dr. Mathews:

Southern Nuclear Operating Company (SNC) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Joseph M. Farley Nuclear Plant (FNP), which expire in June 2017 for Unit 1 and March 2021 for Unit 2. As part of the license renewal process, NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." NRC may also request an informal consultation with your office at a later date under Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and Federal Advisory Council on Historic Preservation regulations (36 CFR 800). We are contacting you early in the application process to identify any issues that need to be addressed or any information your office may need to expedite the NRC's consultation.

SNC has operated FNP since 1977. FNP is in Houston County, Alabama, approximately 16 miles east of the City of Dothan (latitude N31°17'21.23", longitude W85°6'41.93" for Unit 1 and N31°13'24.01", W85°6'41.93" for Unit 2) (see Figure 2-1). The Plant lies on the west shoreline of the Chattahoochee River, which serves as its makeup water source for the service water pond onsite that provides cooling water for the Plant. An exclusion area, defined as the area approximately one mile around the reactor buildings, is posted and access to the land portions is controlled. The FNP property includes approximately 1,850 acres.

Alabama Power Company, owner of the Plant, built five transmission lines for the specific purpose of connecting FNP to the regional transmission system (see Figure 3-2). Beginning at the FNP site, two transmission lines continue easterly into Georgia, two proceed westerly to the Dothan, Alabama area, and the fifth line runs northwesterly toward Montgomery, Alabama. There is a sixth line, which is currently under construction, that runs south into the Florida panhandle.

Using the National Register Information System (NRIS) on-line database, we have compiled a list of sites on the National Register of Historic Places within a six-mile radius of the FNP property. One site, the Purcell-Killingsworth House, is located in Columbia, Alabama north of FNP. The second, the Coheelee Creek Covered Bridge, is located in Hilton, Georgia approximately 5.5 miles northeast of FNP. We will provide all of this information to the NRC to aid in their evaluation of the license application.

SNC does not expect FNP operation through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area because SNC has no plans to alter current operations over the license renewal period. 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 repairs.

We would appreciate your sending a letter to us by June 16, 2002 detailing any concerns you may have about historic/archaeological properties in the area of FNP or confirming SNC's conclusion that operation of FNP over the license renewal term would have no effect on any historic or archaeological properties in Florida. This will enable us to meet our application preparation schedule. SNC will include a copy of this letter and your response in the license renewal application that we submit to the NRC.

Please do not hesitate to call Mr. Jim Davis at (205) 992-7692 if you have any questions or require any additional information to review the proposed action.

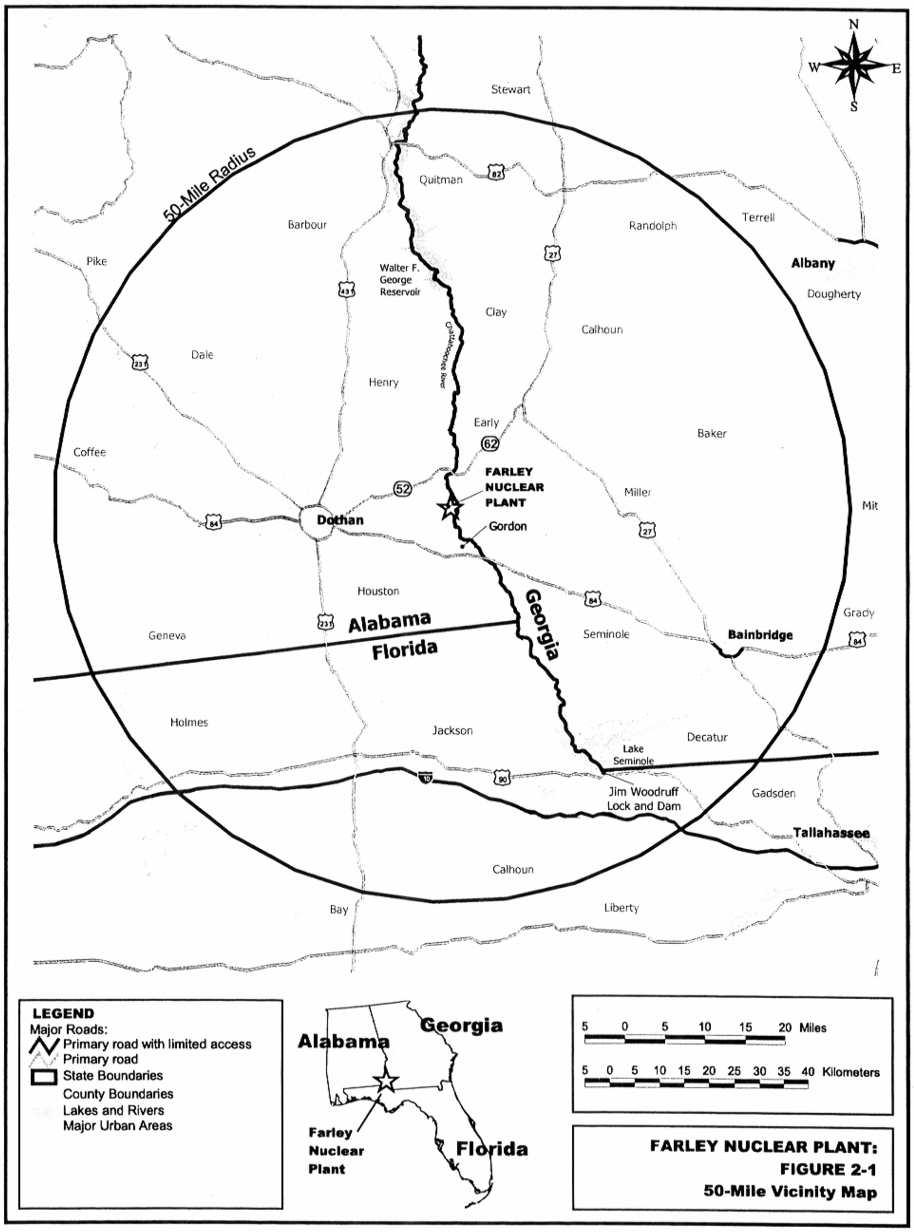
Sincerely,

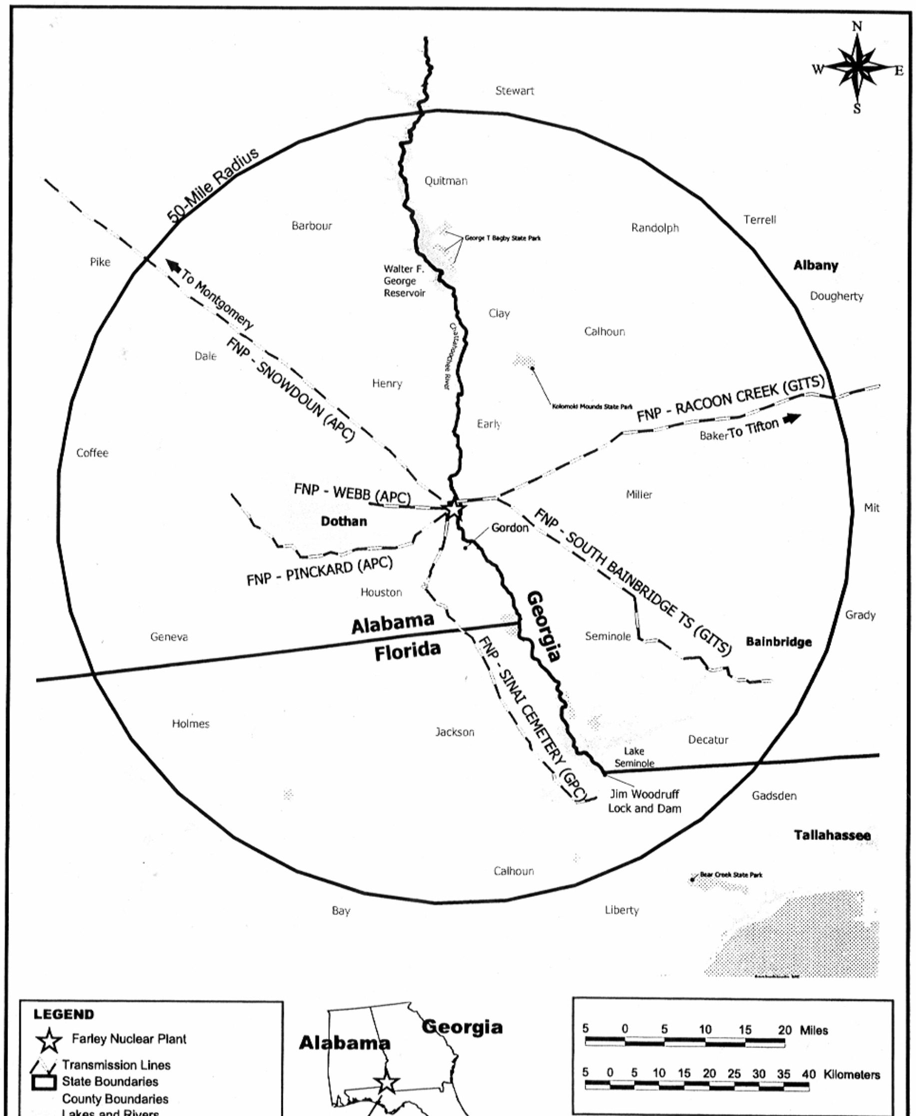
C. R. Pierce
License Renewal Services Manager

Enclosure: Figures 2-1 and 3-2

cc: L. M. Stinson
M. J. Ajluni
W. C. Carr
T. C. Moorer
J. T. Davis

900 Trail Ridge Road, Aiken, South Carolina 29803


N
W
E
S
50-Mile Radius
Stewart
Quitman
Barbour
Randolph
Terrell
Pike
Walter F. George Reservoir
Albany
Dougherty
Clay
Calhoun
Dale
Henry
Chattahoochee River
Early
Baker
Coffee
FARLEY NUCLEAR PLANT
Miller
Mit
Dothan
Gordon
Houston
Georgia
Grady
Alabama
Florida
Geneva
Seminole
Bainbridge
Holmes
Jackson
Decatur
Lake Seminole
Jim Woodruff Lock and Dam
Gadsden
Tallahassee
Calhoun
Bay
Liberty
LEGEND
Major Roads:
Primary road with limited access
Primary road
State Boundaries
County Boundaries
Lakes and Rivers
Major Urban Areas
Alabama
Georgia
Farley Nuclear Plant
Florida
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 40 Kilometers
FARLEY NUCLEAR PLANT:
FIGURE 2-1
50-Mile Vicinity Map



FARLEY NUCLEAR PLANT:
FIGURE 3-2
Transmission Line Map

FLORIDA DEPARTMENT OF STATE
Katherine Harris
Secretary of State
DIVISION OF HISTORICAL RESOURCES

June 11, 2002

Mr. C. R. Pierce
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, Alabama 35201-1295

Re: DHR No. 2002-04815 / Received by DHR: May 14, 2002
Additional Information Provided by Jim Davis, Southern Nuclear Operating Company, and Rachel Terry, Gulf Power Company, on June 11, 2002
Joseph M. Farley Nuclear Plant License Renewal
Houston County, Alabama

Dear Mr. Pierce:

Our office has received the above referenced project in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992, and the *National Environmental Policy Act of 1969* (Public Law 91-190), as amended. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties listed, or eligible for listing, in the *National Register of Historic Places*, assessing effects upon them, and considering alternatives to avoid or minimize adverse effects.

We have reviewed the information provided and note that one transmission line is currently under construction in Jackson County, Florida. Provided all work takes place in previously disturbed right-of-way, it is the opinion of this office that construction of the Sinai Cemetery transmission line will have no effect on any historic properties eligible for listing in the *National Register of Historic Places*. Further, it is the opinion of this office that the proposed license renewal will have no effect on any historic properties listed, or eligible for listing, in the *National Register*.

If you have any questions concerning our comments, please contact Mary Beth Fitts, Historic Sites Specialist, at mbfitts@mail.dos.state.fl.us or (850) 245-6333. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

Frederick P. Gaske, Deputy SHPO
for Janet Snyder Matthews, Ph.D., Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6435
☐ Archaeological Research (850) 245-6444 • FAX: 245-6436
☒ Historic Preservation (850) 245-6333 • FAX: 245-6437
☐ Historical Museums (850) 245-6400 • FAX: 245-6433
☐ Palm Beach Regional Office (561) 279-1475 • FAX: 279-1476
☐ St. Augustine Regional Office (904) 825-5045 • FAX: 825-5044
☐ Tampa Regional Office (813) 272-3843 • FAX: 272-2340

PAGE INTENTIONALLY LEFT BLANK

Attachment F

Severe Accident Mitigation Alternatives (SAMA)

PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

List of Tables

1.0 METHODOLOGY

The methodology selected for this analysis involves identifying those SAMA candidates that have the most potential for reducing core damage frequency and person-rem risk. The phased approach consists of:

- Extending the FNP PRA/IPE results to a Level 3 analysis by determining off-site dose and economic baseline risk value,
- Determining the maximum averted risk that is possible based on the FNP baseline risk,
- Identifying potential SAMA candidates based on NRC and industry documents,
- Screening out potential SAMA candidates that are not applicable to the FNP design or are of low benefit in Pressurized Water Reactors (PWRs),
- Screening out SAMA candidates whose estimated cost exceeds the maximum possible averted risk, and
- Performing a more detailed cost estimate and Level 3 dose and economic risk evaluation of remaining candidates to see if any have a benefit in risk aversion that exceeds the expected cost.

1.1 HISTORY OF FNP PRA MODEL

Southern Nuclear Operating Company (SNC) conducted a full-scope Level 2 Probabilistic Risk Assessment (PRA) in response to the requirements of the U.S. Nuclear Regulatory Commission (NRC) Generic Letter 88-20 (**Reference 1**) and Supplements 1 and 2 (**Reference 2**). SNC's approach to the Individual Plant Examination (IPE) was to perform a realistic evaluation of FNP's anticipated response to severe accidents. The FNP IPE was performed with the purpose of supporting an objective decision-making process by senior management aimed at maintaining an adequate level of safety to protect against risks associated with postulated severe accidents. The entire IPE analysis process was thoroughly documented and is scrutable.

The IPE was conducted using standard systems analysis practices such as those outlined in NUREG/CR-2300, "PRA Procedures Guide – A Guide to the Performance of Probabilistic Risk Assessments for Nuclear Power Plants" (**Reference 3**) and NUREG/CR-2815, "Probabilistic Safety Analysis Procedures Guide" (**Reference 4**). However, innovative techniques were developed for several areas of the analyses. The traditional event tree analysis and containment analysis portions of the PRA were integrated through the use of plant response trees (PRTs) that depict the combinations of events and model the plant behavior from the initiating event to an end state characterized by retention of fission products within the containment boundary or release to the environment. The accident sequence and containment response code, Modular Accident Analysis Program (MAAP) (**Reference 5**), was utilized to characterize success criteria, timing, and containment response.

The Back-End Analysis involved analyzing representative sequences to determine the timing and nature of any radionuclide releases to the environment. This task required gathering information relative to the FNP containment design, modeling the response of the containment systems, assessing the impact of phenomena controlling severe accident progression, and modeling the mechanistic processes that control the transport of fission products within the containment boundary.

The models developed in the IPE represented the as-built, as-operated, as-maintained FNP as of May 1, 1991, with some exceptions that were explicitly cited throughout the IPE Submittal Report. Care was taken to ensure that only formal procedures in which the operators are trained were credited. The value of equipment or procedural improvements was investigated through sensitivity studies.

Subsequent to the IPE, the FNP PRA model was converted from the Large Event Tree methodology based on the Westinghouse GRAFTER and WESCUT computer codes to a Linked Fault Tree methodology based on the Electric Power Research Institute (EPRI) Computer Aided Fault Tree Analysis (CAFTA) computer code suite. This conversion was completed in March 1998 and the resulting model was designated as Revision 1 of the FNP PRA. Revision 1 updated plant design features to represent the as-built, as-operated, as-maintained FNP as of 12/31/1997. The data and HRA analysis used in Revision 1 continued to be based on the IPE analysis. This revision is documented in the FNP CAFTA Conversion Project notebooks and SNC Technical Services Calculation PSA-F-98-003 (**Reference 6**).

Revision 2 of the FNP PRA was issued in May 1998. This revision continued the refinement of the CAFTA Linked Fault Tree model and incorporated a new accident sequence event tree for Loss of RCP Seal Cooling. This new event tree structure changed the way RCP Seal LOCA sequences were quantified by binning these events into either a general transient mitigation model for leakage rates less than 21 gpm per pump or into a Small LOCA mitigation model for leakage rates greater than 21 gpm per pump. The data and HRA analysis used in Revision 2 continued to be based on the IPE analysis. Revision 2 is documented in SNC Technical Services Calculation PSA-F-98-004 (**Reference 7**).

Revision 3 of the FNP PRA was issued in August 1999. This revision continued the refinement of the CAFTA Linked Fault Tree model and incorporated plant design changes through May 1999. The initiating event and component reliability data used in Revision 3 were based on plant data collected through December 31, 1997 as documented in SNC Technical Services Calculation PSA-F-99-007 (**Reference 8**). The initiating event analysis for Revision 3 was also updated to be consistent with the initiating event categories in NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995" (**Reference 9**). In addition, new event tree models for SBO and Anticipated Transient Without Trip (ATWT) were incorporated. Revision 3 is documented in SNC Technical Services Calculation PSA-F-99-010 (**Reference 10**).

Revision 4 of the FNP PRA was issued in May 2000. This revision included model enhancements to more effectively use the FORTE quantification code, revised HRA analysis for several events where procedural changes had occurred (SNC Technical Services Calculation PSA-F-00-00115), revised flooding analysis for the CCW heat exchanger/pump room and the Service Water Intake Structure (SNC Technical Services Calculation PSA-F-00-00216), and new system models for the emergency air system and the Unit 2 Service Water Pump Lube and Cooling system. Revision 4 is documented in SNC Technical Services Calculation PSA-F-00-009 (**Reference 11**).

A minor update to modify the flag events used to designate the running status of Instrument Air Compressors was issued as Revision 4a in September 2000. This change did not affect the baseline quantification results, but added flexibility to the model needed for the Equipment Out Of Service (EOOS) application used in work planning. Revision 4a is documented in SNC Technical Services Calculation PSA-F-00-019 (**Reference 12**).

Revision 5 of the FNP PRA was issued in November 2001. This revision included model changes to address comments from the WOG PRA Peer Review conducted in August 2001 and incorporated plant design changes completed or planned for completion through the Unit 1 17th refueling outage. Revision 5 is documented in SNC Technical Services Calculation PSA-F-01-017 (**Reference 13**).

1.2 TREATMENT OF EXTERNAL EVENT CONTRIBUTORS

The contribution from external events was treated by doubling the internal events contribution. This sufficiently bounds the risk from external events for the following reasons:

- The FNP IPEEE found that containment response to core damage external events was similar to that from the internal events in the IPE. The FNP IPEEE found no external events vulnerabilities in terms of containment bypass or isolation failure, so an internal events profile can be used to bound the offsite consequences.

- Modifications have been completed to improve equipment response to seismic events as a result of insights from the IPEEE.

- Modifications have been made to improve tornado missile protection for several yard structures at FNP since the completion of the IPEEE.

- Modifications are planned to eliminate dependence on Kaowool barriers for Appendix R compliance. The planned improvements being considered involve a combination of cable re-routes, fire barrier upgrades, analyses to demonstrate the acceptability of the existing condition with no credit for Kaowool, and other measures.

- The CDF calculated in the IPEEE was comparable to the internal events CDF at the time. Since completion of the IPEEE, the FNP internal events PRA has been converted from a large event tree model to a linked fault tree. This and other improvements in model fidelity and plant design have resulted in a reduction of the internal events CDF by a factor of approximately 3. Since the major contributors to CDF from external events are similar to the major contributors to CDF from internal events, and since improvements have been made or are planned to improve plant response to seismic and fire events, a similar or greater reduction would be expected for the external events CDF.

2.0 LEVEL 3 PRA ANALYSIS

The MACCS2 code (**Reference 14**) was used to perform the Level 3 PRA for the FNP. The input parameters given with the MACCS2 "Sample Problem A," which included the NUREG-1150 food model (**Reference 15**), formed the basis for the present analysis. These generic values were supplemented with parameters specific to FNP and the surrounding area. Site-specific data included population distribution, economic parameters, and agricultural production. Plant-specific release data included the time-activity distribution of nuclide releases and release frequencies. The behavior of the population during a release (evacuation parameters) was based on plant and site-specific set points (i.e., declaration of a General Emergency) and evacuation time estimates (**Reference 16**). These data were used in combination with site and region-specific meteorology to simulate the probability distribution of impact risks (exposure and economic) to the surrounding (within 50 miles) population from the evaluated accident sequences at FNP.

2.1 POPULATION

The collective dose to the public was calculated by considering the population within a 50-mile radius from FNP. A fifty-mile circular area is the standard range used in modeling consequences to the off-site population from an airborne release. The area was divided into 16 pie-shaped wedges, each spanning 22.5-degree angles representing compass directions which start at north and move clockwise through north-northwest. The area was further divided into 10 annular regions, at radii corresponding to 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles from the center. The combination of 10 radial and 16 angular divisions resulted in 160 sectors in which the concentrations were calculated by the airborne dose models.

The population in each of these 160 sectors was calculated using 1990 and 2000 US Census population data as follows:

- Geographical information system (GIS) software was used to create a 160-sector overlay onto a regional map centered at the site coordinates.
- Block-group (BG) population data from the 1990 and 2000 U.S. Census for the 50-mile radius encompassing the site were downloaded to the GIS. These data consist of total populations within the geographic boundaries of each BG.
- The geographic boundaries of each BG were defined in the GIS and overlain onto the sector map. Some sectors contained one or more whole BGs and/or partial BGs. The area that each BG occupied within a sector was calculated and used to estimate the BG's population contribution to that sector.
- The population in each sector was calculated as the sum of each BG's population, prorated by the fraction of the BG's area within that sector.

Tables F-1 and **F-2** list the population for the years 1990 and 2000, respectively, in each of the 160 sectors, as well as the radial totals, directional totals and grand totals for the entire 50-mile radius. A constant population growth/loss rate model, based on the year 1990 and year 2000 population changes in each sector, was applied to project the population to the year 2041. This model consists of calculating the rate of population growth or loss – dividing the year 2000 population by the year 1990 population in each sector – and assuming this growth or loss rate will remain constant over the projected period. **Table F-3** lists the annualized population growth or loss rate for each sector based on the changes in population between 1990 and 2000. For the year 2041 projection, the decennial growth or loss in a sector's population was raised to the power of 4.1 (the 41-year difference between 2041 and 2000, divided by 10 years). The resulting scaling factor was applied to the sector's year 2000 population. For example, if a sector's population decreased from 100 to 90 people between 1990 and 2000, the resulting ratio of 0.90 was raised to the power of 4.1. This scaling factor of 0.65 was applied to the year 2000 population of 90 in that sector, to obtain a year 2041 projection of 58. Alternatively, if the population increased from 100 to 110, the resulting ratio of 1.1 raised to the power of 4.1 would give a scaling factor of 1.48. Multiplying the year 2000 population of 110 by 1.48 results in a year 2041 projection of 163. **Table F-4** lists the population projected to the year 2041 for the 50-mile radius around FNP.

The population projection approach used here is more conservative (that is, it will likely overestimate future populations) than a constant linear growth or loss model. In a constant linear growth/loss model, the number of people added to, or lost from, each sector between 1990 and 2000 is first calculated. The net change in population between 1990 and 2000 is then multiplied by 4.1 to estimate the net change in population that may occur between 2000 and 2041. That net change (positive for population growth, negative for population loss) is added to the year 2000 population for that sector. This approach yields a lower population growth than the constant growth rate model, and sometimes results in negative population values for those sectors in which a large fraction of the population was lost between the years 1990 and 2000.

2.2 ECONOMY

MACCS2 requires the spatial distribution of certain economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and non-farm land) in the same manner as the population. This was done by specifying the data for each of the 28 counties surrounding the plant, to a distance of 50 miles. The values used for each of the 160 sectors were obtained from the data corresponding to the counties which made up more than 2/3rd of the area in their sectors. For 34 sectors, no county encompassed more than 2/3rd of the area, so data, weighted by the fraction of each county in that sector, was defined.

In addition, generic economic data that are applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. These revised parameters include per diem living expenses (applied to owners of interdicted properties and relocated populations), relocation costs (for owners of interdicted properties), value of farm and non-farm wealth, and fraction of farm wealth from improvements (e.g., buildings, equipment).

2.3 AGRICULTURE

Agricultural production information was taken from the 1997 Agricultural Census (**Reference 17**). Production within 50 miles 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. Cotton and tobacco, non-foods, were harvested from 24 percent of the croplands within 50 miles of the site. Of the food crops, legumes (26 percent of total cropland, consisting mainly of peanuts and soybeans) and grain (18 percent, chiefly corn and wheat) were harvested from the largest areas. The total food and commercial harvest consumed approximately 75 percent of the croplands within 50 miles of the site; pasture made up another 15 percent of this land.

The growing seasons' durations were obtained from **Reference 18**, when available. **Reference 19** was used as a secondary source.

2.4 NUCLIDE RELEASE

The core inventory at the time of the accident was based on the input supplied in the MACCS User's Guide (**Reference 14**). The core inventory corresponds to the end-of-cycle values for a 3412-MWth PWR plant. A scaling factor of 0.813 was used to provide a representative core inventory of 2775-MWth at FNP. **Table F-5** gives the estimated FNP core inventory. Release frequencies, shown in **Table F-6,** and nuclide release fractions (of the core inventory) were analyzed to determine the sum of the exposure (50-mile dose) and economic (50-mile economic costs) risks from 13 accident sequences (also given in Table F-6). Each accident frequency was chosen to represent the set of similar accidents. FNP nuclide release categories were related to the MACCS categories as shown in **Table F-7.** Multiple release duration periods were defined which represented the time distribution of each category's releases.

The reactor building has a diameter of 137.5 feet and a height of 135.75 feet. All releases were modeled as occurring at ground level. The thermal content of each of the releases was conservatively assumed to be the same as ambient, i.e., buoyant plume rise was not modeled.

2.5 EVACUATION

Reactor trip for each sequence was taken as time zero relative to the core containment response times. A General Emergency is declared when plant conditions degrade to the point where it is judged that there is a credible risk to the public; it was assumed here that the declaration would coincide with the onset of core melt. **Table F-8** shows the resulting declaration times.

The MACCS2 User's Guide input parameters of 95 percent of the population within 10 miles of the plant (Emergency Planning Zone) evacuating and 5 percent not evacuating were employed. These values have been used in similar studies (e.g., **References 20** and **21**) and are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the Emergency Planning Zone (**Reference 15**). The evacuees are assumed to begin evacuation 30 minutes (**Reference 16**) after a general emergency has been declared and are evacuated at a radial speed of 0.65 meters/sec. This speed is derived from the minimum speed from any evacuation zone under adverse conditions. As such, it encompasses not only adverse traffic and weather conditions, but also that some evacuees will begin evacuating at times later than 30 minutes.

2.6 METEOROLOGY

Annual meteorology data sets from 1998 through 2000 were investigated for use in MACCS2. The 1998 data set was found to result in the largest doses and was subsequently used to create the one-year sequential hourly data set used in MACCS2. The conditional dose from each of the other years was within 10 percent of the chosen year. Onsite wind speed and direction from the 35-foot sensor were combined with atmospheric stability (specified according to the vertical temperature gradient as measured between the 200-foot and 35-foot levels). Hourly stability was classified according to the scheme used by the NRC (**Reference 22**).

National Weather Service (NWS) precipitation measurements at Dannelly Field in Montgomery, Alabama, were used in the simulation. This location was the closest to the FNP site having a complete set of hourly precipitation for the time period of interest (1998-2000). A complete onsite data set for the year 1998 was available; substitution of the latter for the NWS data resulted in a decrease in dose and economic risk of 2 percent. Inspection of annual precipitation quantities (**Reference 23**) indicated that 1998 was a year with historically low precipitation. The effect of a greater precipitation rate was investigated by multiplying the 1998 hourly precipitation data set by the ratio (1.42) of the annual quantities from 1996 (a recent year of high precipitation) and 1998; the result was a decrease in risk of less than 2 percent.

Atmospheric mixing heights were specified for AM and PM hours. These values were taken as 500 and 1400 meters, respectively (**Reference 24**).

2.7 MACCS2 RESULTS

The resulting annual risk from the analyzed FNP releases is provided in **Table F-9.**

The largest risk is from sequence B09 (representing bin 11). Almost all of the noble gases, iodine, and cesium (as well as much of the other release categories) are released shortly after a general emergency is declared for this sequence. As such, it represents close to a bounding accident scenario. Any scenario (e.g., beyond design basis external event initiators) not encompassed by the sequences analyzed here would be expected to have impacts (i.e., dose and costs) not significantly greater than B09. Although the risk from this sequence is ameliorated by its relatively small frequency of occurrence, beyond design basis external events will likely have similar frequencies.

MACCS2 calculated the annual baseline population dose risk within 50 miles at 1.214 person-rem. The total annual economic risk was calculated at $1,824. These values apply to Unit 1 and are assumed to apply to Unit 2 due to the similar results obtained in the Level 1 and Level 2 PSA models for the two units.

Table F-1. Year 1990 Population within 50 Miles of FNP.

Sector	0 - 1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50-mile total
N	4	11	15	36	271	582	638	1,821	2,473	12,570	18,421
NNE	4	9	12	18	94	486	1,634	1,820	2,379	3,743	10,199
NE	4	7	12	16	24	375	2,471	1,790	2,848	2,706	10,253
ENE	4	8	12	16	22	284	2,278	1,316	1,346	1,667	6,953
E	3	8	12	16	22	179	1,238	2,680	1,565	3,011	8,734
ESE	4	8	12	16	22	199	900	2,502	3,156	3,619	10,438
SE	4	7	12	16	22	222	3,676	2,682	10,379	8,647	25,667
SSE	4	8	12	17	27	231	1,297	1,447	8,106	8,558	19,707
S	4	10	24	38	49	381	1,240	3,478	5,023	4,400	14,647
SSW	4	11	24	40	52	408	1,331	4,078	12,138	2,945	21,031
SW	4	11	18	31	47	485	2,621	3,493	6,863	10,894	24,467
WSW	4	11	18	24	80	1,481	4,689	5,064	5,467	7,597	24,435
W	4	11	18	26	99	1,646	43,988	11,216	7,828	12,186	77,022
WNW	4	11	18	24	32	698	9,547	7,876	26,881	22,165	67,256
NW	4	11	18	24	32	452	3,306	2,073	3,904	4,598	14,422
NNW	4	11	18	24	32	216	874	4,222	2,269	3,645	11,315
Total	63	153	255	382	927	8,325	81,728	57,558	102,625	112,951	364,967

Table F-2. Year 2000 Population within 50 Miles of FNP.

Sector	0 - 1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50-mile total
N	0	7	14	42	240	560	681	2,515	3,519	13,311	20,889
NNE	0	7	12	12	91	487	1,486	1,159	2,343	3,827	9,424
NE	0	12	12	23	32	397	2,439	1,678	3,525	2,723	10,841
ENE	0	12	12	23	23	349	2,589	1,416	1,893	2,000	8,317
E	0	12	12	23	23	185	1,356	2,731	1,672	3,616	9,630
ESE	0	12	12	23	23	220	1,021	2,120	3,291	4,145	10,867
SE	0	12	12	23	23	262	3,569	2,896	11,689	9,462	27,948
SSE	0	12	12	23	35	254	1,281	1,561	7,849	8,820	19,847
S	0	7	24	36	48	386	1,304	4,389	6,005	5,223	17,422
SSW	0	7	19	36	48	396	2,129	4,931	12,923	4,253	24,742
SW	0	7	14	26	43	535	2,942	3,823	7,107	12,787	27,284
WSW	0	7	14	21	82	1,433	6,227	6,028	6,663	8,192	28,667
W	0	7	14	21	97	1,770	42,017	16,949	8,234	12,509	81,618
WNW	0	7	14	21	29	781	9,793	9,533	25,508	23,222	68,908
NW	0	7	14	21	29	478	3,553	2,267	4,591	5,893	16,853
NNW	0	7	14	21	29	235	931	4,141	2,484	3,508	11,370
Total	0	142	225	395	895	8,728	83,318	68,137	109,296	123,491	394,627

Table F-3. Annualized Population Growth/Loss Rates between 1990 and 2000 for Sectors within 50 Miles of FNP.[a]

Sector	0 - 1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles
N	0.0000	**0.9596**	**0.9920**	1.0142	**0.9880**	**0.9963**	1.0065	1.0328	1.0359	1.0057
NNE	0.0000	**0.9810**	**0.9969**	**0.9573**	**0.9972**	1.0000	**0.9906**	**0.9559**	**0.9985**	1.0022
NE	0.0000	1.0481	**0.9969**	1.0358	1.0273	1.0059	**0.9987**	**0.9936**	1.0216	1.0006
ENE	0.0000	1.0430	**0.9969**	1.0358	1.0065	1.0208	1.0129	1.0073	1.0347	1.0184
E	0.0000	1.0430	**0.9969**	1.0358	1.0065	1.0034	1.0091	1.0019	1.0066	1.0185
ESE	0.0000	1.0430	**0.9969**	1.0358	1.0065	1.0099	1.0127	0.9836	1.0042	1.0136
SE	0.0000	1.0481	**0.9969**	1.0358	1.0065	1.0165	**0.9970**	1.0077	1.0120	1.0090
SSE	0.0000	1.0432	**0.9969**	1.0284	1.0264	1.0093	**0.9988**	1.0076	**0.9968**	1.0030
S	0.0000	**0.9629**	**0.9978**	**0.9926**	**0.9963**	1.0013	1.0050	1.0235	1.0180	1.0173
SSW	0.0000	**0.9596**	**0.9788**	**0.9893**	**0.9915**	**0.9972**	1.0481	1.0192	1.0063	1.0374
SW	0.0000	**0.9596**	**0.9746**	**0.9824**	**0.9899**	1.0097	1.0116	1.0091	1.0035	1.0161
WSW	0.0000	**0.9596**	**0.9772**	**0.9869**	1.0013	**0.9967**	1.0288	1.0176	1.0200	1.0076
W	0.0000	**0.9596**	**0.9772**	**0.9796**	**0.9984**	1.0073	**0.9954**	1.0422	1.0051	1.0026
WNW	0.0000	**0.9596**	**0.9772**	**0.9869**	**0.9898**	1.0112	1.0025	1.0193	**0.9948**	1.0047
NW	0.0000	**0.9596**	**0.9772**	**0.9869**	**0.9898**	1.0056	1.0072	1.0090	1.0164	1.0251
NNW	0.0000	**0.9596**	**0.9772**	**0.9869**	**0.9898**	1.0084	1.0064	**0.9981**	1.0091	**0.9962**

a. Numbers in bold indicate sectors in which a population loss is projected after the year 2000. All others are sectors with population growth.

Table F-4. Projected Year 2041 Population within 50 Miles of FNP.[a]

Sector	0 - 1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50-mile total
N	0	**1**	**10**	75	**147**	**481**	889	9,464	14,938	16,833	42,838
NNE	0	**3**	**10**	**2**	**81**	488	**1,008**	**182**	**2,202**	4,191	8,167
NE	0	79	**10**	98	96	506	**2,312**	**1,288**	8,450	2,794	15,633
ENE	0	65	**10**	98	30	811	4,378	1,911	7,656	4,222	19,181
E	0	65	**10**	98	30	212	1,969	2,949	2,193	7,654	15,180
ESE	0	65	**10**	98	30	330	1,716	1,076	3,906	7,223	14,454
SE	0	79	**10**	98	30	512	**3,161**	3,967	19,032	13,687	40,576
SSE	0	65	**10**	73	102	370	**1,218**	2,128	**6,875**	9,983	20,824
S	0	**2**	**22**	**26**	**41**	408	1,602	11,398	12,494	10,548	36,541
SSW	0	**1**	**8**	**23**	**34**	**353**	14,600	10,745	16,708	19,188	61,660
SW	0	**1**	**5**	**13**	**28**	794	4,726	5,536	8,199	24,659	4,3961
WSW	0	**1**	**6**	**12**	86	**1,250**	19,923	12,318	14,991	11,161	59,748
W	0	**1**	**6**	**9**	**91**	2,388	**34,815**	92,112	10,127	13,926	153,475
WNW	0	**1**	**6**	**12**	**19**	1,235	10,866	20,855	**20,576**	28,109	81,679
NW	0	**1**	**6**	**12**	**19**	600	4,775	3,277	8,927	16,309	33,926
NNW	0	**1**	**6**	**12**	**19**	331	1,209	**3,823**	3,603	**3,001**	12,005
Total	0	431	**145**	759	**883**	11,069	109,167	183,029	160,877	193,488	659,848

a Numbers in bold indicate sectors in which a population loss is projected after the year 2000. All others are sectors with population growth.

Table F-5. Estimated FNP Core Inventory.

Nuclide	Core Inventory (Becquerels)	Nuclide	Core Inventory (Becquerels)
Co-58	2.62×10^{16}	Te-131m	3.80×10^{17}
Co-60	2.00×10^{16}	Te-132	3.79×10^{18}
Kr-85	2.01×10^{16}	I-131	2.61×10^{18}
Kr-85m	9.42×10^{17}	I-132	3.84×10^{18}
Kr-87	1.72×10^{18}	I-133	5.51×10^{18}
Kr-88	2.33×10^{18}	I-134	6.05×10^{18}
Rb-86	1.53×10^{15}	I-135	5.20×10^{18}
Sr-89	2.92×10^{18}	Xe-133	5.51×10^{18}
Sr-90	1.58×10^{17}	Xe-135	1.03×10^{18}
Sr-91	3.75×10^{18}	Cs-134	3.52×10^{17}
Sr-92	3.90×10^{18}	Cs-136	1.07×10^{17}
Y-90	1.69×10^{17}	Cs-137	1.97×10^{17}
Y-91	3.56×10^{18}	Ba-139	5.11×10^{18}
Y-92	3.92×10^{18}	Ba-140	5.05×10^{18}
Y-93	4.43×10^{18}	La-140	5.16×10^{18}
Zr-95	4.49×10^{18}	La-141	4.74×10^{18}
Zr-97	4.68×10^{18}	La-142	4.57×10^{18}
Nb-95	4.25×10^{18}	Ce-141	4.59×10^{18}
Mo-99	4.96×10^{18}	Ce-143	4.47×10^{18}
Tc-99m	4.28×10^{18}	Ce-144	2.77×10^{18}
Ru-103	3.69×10^{18}	Pr-143	4.39×10^{18}
Ru-105	2.40×10^{18}	Nd-147	1.96×10^{18}
Ru-106	8.39×10^{17}	Np-239	5.26×10^{19}
Rh-105	1.66×10^{18}	Pu-238	2.98×10^{15}
Sb-127	2.27×10^{17}	Pu-239	6.72×10^{14}
Sb-129	8.03×10^{17}	Pu-240	8.47×10^{14}
Te-127	2.19×10^{17}	Pu-241	1.43×10^{17}
Te-127m	2.90×10^{16}	Am-241	9.42×10^{13}
Te-129	7.53×10^{17}	Cm-242	3.61×10^{16}
Te-129m	1.99×10^{17}	Cm-244	2.11×10^{15}

Table F-6. Accident Sequence Frequencies.

Sequence	B01	B20	B37	B03	B07
Frequency	2.39×10^{-6}	6.75×10^{-6}	1.22×10^{-7}	7.65×10^{-6}	7.97×10^{-6}
Sequence	B04	B02	B735	B2153	B29
Frequency	3.48×10^{-6}	4.11×10^{-6}	1.94×10^{-7}	4.64×10^{-9}	1.00×10^{-7}
Sequence	B09	B1933	B4998		
Frequency	3.34×10^{-7}	2.72×10^{-7}	8.36×10^{-8}		

Table F-7. MACCS Release Categories vs. FNP Release Categories.

MACCS Release Categories	FNP Release Categories
Xe/Kr	1 – noble gases
I	2 – CsI
Cs	2 & 6 – CsI and CsOH
Te	3 & 11- TeO_2 & Te_2
Sr	4 – SrO
Ru	5 – MoO_2 (Mo is in Ru MACCS category)
La	8 – La_2O_3
Ce	9 – CeO_2 & UO_2
Ba	7 – BaO
Sb (supplemental category)	10 – Sb

Table F-8. General Emergency Declaration Times (hours from reactor trip).

Sequence	B01	B20	B37	B03	B07
G.E. Time	1.1	1.1	5.0	5.5	19.8
Sequence	B04	B02	B735	B2153	B29
G.E. Time	2.2	14.5	6.6	5.2	0.02
Sequence	B09	B1933	B4998		
G.E. Time	7.9	2.0	19.8		

Table F-9. Results of FNP Level 3 PRA Analysis (Annual Risk).

Sequence	B01	B20	B37	B03	B07	B04	B02
Population dose risk (person-rem) 0-50 miles	0.062	0.100	0.002	0.044	0.060	0.029	0.003
Total economic cost risk ($) 0-50 miles	2.58	1.92	0.06	0.86	1.43	0.52	0.03

Sequence	B735	B2153	B29	B09	B1933	B4998	**SUM**
Population dose risk (person-rem) 0-50 miles	0.004	0.000	0.002	0.695	0.167	0.045	**1.214**
Total economic cost risk ($) 0-50 miles	0.12	0.00	0.06	1,486	249.7	80.6	**1,824**

3.0 DETERMINATION OF PRESENT VALUE FOR THE BASE CASE

This section explains how SNC calculated the monetized value of the status quo (i.e., accident consequences without SAMA implementation). SNC also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all FNP risk.

3.1 OFFSITE EXPOSURE COST

The baseline annual offsite exposure risk was converted to dollars using the NRC's conversion factor of $2,000 per person-rem (**Reference 25,** Section 5.7.1.2), and discounting to present value using the NRC standard formula (Reference 25, Section 5.7.1.3):

$W_{pha} = C \times Z_{pha}$

Where:

W_{pha} = monetary value of public health risk after discounting
C = $[1-\exp(-rt_f)]/r$
T_f = years remaining until end of facility life = 20 years
r = real discount rate (as fraction) = 0.07/year
Z_{pha} = monetary value of public health (accident) risk per year before discounting ($/year)

The Level 3 analysis showed an annual offsite population dose risk of 1.214 person-rem. The calculated value for C using 20 years and a 7 percent discount rate is approximately 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose (person-rem per year) by $2,000 and by the C value (10.76). The calculated offsite exposure cost is $26,123.

3.2 OFFSITE ECONOMIC COST

The Level 3 analysis showed an annual offsite economic risk of $1,824. Calculated values for offsite economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting value is $19,633.

3.3 ONSITE EXPOSURE COST

SNC evaluated occupational health using the NRC methodology in Reference 25, Section 5.7.3, which involves separately evaluating "immediate" and long-term doses.

<u>Immediate Dose</u> - For the case where the plant is in operation, the equation that NRC recommends using (Reference 25, Sections 5.7.3 and 5.7.3.3) is:

Equation 1:

$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\}\{[1 - \exp(-rt_f)]/r\}$

Where:

W_{IO} =monetary value of accident risk avoided due to immediate doses, after discounting
R = monetary equivalent of unit dose ($/person-rem)
F = accident frequency (events/yr)
D_{IO} = immediate occupational dose (person-rem/event)
$_S$ = subscript denoting status quo (current conditions)
$_A$ = superscript denoting after implementation of proposed action

r = real discount rate
t_f = years remaining until end of facility life.

The values used in the FNP analysis are:

R = \$2,000/person-rem
r = 0.07
D_{IO} = 3,300 person-rem/accident (best estimate)
t_f = 20 years (license extension period)
F = 3.35×10^{-5} (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$$W_{IO} = R\,(FD_{IO})_S\,\{[1 - \exp(-rt_f)]/r\}$$
$$= 2{,}000*3.35\times10^{-5}*3{,}300*\{[1 - \exp(-0.07*20)]/0.07\}$$
$$= \$2{,}376$$

<u>Long-Term Dose</u> - For the case where the plant is in operation, the NRC equation (**Reference 25,** Sections 5.7.3 and 5.7.3.3) is:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\,\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$$

Where:

W_{IO} = monetary value of accident risk avoided long-term doses, after discounting, \$
m = years over which long-term doses accrue
D_{LTO} = long-term occupational dose

The values used in the FNP analysis are:

R = \$2,000/person-rem
r = 0.07
D_{LTO} = 20,000 person-rem/accident (best estimate)
m = "as long as 10 years"
t_f = 20 years (license extension period)
F = 3.35×10^{-5} (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

$$W_{LTO} = R\,(FD_{LTO})_S\,\{[1 - \exp(-rt_f)]/r\}\,\{[1 - \exp(-rm)]/rm\}$$
$$= 2{,}000*3.35\times10^{-5}*20{,}000*\{[1 - \exp(-0.07*20)]/0.07\}\,\{[1 - \exp(-0.07*10)]/0.07*10\}$$
$$= \$10{,}358$$

<u>Total Occupational Exposure</u> - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) is:

$$W_O = W_{IO} + W_{LTO} = (\$2{,}376 + \$10{,}358) = \$12{,}735$$

3.4 ONSITE CLEANUP AND DECONTAMINATION COST

The net present value that NRC provides for cleanup and decontamination for a single event is \$1.1 billion, discounted over a 10-year cleanup period (Reference 25, Section 5.7.6.1). NRC uses the following equation in integrating the net present value over the average number of remaining service years:

$$U_{CD} = [PV_{CD}/r][1-\exp(-rt_f)]$$

Where:

PV_{CD} = Net present value of a single event
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the FNP analysis are:

PV_{CD} = $\$1.1\times10^9$
r = 0.07
t_f = 20

The resulting net present value of cleanup integrated over the license renewal term, $\$1.18\times10^{10}$, must be multiplied by the total core damage frequency of 3.35×10^{-5} to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is $396,083.

3.5 REPLACEMENT POWER COST

Long-term replacement power costs were determined following the NRC methodology in **Reference 25,** (Section 5.7.6.2). The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$$PV_{RP} = [\$1.2\times10^8/r] * [1 - \exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)
R = 0.07
t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$$U_{RP} = [PV_{RP} /r] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for FNP Unit 1's size relative to the "generic" reactor described in Reference 25 (i.e., 852 MWe/910 MWe), the replacement power costs are determined to be 7.39×10^9 ($-year). Multiplying this value by the CDF (3.35×10^{-5}) results in a replacement power cost of $247,148.

3.6 BASELINE SCREENING

The sum of the baseline costs is as follows:

Offsite exposure cost	=	$26,123
Offsite economic cost	=	$19,633
Onsite exposure cost	=	$12,735
Onsite cleanup cost	=	$396,083
Replacement Power cost	=	$247,148
Total cost	=	$701,722

SNC doubled this value to account for external events contributors to the CDF and rounded this value up to $1,400,000 to use in screening out SAMAs as economically infeasible; if the estimated cost of implementing a SAMA exceeded $1,400,000, SNC discarded it from further analysis. Exceeding this threshold would mean that a SAMA could not have a positive net value even if it could eliminate all severe accident costs.

3.7 SENSITIVITY ANALYSIS

A sensitivity analysis was performed by changing the real discount rate from seven to three percent. This had the effect of increasing the baseline cost-risk to $811,190. This change in the discount rate did not affect the number of SAMAs that were retained for further analysis.

4.0 PHASE I SAMA CANDIDATES AND SCREENING PROCESS

An initial list of 128 SAMA candidates (including 3 variants – 5A, 35A, and 63A) was developed from lists of Severe Accident Mitigation Design Alternatives at other nuclear power plants, NRC documents, and documents related to advanced power reactor designs. This initial list was then screened to remove those that were not applicable to the FNP plant due to design differences.

Twenty-eight of the initial 128 candidate SAMAs were removed from further consideration as they did not apply to the design used at FNP. Another 30 SAMA candidates have already been addressed in the existing FNP design and were thus dropped from further consideration. Seventeen procedural SAMA candidates were found that had already been addressed in FNP's procedures and/or training program and were also dropped from further consideration. Thirteen SAMA candidates were of sufficient similarity to other SAMA candidates that they were either combined or dropped from further consideration.

This left 40 unique SAMA candidates that were applicable to FNP and were of potential value in averting the risk of severe accidents. A preliminary cost estimate was prepared for each of these candidates to focus on those that had the possibility of having a net positive benefit and to eliminate those whose costs were clearly beyond the possibility of any corresponding benefit.

When the screening cutoff of $1,400,000 (**Section 3.6**) was applied, 25 candidates were eliminated that were more expensive than any possible off-setting benefit. This left 15 candidates for further analysis.

Table F-10 shows the disposition of the initial set of candidate SAMAs, including an indication of the screening criterion that was applicable for those candidate SAMAs that were removed from further consideration.

5.0 PHASE II SAMA ANALYSIS

For each of the 15 remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed estimated cost. This information was then used to evaluate the effect of the candidate changes upon the plant safety model.

During the Phase II analysis, it was determined that two of the SAMA candidates (numbers 102 and 125 in **Table F-10**) would not contribute to a significant reduction in the CDF and where very expensive ($1,000,000 each). These two SAMAs were subsequently excluded from a more detailed analysis. Another two SAMAs (numbers 41 and 46 in Table F-10) were determined to mitigate only the post core-damage release of radionuclides, but would not contribute to reducing the CDF itself. Their estimated costs, $900,000 and $450,000, respectively, greatly exceed the maximum attainable benefit from avoiding off-site releases (see **Sections 3.1** and **3.2**), which would not exceed $46,000. Therefore, these two SAMA candidates were further removed from detailed analysis.

Some of the remaining SAMAs were grouped to reflect similarities in modeling their implementation. The next step in the evaluation of these SAMAs was to develop a PRA model for each of the groups. This model was used to determine the change in CDF that could occur if the SAMA candidate were to be implemented. Since the implementation for these potential modifications has not been designed, a bounding approach to the analyses was used. Such a bounding model typically assumes the change is "perfect" in that it removes portions of the model representing failure of the affected portions of the PRA model. This approach gives the upper bound of the impact of the modification and is useful in elimination of candidates if this bounding impact is less than the implementation costs.

To focus cost estimate refinements, it is necessary to translate the change in CDF resulting from analyzing the SAMA candidate PRA model to a benefit in dollars to compare with the implementation cost estimates. For this purpose a bounding estimate of the benefit associated with each of the SAMA analysis cases was developed from the contributions to the maximum benefit that could possibly be attained from plant improvements (Maximum Attainable Benefit, MAB - equivalent to eliminating all risk due to the presence of the plant).

The MAB is made up on several contributions, as described in **Section 3.0:**

- offsite exposure costs
- offsite economic costs
- onsite exposure costs
- plant cleanup costs
- replacement power costs

The first two of these contributions are directly calculated in the Level 3 PRA analysis. The last three are calculated in accordance with methods published by the NRC and are proportional to core damage frequency.

Therefore, the estimate of the benefit for each SAMA sensitivity was made by determining the change in CDF between the current (baseline) model and that resulting from a model changed to represent the plant after implementation of a modification suggested by the SAMA. This change in CDF was used to estimate the change in the contribution to the last three cost contributors. The offsite costs were estimated by applying any changes from the baseline accident sequence frequencies (**Table F-6**) to the offsite dose and economic cost impacts evaluated in the Level 3 PRA model.

Comparing the implementation costs with the estimated benefit allows more of the SAMAs to be eliminated from further consideration. Those SAMAs that have an implementation cost much greater than the estimated benefit can be screened from further consideration. These SAMAs whose estimated benefits are close to or greater than the expected cost need to be further examined to ensure that the cost estimates are realistic.

A description of the remaining 11 SAMA candidates, the modeling changes that were made, and the results of the cost/benefit calculations, are provided in the following sections. A summary of the Phase II analyses is presented in **Table F-11.**

5.1 SAMA CANDIDATE 7 - INCREASE CHARGING PUMP LUBE OIL CAPACITY

SAMA Objective: SAMA would lengthen the time before centrifugal charging pump failure due to lube oil.

Applicability to FNP

The charging pumps perform functions associated with both HHSI and CVCS. The pumps are each located in separate watertight compartments, are seismically qualified, and are designed to perform functions important to safety.

Conceptual Modification

Fabricate a supplemental lube oil reservoir for each charging pump using safety-related piping. A rectangular tank 6" wide x 3' tall x 4' long would double the lube oil reservoir capacity. A tank this size could be installed on the wall adjacent to each pump and connected to the existing reservoir with small bore piping. Each new tank (including sight glass & vent, fill and drain valves) would be seismically supported to not affect the seismic qualification of the existing pump. The new reservoir would provide a parallel gravity fed supply source to the lube oil pump suction. The new reservoir would contain oil at the same static head as the existing reservoir. As oil was consumed from the existing system, oil from the supplemental system would allow for the addition of supplemental oil to equalize the static heads between the two reservoirs.

Model Changes: In this SAMA analysis, it is assumed that the charging pumps do not require any cooling (i.e., cooling is perfectly reliable).

The following gates were removed to delete the dependence on oil cooling. Similar changes were made for Cooling to High Head Pumps B and C.

Cooling to High Head Pump A;

Gate HH0070A (input to HH0023A),

Gate HH0070A-SBO (input to HH0023A-SBO),

Gate HHR0070A (input to HHR0023A),

Gate HHR0070A (input to HH0070A),

Gate HHR0070A-SBO (input to HHR0023A-SBO),

Gate HHR0070A-SBO (input to HH0070A-SBO),

Gate SINJ0104 (input to SINJ0099),

Gate SINJ0104 (input to SREC071).

Assumptions Used in Conceptual Modification

Increasing the oil volume in each room would increase the combustible loading. This increase in combustible loading would be addressed by engineering analysis or evaluation and would not require modifications to the plant.

Cost/Benefit Calculation

Estimated Implementation Cost: $270,000/unit

Estimated Reduction in Risk Benefit: $59,621/unit

Estimated Net Benefit: ($210,379/unit)

Sensitivity Analysis

Another case was developed to be more realistic; rather than eliminating the cooling dependency, in this case a "recovery potential" was modeled (event SAMA-CHG-OILCLG), which was ANDed with the existing dependency and the new event was assigned a value of 0.2. This event was ANDed with each of the gates listed above. This case resulted in a reduction in risk benefit of $45,904 and a net benefit of -$224,096.

Conclusion

A large negative net benefit was determined for both cases, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.2 SAMA CANDIDATE 11 - USE EXISTING HYDRO TEST PUMP FOR RCP SEAL INJECTION

SAMA Objective: SAMA would provide an independent seal injection source, without the cost of a new system.

Applicability to FNP

RCP seal injection is performed by the charging pumps. The charging pumps take suction from the RWST during emergency conditions. The hydro test pump also takes suction from the RWST. Therefore this SAMA would provide another prime mover of the cooling medium but not an independent cooling medium.

Conceptual Modification

For this SAMA to be effective at FNP, an alternate source of seal injection would have to be established in less than 15 minutes. Process connections would be required in the hydro test pump discharge and the RCP seal injection line, upstream of the split to supply each pump. The hydro test pump suction isolation valve would be replaced with an MOV. An MOV would be installed in the new line from the hydro test pump to the seal injection line and an MOV would be required in the seal injection line, upstream of the new process connection. All of these new MOVs would be safety-related. Additionally, the power supply to the hydro test pump would have to be changed to a class 1E supply.

Model Changes: The model represents improvement in the recovery potential for CCW through improved procedures and/or additional seal injection alternatives.

(1) Added an event under Gate #GENTRA-RCP-SC called SAMA-CCWREC-SENS to represent the probability of failure of use of another system that could provide seal injection.

(2) Set value to 0.1.

Assumptions Used in Conceptual Modification

Seal injection flow from the hydro test pump can leave the pump through the normal seal return flow path.

Cost/Benefit Calculation

Estimated Implementation Cost: $520,000/unit

Estimated Reduction in Risk Benefit: $229,028/unit

Estimated Net Benefit: ($290,972/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.3 SAMA CANDIDATE 24 - PROCEDURES FOR ACTIONS ON LOSS OF HVAC

SAMA Objective: SAMA would provide for improved credit to be taken for loss of HVAC sequences (improved affected electrical equipment reliability upon a loss of Control Building HVAC).

Applicability to FNP

A review of FNP procedures did not locate specific procedures to accomplish the objective of this SAMA. Therefore this SAMA is applicable to FNP.

Conceptual Modification

For this SAMA to be effective at FNP, remote indication of room temperature would be required so that operators would know when to take action. This would require installation of temperature sensors in the following pump rooms: Charging, RHR, Containment Spray, Auxiliary Feedwater and Component Cooling. Control circuits would be designed to generate an alarm in the main control room when room temperatures exceeded the design limit. The existing fan trouble alarm annunciator for each room could be used to alarm the over-temperature condition. This would require re-labeling of the annunciator window and procedure revisions to instruct operators to perform actions to mitigate the effects of a loss of HVAC. All components including the new temperature sensors, conduit & cabling, relays, etc. would be safety related.

Model Changes: The SAMA analysis models (one for each system requiring room cooling) represent the bounding case for each system in which it is assumed that the room cooling is perfect (cannot fail, i.e., removed from the model).

Auxiliary Feedwater Dependence on Room Cooling:

Train A MDAFW pump room cooling is modeled in gate HVAC-AFWA (input to AFW-0048) and HVAC-AFWA-SL (input to AFW-0048-SL). These HVAC gates were removed in this model to delete the dependence on HVAC.

Train B MDAFW pump room cooling is modeled in gate HVAC-AFWB (input to AFW-0113) and HVAC-AFWB-SL (input to AFW-0113-SL). These HVAC gates were removed in this model to delete the dependence on HVAC.

Cost/Benefit Calculation

Estimated Implementation Cost: $830,000/unit

Estimated Reduction in Risk Benefit: $64,019/unit

Estimated Net Benefit: ($765,981/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.4 SAMA CANDIDATE 89 - INSTALL ADDITIONAL INSTRUMENTATION FOR ISLOCAS

SAMA Objective: Presence of leak monitoring instruments installed between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HHSI lines would decrease ISLOCA frequency.

Applicability to FNP

This SAMA is directly applicable to FNP.

Conceptual Modification

Provide taps with isolation valves, pressure sensors for the subject lines. The sensors would be wired to local control stations for annunciation.

Model Changes: In this model, the ISLOCA sequences have been removed as a contributor. Gate @ISL (input to gates CDF1, VA, and LER-2) was removed to quantify the model without ISLOCA contribution.

Assumptions Used in Conceptual Modification

- Assume no existing taps are between the isolation valves
- Assume local indication only

Cost/Benefit Calculation

Estimated Implementation Cost: $425,000/unit

Estimated Reduction in Risk Benefit: $37,500/unit

Estimated Net Benefit: ($387,500/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.5 SAMA CANDIDATE 96 - ADD REDUNDANT AND DIVERSE LIMIT SWITCHES TO EACH CONTAINMENT ISOLATION VALVE

SAMA Objective: Enhanced isolation valve position indication could reduce the frequency of containment isolation failure and ISLOCAs.

Applicability to FNP

Containment isolation valves form a part of the containment boundary. The containment isolation valves' safety function is related to minimizing the loss of reactor coolant inventory and establishing the containment boundary during a DBA.

This SAMA proposes to install redundant and diverse limit switches to each containment isolation valve to enhance isolation valve position indication, which could reduce the frequency of containment isolation failure and ISLOCAs.

Conceptual Modification

Provide additional limit switches for all containment isolation valves.

Model Changes: In this model, the ISLOCA sequences have been removed as a contributor, as have failures of containment isolation. This is modeled by setting gates @ISL and CI2 in the model to "FALSE" and performing the "COMPRESS TRUE/FALSE" function, effectively removing the Interfacing Systems LOCA initiator and the failure of Containment Isolation from the model.

Gate @ISL is an input to gates
CDF1,
VA, and
LER-2).

Gate CI2 is an input to gates
IA-7-001,
IAS-7-001,
IB-7-001,
IBS-7-001,
IIA-7-001,
IIB-7-001,
IIIA13,
IIIA15,
IIIA17,
IIIA19,
IIIA21,
IIIA23,
IIIB13,
IIIB15,
IIIB17,
IIIB19,
IIIB21,
IIIB23,
IIIC13,
IIIC15,
IIIC17,
IIIC19,
IIIC21,
IIIC23,

IIID13,
IIID15,
IIID17,
IIID19,
IIID21,
IIID23,
IV-32,
IV-34,
IV-36,
IV-38,
IV-40, and
IV-42).

Cost/Benefit Calculation

Estimated Implementation Cost: $960,000/unit

Estimated Reduction in Risk Benefit: $37,500/unit

Estimated Net Benefit: ($922,500/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.6 SAMA CANDIDATE 101 - INSTALL A DIGITAL FEEDWATER UPGRADE

SAMA Objective: This SAMA would reduce the chance of a loss of main feedwater following a plant trip.

Applicability to FNP

The turbine-generator system is already equipped with a WDPF digital electrohydraulic (DEH) control system to control steam flow through the turbine. The DEH control system performs two main functions -control of turbine speed and control of turbine load. The operator controls the turbine and receives his information from the manual OIM panel or the operator's/alarm CRT and keyboard along with an alarm and message printer. Pre-assembled cables connect the operator's man-machine interface (MMI) and printer to the operator's DPU.

FNP anticipates the installation of a similar control system for the feedwater system.

Conceptual Modification

Install input/output devices, instrumentation and cable to enable key parameters of the feedwater system to be monitored and or controlled digitally. The I/O devices would be connected to a computer with control room display.

Model Changes: This case is represented by the base model with gates representing FW Flow Control Valve failures removed to represent perfect FRV behavior. These are gates MFW50043 (A), MFW50180 (B), and MFW50208 (C). In this model these gates are removed from gates MFW50002 (A), MFW51070 (B) and MFW50198 (C), respectively.

Assumptions Used in Conceptual Modification

Some piping taps with isolation valves would have to be installed in the feedwater piping.

Cost/Benefit Calculation

Estimated Implementation Cost: $900,000/unit

Estimated Reduction in Risk Benefit: $92,233/unit

Estimated Net Benefit: ($807,767/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.7 SAMA CANDIDATE 117 - LEAK-TIGHT ENCLOSURE FOR FIRE PROTECTION PIPING IN UNIT 1 CABLE SPREADING ROOM

SAMA Objective: SAMA would eliminate flooding scenario.

Applicability to FNP

A fire protection pre-action sprinkler system provides area coverage throughout the Unit 1 Cable Spreading Room (CSR) with spray nozzles located near the ceiling. The sprinkler system piping is supplied by an 8" header located in the CSR that penetrates the west wall and goes down through the floor to el. 121'. The portion of the 8" header that is located in the CSR is approximately 7'-3" in length and is normally filled with water up to the control valve station located in room 319, which is immediately outside the CSR.

Conceptual Modification

This section of the 8" fire protection would be enclosed in a leak-tight enclosure to the wall and ceiling of the CSR.

Installing a leak-tight enclosure on the 8" header piping could be accomplished by the use of grooved-joint piping with Victaulic fittings including elbows and couplings. The pipe specification would be for carbon steel schedule 40 pipe with grooved-joints and fittings, which would allow for a more flexible installation. The piping would require attachments to the wall and floor and a way to drain the piping if a rupture should occur. The guard piping would need to be seismically restrained to prevent potential damage to safety-related equipment or cable trays located in the Cable Spreading Room.

Model Changes: This SAMA would install a guard pipe on the current fire protection ring header. This would mean that the ring header would have to rupture (8.4×10^{-6}) and then the guard pipe would have to rupture. For this evaluation, it is assumed that the guard pipe has a rupture probability of 0.001. This was modeled by ANDing a new event called SAMA-FLD4-SENS (0.001) with the current event %FFLOOD4 under a new gate called SAMA001. SAMA001 is an input to #FFLOOD34.

Assumptions Used in Conceptual Modification

It is assumed the sprinkler system piping is filled with water because the system has been activated.

Cost/Benefit Calculation

Estimated Implementation Cost: $122,000/unit

Estimated Reduction in Risk Benefit: $8,474/unit

Estimated Net Benefit: ($113,526/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.8 SAMA CANDIDATE 118 - IMPROVE RELIABILITY OF FIRE PROTECTION CLAPPER VALVES IN THE CABLE SPREADING ROOM

SAMA Objective: SAMA would reduce spurious trips and therefore lower flooding exposure.

Applicability to FNP

The fire protection system protecting the Cable Spreading Room is a pre-action sprinkler system that normally has no water contained in the piping. The piping is air supervised so if a line break occurs or a sprinkler is inadvertently opened the system will not trip and a trouble signal will be initiated. The sprinkler system can be activated by a smoke detector in the room or by manual means at the control station located in the corridor (room no. 319/2319). When the system is activated by a smoke detector going into an alarm a signal is sent to the solenoid located at the control station. The solenoid is normally energized closed, but when the signal is sent from the Fire Alarm Control Panel (FACP) due to a smoke detector placed in alarm then the solenoid de-energizes thus tripping the pre-action valve and permitting the sprinkler piping to be filled with water. The solenoid valve has a history of being de-energized inadvertently and allowing the pre-action valve to trip.

Conceptual Modification

Avoiding spurious trips of the pre-action sprinkler system could be accomplished by reconfiguring the solenoid valve located at each control station. The loss of electrical power to the solenoid valve could occur from a normal loss of power in the electrical system or when resetting the FACP incorrectly. Reconfiguring the solenoid valve by having it de-energized closed and energized open would allow the sprinkler system to not activate upon loss of electrical power or when the FACP is operated/reset incorrectly.

Model Changes: This SAMA would reduce the likelihood of the clapper valve being in an open position. The model assumes that the clapper valve is open 0.17 percent of the year. This sensitivity assumes the valve is open only 62 days/year rather than the assumed 62 days/yr. Event SAMA-FLD3-SENS was added under %FFLOOD3-INIT to represent this improvement in the amount of time the clapper is open. SAMA-FLD3-SENS was assumed to have a probability of 0.1 and is ANDed with 11FPCL1A-43---O (0.17).

Assumptions Used in Conceptual Modification

The solenoid valve would be reconfigured to be de-energized closed and energized open, thus eliminating a fail-safe feature as the solenoid is presently installed. The valve would still function as required with manual operation at the control station or from a smoke detector going into an alarm mode. This configuration of the solenoid valve, while not typical, is acceptable under the NFPA requirements.

Cost/Benefit Calculation

Estimated Implementation Cost: $122,000/unit

Estimated Reduction in Risk Benefit: $7,668/unit

Estimated Net Benefit: ($114,232/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.9 SAMA CANDIDATE 119 - ADD SERVICE WATER LOW FLOW ALARMS FOR CRITICAL ROOM COOLERS (AFW, CHARGING, RHR & CS)

SAMA Objective: SAMA would provide notification of local Service Water faults and allow for recovery from those failures.

Applicability to FNP

This SAMA is applicable to FNP.

Conceptual Modification

Install differential pressure (DP) transmitters across the Service Water inlet and outlet on the room coolers for the AFW, Charging, RHR and CS pumps. Low flow condition would be annunciated in the Control Room.

Model Changes: This SAMA is modeled in the same way as SAMA number 24 (**Section 5.4**).

Assumptions Used in Conceptual Modification

- New transmitters are safety related.
- Instrument loop power is supplied from a class 1E power supply.
- Annunciators are available in the Control Room.
- Cable and conduit are new.
- Low flow DP setpoints determined from SW flow model.

Cost/Benefit Calculation

Estimated Implementation Cost: $930,000/unit

Estimated Reduction in Risk Benefit: $64,019/unit

Estimated Net Benefit: ($865,981/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.10 SAMA CANDIDATE 120 - SEAL ELECTRICAL CABINETS IN CABLE SPREADING ROOM TO PREVENT WATER INTRUSION DURING ROOM FLOODING

SAMA Objective: SAMA would lengthen time for potential discovery and recovery from flooding event.

Applicability to FNP

This SAMA is applicable to FNP.

Conceptual Modification

Seal electrical cabinets in cable spreading room.

Model Changes: It is assumed in this evaluation that sealing the cabinets would prevent the initiating events in the cable spreading room. This is modeled by setting the initiator gate (#FFLOOD34) in the model to "FALSE" and performing the "COMPRESS TRUE/FALSE" function, effectively removing the Cable Spreading Room flooding initiators from the model. This gate is an input to the following gates:

#CSR
#GENTRA
#MFW-TRA-1
#MFW-TRA-2
#TRA-DIV
#TRA-NLOSP
1IA0603
AFW-2126
AFW-2143
CSI0002
CSI0029
FC0002
FC0046
FC0086
FC0130
OP-FLOOD
SI-NO-RECOV

Cost/Benefit Calculation

Estimated Implementation Cost: $475,000/unit

Estimated Reduction in Risk Benefit: $17,049/unit

Estimated Net Benefit: ($457,951/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

5.11 SAMA CANDIDATE 123 - INSTALL PRESSURE SENSOR BETWEEN RHR ISOLATION MOVS TO ALLOW DETECTION OF UNSEATED OUTBOARD ISOLATION VALVE

SAMA Objective: SAMA would reduce ISLOCA potential.

Applicability to FNP

This SAMA is applicable to FNP.

Conceptual Modification

Install a pressure switch between RHR outboard isolation valves with annunciation in the Control Room.

Model Changes: This SAMA is modeled in the same way as SAMA number 89 (**Section 5.5**).

Assumptions Used in Conceptual Modification

- Instrument loop will be powered from a class 1E power supply.
- Conduit and cables will be new.
- Control Room annunciator is available.

Cost/Benefit Calculation

Estimated Implementation Cost: $330,000/unit

Estimated Reduction in Risk Benefit: $37,500/unit

Estimated Net Benefit: ($292,500/unit)

Conclusion

A large negative net benefit was determined for this SAMA, and even doubling the estimated reduction in risk benefit to account for external event contributors to the CDF would not be large enough to offset the cost of implementing this SAMA. Therefore, implementation of this SAMA would not be cost beneficial.

Table F-10. Disposition of Initial SAMAs Investigated.

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
1	Cap downstream piping of normally closed component cooling water drain and vent valves.	SAMA to reduce the frequency of a loss of component cooling event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	A	N/A	N
2	Enhance loss of component cooling procedure to facilitate stopping reactor coolant pumps.	SAMA to reduce the potential for RCP seal damage due to pump bearing failure.	B	N/A	N
3	Enhance loss of component cooling procedure to present desirability of cooling down RCS prior to seal LOCA.	SAMA would reduce the potential for RCP seal failure.	B/D	N/A	N
4	Additional training on the loss of component cooling.	SAMA would potentially improve the success rate of operator actions after a loss of component cooling (to restore RCP seal damage).	D	N/A	N
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	SAMA would reduce effect of loss of component cooling by providing a means to maintain the centrifugal charging pump seal injection after a loss of component cooling.	A	N/A	N
5A	Procedures changes to allow cross connection of motor cooling for RHRSW pumps.	SAMA would allow continued operation of both RHRSW pumps on a failure of one train of PSW.	N/A	N/A	N
6	On loss of essential raw cooling water, proceduralize shedding component cooling water loads to extend component cooling heatup.	SAMA would increase time before the loss of component cooling (and reactor coolant pump seal failure) in the loss of essential raw cooling water sequences.	B	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
7	Increase charging pump lube oil capacity.	SAMA would lengthen the time before centrifugal charging pump failure due to lube oil	Not Screened in Phase I	$270,000	Y
8	Eliminate the RCP thermal barrier dependence on component cooling such that loss of component cooling does not result directly in core damage.	SAMA would prevent the loss of RCP seal integrity after a loss of component cooling.	E	$1,660,000	N
9	Add redundant DC Control Power for SW Pumps C & D	SAMA would increase reliability of PSW and decrease core damage frequency due to a loss of SW.	E	$3,200,000	N
10	Create an independent RCP seal injection system, with a dedicated diesel.	SAMA would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of component cooling or service water or from a station blackout event.	E	$3,800,000	N
11	Use existing hydro test pump for RCP seal injection.	SAMA would provide an independent seal injection source, without the cost of a new system.	Not Screened in Phase I	$520,000	Y
12	Replace ECCS Cooling System pump motor with air-cooled motors.	SAMA would eliminate ECCS dependency on component cooling system.	N/A	N/A	N
13	Install improved RCS pumps seals.	RCP seal O-ring constructed of improved materials would reduce probability of RCP seal LOCA	A	N/A	N
14	Install additional component cooling water pump.	SAMA would reduce probability of loss of component cooling leading to RCP seal LOCA.	E	$1,500,000	N
15	Prevent centrifugal charging pump flow diversion from the relief valves.	If relieve valve opening causes a flow diversion large enough to prevent RCP seal injection, then the modification would reduce the frequency of the loss of RCP seal cooling.	N/A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
16	Change procedures to isolate RCP seal letdown flow on loss of component cooling, and guidance on loss of injection during seal LOCA.	SAMA would reduce CDF from loss of seal cooling.	B	N/A	N
17	Implement procedures to stagger HPSI pump use after a loss of service water.	SAMA would allow HPSI to be extended after a loss of service water.	N/A	N/A	N
18	Use fire protection system pumps as a backup seal injection and high pressure make-up.	SAMA would reduce the frequency of the RCP seal LOCA and the SBO CDF.	C	N/A	N
19	Procedural guidance for use of cross-tied component cooling or service water pumps.	SAMA would reduce the frequency of the loss of component cooling water and service water.	E	$1,750,000	N
20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	SAMA would potentially improve the success rate of operator actions subsequent to support system failures.	C	N/A	N
21	Improved ability to cool the residual heat removal heat exchangers	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water cross-tie.	B (19)	N/A	N
22	Provide reliable power to Control Building fans	SAMA would increase availability of control room ventilation on a loss of power.	A	N/A	N
23	Provide a redundant train of ventilation.	SAMA would increase the availability of components dependent on room cooling.	C (22 and 25)	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
24	Procedures for actions on loss of HVAC.	SAMA would provide for improved credit to be taken for loss of HVAC sequences (improved affected electrical equipment reliability upon a loss of Control Building HVAC).	Not Screened in Phase I	$830,000	Y
25	Add a diesel building switchgear room high temperature alarm.	SAMA would improve diagnosis of a loss of switchgear room HVAC. Option 1: Install high temp alarm Option 2: Redundant louver and thermostat	A	N/A	N
26	Create ability to switch fan power supply to direct current (DC) in an SBO event.	SAMA would allow continued operation in an SBO event. This SAMA was created for reactor core isolation cooling system room at Fitzpatrick Nuclear Power Plant.	N/A	N/A	N
27	Delay containment spray actuation after large LOCA.	SAMA would lengthen time of RWST availability.	B	N/A	N
28	Install containment spray pump header automatic throttle valves.	SAMA would extend the time over which water remains in the RWT, when full CS flow is not needed	B	N/A	N
29	Install an independent method of suppression pool cooling.	SAMA would decrease the probability of loss of containment heat removal.	N/A	N/A	N
30	Develop an enhanced drywell spray system.	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	N/A	N/A	N
31	Provide dedicated existing drywell spray system.	SAMA would provide a source of water to the containment to control containment pressure, when used in conjunction with containment heat removal. This would use an existing spray loop instead of developing a new spray system.	N/A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
32	Install an unfiltered hardened containment vent.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products not being scrubbed.	N/A	N/A	N
33	Install a filtered containment vent to remove decay heat.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products being scrubbed. Option 1: Gravel Bed Filter Option 2: Multiple Venturi Scrubber	N/A	N/A	N
34	Install a containment vent large enough to remove ATWS decay heat.	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	N/A	N/A	N
35	Create/enhance hydrogen recombiners with independent power supply.	SAMA would reduce hydrogen detonation at lower cost, Use either a new, independent power supply, a nonsafety-grade portable generator, existing station batteries, or existing AC/DC independent power supplies (security system diesel?).	A	N/A	N
35A	Install hydrogen recombiners.	SAMA would provide a means to reduce the chance of hydrogen detonation.	A	N/A	N
36	Create a passive design hydrogen ignition system.	SAMA would reduce hydrogen denotation system without requiring electric power.	E	$1,520,000	N
37	Create a large concrete crucible with heat removal potential under the basemat to contain molten core debris.	SAMA would ensure that molten core debris escaping form the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt-through of the basemat.	E	$90,000,000	N
38	Create a water-cooled rubble bed on the pedestal.	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	E	<$90,000,000	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
39	Provide modification for flooding the drywell head.	SAMA would help mitigate accidents that result in the leakage through the drywell head seal.	N/A	N/A	N
40	Enhance fire protection system and/or standby gas treatment system hardware and procedures.	SAMA would improve fission product scrubbing in severe accidents.	C (41 & 46)	N/A	N
41	Create a reactor cavity flooding system.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	Not Screened in Phase I	$900,000	Y
42	Create other options for reactor cavity flooding.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	C (41)	N/A	N
43	Enhance air return fans (ice condenser plants).	SAMA would provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	N/A	N/A	
44	Create a core melt source reduction system.	SAMA would provide cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal form the vitrified compound would be facilitated, and concrete attack would not occur.	E	$90,000,000	N
45	Provide a containment inerting capability.	SAMA would prevent combustion of hydrogen and carbon monoxide gases.	E	$3,200,000	N
46	Use the fire protection system as a back-up source for the containment spray system.	SAMA would provide redundant containment spray function without the cost of installing a new system.	Not Screened in Phase I	$450,000	Y
47	Install a secondary containment filter vent.	SAMA would filter fission products released from primary containment.	A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
48	Install a passive containment spray system.	SAMA would provide redundant containment spray method without high cost.	E	$2,000,000	N
49	Strengthen primary/secondary containment.	SAMA would reduce the probability of containment overpressurization to failure.	E	$3,260,000	N
50	Increase the depth of the concrete basemat or use an alternative concrete material to ensure melt-through does not occur.	SAMA would prevent basemat melt-through.	E	>$5,000,000 <$90,000,000	N
51	Provide a reactor vessel exterior cooling system.	SAMA would provide the potential to cool a molten core before it causes vessel failure, if the lower head could be submerged in water.	C (41)	N/A	N
52	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	SAMA would provide a method to depressurize containment and reduce fission product release.	N/A	N/A	N
53	Not Used		N/A	N/A	N
54	Proceduralize alignment of spare diesel to shutdown board after Loss of Offsite Power and failure of the diesel normally supplying it.	SAMA would reduce the SBO frequency.	C (56)	N/A	N
55	Not Used		N/A	N/A	N
56	Provide an additional diesel generator.	SAMA would increase the reliability and availability of onsite emergency AC power sources.	E	$74,500,000	N
57	Provide additional DC battery capacity	SAMA would ensure longer batter capability during an SBO, reducing the frequency of long-term SBO sequences.	A	N/A	N
58	Use fuel cells instead of lead-acid batteries.	SAMA would extend DC power availability in an SBO.	N/A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
59	Procedure to cross-tie high pressure core spray diesel.	SAMA would improve core injection availability by providing a more reliable power supply for the high pressure core spray pumps.	N/A	N/A	N
60	Improve 4.16 kV bus cross-tie ability.	SAMA would improve AC power reliability.	A	N/A	N
61	Incorporate an alternate battery charging capability.	SAMA would improve DC power reliability by either cross-tying the AC buses, or installing a portable diesel-driven batter charger.	A	N/A	N
62	Increase/improve DC bus load shedding.	SAMA would extend battery life in an SBO event.	A	N/A	N
63	Replace existing batteries with more reliable ones.	SAMA would improve DC power reliability and thus increase available SBO recovery time.	A	N/A	N
63A	Mod for DC Bus A reliability	Loss of DC Bus A causes a loss of main condenser, prevents transfer from the main transformer to offsite power, and defeats one half of the low vessel pressure permissive for LPCI/CS injection valves. SAMA would increase the reliability of AC power and injection capability.	A	N/A	N
64	Create AC power cross-tie capability with other unit.	SAMA would improve AC power reliability.	A	N/A	N
65	Create a cross-tie for diesel fuel oil.	SAMA would increase diesel fuel oil and, thus diesel generator, reliability.	A	N/A	N
66	Develop procedures to repair or replace failed 4 kV breakers.	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16kV non-emergency buses form unit station service transformers, leading to loss of emergency AC power.	E	$7,150,000	N
67	Emphasize steps in recovery of offsite power after an SBO.	SAMA would reduce human error probability during offsite power recovery.	B	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
68	Develop a severe weather conditions procedure.	For plants that do not already have one, this SAMA would reduce the CDF for external weather-related events.	B	N/A	N
69	Develop procedures for replenishing diesel fuel oil.	SAMA would allow for long-term diesel operation.	B	N/A	N
70	Install gas turbine generator.	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	E	$16,100,000	N
71	Not Used		N/A	N/A	N
72	Create a back-up source for diesel cooling. (Not from existing system)	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability.	A	N/A	N
73	Use Fire Protection System as a back-up source for diesel cooling.	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability.	A	N/A	N
74	Provide a connection to an alternate source of offsite power.	SAMA would reduce the probability of a loss of offsite power event.	A	N/A	N
75	Bury offsite power lines.	SAMA could improve offsite power reliability, particularly during severe weather.	A	N/A	N
76	Replace anchor bolts on diesel generator oil cooler.	Millstone Nuclear Power Station found a high seismic SBO risk due to failure of the diesel oil cooler anchor bolts. For plants with a similar problem, this would reduce seismic risk. Note that these were Fairbanks Morse DGs.	C (114)	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
77	Change Undervoltage (UV), Auxiliary Feedwater Actuation Signal (AFAS) Block and High Pressurizer Pressure Actuation Signals to 3-out-of-4, instead of 2-out-of-4 logic.	SAMA would reduce risk of 2/4 inverter failure.	N/A	N/A	N
78	Provide DC power to the 120/240 V vital AC system from the Class 1E station service battery system instead of its own battery.	SAMA would increase the reliability of the 120 VAC Bus.	A	N/A	N
79	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture (SGTR).	SAMA would enhance depressurization during a SGTR.	E	$2,270,000	N
80	Improve SGTR coping abilities.	SAMA would improve instrumentation to detect SGTR, or additional system to scrub fission product releases.	E	$1,670,000	N
81	Add other SGTR coping abilities.	SAMA would decrease the consequences of an SGTR.	C	N/A	N
82	Increase secondary side pressure capacity such that an SGTR would not cause the relief valves to lift.	SAMA would eliminate direct release pathway for SGTR sequences.	E	$13,000,000	N
83	Replace steam generators (SG) with a new design.	SAMA would lower the frequency of an SGTR.	A	N/A	N
84	Revise emergency operating procedures to direct that a faulted SG be isolated.	SAMA would reduce the consequences of an SGTR.	B	N/A	N
85	Direct SG flooding after a SGTR, prior to core damage.	SAMA would provide for improved scrubbing of SGTR releases.	B	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
86	Implement a maintenance practice that inspects 100% of the tubes in a SG.	SAMA would reduce the potential for an SGTR.	E	$3,000,000	N
87	Locate RHR inside of containment.	SAMA would prevent ISLOCA out the RHR pathway.	E	$28,000,000	N
88	Not Used.		N/A	N/A	N
89	Install additional instrumentation for ISLOCAs.	Pressure of leak monitoring instruments installed between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HPSI lines would decrease ISLOCA frequency.	Not Screened in Phase I	$425,000	Y
90	Increase frequency for valve leak testing.	SAMA could reduce ISLOCA frequency.	C (93)	N/A	N
91	Improve operator training on ISLOCA coping.	SAMA would decrease ISLOCA effects.	B	N/A	N
92	Install relief valves in the CC System.	SAMA would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	B	N/A	N
93	Provide leak testing of valves in ISLOCA paths.	At Kewaunee Nuclear Power Plant, four MOVs isolating RHR from the RCS were not leak tested. This SAMA would help reduce ISLOCA frequency.	B	N/A	N
94	Revise EOPs to improve ISLOCA identification.	Salem Nuclear Power Plant had a scenario where an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside Containment. Procedure enhancements would ensure LOCA outside Containment could be identified as such.	B	N/A	N
95	Ensure all ISLOCA releases are scrubbed.	This SAMA would scrub all ISLOCA releases. One example is to plug drains in the break area so that the break point would cover with water.	A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
96	Add redundant and diverse limit switches to each containment isolation valve.	Enhanced isolation valve position indication could reduce the frequency of containment isolation failure and ISLOCAs.	Not Screened in Phase I	$960,000	Y
97	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	SAMA would prevent flood propagation, for a plant where internal flooding from turbine building to safeguards areas is a concern.	A	N/A	N
98	Improve inspection of rubber expansion joints on main condenser.	SAMA would reduce the frequency of internal flooding, for a plant where internal flooding due to a failure of circulating water expansion joints is a concern.	A	N/A	N
99	Implement internal flood prevention and mitigation enhancements.	This SAMA would reduce the consequences of internal flooding.	C (116-118)	N/A	N
100	Implement internal flooding improvements such as those implemented at Fort Calhoun.	This SAMA would reduce flooding risk by preventing or mitigating : (1) a rupture in the RCP seal cooler of the component cooling system (2) an ISLOCA in a shutdown cooling line, (3) an AFW flood involving the need to remove a watertight door.	C (99)	N/A	N
101	Install a digital feedwater upgrade.	This SAMA would reduce the chance of a loss of main feedwater following a plant trip.	Not Screened in Phase I	$900,000	Y
102	Perform surveillances on manual valves used for back-up AFW pump suction.	This SAMA would improve success probability for providing alternative water supply to the AFW pumps.	Not Screened in Phase I	$1,000,000	Y

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
103	Install manual isolation valves around AFW turbine-driven steam admission valves.	This SAMA would reduce the dual turbine-driven AFW pump maintenance unavailability.	A	N/A	N
104	Install accumulators for turbine-driven AFW pump flow control valves (CVs).	This SAMA would provide control air accumulators for the turbine-driven AFW flow CVs, the motor-driven AFW pressure CVs and SG PORVs. This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOOP.	A	N/A	N
105	Proceduralize intermittent operation of HPCI.	SAMA would allow for extended duration of HPCI availability.	N/A	N/A	N
106	Increase the reliability of safety relief valves. (Adding signals to add electrical signal to open automatically).	SAMA reduces the probability of a certain type of medium break LOCA. Hatch evaluates medium LOCA initiated by an MSIV closure transient with a failure of SRVs to open. Reducing the likelihood of the failure for SRVs to open, subsequently reduces the occurrence of this medium LOCA.	N/A	N/A	N
107	Install motor-driven feedwater pump.	This would increase the availability of injection subsequent to MSIV closure.	E	$2,200,000	N
108	Procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	SAMA increases availability of required RHR/CS pumps. Reduction in room heat load allows continued operation of required RHR/CS pumps, when room cooling is lost.	C (24)	N/A	N
109	Increase available NSPH for injection pumps.	SAMA increases the probability that these pumps will be available to inject coolant into the vessel by Increasing the available NPSH for the injection pumps.	A	N/A	N
110	Increase the SRV reseat reliability.	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after SLC injection.	N/A	N/A	N

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
111	Reduce DC dependency between high pressure injection system and ADS.	SAMA would ensure containment depressurization and high pressure injection upon a DC failure.	N/A	N/A	N
112	Modify RWCU for use as a decay heat removal system and proceduralize use.	SAMA would provide an additional source of decay heat removal.	N/A	N/A	N
113	Use of CRD for alternate boron injection.	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	N/A	N/A	N
114	Increase seismic ruggedness of plant components.	SAMA would increase the availability of necessary plant equipment during and after seismic events.	A	N/A	N
115	Allow cross connection of uninterruptable compressed air supply to opposite unit.	SAMA would increase the ability to depressurize containment using the hardened vent.	N/A	N/A	N
116	Install flooding alarm in Cable Spreading Room	SAMA would allow early detection of flooding due to Fire Protection System Failures.	A	N/A	N
117	Leak-tight enclosure for Fire Protection piping in Unit 1 Cable Spreading Room	SAMA would eliminate flooding scenario.	Not Screened in Phase I	$122,000	Y
118	Improve reliability of Fire Protection clapper valves in the Cable Spreading Room	SAMA would reduce spurious trips and therefore lower flooding exposure.	Not Screened in Phase I	$122,000	Y
119	Add SW low flow alarms for critical room coolers (AFW, Charging, RHR & CS)	SAMA would provide notification of local Service Water faults and allow for recovery from those failures.	Not Screened in Phase I	$930,000	Y
120	Seal electrical cabinets in Cable Spreading Room to prevent water intrusion during room flooding	SAMA would lengthen time for potential discovery and recovery from flooding event.	Not Screened in Phase I	$475,000	Y

Table F-10. Disposition of Initial SAMAs Investigated. (Cont'd)

Phase I SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criteria	Estimated Cost	Item Passed Screening
121	Modify Unit 2 SW Pumps to eliminate dependence on lube & cooling booster pumps	SAMA would improve the reliability of the SW Pumps	E	$1,760,000	N
122	Replace RHR HX heads with stronger material	SAMA would reduce the probability of failure during ISLOCA	E	$1,400,000	N
123	Install pressure sensor between RHR isolation MOVs to allow detection of unseated outboard isolation valve	SAMA would reduce ISLOCA potential	Not Screened in Phase I	$330,000	Y
124	Redesign CCW miscellaneous header to allow either train to supply RCP thermal barrier without need for local manual re-alignment	SAMA would add reliability by removing the need for operator action.	E	$1,746,000	N
125	Install auto-start of standby CCW train on loss of on-service train pressure	SAMA would add reliability by removing the need for operator action.	Not Screened in Phase I	$1,000,000	Y

*Screening Criteria

A – Already addressed by existing FNP design.
B – Already addressed by existing FNP procedures.
C – Addressed by other SAMAs (Other SAMA numbers in parentheses)
D – Already addressed by FNP training program
E – Estimated cost exceeds twice the maximum attainable benefit from internal events mitigation
N/A – Not applicable to FNP.

Table F-11. Summary of Phase II SAMA Analyses.

SAMA ID number	Averted offsite exposure	Averted offsite cost	Averted onsite exposure	Averted onsite cleanup cost	Averted replacement power	Total benefits	Cost of implementation	Net value of modifications
SAMA 7	$396	$6	$1,150	$35,757	$22,312	$59,621	$270,000/unit	($210,379/unit)
SAMA 11	$2,179	$39	$4,403	$136,952	$85,455	$229,028	$520,000/unit	($290,972/unit)
SAMA 24	$1,849	$456	$1,198	$37,264	$23,252	$64,019	$830,000/unit	($765,981/unit)
SAMA 89	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$425,000/unit	($387,500/unit)
SAMA 96	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$960,000/unit	($922,500/unit)
SAMA 101	$1,624	$24	$1,759	$54,697	$34,130	$92,233	$900,000/unit	($807,767/unit)
SAMA 117	$234	$5	$160	$4,972	$3,103	$8,474	$122,000/unit	($113,526/unit)
SAMA 118	$215	$4	$147	$4,558	$2,844	$7,768	$122,000/unit	($114,232/unit)
SAMA 119	$1,849	$456	$1,198	$37,264	$23,252	$64,019	$930,000/unit	($865,981/unit)
SAMA 120	$471	$10	$322	$10,004	$6,242	$17,049	$475,000/unit	($457,951/unit)
SAMA 123	$14,954	$15,997	$127	$3,954	$2,467	$37,500	$330,000/unit	($292,500/unit)

6.0 CONCLUSIONS

None of the 11 SAMAs analyzed in detail in Phase II had estimated benefits that were close to, or exceeded, the cost of implementation; even when considering the contributions of external event contributors to the CDF. These 11 SAMAs had large negative net benefits relative to the cost of implementing the SAMA, indicating that such SAMAs would not be cost-beneficial.

7.0 REFERENCES

1. Generic Letter No. 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities – 10 CFR §50.54(f)," NRC Letter to All Licensees Holding Operating Licenses and Construction Permits for Nuclear Power Reactor Facilities, November 23, 1988.

2. Generic Letter No. 88-20, Supplement 1, "Initiation of the Individual Plant Examination for Severe Accident Vulnerabilities – 10 CFR §50.54(f)," August 29, 1989 and Supplement 2, "Accident Management Strategies for Consideration in the Individual Plant Examination Process," April 4, 1990.

3. NUREG/CR-2300, "PRA Procedures Guide – A Guide to the Performance of Probabilistic Risk Assessments for Nuclear Power Plants," January 1983.

4. NUREG/CR-2815, "Probabilistic Safety Analysis Procedures Guide," Vol. 1, Rev. 1, August 1985.

5. EPRI, "MAAP 3.0B Complete Code Manual," EPRI NP-777-1-CCML, 1990 and "MAAP 4 User's Manual," EPRI RP 3131-02, May 1994.

6. SNC Technical Services Calculation PSA-F-98-003, "PRA Revision 1 including conversion to CAFTA and EOOS At-power model," March 1998.

7. SNC Technical Services Calculation PSA-F-98-004, "EOOS Status Panel and Test.dbf revision (Rev. 2)," May 1998.

8. Technical Services Calculation PSA-F-99-007, "Joseph M. Farley Nuclear Plants Units 1 and 2 Data Update for Probabilistic Risk Analysis," June 1999.

9. NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995," February 1999.

10. SNC Technical Services Calculation PSA-F-99-010, "Joseph M. Farley Nuclear Plant Units 1 and 2 PRA Model and EOOS Revision 3," August 1999.

11. SNC Technical Services Calculation PSA-F-00-009, "Farley PRA/EOOS Revision 4," May 2000.

12. SNC Technical Services Calculation PSA-F-00-019, "PRA/EOOS Revision 4a", September 2000.

13. Technical Services Calculation PSA-F-01-017, "Farley Units 1 and 2 PRA and EOOS Revision 5," October 2001.

14. Chanin, D. and Young, M., Code Manual for MACCS2: Volume 1, User's-Guide, SAND 97-0594, 1997.

15. NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," U.S. Nuclear Regulatory Commission, Washington, D.C., June 1989.

16. Evacuation Time Estimates for the Farley Nuclear Plant, HMM Associates, July 1993.

17. U.S. Department of Agriculture, "1997 Census of Agriculture," National Agricultural Statistics Service, 1998.

18. U.S. Department of Agriculture, "Usual Planting and Harvesting Dates for Crops in South Carolina," National Agricultural Statistics Service, http://usda.mannlib.cornell.edu/reports/nassr/field/planting/uph97.pdf, December 1997.

19. Alabama Cooperative Extension, "Planting Guide For Home Gardening In Alabama," http://www.aces.edu/department/extcomm/publications/anr/ANR-63/anr-63.htm, April 1998.

20. Southern Nuclear Operating Company, "Severe Accident Mitigation Alternatives at the Edwin I. Hatch Nuclear Plant." Attachment F of Appendix D (Applicant's Environmental Report - Operating License Renewal Stage) of Edwin I. Hatch Nuclear Plant Application for License Renewal. February 2000.

21. NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Calvert Cliffs Nuclear Power Plant," Supplement 1, U.S. Nuclear Regulatory Commission, Washington, D.C., February 1999.

22. John E. Till and H. Robert Meyer, Radiological Assessment, A Textbook on Environmental Dose Analysis, NUREG/CR-3332, ORNL-5968, p. 2-23. September 1983, prepared for USNRC, Washington, D.C.

23. "Local Climatological Data, Annual Summaries for 1999, Part II Southern Region," Montgomery, Alabama (MGM), National Climatic Data Center, Asheville, N.C.

24. "Mixing Heights, Wind Speeds, and Potential for Urban Pollution Throughout the Contiguous United States," George C. Holzworth, EPA, Office of Air Programs, Research Triangle Park, North Carolina, January 1972.

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