8.0 Environmental Impacts of Alternatives to License Renewal

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

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

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

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

8.1 No-Action Alternative

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8.2 Alternative Energy Sources

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

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

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

The potential for using imported power is discussed in Section 8.2.3. In 1995, Georgia was a substantial net seller of electricity. During 1995, the net interstate flow of electricity was 15,246 million kilowatt hours (kWh) or about 15 percent of all electricity produced in Georgia (SNC 2000). During 1996, SNC facilities in Georgia (including those of subsidiaries Georgia Power and Savannah Electric) generated approximately 90 percent (90,000 million kWh) of the power in Georgia. HNP generated approximately 13,000 million kWh during 1996 (SNC 2000). Even though Georgia is a net exporter of electricity, SNC does not discount the option of importing electric power depending on economic conditions within a deregulated market.

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

8.2.1 Coal-Fired Generation

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

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

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

8.2.1.1 Closed-Cycle Cooling System

Closed-cycle cooling would be the most likely cooling system if the existing HNP site were used. The plant would use the existing HNP intake, discharge structures, and cooling towers as part of a closed-loop cooling system. This alternative would minimize environmental impacts, because minimal construction would be required to adapt the existing system to the coal-fired alternative. It is assumed that the coal-fired alternative would require a water-use volume (including cooling water, wet scrubber sulfur oxides emission controls, and boiler make-up) of approximately 110,000 m^3/d (30 million gpd), which would be less than the existing HNP withdrawal of approximately 216,000 m^3/d (57 million gpd). Based on the design and efficiency of the existing cooling towers, discharge temperatures would be less than or equal to those currently observed. The overall impacts of this system are discussed in the following sections. The impacts are summarized in Table 8-2.

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

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

Table 8-2. (contd)

Impact Category	HNP Site Impact	HNP Site Comments	Alternative Greenfield Site Impact	Alternative Greenfield Site Comments
Waste	MODERATE	Total waste volume would be estimated around 1.4 million MT/yr (1.5 million tons/yr) of ash and scrubber sludge; land devoted to waste disposal is approximately 240 to 360 ha (600 to 900 acres), respectively	MODERATE	Same impacts as HNP site; waste disposal constraints may vary
Human Health	SMALL	Impacts considered minor	SMALL	Same impact as HNP site
Socioeconomics	MODERATE to LARGE	1200 to 2000 additional workers during peak period of the 5-year construction period, followed by reduction from current HNP workforce of 950 to 250; tax base preserved For transportation, the impact is considered SMALL. The area is very rural; 20 train trips per week for coal and lime; 115 cars per train. Plant workforce less, so commuting impacts less than current HNP site situation	MODERATE to LARGE	Depends on whether alternate site outside of Appling County. If outside, construction impacts would be relocated. Appling County would experi-ence loss of tax base and employment. For transportation, the impact is considered SMALL to MODERATE and will vary depending on plant location
Aesthetics	SMALL to MODERATE	Visual impact of power plant units and stacks that would be visible from offsite; noise impacts minimized by site location	MODERATE to LARGE	Alternate locations could reduce aesthetic impact if siting is in an industrial area; large if siting is largely in undeveloped area
Historic and Archeological Resources	SMALL	Affects previously developed parts of current HNP site; cultural resource inventory should minimize any impacts on undeveloped lands	SMALL	Alternate location would necessitate cultural resource studies
Environmental Justice	MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construc-tion; loss of 700 jobs in a economic-ally depressed county could reduce employment prospects for minority and low-income populations	SMALL to LARGE	Impacts will vary depending on population distribution and make-up

- **Land Use**

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

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

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

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

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

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

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

Construction of the coal-fired generation alternative at a new site could impact up to 450 ha (1100 acres). In addition to the 360 ha (900 acres) needed for the plant, coal storage, and ash and scrubber sludge disposal areas, an additional 60 ha (150 acres) for offices, roads, parking areas, and a switchyard would be required. Cooling water intake and discharge structures and mechanical or natural draft cooling towers would have to be constructed. An additional 120 ha (300 acres) would be needed for transmission lines, assuming the plant is sited 16 km (10 mi) from the nearest substation. Approximately 70 ha (160 acres) would also be needed for a rail line for coal delivery, assuming that the alternative site location is within 16 km (10 mi) from nearest railway connection. Depending particularly on transmission line and rail line routing, this alternative would result in MODERATE to LARGE land-use impacts.

- **Ecology**

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

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

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

- **Water Use and Quality**

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

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

Groundwater. Variations in groundwater use are expected to be small, because groundwater wells are used only to supply water for drinking and the restroom facilities at the HNP. The reduced work force size for the coal-fired alternative (from 950 down to 250) would reduce the groundwater withdrawals for potable water use. Assuming 130 L/d (35 gpd) per person, maximum groundwater usage would be approximately 33 m^3/d (8750 gpd), or approximately 93 m^3/d (24,500 gpd) less than under the license renewal option.

However, the leachate from ash and scrubber waste disposal areas and the runoff from coal storage areas would have to be controlled to avoid groundwater and surface-water contamination. For this reason, the appropriate characterization of coal-fired generation groundwater impacts would be SMALL; the impacts would be so minor that they would not noticeably alter any important attribute of the resource.

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

- **Air Quality**

The air-quality impacts of coal-fired generation vary considerably from those of nuclear power due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, and mercury. These impacts are described as follows:

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

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

Nitrogen oxides emissions. Using currently available control technology, the total annual NO_x emission would be approximately 1550 MT (1710 tons). Title IV of the 1990 CAA amendments established an annual NO_x emissions reduction policy. In addition, the U.S. Environmental Protection Agency (EPA) has promulgated regulations (63 FR 57355) that require the reduction of NO_x emissions by 1.0 million MT (1.1 million tons) per year by

2003, or by 28 percent overall by 2007.[a] EPA has indicated it will work with the states to develop a market-based emissions trading system for utilities. In order to implement an HNP site coal-fired alternative, SNC would have to offset its corporate NO_x emissions in Georgia through further reductions in NO_x emissions elsewhere, either by shutting other sources down or by back-fitting to reduce NO_x formation (e.g., installing over-fired air, low NO_x burners, flue gas re-circulation, and selective non-catalytic and catalytic reduction systems). Precise reduction requirements are speculative at this time; however, air emissions of NO_x emissions would be greater than the license renewal alternative.

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

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

Mercury. Coal-fired boilers account for nearly one-third of mercury emissions in the United States. Technologies available to control mercury emissions have varying degrees of success. In response to growing concerns about mercury, the CAA Amendments of 1990 have required the EPA to identify mercury emission sources, evaluate the contributions of power plants and municipal incinerators, identify control technologies, and evaluate the toxicological effects from the consumption of mercury-contaminated fish. It is likely that these studies will lead to additional restrictions concerning mercury emissions associated with coal-fired power plants, as well as other sources of mercury emissions. Recent studies by the Maryland Power Plant Research Program have indicated that, although coal-fired power plants contribute to mercury emissions, the resulting concentrations are not high enough to adversely affect humans or other organisms (SNC 2000). Therefore, the probable effect of trace mercury emissions on human health would be SMALL, although larger than the license renewal alternative.

(a) On May 14, 2000, the Court of Appeals for the District of Columbia (D.C. Circuit) ruled that the EPA's standards for nitrogen oxides (NO_x) constituted an unconstitutional delegation of legislative power (D.C. Circuit 1999a). The Supreme Court has decided to review this case during its 2000-2001 Term. On May 25, 1999, the Court of Appeals for the District of Columbia issued an order partially staying the implementation of EPA's plan to reduce the state-to-state transport of smog (NO_x State Implementation Plan call). This is not a ruling on the merits of the plan, but a delay to allow all parties to present their case to the court (D.C. Circuit 1999b).

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

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

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. Three 600-MW(e) coal-fired plants at the HNP site would generate approximately 1.4 million MT (1.5 million tons) of this waste annually for 40 years. The waste would be disposed of onsite, accounting for between 240 ha to 360 ha (600 to 900 acres) of land area. While only half of these values are directly attributable to the alternative to a 20-year HNP license renewal, the total values are pertinent as a cumulative impact. This impact could extend well after the 40-year operation life because revegetation management and groundwater monitoring for leachate contaminant impacts could be a permanent requirement.

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

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

- **Human Health**

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

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

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

- **Socioeconomics**

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

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

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

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

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

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

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

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

- **Aesthetics**

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

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

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

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

- **Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively SMALL unless important site-specific resources were affected. Under this alternative, cultural resource inventories would be required for any lands that have not been previously disturbed to the extent that no historic or archaeological resources might remain. Other lands that are purchased to support the facility would also require an inventory of field cultural resources, identification and recording of extant historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

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

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

- **Environmental Justice**

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

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

8.2.1.2 Once-Through Cooling System

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

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

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

8.2.2 Gas-Fired Generation

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

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

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

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

8.2.2.1 Closed-Cycle Cooling System

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

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

The SNC gas-fired generation alternative consists of four 440-MW(e) (International Standards Organization rating) combined-cycle units each consisting of two 155-MW(e) simple-cycle combustion turbines and a 130-MW(e) heat-recovery steam generator. On an average annual basis, these units would generate up to 440 MW(e) each, providing the 1760 MW(e) needed to replace HNP-generated power.

Natural gas typically having an average heating value of 1000 BTU/ft^3 would be the primary fuel. The gas-fired plant would burn approximately 283,000 m^3 (10 million ft^3) per hour. Low-sulfur No. 2 fuel oil would be the backup fuel. Natural gas would be delivered via an existing pipeline located approximately 7 km (4.5 mi) from the HNP site. Approximately 20 to 50 ha (55 to 121 acres) would be disturbed during pipeline construction. The existing line currently has sufficient reserve capacity to supply the needs of the gas-fired alternative (SNC 2000).

Each unit would be less than 30 m (100 ft) high and would be designed with dry, low NO_x combusters, water injection, and selective catalytic reduction, and would exhaust through a 70-m (230-ft) stack after passing through heat-recovery steam generators. The 70-m (230-ft) height is based on good engineering practice formula using the tallest proposed onsite facility (i.e., the 28-m [92-ft] turbine building). While modeling would have to be used to justify stack height greater than 70 m (230 ft), the relatively flat terrain and low structures of the area probably mean that modeling would not support a greater stack height.

NO_x emissions from the gas-fired alternative would be 350 MT/yr (386 tons/yr). There would be no solid waste products (i.e., ash) from natural gas fuel burning.

The plant would use the existing HNP intake and discharge and the existing mechanical cooling towers. Cooling requirements would be less; average withdrawal flows would be approximately 57,000 m^3/d (15 million gpd).

Construction of the gas-fired alternative would take approximately 3 years and the workforce during the construction period would average 500, with a peak of 750. The workforce during operations would average 125.

The overall impacts of this system are discussed in the following sections. The impacts are summarized in Table 8-4.

- **Land Use**

  Gas-fired generation at the HNP site would require converting an additional 200 ha (500 acres) of the site to industrial use (SNC 2000). Currently, this land is mostly forested. An additional 20 to 50 ha (55 to 121 acres) would be disturbed during pipeline construction but, because this disturbance would be temporary and would not alter existing land-use patterns (access road right-of-way and cultivation), the land-use impacts from pipeline construction would be SMALL. These changes in aggregate would noticeably alter current HNP land-use patterns and would create MODERATE impacts; the impact would noticeably alter habitat but would not destabilize any important attribute of the resource.

  Construction of the gas-fired generation plant at a new site could impact approximately 240 ha (600 acres). In addition to the 200 ha (500 acres) needed for the power block area and pipeline construction described above, approximately 40 ha (100 acres) would be required for offices, roads, parking areas, and a switchyard. In addition, approximately 120 ha (300 acres) would be needed for transmission lines, assuming the plant is sited 16 km (10 mi) from the nearest substation (SNC 2000). Plants of this type are usually built very close to existing natural gas pipelines. Including the land required for pipeline construction, a greenfield site would require approximately 360 ha (900 acres). The greenfield site alternative could result in MODERATE land-use impacts.

Table 8-4. Summary of Environmental Impacts of Gas-Fired Generation—Closed-Cycle Cooling

	HNP Site		Alternative Greenfield Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Land Use	MODERATE	Additional 200 ha (500 acres) for power block, 20 to 50 ha (55 to 121 acres) disturbed for gas pipeline; land disturbed currently forested and would be in addition to land already disturbed onsite; additional land for backup oil storage tanks	MODERATE	364 ha (900 acres) for power block, offices and transmission lines; additional land for backup oil storage tanks
Ecology	MODERATE to LARGE	Constructed on cleared land adjacent to HNP site on approximately 200 ha (500 acres); habitat loss	MODERATE to LARGE	Impact depends on location and ecology of the site; potential habitat loss and fragmentation; reduced productivity and biological diversity
Water Use and Quality				
- Surface Water	SMALL	75% reduction in water flow over existing HNP use	SMALL to MODERATE	Impact depends on volume and characteristics of receiving body of water
- Groundwater	SMALL	Reduced groundwater withdrawals due to reduced workforce	SMALL to LARGE	Groundwater would be used for potable water only
Air Quality	MODERATE	Primarily NO_x – 350 MT/yr (386 tons/yr) with gas; 265 MT/yr (290 tons/yr) with flue gas-recirculation. – emissions less than coal-fired alternative	MODERATE	Same impacts as for HNP site
Waste	SMALL	Small amount of ash produced	SMALL	Same impacts as for HNP site
Human Health	SMALL	Impacts considered to be minor	SMALL	Same impacts as for HNP site

Table 8.4. (contd)

	HNP Site		Alternative Greenfield Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comments**
Socioeconomics	MODERATE	500 to 750 additional workers during 3-year construction period; followed by reduction from 950 persons to 125 persons; tax base sustained with new gas-fired plant replacing HNP Transportation impacts are considered SMALL because there is less commuting workforce than current HNP or coal-fired alternative	MODERATE to LARGE	Construction impacts would be relocated. Appling and Toombs counties could experience workforce reduction, plus loss of tax base if plant locates outside county Transportation impacts would depend on population density and transportation infrastructure, but generally would be SMALL due to workforce size (125)
Aesthetics	SMALL to MODERATE	Visual impact of stacks and equipment would be noticeable, but not as significant as coal option or existing HNP reactor building and stack	SMALL to MODERATE	Alternate locations could reduce the aesthetic impact if siting is in an industrial area
Historic and Archaeological Resources	SMALL	Plant footprint less than coal-fired alternative; site knowledge minimizes possible cultural impacts	SMALL	Alternate location would necessitate cultural resource preservation measures
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Impacts on housing are possible during construction; loss of 825 high-paying jobs might lessen employment opportunities for minority and low-income populations.	SMALL to LARGE	Impacts vary depending on population distribution and makeup; impacts to Appling County could be MODERATE to LARGE if new plant built outside of county

The GEIS estimated that land-use requirements for a 1000-MW gas-fired plant at a greenfield site would be SMALL (approximately 45 ha [110 acres] for the plant site), and that co-locating with a retired nuclear plant would reduce these impacts. The HNP land-use estimate exceeds the GEIS estimate, even factoring in the fact that the SNC plants are considerably larger. The land-use change would noticeably alter the overall site pattern for natural land use, particularly if such land is wooded and would have to be cleared prior to constructing the plant and associated facilities. The impacts are considered MODERATE, depending on the length and routing of required pipelines and transmission lines.

- **Ecology**

Roughly 200 ha (500 acres) of established forest land would need to be converted to industrial use if the gas-fired units are sited at the existing HNP site. This is in addition to the cleared land devoted to the nuclear units even though some of the land currently devoted to the nuclear power plant operations may be used in the gas-fired generation scenario. Ecological impacts would also be minimized by using the existing cooling water intake and discharge system.

The GEIS noted that land-dependent ecological impacts from construction would be SMALL unless site-specific factors indicate a particular sensitivity and that operational impacts would be smaller than for other fossil fuel technologies of equal capacity. The staff has identified the conversion of 200 ha (500 acres) of forested land to industrial use as one of these site-specific impacts. Thus, siting at the existing HNP site would have a MODERATE to LARGE ecological impact and would definitely be more adverse to the environment than the proposed relicensing alternative.

At an undisturbed greenfield site, the impacts would certainly alter the ecology and could impact threatened and endangered species. These ecological impacts could be MODERATE to LARGE. Impacts would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity.

- **Water Use and Quality**

<u>Surface water</u>. The plant would use the existing HNP intake and discharge structures as part the cooling system; however, cooling requirements would be less (75 percent reduction over existing HNP use—approximately 57,000 m^3/d [15 million gpd] would be used for condenser cooling and to meet existing limitations on discharge temperatures [SNC 2000]). Because existing limitations on discharge temperatures would be met, water-quality impacts would continue to be SMALL.

Water-quality impacts from sedimentation during construction was another land-related impact that the GEIS categorized as SMALL. The GEIS also noted that operational water-quality impacts would be similar to, or less than, those from other centralized generating technologies. The staff has concluded that water-quality impacts from coal-fired generation would be SMALL, and gas-fired alternative water usage would be less than that for coal-fired generation. Surface-water impacts would remain SMALL; the impacts would not be detectable or would be so minor that they would not noticeably alter any important attribute of the resource.

For alternative greenfield sites, the impact on surface water would depend on the volume and other characteristics of the receiving body of water. The impacts would be SMALL to MODERATE.

Groundwater. Little variation would be expected in the amount of groundwater used because the groundwater wells are only used to supply water for drinking and the restroom facility at the HNP baseball field as well as to supply irrigation water for site landscaping during the summer months. The reduced workforce size (from 950 to 125) would reduce groundwater withdrawals for potable water use. The groundwater impacts would be very SMALL; i.e., the impacts would be so minor that they would not noticeably alter any important resource.

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

- **Air Quality**

Natural gas is a relatively clean-burning fuel. NO_x emissions from the gas-fired alternative would be 353 MT (386 tons) with gas. By comparison, NO_x emissions assuming flue gas re-circulation would be 265 MT/yr (290 tons/yr) (SNC 2000). New CAA provisions might result in SNC having to further reduce NO_x by shutting other sources down or by modifying plants to reduce NO_x formation (e.g., installing over-fired air, low NO_x burners, flue gas re-circulation, and selective non-catalytic and catalytic reduction systems). Precise reduction requirements are speculative at this time (SNC 2000).

The GEIS noted that gas-fired air-quality impacts are less than other fossil technologies because fewer pollutants are emitted, and SO_x is not emitted at all. Emissions from the gas-fired alternative would be less than emissions from the coal-fired alternative. However, the GEIS also noted, as did SNC, that the gas-fired alternative would contribute NO_x emissions to an area that in the future may become a non-attainment area for ozone.

Because NO_x contribute to ozone formation, the reduced NO_x emissions are still of future concern, and low NO_x combusters, water injection, and selective catalytic reduction could become regulatory-imposed mitigation measures.

For these reasons, the appropriate characterization of air impacts from a gas-fired plant would be MODERATE; the impacts, primarily NO_x, would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole at this time.

Siting the gas-fired plant elsewhere would not significantly change air-quality impacts because the site could also be located in a greenfield area that was not a serious non-attainment area for ozone. In addition, the location could result in installing more or less stringent pollution control equipment to meet the regulations. Therefore, the impacts would be MODERATE.

- **Waste**

There will be only small amounts of solid-waste products (i.e., ash) from burning natural gas fuel. The GEIS concluded that waste generation from gas-fired technology would be minimal. Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation would be limited to typical office wastes. This impact would be SMALL; waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute.

Siting the facility at an alternate greenfield site would not alter the waste generation; therefore, the impacts would continue to be SMALL.

- **Human Health**

The GEIS analysis mentions potential gas-fired alternative health risks (cancer and emphysema). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. As discussed in Section 8.2.1 for the coal-fired alternative, legislative and regulatory control of the Nation's emissions and air quality are protective of human health. The impacts of the gas-fired alternative on human health would be SMALL; that is, human health effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

Siting of the facility at an alternate greenfield site would not alter the human health effects that would be expected. Therefore, the impacts would be SMALL.

- **Socioeconomics**

It is assumed that construction of new gas-fired generating facilities would take place while HNP continues operation, with completion at the time that the nuclear units would halt operations. Therefore, for the 3-year construction period, the site would have between 500 and 750 additional workers. During this time, the surrounding communities would experience demands on housing and public services that could have large impacts. After construction, the communities would be impacted by the loss of jobs; construction workers would leave, the nuclear plant workforce (of 950 workers) would decline through a decommissioning period to a minimal maintenance size, and the gas-fired plant would introduce a replacement tax base and only 125 new jobs. Socioeconomic impacts from start of construction through nuclear plant decommissioning would be MODERATE.

The GEIS concluded that socioeconomic impacts from constructing a gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts (local purchases and taxes) of any nonrenewable technology. Compared to the coal-fired alternative, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would all reduce some of the socioeconomic impacts. For these reasons, gas-fired generation socioeconomic impacts themselves would be SMALL to MODERATE; that is, depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize any important attribute of the resource.

Construction at another site would relocate some socioeconomic impacts, but would not eliminate them. The community around the HNP site would still experience the impact of the loss of HNP operational jobs and the tax base. The communities around the new site would have to absorb the impacts of a moderate, temporary workforce and a small, permanent workforce. Therefore, the impacts would be MODERATE to LARGE, based on net job and tax-base losses.

As indicated above, the HNP workforce (of 950 workers) would decline and the gas-fired plant would introduce only 125 new jobs. Therefore, traffic impacts associated with commuting plant personnel would be expected to be less than the current impacts from HNP operations and would be SMALL. The impact of re-locating the plant to a new greenfield site would also be considered SMALL because of the small workforce size associated with the gas-fired plant.

- **Aesthetics**

The combustion turbines and heat-recovery boilers would be relatively low structures, less than 30 m (100 ft) tall, and would be screened from most offsite vantage points by intervening woodlands. The steam turbine building would be taller, approximately 46 m (150 ft) in height, and together with the exhaust stacks (70 m [230 ft] in height), would be visible offsite. The use of these facilities along with the existing mechanical-draft cooling towers and associated facilities, would have less visual impact than the existing HNP reactor building and stack which are considerably taller (60 m [200 ft] and 120 m [393 ft] tall, respectively) (SNC 2000).

The GEIS analysis noted that land-related impacts, such as aesthetic impacts, would be small unless site-specific factors indicate a particular sensitivity. As in the case of the coal-fired alternative, aesthetic impacts from the gas-fired alternative would be noticeable. However, because the gas-fired structures are shorter than the coal-fired structures and more amenable to screening by vegetation, the staff concluded that the aesthetic resources would not be destabilized by the gas-fired alternative. For these reasons, the appropriate characterization of aesthetic impacts from a gas-fired plant would be SMALL to MODERATE; the impacts would be clearly noticeable, but would not destabilize this important resource.

Alternative locations could reduce the aesthetic impact of gas-fired generation if siting were in an area that was already industrialized. In such a case, however, the introduction of the steam generator building, stacks, and cooling-tower plumes would probably still have a SMALL to MODERATE incremental impact.

- **Historic and Archaeological**

Gas-fired generation at HNP would not directly affect cultural resources (SNC 2000). The GEIS analysis noted that cultural resource impacts associated with the gas-fired alternative would be small unless important site-specific resources were affected. Gas-fired alternative construction at the HNP site would affect a smaller area within the footprint of the coal-fired alternative. As discussed in Section 8.2.1, site knowledge minimizes the possibility of cultural resource impacts. Impacts on cultural resources would be SMALL; that is, the effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

Construction at another, alternative site could necessitate instituting cultural resource preservation measures (power block area or transmission line right-of-way), but impacts to cultural resources could generally be managed and kept SMALL. Cultural resource studies would be required for the pipeline construction and any other areas of ground disturbance associated with this alternative.

- **Environmental Justice**

No environmental pathways have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement gas-fired plant was built at the HNP site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect the minority or low-income populations. The impacts would be SMALL to MODERATE. Impacts at other sites would depend upon the site chosen. If the replacement plant was built in Appling County, the County's tax base would be largely maintained, and some potential negative socioeconomic impacts on the minority or low-income populations would be avoided. If the plant was built elsewhere, outside of Appling County, then the environmental justice impacts of losing the plant would be LARGE. The impacts to the other areas would be SMALL to LARGE, depending on the population distribution.

8.2.2.2 Once-Through Cooling System

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

The impacts (SMALL, MODERATE, or LARGE) of this option are the same as the impacts for a gas-fired plant using the closed-cycle system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences. Given that the once-through cooling system would most likely be constructed at a new greenfield site, the differences noted in Table 8-5 should be compared with the Alternative Greenfield Site column in Table 8-4.

8.2.3 Imported Electrical Power

SNC adopts by reference, as representative of the environmental impacts of the imported electrical power alternative to HNP license renewal, the GEIS discussion of environmental impacts from generic alternatives.

Table 8-5. Summary of Environmental Impacts of Gas-Fired Generation With the Alternate Cooling System—Once-Through Cooling

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

"Imported power" means power purchased and transmitted from electric power-generation plants that the applicant does not own and that are located elsewhere within the region, United States, or Canada. Georgia is a net exporter of electric power (SNC 2000). However, SNC cannot discard imported power as a feasible alternative to HNP license renewal. Market conditions, particularly the anticipated free market created by deregulation, could result in a company finding it advantageous to import power to replace a retired Georgia plant while exporting other power generated in the State (SNC 2000). SNC assumes that if it did import power to replace HNP-generated capacity, the power would be generated elsewhere using one or more of the technologies that NRC discusses in GEIS Chapter 8. SNC has no basis for estimating which generation technology, or what mix of technologies, would be used other than to point to the currently available mix of technologies. Thus, importing (purchasing) additional power is a feasible alternative to SNC license renewal.

According to the DOE EIA's International Energy Outlook 1998 (DOE 1997),

> Hydro Quebec has targeted the U.S. market for future sales growth. Hydro Quebec currently owns Vermont Gas and has signed a deal with Enron to market electricity in the Northeast while selling Enron's gas in Quebec. In April 1997, Hydro Quebec petitioned the FERC (Federal Energy Regulatory Commission) to sell electricity in the United States. In return, it would allow U.S. competitors to wheel electricity into Quebec. In November 1997, Hydro Quebec received FERC approval to sell power in the United States at market-based rates.

Depending on transmission availability, relative power costs, whether Canadian environmental and aboriginal rights controversies over the hydroelectric James Bay Project in Northern Quebec can be solved, and whether appropriate transmission agreements and facilities could be put in place, Hydro Quebec could be a future source of imported power. However, there could be significant environmental impacts in Northern Quebec.

Regardless of the technology used to generate imported power, the generating technology would be one of those described in this SEIS and in the GEIS (probably coal, natural gas, nuclear, or Canadian hydroelectric). The GEIS, Chapter 8, description of the environmental impacts of other technologies is representative of the imported electrical power alternative to HNP license renewal. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or Canada.

8.2.4 Other Alternatives

Other commonly known generation technologies considered by NRC are listed in the following paragraphs. However, these sources have been eliminated as "reasonable alternatives" to the proposed action because the generation of 1690 MW(e) of electricity as a base-load supply using these technologies is not technologically feasible (NRC 1996).

8.2.4.1 Wind

Wind speeds in central and eastern Georgia (Macon and Savannah data) average 12 km/hr (7.8 mph) (SNC 2000), whereas average wind speeds of more than 21 km/hr (13 mph) are required for wind turbines to generate electricity. Regions with wind speeds of this magnitude include the Great Plains, the West, coastal areas, and parts of the Appalachians, including a small area of northeast Georgia (SNC 2000). The staff concludes that locating a wind-energy facility on or near the HNP site would not be feasible given the current state of the technology.

Based on the GEIS land-use estimate for wind power,[a] replacement of HNP generating capacity, even assuming ideal wind conditions, would require dedication of almost 109,000 ha (270,000 acres) or 1090 km^2 (422 mi^2). The current HNP site is about 910 ha (2240 acres), and Appling County, in which the facility is located, is about 1330 km^2 (514 mi^2) (SNC 2000). The size of the site needed eliminates the possibility of co-locating a wind facility at the HNP site even if such technology were technological feasible. Locating at an alternative greenfield site could be undertaken, but the required land-use resources would be large and potentially ecologically disruptive. Thus, based on the lack of adequate wind speeds and the amount of land that would be required for wind-powered generating facilities, the staff has concluded that the wind alternative is not feasible at a greenfield site. And if undertaken, a large greenfield site would be necessary, which would result in a LARGE environmental impact.

8.2.4.2 Solar

Solar power technologies, photovoltaic and thermal, cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity (DOE 1995). The average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 percent to 40 percent. Energy storage requirements prevent the use of solar energy systems as base load.

Second, there also are substantial impacts to natural resources (wildlife habitat, land use, and aesthetic impacts) from construction of these facilities. According to the GEIS, land requirements are high—14,000 ha (35,000 acres) per 1000 MW(e) for photovoltaic and approximately 6000 ha (14,000 acres) per 1000 MW(e) for solar thermal systems. Neither type of solar electric system would fit at the HNP site, and either would have large environmental impacts at a greenfield site.

Third, in addition to the dedicated land-use requirements, the HNP site receives less than 3.9 kWh of solar radiation per square meter per day, compared to 5 to 7.2 kWh of solar radiation per square meter per day in areas of the West, such as California, which are most promising for solar technologies (GEIS, Sections 8.3.2 and 8.3.3). Because of the natural resource impacts (land and ecological), the area's low rate of solar radiation and high technology costs, the staff views the role of solar electric power in Georgia as limited to niche applications and not a feasible baseload alternative to HNP license renewal. Some solar power

(a) GEIS, Section 8.3.1 estimates 150,000 acres per 1000 MW(e) for wind power.

may substitute for electric power in roof-top and building applications. Any attempt to implement solar technology would result in LARGE environmental impacts.

8.2.4.3 Hydropower

Approximately 15 percent, or 3412 MW(e), of Georgia's generating capacity is hydroelectric (SNC 2000). As GEIS Section 8.3.4 points out, hydropower's percentage of the country's generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. Based on the GEIS, land use estimates for hydroelectric power require approximately 400,000 ha (1 million acres) per 1000 MW(e). Replacement of HNP generating capacity would require flooding more than 7300 km^2 (2800 mi^2) (SNC 2000). Due to the large land-use and related environmental and ecological resource impacts associated with siting a hydroelectric facility large enough to replace HNP, the staff concludes that local hydropower is not a feasible alternative to HNP license renewal on its own. Any attempts to site hydroelectric facilities large enough to replace HNP would result in LARGE environmental impacts.

8.2.4.4 Geothermal

Geothermal has an average capacity factor of 90 percent and can be used for base-load power where available. However, as illustrated by GEIS Figure 8.4, geothermal plants might be located in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. But there is no feasible location for 1690 MW(e) of geothermal capacity to serve as an alternative to HNP license renewal.

The technology is not widely used as base-load generation due to the limited geographical availability of the resource and immature status of the technology (NRC 1996). Although small-scale applications such as geothermal heat pumps may be viable, the technology is not applicable to the region when the replacement of 1690 MW(e) is needed. The staff concludes that geothermal is not a feasible alternative to HNP license renewal.

8.2.4.5 Wood Energy

A wood-burning facility can provide base-load power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (GEIS, Section 8.3.6). The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered fuel cost and high construction cost per equivalent generating capacity with nuclear. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

In Georgia, the pulp, paper, and paperboard industries, which consume large quantities of electricity, are the largest consumers of wood and wood waste for energy, benefitting from the use of waste materials that could otherwise represent a disposal problem. In 1995, processing of wood products in Georgia generated 13.5 million m^3 (478 million ft^3) of wood and bark residues. Approximately 48 percent, or 6.5 million m^3 (230 million ft^3), of the residue was used as industrial fuel (SNC 2000). The 90 trillion BTU of energy estimated to be available annually from Georgia forests would only produce the amount of electricity that HNP produces in 7 hours (SNC 2000).

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has concluded that wood waste is not a feasible alternative to renewing the HNP license.

8.2.4.6 Municipal Solid Waste

The initial capital costs for municipal solid waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and handling equipment for municipal solid waste. The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining in “real” terms (DOE 2000). Therefore, municipal solid waste would not be a feasible alternative to HNP license renewal, particularly at the scale required.

8.2.4.7 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive for automotive fuel), and gasifying energy crops (including wood waste). The GEIS points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as HNP. For these reasons, such fuels do not offer a feasible alternative to HNP license renewal. In addition, these systems have LARGE impacts on land use.

8.2.4.8 Oil

Oil is not considered a stand-alone fuel because it is not cost-competitive when natural gas is available. The cost of oil-fired operation is as high as eight times as expensive as nuclear and coal-fired operation. More specifically, GPC has six oil-fired units. It has been GPC's experience that the cost of oil-fired operation is about six times that of nuclear operation and two times that of coal-fired operation (SNC 2000). Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation (DOE 1996). For these reasons, oil-fired generation is not a feasible alternative to HNP license renewal nor is it likely to be included in a mix with other resources, except as a backup fuel.

8.2.4.9 Advanced Nuclear Power

Work on advanced reactor designs has continued and nuclear plant construction continues overseas. However, the cost of building a new nuclear plant and the political uncertainties that have historically surrounded many nuclear plant construction projects are among the factors that have led energy forecasters (such as the EIA) to predict no new domestic nuclear power plant orders for the duration of current forecasts—through the year 2020 (DOE 1996). For these reasons, the staff does not consider new nuclear plant construction as a feasible alternative to HNP license renewal.

8.2.4.10 Fuel Cells

Phosphoric acid fuel cells are the most mature fuel cell technology, but they are only in the initial stages of commercialization. Two-hundred turnkey plants have been installed in the United States, Europe, and Japan. Recent estimates suggest that a company would have to produce about 100 MW of fuel-cell stacks annually to achieve a price of $1000 to $1500/kW (DOE 1999). However, the current production capacity of all fuel-cell manufacturers only totals about 60 MW/yr. The use of fuel cells for base-load capacity requires very large energy storage devices that are not feasible for storage of sufficient electricity to meet the base-load generating requirements. This is a very expensive source of generation, which prevents it from being competitive. This technology also has a high land-use impact, which, like wind technology, results in a large impact on the natural environment. It is estimated that 14,000 ha (35,000 acres) of land would be required to generate 1000 MW(e) of electricity (NRC 1996). Therefore, the staff considers fuel cells not to be a feasible alternative to license renewal at this time.

8.2.4.11 Delayed Retirement

HNP provides approximately 12 million MWh of GPC's generating capacity and approximately 14 percent of its energy requirements (SNC 2000). As a subsidiary of SNC, GPC supplies electrical power to the SNC regional electric grid (which includes Savannah Electric, Alabama Power, Gulf Power, and Mississippi Power). SNC expects the demand on its regional grid to increase approximately two percent (700 MW/yr), including reserve capacity, through the year 2018. In its planning, SNC considered the delayed retirement of older, less-efficient base-load plants. However, the cost of refurbishing these plants to make them more efficient and meet future emission limits would exceed the cost of building new plants (SNC 2000). For these reasons, delayed retirement of other SNC generating units would not be a feasible alternative to HNP license renewal.[a]

8.2.4.12 Utility-Sponsored Conservation

GPC has developed residential, commercial, and industrial programs to reduce both peak demands and daily energy consumption (demand-side management). GPC program components include the following:

- Peak clipping programs – This includes energy saver switches for air conditioners, heat pumps, and water heaters and allows GPC to interrupt electrical service to reduce load during periods of peak demand. It includes dispersed generation, giving GPC dispatch control over customer backup generation resources; and curtailable service, allowing GPC to reduce customers' load during periods of peak demand.

- Load shifting programs – These programs use time-of-use rates to encourage shifting loads from on-peak to off-peak periods. Use of computerized real-time displays allow the customer to monitor power usage and to keep power usage below peak thresholds levels while maintaining optimal product production.

- Conservation programs – These promote use of high-efficiency heating, ventilating, and air conditioning systems; encourage the construction of energy-efficient homes and commercial buildings; improve energy efficiency in existing homes; and provide incentives for use of energy-efficient lighting, motors, and compressors.

(a) An exception to this statement might occur if the new plants were constructed at a greenfield site. Adding the economic costs of new construction to the ecological damages that could occur with development at the virgin site, plus associated permitting costs and delays with plant and site development, the refurbishment of the existing plants might become economically attractive.

The GPC demand-side management program currently produces an estimated annual peak demand generation reduction of about 885 MW(e). The GPC load growth projection anticipates a demand-side management savings of about 1120 MW(e) in 2016. Because these savings are part of the long-range plan for meeting projected demand, SNC does not view these savings as available "offsets" for HNP. Nor does SNC foresee the availability of another 1690 MW(e) (HNP capacity) (SNC 2000). Therefore, the conservation option is not considered a reasonable replacement for the license renewal alternative.

8.2.4.13 Combination of Alternatives

Even though individual alternatives to HNP might not be sufficient on their own to replace HNP due to the small size of the resource (hydro) or lack of cost-effective opportunities (e.g., for conservation), it is conceivable that a mix of alternatives might be cost-effective. For example, if some additional cost-effective conservation opportunities, combined with limited wind, small-scale solar, and geothermal, could be found and combined with a smaller imported power or natural gas-fired alternative, it might be possible to reduce some of the key environmental impacts of alternatives. However, it is unlikely that the environmental impact of all aspects of such a hypothetical mix could be reduced to SMALL (see Table 8-6). In comparison, the impacts of renewing the HNP licenses are SMALL on all dimensions.

Table 8-6 provides a summary of the environmental impacts of one assumed combination. The impacts are based on the gas-fired generation impact assumptions discussed in Section 8.2.2 of this report, adjusted for the reduced power generation—1848 MW(e) versus 1200 MW(e)—plus 500 MW(e) obtained through additional conservation measures. While conservation measures would have very little or no negative environmental effects, the gas-fired generation option would increase emissions and environmental impacts. Based on the estimated environmental impacts of the assumed combination, the staff concludes that it is unlikely that the environmental impacts of such a hypothetical mix could be reduced to SMALL.

Table 8-6. Summary of Environmental Impacts of 500-MW(e) Demand-Side Measures, Plus 1200-MW(e) Gas-Fired Generation—Closed-Cycle Cooling

Impact Category	HNP Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Land Use	MODERATE	Additional 200 ha (500 acres) for power block, 49 ha (121 acres) disturbed for gas pipeline; land disturbed currently forested	MODERATE	360 ha (900 acres) for power block, offices and transmission lines
Ecology	SMALL	Constructed on land adjacent to HNP site; habitat loss due to pipeline construction	SMALL to MODERATE	Impact depends on location and ecology of the site
Water Use and Quality				
- Surface Water	SMALL	>75% reduction in water flow; 39,000 m^3 (10 million gpd) water versus 216,000 m^3 (57 million gpd) for existing HNP	SMALL to MODERATE	Impact depends volume and characteristics of receiving body of water
- Groundwater	SMALL	Reduced groundwater withdrawals due to reduced workforce	SMALL to MODERATE	Groundwater would depend on uses and available supply
Air Quality	SMALL to MODERATE	Primarily NO_x for gas-fired plant	SMALL to MODERATE	Impacts depend on air quality for alternate site
Waste	SMALL	Minor waste generation with gas (oil not evaluated)	SMALL	Same impacts as for HNP site
Human Health	SMALL	Impacts considered to be minor (see discussion of gas-fired alternative)	SMALL	Same impacts as for HNP site

Table 8.6. (contd)

Impact Category	HNP Site Impact	HNP Site Comments	Alternative Greenfield Site Impact	Alternative Greenfield Site Comments
Socioeconomics	MODERATE	500 to 750 additional workers during 3-year construction period; followed by a reduction in employment from 950 persons at HNP to 125 persons; tax base sustained with new gas-fired plant replacing HNP Transportation impacts would be SMALL due to less commuting workforce than HNP or coal-fired alternatives	MODERATE to LARGE	Construction impacts would be relocated. Appling and Toombs counties would experience workforce reduction plus loss of tax base if plant were located elsewhere. Other community gains 125 workers Transportation impacts would most likely be SMALL; actual impacts depend on population, transportation systems
Aesthetics	SMALL to MODERATE	Visual impact of stacks would be noticeable, but not as significant as coal-fired option or existing HNP reactor building and stacks	SMALL to MODERATE	Alternate locations could reduce aesthetic impact if siting is in an industrial area
Archaeological and Historic Resources	SMALL	Plant footprint less than coal-fired alternative; HNP site knowledge minimizes possible cultural resource impacts	SMALL	Alternate location would necessitate cultural resource preservation measures
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Impacts on housing are possible during construction; loss of 825 high-paying jobs might lessen employment opportunities for minority and low-income populations.	SMALL to MODERATE	Impacts vary depending on population distribution and makeup; impacts to Appling County could be MODERATE to LARGE if new plant built outside county

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