8.0 Environmental Impacts of the Alternatives

This chapter describes alternatives to the proposed action and discusses the environmental impacts of those alternatives. The evaluation of alternative sites is a two-step process, as set forth in NUREG-1555, Section 9.3 (NRC 2000), and stems from the U.S. Nuclear Regulatory Commission (NRC) decision related to licensing the Seabrook Nuclear Power Plant (*Public Service Co. of New Hampshire* 1977). The first step looks at a full suite of environmental issues, using reconnaissance-level information to determine if any of the alternative sites are environmentally preferable to the proposed Grand Gulf early site permit (ESP) site. If an alternative site appears environmentally preferable to the proposed site, the analysis proceeds to the second step. If not, then the evaluation of alternative sites ends at the first step. The second step considers economic, technological, and institutional factors among the environmentally preferred sites to determine if any is obviously superior to the proposed site. If there is no obviously superior site, then the proposed site prevails. A staff conclusion that an alternative site is obviously superior to System Energy Resources, Inc.'s (SERI's) proposed ESP site would normally lead to a recommendation that the ESP application be denied.

The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality guidelines (CEQ 1997) and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B. The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[(a)] with the additional impact category of environmental justice. While the GEIS was developed for license renewal, it provides useful information for this review and is referenced throughout this chapter.

Because 10 CFR 52.18 does not require an environmental impact statement (EIS) for an ESP to include consideration of the benefits of construction and operation of a new reactor or reactors at the ESP site, this EIS does not consider such matters. Accordingly, should the NRC issue an ESP for the Grand Gulf ESP site, these matters would be considered in the EIS for any construction permit (CP) or combined license (COL) application that references such an ESP.

Section 8.1 discusses the no-action alternative. Section 8.2 addresses alternative energy sources. Section 8.3 examines plant design alternatives. Section 8.4 reviews SERI's region of interest (ROI) and examines its suitability and the suitability of SERI's alternative site-selection process. It describes the method Entergy Nuclear used to select the candidate and alternative

(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.

sites. Entergy Nuclear, a division of Entergy, documented the process used to identify alternative sites in the *Early Site Permit Selection Committee Notebook* (Entergy Nuclear 2001). Section 8.4 also examines issues that are common to all of the alternative sites and addresses them collectively for all the alternative sites, and evaluates the selected alternative sites individually. Section 8.5 summarizes the environmental impacts for the alternative sites. The comparison of the alternative sites with the Grand Gulf ESP site is made in Chapter 9.

8.1 No-Action Alternative

For purposes of this ESP application, the no-action alternative refers to a scenario in which the NRC would deny the ESP request. Upon such a denial, the construction and operation of one or more new nuclear units at the proposed ESP location in accordance with the 10 CFR Part 52 process referencing an approved ESP would not occur.

The no-action alternative generally consists of two parts. First, under the no-action alternative NRC would not issue the ESP. There are no environmental impacts associated with not issuing the ESP, except that the impacts associated with site preparation and preliminary work that could be allowed pursuant to 10 CFR 52.17(c) and 10 CFR 52.25(a) would be avoided. SERI chose not to include a site redress plan in its ESP application, and therefore, would not be permitted to undertake site preparation and preliminary work pursuant to 10 CFR 52.17(c).

Second, given that the EIS addresses the environmental effects of construction and operation as directed by the Commission in 10 CFR 52.18, the no-action alternative would result in no such construction and operation. Therefore, the impacts predicted in this EIS would not occur.

In this context, the no-action alternative would accomplish none of the benefits intended by the ESP process, which would include

- Early resolution of siting issues prior to large investments of financial capital and human resources in new plant design and construction
- Early resolution of issues on the environmental impacts of construction and operation of reactors that fall within the plant parameters
- The ability to bank sites on which nuclear plants may be located
- The facilitation of future decisions on whether to construct new nuclear power generation facilities.

8.2 Energy Alternatives

This section examines the potential environmental impacts associated with electric generating sources other than a new nuclear generation facility at the Grand Gulf ESP site; purchasing electric power from other sources to replace power that would have been generated by a new nuclear facility at the ESP site; a combination of new generating capacity and conservation measures; and other generation alternatives that were deemed not to be viable replacements for a new nuclear facility at the ESP site. Section 8.2.1 discusses energy alternatives not requiring new generating capacity. Section 8.2.2 discusses energy alternatives requiring new generating capacity. Other alternatives are discussed in Section 8.2.3. A combination of alternatives is discussed in Section 8.2.4. Section 8.2.5 compares the environmental impacts from new nuclear, coal-fired, and natural gas-fired generating units at the Grand Gulf ESP site.

In Section 9.2.2.2 of its ESP application, SERI established a target value for the desired electrical output of 2000 MW(e) for a new nuclear generating facility constructed at the Grand Gulf ESP site and used this value in its analysis of energy alternatives (SERI 2005). The staff also used this level in Section 8.2 for analyzing the potential environmental impacts of alternative energy sources. The 2000 MW(e) output level is lower than the 3000 MW(e) maximum output level used in the analysis of construction and operation impacts in Chapters 4 and 5. The 3000 MW(e) figure derives from the SERI plant parameter envelope (PPE) (see Appendix I).

8.2.1 Alternatives Not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require SERI to construct new generating capacity are to

- Purchase the needed electric power from other suppliers
- Reactivate retired power plants
- Extend the operating life of existing power plants
- Implement conservation or demand side management programs.

The Commission determined (NRC 2005) that conservation or demand side management programs are not a reasonable alternative to an ESP for a base load nuclear power plant. Consequently, this alternative is not further considered.

The viability of the other three alternatives depends on when SERI would seek a CP or COL from NRC (assuming an ESP is granted). For example, the status of existing and retired nuclear power plants will vary over time. At the present time, no information is available on when SERI would seek to construct a new nuclear power facility at the Grand Gulf ESP site if it receives an ESP. If SERI is granted an ESP, the duration of the permit would be for 10 to

20 years (10 CFR 52.27(a)). In addition, if SERI is granted an ESP, it may apply for renewal of the permit under the procedures in 10 CFR 52.29 through 52.33.

The viability of the preceding alternatives also depends on whether the nuclear unit or units SERI would seek to build at the Grand Gulf ESP site would be merchant or regulated facilities. Merchant power facilities generate electricity to sell on the open market to any buyer willing to pay the price asked by the facility owner. Owners of regulated nuclear power facilities are generally obligated to sell electricity to all buyers in the designated service area, usually at a price approved by a regulatory body. In return for assuming this obligation, the owners of regulated nuclear power facilities generally receive a guarantee that the approved price can provide a rate of return commensurate with the risk/return of comparable investments. SERI has indicated its intent that a new nuclear power facility built at the ESP location would be a merchant facility operated in a base load manner to provide electricity to the competitive marketplace (SERI 2005). However, SERI also stated that it is possible that a new nuclear facility constructed at the Grand Gulf ESP site could be operated as a regulated facility (SERI 2005).

Because of the uncertainty in timing for the construction of a new nuclear generating facility at the Grand Gulf ESP site and whether the plant would be a merchant or a regulated facility, energy alternatives not requiring new generating capacity are not evaluated in great detail in this EIS.

If power to replace the capacity of a new nuclear unit were to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one of those described in the GEIS for license renewal (probably coal, natural gas, or nuclear) (NRC 1996). The description of the environmental impacts of other technologies described in the GEIS for license renewal is representative of the impacts associated with the construction and the operation of a new nuclear unit or units at the Grand Gulf ESP site. Under the purchased power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region, nation, or in another country. The environmental impacts of coal-fired and natural gas-fired plants are discussed in Section 8.2.2.

If the purchased power alternative is implemented, the only environmental unknown is whether new transmission line rights-of-way would be required. The construction of these lines could have both environmental and aesthetic consequences, particularly if new transmission line rights-of-way have to be acquired. The staff concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line rights-of-way are used and could range from SMALL to LARGE if acquisition of new rights-of-way is required. The environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown.

Nuclear power facilities are initially licensed for a period of 40 years. The license can be renewed for up to 20 years, and NRC regulations permit additional license renewal. SERI did not consider nuclear power plant license renewal in its environmental report. While SERI does not hold operating licenses for other nuclear power plants, it is a subsidiary of Entergy Corporation and other Entergy Corporation subsidiaries hold operating licenses for nuclear power plants around the country. A number of these plants have had operating licenses renewed and others are expected to seek license renewal.

The environmental impacts of continued operation of a nuclear power plant are significantly less than construction of a new plant. However, continued operation of an existing nuclear plant does not provide additional generating capacity.

Fossil plants slated for refurbishment, predominately coal- and natural gas-fired plants, tend to be ones that are old enough to have difficulty in economically meeting today's restrictions on air contaminant emissions and, as a result, would require extensive refurbishing to meet the more restrictive environmental standards at great economic cost. As a result, SERI concluded that the environmental impacts of a refurbishment scenario are bounded by the coal- and natural gas-fired alternatives.

The staff believes that it is unreasonable for an applicant to request a CP or COL if power could be purchased from other electricity suppliers at a reasonable cost, or if the power could be obtained by reactivating one or more of SERI's retired generating plants or by extending the life of one or more existing generating plants.

The staff concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, and extending the operating life of existing power plants are not reasonable alternatives to providing new base load power generation capacity.

8.2.2 Alternatives Requiring New Generating Capacity

In keeping with the NRC's evaluation of alternatives to license renewal, a reasonable set of energy alternatives to the construction and operation of one or more new nuclear units at the Grand Gulf ESP site should be limited to analysis of discrete power generation sources and those power generation technologies that are technically reasonable and commercially viable (NRC 1996). The current mix of base load power generation options in Mississippi is one indicator of the feasible choices for power generation technology within the State.

This section discusses the environmental impacts of those energy alternatives to the proposed action that would require SERI to construct new generating capacity, and is limited to the individual alternatives that are viable: coal-fired and natural gas-fired generation. The impacts

discussed in this section are estimates based on present technology. It is not known with certainty when one or more new nuclear generating units might be constructed at the Grand Gulf ESP site.

The staff assumed that new generation capacity would be located at the Grand Gulf ESP site for the coal-fired and natural gas-fired alternatives. Consistent with the cooling system assumption made by SERI for siting a new nuclear generating plant at the Grand Gulf ESP site (SERI 2005), a closed-cycle cooling system using either natural draft or mechanical cooling towers is also assumed for the coal-fired and natural gas-fired alternatives. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf ESP site (SERI 2005), albeit that upgrades, including transmission line right-of-way widening, may be necessary within the existing rights-of-way. Given the original plan for the Grand Gulf site was for multiple units, the staff finds this reasonable for new capacity up to the available transmission capacity margin. The analysis of alternative energy sources provided by SERI in its application draws on the information in Sections 8.2.1 and 8.2.2 of the supplemental EIS prepared by NRC related to the application to renew the operating licenses for Peach Bottom Atomic Power Station, Units 2 and 3 (NRC 2003).

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its *Annual Energy Outlook 2005*, the EIA reference case projects that combined-cycle, combustion turbine, or distributed generation technology fueled by natural gas is likely to account for more than 60 percent of new electricity-generating capacity added between 2004 and 2025 (DOE/EIA 2005). Combined-cycle technology can be used to meet base load requirements. 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 boiler to make steam to generate additional electricity.

Coal-fired plants are projected by EIA to account for nearly 33 percent of new capacity during this period. Coal-fired plants are generally used to meet base load requirements. Renewable generating units are projected by EIA to account for approximately 5 percent of the projected capacity expansion during the 2004-2025 time period.

The EIA projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. EIA projects that oil-fired plants will account for no new generation capacity in the United States through the year 2025, except for limited industrial combined heat and power applications because of higher fuel costs and lower efficiencies (DOE/EIA 2005).

8.2.2.1 Coal-Fired Power Generation

SERI chose to evaluate coal-fired generation in its environmental report. The staff assumed construction of four 509 MW(e) coal-fired units at the Grand Gulf ESP site. These assumptions are consistent with the application submitted by SERI (SERI 2005). The plant is assumed to have an operating life of 40 years.

Coal and lime (calcium oxide) or limestone (calcium carbonate) for a coal-fired plant would be delivered to the plant by railroad or barge. Currently there is no rail service to the Grand Gulf site or in the vicinity of the site (SERI 2005). SERI estimates that the plant would consume approximately 6 million MT/yr (6.6 million tons/yr) of pulverized bituminous coal with an ash content of approximately 11.9 percent (SERI 2005). Lime or limestone, used in the scrubbing process for control of sulfur dioxide emissions, is injected as a slurry into the hot effluent combustion gases to remove entrained sulfur dioxide. The lime-based scrubbing solution reacts with sulfur dioxide to form calcium sulfite, which precipitates and is removed from the process as sludge. SERI estimates that approximately 223,000 MT (246,000 tons) of lime would be used annually for flue gas desulfurization (SERI 2005).

Air Quality

SERI has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. In the environmental report, SERI (SERI 2005) estimates the coal-fired alternative emissions for sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM) to be as follows:

- SO_x – 12,100 MT (13,340 tons) per year
- NO_x – 11,600 MT (12,800 tons) per year
- CO – 1500 MT (1650 tons) per year
- PM – 350 MT (390 tons) per year.

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear generation because of emissions of SO_x, NO_x, CO, PM, and hazardous air pollutants such as mercury. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

The acid rain requirements of the Clean Air Act capped the nation's sulfur dioxide emissions from power plants. SERI would have to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from the plant. The market-based allowance system used for sulfur dioxide emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standard for such

plants (40 CFR 60.44a(d)(1)), which limits the discharge of any gases that contain NO_x (expressed as nitrogen dioxide) to 200 ng/J (1.6 lb/MWh) of gross energy output, based on a 30-day rolling average.

A new coal-fired generation plant would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. The plant would need to comply with the new source performance standards for such plants in 40 CFR Part 60 Subpart Da. The standards establish emission limits for particulate matter and opacity (40 CFR 60.42a), sulfur dioxide (40 CFR 60.43a), and nitrogen oxide (40 CFR 60.44a).

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified for criteria pollutants under the Clean Air Act (40 CFR 51.307(a)). Criteria pollutants under the Clean Air Act are lead, ozone, particulates, carbon monoxide, nitrogen oxide, and sulfur dioxide. Ambient air quality standards for criteria pollutants are in 40 CFR Part 50. The Grand Gulf ESP site is in an area designated as attainment or unclassified for criteria pollutants (40 CFR 81.325).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment occurs because of air pollution resulting from human activities. In addition, EPA regulations provide that, for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for those days on which visibility is most impaired over the period of the implementation plan and ensure no degradation in visibility for the least visibility-impaired days over the same period (40 CFR 51.308(d)(1)). If a new coal-fired power station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 160 km (100 mi) of the Grand Gulf ESP site. Louisiana has one Class I Federal area, the Breton Wilderness. The Breton Wilderness is located approximately 320 km (200 mi) southeast of the Grand Gulf ESP site.

The GEIS for license renewal (NRC 1996) did not quantify emissions from coal-fired power plants, but implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from sulfur oxides and nitrogen oxide emissions as a potential impact (NRC 1996). Adverse human health effects, such as cancer and emphysema, have been associated with the products of coal combustion. Overall, the staff concludes that air quality impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Waste Management

The GEIS for license renewal (NRC 1996) and NRC experience from license renewal analyses indicate that coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. In the environmental report, SERI estimates that a 2000 MW(e) coal-fired plant would generate approximately 711,000 MT (784,000 tons) of ash and spent catalyst and an additional 660,000 MT (728,000 tons) of scrubber sludge annually (SERI 2005).

In May 2000, EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (65 FR 32214). EPA concluded that some form of national regulation is warranted to address coal combustion waste products because of health concerns. Accordingly, EPA announced its intention to issue regulations for disposal of coal-combustion waste under subtitle D of the Resource Conservation and Recovery Act (RCRA 1976).

Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities.

For the reasons stated above, the staff concludes that the impacts from waste generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable, but would not destabilize any important resource.

Human Health

Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal-combustion waste, and public risk from inhalation of stack emissions. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. The EPA has recently concluded that certain segments of the U.S. population (such as the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects caused by exposures to mercury from sources such as coal-fired power plants. However, given the regulatory

oversight exercised by the EPA and by State agencies, the staff concludes that the human health impacts from radiological doses and inhaled toxins and particulates generated from coal-fired generation would be SMALL.

Other Impacts

Approximately 610 ha (1500 ac) of land would need to be converted to industrial use for the power block, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Given the proximity of the ESP site to the Mississippi River, ash, scrubber sludge, and spent SCR catalyst (used for control of nitrogen oxide emissions) would likely be disposed of offsite. Disposal of ash and sludge over a 40-year plant life would require approximately 320 ha (790 ac) of the 610 ha (1500 ac). Additional land may be needed in the site vicinity for infrastructure facilities, rail spur, and cooling water intake and discharge facilities. Total land requirements would be approximately 1085 ha (2680 ac) (SERI 2005). Additional land adjacent to the ESP site would likely need to be acquired by SERI if the coal alternative were to be implemented. The Grand Gulf site consists of approximately 850 ha (2100 ac), about half of which lies in seasonally flooded bottomlands (SERI 2005). Land use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. Overall, the staff concludes that the land-use impacts would be MODERATE.

The coal-fired generation alternative would introduce impacts from construction and new incremental impacts from operations. The impacts could include wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity. The impacts could occur at the ESP site and at the sites used for coal and limestone mining. Extraction of cooling makeup water could have adverse impacts on aquatic resources. Construction and maintenance of a rail spur and, only if needed, new or upgraded transmission lines would have ecological impacts. Cooling tower drift would have minimal impacts on terrestrial ecology. Disposal of fly ash could affect water quality and the aquatic environment. The impacts on threatened and endangered species at the ESP site would be similar to the impacts from a new nuclear facility. Overall, the staff concludes that the ecological impacts could be MODERATE to LARGE.

The impacts on water use and quality from constructing and operating a coal-fired plant at the ESP site would be comparable to the impacts associated with a new nuclear facility. Cooling water would likely be withdrawn directly from the Mississippi River or from collector wells located in the floodplain. Closed-cycle cooling with cooling towers is assumed. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (for example, chlorine). Treated process waste streams and sanitary wastewater may also be discharged. All discharges would be regulated by the Mississippi Department of Environmental Quality (MDEQ) through a National Pollution Discharge Elimination System (NPDES) permit. Indirectly, water quality could be affected by

acids and mercury from air emissions. Water would be consumed because of evaporation from the cooling towers. In the GEIS for license renewal the staff determined that some erosion and sedimentation would likely occur during construction (NRC 1996). Overall, the staff concludes that the water use and quality impacts would be SMALL.

Socioeconomic impacts would result from the approximately 300 workers needed to operate the coal-fired facility, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be SMALL to MODERATE, resulting from the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to operate the plant. The plant would pay very significant property taxes to Claiborne County. Considering the population and economic condition of the County, the staff concludes that the taxes would have a LARGE beneficial impact on the County.

The four coal-fired power block units would be as much as 60 m (200 ft) tall and would be visible offsite during daylight hours. The four exhaust stacks would be as much as 180 m (600 ft) high. The stacks and associated emissions would likely be visible in daylight hours for distances greater than 16 km (10 mi). Cooling towers and associated plumes also would have aesthetic impacts. Natural draft towers could be up to 170 m (550 ft) high (SERI 2005), and mechanical draft towers could be up to 30 m (100 ft) high. The stacks would be visible from parks and other recreational areas in the vicinity of the plant. The power block units and associated stacks and cooling towers would also be visible at night because of outside lighting. The Federal Aviation Administration generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). A mitigating factor is that the Grand Gulf ESP site is currently an industrial site located in a rural, forested area. The visual impacts of a new coal-fired plant could be further mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, provided the lighting meets Federal Aviation Administration requirements, and appropriate use of shielding. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf site (SERI 2005). However, as discussed in Section 4.1.2, some widening of the transmission line rights-of-way and related support structures could be needed.

Coal-fired power generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations and mechanical draft cooling towers. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route if rail service is

re-established. Although noise from passing trains significantly increases noise levels near the rail corridor, the short duration of the noise reduces the impacts. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the railway, the impacts of noise on residents in the vicinity of the facility and of the rail line are considered significant. Noise associated with barge transportation of coal and lime/limestone would be minor. Noise and light from the plant would be detectable offsite.

For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the ESP site (SERI 2005). Given the original plan for the Grand Gulf site was for multiple units, the staff finds this assumption reasonable for new capacity up to the available transmission capacity margin. Constructing and operating a coal-fired generation plant would be consistent with the industrial nature of the ESP site. Although best management practices would be expected to be implemented, the viewshed would be affected. Therefore, the staff concludes that the visual and aesthetic impacts of a coal-fired generation plant would be MODERATE.

The ESP site was disturbed during construction of the Grand Gulf Nuclear Station (GGNS). As a result, significant historic and cultural resource impacts would be unlikely and would be minimized by survey and recovery techniques. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse effect from ground-disturbing actions. Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new power plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the plant site, any offsite affected areas, such as mining and waste disposal sites, and along associated rights-of-way where new construction would occur, for example, roads, transmission line rights-of-way (if transmission capacity margins were approached), rail lines, or other rights-of-way. The staff concludes that the historic and cultural resource impacts would be SMALL.

There is evidence of potential environmental justice issues at the ESP site. Some MODERATE adverse impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations. Local property tax yields, however, should be beneficial and LARGE. Therefore, the staff concludes that environmental justice impacts would be LARGE and beneficial.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The impacts of coal-fired power generation at the ESP site are summarized in Table 8-1.

Table 8-1. Summary of Environmental Impacts of Coal-Fired Power Generation – 2000 MW(e)

Impact Category	Impact	Comment
Air quality	MODERATE	SO_x – 12,100 MT (13,340 tons) per year NO_x – 11,600 MT (12,800 tons) per year CO – 1500 MT (1650 tons) per year PM – 350 MT (390 tons) per year Small amounts of hazardous air pollutants.
Waste management	MODERATE	Total waste volume would be approximately 711,000 MT/yr (784,000 tons/yr) of ash and spent catalyst and an additional 660,000 MT/yr (728,000 tons/yr) of scrubber sludge.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	MODERATE	Uses up to 1085 ha (2680 ac) for power block; coal handling, storage, and transportation facilities; infrastructure facilities; waste disposal; rail spur; and cooling-water facilities. Mining activities would have additional impacts offsite.
Ecology	MODERATE to LARGE	Uses the undeveloped upland area of the ESP site and probably some adjacent offsite undeveloped land. Potential upland hardwood forest loss and fragmentation, reduced productivity and biological diversity, and impacts on terrestrial ecology from cooling tower drift. Additional impacts associated with coal mining and construction of a rail spur.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear facility located at the ESP site.
Socioeconomics	LARGE Beneficial	Construction-related impacts would be noticeable. Impacts during operation would be minor. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts during operation likely would be smaller than during construction.
Aesthetics	MODERATE	Best management practices can be used to mitigate visual impacts from exhaust stacks, cooling towers, and plumes. Some offsite noise impacts would occur.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	LARGE Beneficial	Some adverse impacts on housing availability and prices during construction may occur. Local property tax revenues could be major and beneficial during operations.

8.2.2.2 Natural Gas-Fired Power Generation

SERI chose to evaluate natural gas-fired generation in its environmental report. For this alternative, the staff assumed construction and operation of a natural gas-fired plant with a closed-cycle cooling system and cooling towers located at the Grand Gulf ESP site. The staff assumed that the natural gas-fired plant would use combined-cycle combustion turbines, which is consistent with the SERI ESP application (SERI 2005). The staff also used the SERI assumption of four units with a net capacity of 508 MW(e) per unit (SERI 2005).

Air Quality

Natural gas is a relatively clean-burning fuel. When compared with a coal-fired plant, a natural gas-fired plant would release similar types of emissions but in lower quantities.

A new natural gas-fired power generation plant would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. A new combined-cycle, natural gas-fired plant would also be subject to the new source performance standards specified in 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, sulfur dioxide, and nitrogen oxides.

EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as attainment or unclassified under the Clean Air Act. The Grand Gulf ESP site is in an area designated as attainment or unclassified for criteria pollutants (40 CFR 81.325).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, EPA regulations provide, that for each mandatory Class I Federal area located within a State, State regulatory agencies must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least impaired days over the same period (40 CFR 51.308(d)(1)). If a new natural gas-fired power plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 160 km (100 mi) of the Grand Gulf ESP site. Louisiana has one Class I Federal area, the Breton Wilderness. The Breton Wilderness is located approximately 320 km (200 mi) southeast of the Grand Gulf ESP site.

SERI estimates that a natural gas-fired plant equipped with appropriate pollution control technology would have approximately the following emissions (SERI 2005):

- SO_x – 109 MT (120 tons) per year
- NO_x – 417 MT (460 tons) per year
- CO – 553 MT (610 tons) per year
- PM_{10} – 63 MT (70 tons) per year.

PM_{10} is particulate matter having an aerodynamic diameter less than or equal to 10 μm (40 CFR 50.6(c)). A natural gas-fired power plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

The combustion turbine portion of the combined-cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR Part 63, Subpart YYYY) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 10 tons/yr or more of any single hazardous air pollutant or 25 tons/yr or more of any combination of hazardous air pollutants (40 CFR 63.6085(b)).

The fugitive dust emissions from construction activities would be mitigated using best management practices; such emissions would be temporary.

The impacts of emissions from a natural gas-fired power generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, the staff concludes that air quality impacts resulting from construction and operation from new natural gas-fired power generation at the ESP site would be SMALL to MODERATE.

Waste Management

In the GEIS, the staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant waste generated at a natural gas-fired power plant would be spent SCR catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent SCR catalyst, waste generation at an operating natural gas-fired plant would be largely limited to typical office waste. Construction-related debris would be generated during construction activities. Overall, the staff concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

In the GEIS, the staff identified cancer and emphysema as a potential health risk from natural gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. Air emissions from a natural gas-fired power generation plant located at the Grand Gulf ESP site would be regulated by the MDEQ.

The human health effect is expected to be either undetectable or sufficiently minor. Overall, the staff concludes that the impacts on human health from natural gas-fired power generation would be SMALL.

Other Impacts

The natural gas-fired generating plant would require approximately 45 ha (110 ac) for the power block and support facilities and likely would be sited on land that was previously disturbed during the construction of GGNS Unit 1 (SERI 2005). Assuming the natural gas-fired plant uses a closed-cycle cooling system, an additional land area of up to 12 ha (30 ac) would be required for cooling towers and support systems. Construction of a natural gas pipeline from the Grand Gulf ESP site to the closest natural gas distribution line could require up to 34 ha (85 ac) (SERI 2005). Thus, the total land use commitment would be approximately 91 ha (225 ac) (SERI 2005). For any new natural gas-fired power plant, additional land would be required for natural gas wells and collection stations. In the GEIS, the staff estimated that approximately 1500 ha (3600 ac) would be needed for a 1000-MW(e) plant (NRC 1996). Information from the GEIS for license renewal is useful for this analysis as well. Overall, the staff concludes that land-use impacts from new natural gas-fired power generation would be SMALL.

Siting of the natural gas-fired plant would have ecological impacts that would be less than a new nuclear facility. Much of the impact would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Constructing a new underground gas pipeline to the site would cause temporary ecological impacts. Ecological impacts on the plant site and utility easements would not affect threatened or endangered species, although some wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity would be likely. Withdrawal and discharge of makeup water for the cooling system could affect aquatic resources, and drift of condensation from the cooling towers could affect terrestrial ecology. Overall, the staff concludes that ecological impacts would be SMALL to MODERATE.

The impacts on water use and quality from constructing and operating a natural gas-fired plant at the Grand Gulf ESP site would be comparable to the impacts associated with constructing and operating a new nuclear facility. Closed-cycle cooling with cooling towers is assumed. The impacts on water quality from sedimentation during construction of a natural gas-fired plant were characterized in the GEIS as SMALL (NRC 1996). NRC also noted in the GEIS that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies. Information from the GEIS for license renewal is useful for this analysis as well. Overall, the staff concludes that impacts on water use and quality would be SMALL.

Socioeconomic impacts would result from the approximately 150 workers needed to operate the natural gas-fired facility, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be SMALL because of the mitigating influence of the site's proximity to the surrounding population area and

the relatively small number of workers needed to construct and operate the plant in comparison to nuclear and coal-fired generation alternatives. The plant would pay property taxes to Claiborne County. Considering the population and economic condition of the County, the staff concludes that the taxes would have a MODERATE beneficial impact on the County.

The turbine buildings, four exhaust stacks (approximately 60 m (200 ft) tall) and associated emissions, cooling towers, condensation plumes from the cooling towers, and the gas pipeline compressors would be visible during daylight hours from offsite. Noise and light from the plant would be detectable offsite. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf site (SERI 2005). However, as discussed in Section 4.1.2, some widening of the rights-of-way and related support structures could be needed. A mitigating factor is that the Grand Gulf ESP site is currently an industrial site located in a rural, forested area. Overall, the staff concludes that the aesthetic impacts associated with new natural gas-fired power generation at the Grand Gulf ESP site would be SMALL.

The ESP site was disturbed during construction of the GGNS. As a result, significant historical and cultural and historic resource impacts would be unlikely and would be minimized by survey and recovery techniques. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse effects from ground-disturbing actions. Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new power plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the plant site, any offsite affected areas, and along associated rights-of-way where new construction would occur (for example, roads, transmission line rights-of-way, rail lines, or other rights-of-way). The staff concludes that the historic and cultural resource impacts would be SMALL.

There is evidence of potential environmental justice issues at the ESP site. Some temporary impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations, but there would be moderate property tax revenues during operations. Therefore, the staff concludes that environmental justice impacts would be MODERATE and beneficial.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The impacts of natural gas-fired power generation at the ESP site are summarized in Table 8-2.

Table 8-2. Summary of Environmental Impacts of Natural Gas-Fired Power Generation – 2000 MW(e)

Impact Category	Impact	Comment
Air quality	SMALL to MODERATE	SO_x – 109 MT (120 tons) per year NO_x – 417 MT (460 tons) per year CO – 553 MT (610 tons) per year PM_{10} – 64 MT (70 tons) per year Some hazardous air pollutants.
Waste management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	SMALL	90 ha (225 ac) would be needed for power block, cooling towers and support systems, and connection to a natural gas pipeline. Additional land might be needed for infrastructure and other facilities.
Ecology	SMALL to MODERATE	Many of the impacts would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would be negligible. Impacts on terrestrial ecology from cooling tower drift could occur.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear plant located at the ESP site.
Socioeconomics	MODERATE Beneficial	Construction and operations workforces are both relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small work-force involved.
Aesthetics	SMALL	Best management practices can be used to mitigate visual impacts from the plant buildings, exhaust stacks, cooling towers, and condensation plumes from operation of the cooling towers.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	MODERATE Beneficial	Some impacts on housing availability and prices during construction may occur, as might beneficial impacts from property tax revenues.

8.2.3 Other Alternatives

This section discusses alternatives that SERI determined are not reasonable, the staff's conclusions about the overall environmental impacts of each alternative, and the staff's basis for the conclusions. New nuclear units at the ESP site would be a base load generation plant. Any feasible alternative to the new units would need to generate base load power. In performing its initial evaluation in the environmental report, SERI relied on the GEIS for license renewal (NRC 1996). The staff reviewed the information submitted by SERI and conducted the NRC staff's independent review and finds that SERI's conclusion that these generation options are not reasonable alternatives to one or more new nuclear units is acceptable.

The staff has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the ESP site. Any attempt to assign significance levels would require staff speculation about the unknown site.

8.2.3.1 Oil-Fired Power Generation

The EIA projects that, because of higher fuel costs and lower efficiencies, oil-fired power plants will not provide new power generation capacity in the United States through the year 2025, except for limited industrial combined heat and power applications (DOE/EIA 2005). Oil-fired generation is more expensive than either the nuclear or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has resulted in a decline in its use for electricity generation. In Section 8.3.11 of the GEIS for license renewal, the staff estimated that construction of a 1000 MW(e) oil-fired plant would require about 49 ha (120 ac) of land (NRC 1996).

For the proceeding reasons, the staff concludes that an oil-fired power plant at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.2 Wind Power

Mississippi and Louisiana are in a wind power Class 1 region (average wind speeds lower than 5.6 m/s) (DOE 2004a). Class 1 regions have the lowest potential for wind energy generation (DOE 2004a). Mississippi does not have sufficient wind resources to use large-scale wind turbines (DOE 2004b). Small wind turbines may have applications in some areas of the state (DOE 2004b). Wind turbines typically operate at a 25 to 35 percent capacity factor compared to 90 to 95 percent for a base load plant such as a nuclear plant (NWPPC 2000).

For the preceding reasons, the staff concludes that a wind energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar power technologies (both photovoltaic and thermal) cannot currently compete with conventional nuclear and fossil-fueled technologies in grid-connected applications because of solar power's higher capital cost per kilowatt of capacity. Energy storage requirements also limit the use of solar energy systems as base load electricity supply. In the GEIS for license renewal, the staff determined that the average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996).

Construction of solar generating facilities has substantial impacts on natural resources (such as wildlife habitat, land use, and aesthetics). As stated in the GEIS, land requirements are high – 142 km^2 (55 mi^2) per 1000 MW(e) for photovoltaic (NRC 1996) and approximately 57 km^2 (22 mi^2) per 1000 MW(e) for solar thermal systems (NRC 1996). Neither type of solar electric system would fit the land area footprint available at the Grand Gulf ESP site.

The Grand Gulf ESP site receives approximately 4500 to 5000 watt-hr/m^2/day that can be used for flat-plate solar systems, and approximately 4000 to 4500 watt-hr/m^2/day that can be used for solar concentrating systems (DOE 2004c). Areas in the southwest United States receive up to 7500 watt-hr/m^2/day (DOE 2004c). The solar resource in Mississippi can be used for water heating or photovoltaic systems but not for large concentrating solar thermal utility systems (DOE 2004c).

For the preceding reasons, the staff concludes that a solar energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.4 Hydropower

Mississippi has an estimated 92 MW of developable hydroelectric resources (INEEL 1997). As stated in Section 8.3.4 of the GEIS for license renewal (NRC 1996), the percentage of U.S. generating capacity supplied by hydropower is expected to decline because hydroelectric facilities have become difficult to site as a result of public concerns about flooding, destruction of natural habitat, and alteration of natural river courses. In the GEIS, the staff estimated that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac) per 1000 MW(e) (NRC 1996). Because of the relatively low amount of undeveloped hydropower

resource in Mississippi and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 2000 MW(e), the staff concludes that local hydropower is not a feasible alternative to construction of a new nuclear power generation facility operated as a base load plant at the Grand Gulf ESP site.

8.2.3.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for base load power where available. However, geothermal technology is not widely used as base load power generation because of the limited geographical availability of the resource and immature status of the technology (NRC 1996). Geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. Mississippi has low-to-moderate geothermal resources that can be tapped for direct heat or for geothermal heat pumps. However, electricity generation is not possible with these resources (DOE 2004d). No feasible eastern location for geothermal capacity can serve as an alternative to a base load nuclear power plant.

For the preceding reasons, the staff concludes that a geothermal energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.6 Wood Waste

In the GEIS for license renewal, the staff determined that 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 (NRC 1996). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a base load power plant, the ecological impacts of large-scale timber cutting (for example, soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and use the resultant heat to produce steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2004). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. In the GEIS for license renewal, the staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently, approximately 89 waste-to-energy plants are operating in the United States. These plants generate approximately 2500 MW(e), or an average of approximately 28 MW(e) per plant (IWSA 2004). For the preceding reasons, the staff concludes that generating electricity from municipal solid waste would not be a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS for license renewal, the staff determined 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 large base load plant (NRC 1996). For these reasons, the staff concludes that such fuels do not offer a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode,

and then separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow (DOE 2004e). Currently, the most widely marketed fuel cells cost about $4500 per kW of installed capacity. By contrast, a diesel generator costs $800 to $1500 per kW of installed capacity, and a natural gas turbine can be even less (DOE 2004e).

DOE initiated a program – the Solid State Energy Conversion Alliance – to bring about dramatic reductions in fuel cell cost. DOE's goal is to cut costs to as low as $400 per kW of installed capacity by the end of this decade, which would make fuel cells competitive for virtually every type of power application (DOE 2004e).

The staff concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for base load electricity generation. Future gains in cost competitiveness for fuels cells compared to other fuels are speculative.

For the preceding reasons, the staff concludes that a fuel cell energy facility located at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.4 Combination of Alternatives

Individual alternatives to the construction of one or more new nuclear units at the Grand Gulf ESP site might not be sufficient on their own to generate SERI's target value of 2000 MW(e) because of the small size of the resource or lack of cost-effective opportunities. Nevertheless, it is conceivable that a combination of alternatives might be cost effective. There are many possible combinations of alternatives.

Section 8.2.2.2 assumes the construction of four 508 MW(e) natural gas combined-cycle generating units at the Grand Gulf ESP site using closed-cycle cooling with cooling towers. For

a combined alternatives option, the staff assessed the environmental impacts of an assumed combination of three 508 MW(e) natural gas combined-cycle generating units at the Grand Gulf ESP site using closed-cycle cooling with cooling towers, 30 MW of wind energy, 30 MW of hydropower, 90 MW from biomass sources including municipal solid waste, and 326 MW from conservation and demand-side management programs. A summary of the environmental impacts of this combination of alternatives is in Table 8-3.

8.2.5 Summary Comparison of Alternatives

Table 8-4 contains a summary of environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired, combined-cycle generating units at the Grand Gulf ESP site. The combination of alternatives shown in Table 8-4 assumes siting of natural gas-fired/combined-cycle units at the ESP site and siting of other generating units in the general vicinity (within 160 km (100 mi)) of the site. Closed-cycle cooling with cooling towers is assumed for all thermal plants.

The staff reviewed the available information on the environmental impacts of power generation alternatives compared to the construction of new nuclear units at the Grand Gulf ESP site. Based on this review, the staff concludes that, from an environmental perspective, none of the viable energy alternatives are obviously superior to construction of a new base load nuclear power generation plant. If significant changes in generation technology or environmental impacts associated with particular generation technologies should occur and an ESP holder seeks a CP or COL to build a new nuclear generating plant at an ESP location, the staff would verify the analysis of energy alternatives conducted at the ESP stage.

8.3 Plant Design Alternatives

An important factor in assessing environmental impacts on the terrestrial and aquatic environments in the vicinity of a nuclear power plant site is the selection of heat-dissipation and circulating water systems. In Sections 9.4.1 and 9.4.2 of its environmental report, SERI described the selection and evaluation process that resulted in its decision to propose natural or mechanical draft cooling towers or both with a makeup water intake in the Mississippi River and a blowdown discharge outfall downstream of the intake (SERI 2005).

Table 8-3. Summary of Environmental Impacts of a Combination of Power Sources – 2000 MW(e)

Impact Category	Impact	Comment
Air quality[(a)]	SMALL to MODERATE	SO_x – 82 MT (90 tons) per year NO_x – 313 MT (345 tons) per year CO – 415 MT (458 tons) per year PM_{10} – 48 MT (53 tons) per year Some hazardous air pollutants.
Waste management	SMALL	The only significant waste would be spent SCR catalyst used for control of NO_x emissions and ash from biomass sources.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	SMALL to MODERATE	Natural gas-fired plant would have land use impacts for power block, cooling towers and support systems, and connection to a natural gas pipeline. Wind, hydro, and biomass facilities and associated transmission lines would also have land use impacts.
Ecology	SMALL to MODERATE	Many of the impacts would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would be minimal. Impacts on terrestrial ecology from cooling tower drift could occur. Wind energy facilities could result in some avian mortality. Hydropower facilities would impact terrestrial and aquatic habitat.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear plant located at the ESP site.
Socioeconomics	MODERATE Beneficial	Construction and operations workforces are both relatively small. Addition to property tax base, while smaller than for a nuclear, coal-fired, or solely natural gas-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small workforce involved.
Aesthetics	SMALL to MODERATE	Best management practices can be used to mitigate visual impacts from plant buildings, exhaust stacks, cooling towers, and condensation plumes from operation of the cooling towers. Wind energy towers would have aesthetic impact.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facilities and infrastructure at the Grand Gulf ESP site would be built on previously disturbed ground.
Environmental justice	MODERATE Beneficial	Some impacts on housing availability and prices during construction may occur as might beneficial impacts from property tax revenues.

(a) Impacts are principally from natural gas-fired power generation. Municipal solid waste or biomass facilities may generate some additional emissions.

Table 8-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural Gas-Fired Generating Units, and a Combination of Alternatives

Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Air quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste management	SMALL	MODERATE	SMALL	SMALL
Human health	SMALL	SMALL	SMALL	SMALL
Land use	SMALL	MODERATE	SMALL	SMALL to MODERATE
Ecology	SMALL to MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality	SMALL	SMALL	SMALL	SMALL
Socioeconomics	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial
Aesthetics	SMALL	MODERATE	SMALL	SMALL to MODERATE
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial

8.3.1 Heat-Dissipation Systems

The purpose of the plant cooling system is to dissipate energy to the environment. The various cooling system options differ in how the energy transfer takes place, and therefore have different environmental impacts. SERI considered seven heat-dissipation alternatives in its environmental report (SERI 2005):

- Once-through cooling
- Wet mechanical draft cooling towers
- Wet natural draft cooling towers
- Wet-dry cooling towers

- Dry cooling towers
- Cooling pond
- Spray canals.

Of these systems, SERI determined that the only alternatives suitable for the Grand Gulf ESP site were wet mechanical draft towers, wet natural draft towers, and wet-dry cooling towers. However, SERI only included wet natural draft and wet mechanical draft cooling towers in its PPE.

SERI eliminated dry cooling towers, cooling pond, and spray canals from consideration because it determined that the land requirements for these systems made them unsuitable for the site. SERI eliminated once-through cooling because of the aquatic impacts associated with the large volumes of water that would need to be withdrawn from the Mississippi River and subsequently returned to the river at an elevated temperature.

The Grand Gulf site includes approximately 850 ha (2100 ac) in a rural setting along the Mississippi River. Lowlands below the bluffs make up about half of the site. The lowlands include Hamilton and Gin lakes and wetlands that are subject to frequent flooding from the river. Therefore, the staff determined that the lowlands would be less suitable for development than the upland area.

Approximately 60 ha (150 ac) of the uplands area is committed to the existing GGNS Unit 1 facility. Some additional wetlands, particularly along the Stream A and Stream B corridors, occur above the bluffs. The staff determined that the ESP site was unsuitable for cooling pond or spray canal heat-dissipation designs based on the limited area of the site.

The staff also concluded that the Mississippi River is not a suitable source for a once-through cooling system. EPA regulations (40 CFR Part 125, Subpart I) issued in 2001 contain requirements applicable to cooling water intake structures for new facilities under Section 316(b) of the Clean Water Act that make it very difficult for large new generating plants to use once-through cooling. In addition, the staff determined that high sediment concentrations in the Mississippi River may require extensive large-scale water treatment, and that some adverse impacts would occur during the construction and maintenance activities associated with intake and discharge structures and buried piping.

Dry cooling tower systems use either a natural or a mechanical air draft to transfer heat from the condenser tubes to the air. Since dry cooling uses essentially no water, water use is bounded by the wet-tower designs. Although noise from the fans in a dry tower or a wet-dry tower would likely be greater than for a mechanical draft system, the staff believes that these impacts would be minimal in a rural environment such as the Grand Gulf ESP site. In the environmental report, SERI determined that dry cooling for the ESP site would not be suitable because insufficient land would be available (SERI 2005). However, even using SERI's high

estimate of the land requirements for the dry cooling alternative, land requirements would only be approximately 65 ha (160 ac), which is considerably less than the available area. Nevertheless, the staff concludes that dry cooling tower systems would not be suitable for the ESP site for the reasons discussed by EPA in the preamble to EPA's final rule on NPDES regulations addressing cooling water intake structures for new facilities (66 FR 65256). EPA determined that dry cooling is not the best technology available for minimizing adverse environmental impacts in part because the technology of dry cooling carries costs that are sufficient to pose a barrier to entry to the marketplace for some projected new facilities, and dry cooling technology has some detrimental effects on electricity production by reducing the energy efficiency of steam turbines. Therefore, the staff concludes that dry cooling tower systems should only be considered if water supply is an issue. Water supply is not an issue at the Grand Gulf ESP site.

In conventional closed-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. The GEIS for license renewal has a summary of the impacts of wet cooling towers on terrestrial resources (NRC 1996). The impacts identified in the GEIS include visible plumes; noise; icing; deposition of salts, biocides, and microorganisms in the vicinity of towers; avian mortality from collisions of birds with towers; and the visual impacts of the towers themselves. Some of these impacts (for example, icing and deposition of salts) are associated with low, mechanical draft cooling towers, while others (such as avian mortality and visual impacts) are associated with natural draft towers.

Wet-dry cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers. Water use for the wet-dry cooling tower alternative is bounded by mechanical and natural draft wet cooling towers. Compared to wet cooling towers, less evaporation, makeup water, and blowdown are involved in the wet-dry cooling process, thus reducing water-related impacts. However, the disadvantages of dry cooling discussed in the EPA preamble to the final NPDES rule (66 FR 65256) apply to the dry cooling portion of the heat-dissipation process. The dry cooling process is not as efficient as the wet cooling process because it requires the movement of a large amount of air through the heat exchanger to achieve the necessary cooling. This results in less net electrical power for distribution.

Water supply is not an issue at the Grand Gulf ESP site. Based on the NRC staff's independent review, the staff concludes that wet mechanical draft cooling towers and wet natural draft cooling towers are suitable for the site. The specific cooling system design for one

or more new nuclear units or units at the Grand Gulf ESP site has not been selected; therefore, system design alternatives would be discussed at the CP or COL stage if an application were submitted to build a new plant at the site.

8.3.2 Circulating Water Systems

In a once-through cooling process, water is withdrawn from a cooling water source, passed through the condenser once, and then returned to the receiving water body. In a closed-loop system, heat transferred from the condenser to the circulating water is dissipated through auxiliary cooling facilities, after which the cooled water is recirculated to the condenser. This recirculation step means that much less water needs to be withdrawn from the water source than for a once-through cooling system with the same heat rejection capacity. Alternative intake, discharge, water supply, and water treatment systems for a closed-loop design at the Grand Gulf ESP site are discussed below.

8.3.2.1 Intake Systems

GGNS Unit 1 uses multiple radial collector wells located next to the Mississippi River. The wells pump from the alluvial aquifer to provide makeup water for the natural and mechanical draft cooling system used for Unit 1. SERI states in its environmental report that a similar arrangement of collector wells drawing water from the alluvial aquifer for a new power plant located at the Grand Gulf ESP site could not be supported by the aquifer (SERI 2005). Therefore, SERI states that, for a new plant, makeup water for the heat-dissipation system and the circulating water system would be withdrawn directly from the Mississippi River through a shoreline embayment and intake constructed on the bank of the river (SERI 2005).

Two alternative types of river intakes were considered by SERI in its environmental report. One alternative would involve a direct intake from the river with a structure located on the riverbed and a pipeline connecting it to the bank. The Mississippi River is very active with vast amounts of sediment moving along the riverbed making it difficult to maintain structures located on the riverbed. Additionally, the Mississippi River is a critical transportation corridor and any in-stream construction and maintenance activities must consider possible impacts on river traffic. The second alternative would involve a channel directing water to the intake structure on the shoreline. The staff found no basis to suggest that these two water intake alternatives would be environmentally preferable to SERI's proposed intake system.

8.3.2.2 Discharge Systems

GGNS Unit 1 uses a cooling tower/circulating water system. The blowdown from the cooling tower is discharged to the Mississippi River through the existing barge slip embayment. SERI

states that the thermal effluent from a new facility would also be released to the river through a new outfall structure that would be located downstream of the existing outfall (SERI 2005).

The staff evaluated a shoreline diffuser outfall and a submerged single-point discharge. The shoreline diffuser would result in a larger plume; however, its impact on the Mississippi River would be localized and small as discussed in Section 5.3.2. For a submerged port-diffuser located beneath the water surface, the buoyant jet would entrain ambient water as it rises to the surface, thus enhancing mixing. However, a submerged outfall could interfere with traffic on the river, would be more difficult to construct, and may require maintenance dredging. The shoreline discharge proposed by SERI would avoid dredging and in-stream construction. The staff found no basis to suggest that the two discharge alternatives would be environmentally preferable to SERI's proposed discharge system.

8.3.2.3 Water Supply

A source of makeup water at the ESP site would be needed to offset the continuous loss of water from evaporation, drift, and blowdown. The two sources of water on or near the Grand Gulf ESP site that could provide an adequate volume of makeup water are the Mississippi River and wells in the alluvial aquifer. Because of the hydraulic connection between the alluvial aquifer and the river, the wells would effectively withdraw water from the river. The staff also found that the Catahoula aquifer would not provide adequate water supply for any but the dry cooling heat-dissipation system alternative. The staff did not identify any other environmentally preferable water supply.

8.3.2.4 Water Treatment

At this stage, the final design of the various water systems for a new nuclear plant located at the Grand Gulf ESP site has not been specified. The water treatment requirements and water system effluents are not known. However, all chemical and thermal discharges from the water treatment systems, regardless of the methods chosen, would be regulated by the MDEQ through the NPDES process.

8.4 Region of Interest and Alternative Site Selection Process

NRC regulations require that the environmental report submitted in conjunction with an application for an ESP include an evaluation of alternative sites to determine whether any obviously superior alternative exists to the site proposed (10 CFR 52.17(a)(2)). This section includes a discussion of Entergy's ROI for possible siting of a new nuclear power plant and Entergy's alternative site selection process.

SERI is the applicant for an ESP at the Grand Gulf site. SERI is a subsidiary of Entergy Corporation and has the exclusive rights to develop the proposed Grand Gulf ESP site property outside the existing power plant and support facilities (SERI 2005). Entergy Nuclear, a division of Entergy Corporation, conducted the alternative site selection process for the Grand Gulf ESP application.

8.4.1 Applicant's Region of Interest

Generally, the ROI is the geographic area considered in searching for candidate ESP sites (NRC 2000). More specifically, the ROI is

> The geographical area initially considered in the site selection process. This area may represent the applicant's system, the power pool or area within which the applicant's planning studies are based, or the regional reliability council or the appropriate subregion or area of the reliability council (NRC 1976).

Entergy Nuclear selected its ROI for examining potential ESP sites as the locations of the seven existing Entergy sites with operating nuclear power plants licensed by the NRC (SERI 2005) at the time of its application for an ESP. These seven sites are

- Arkansas Nuclear One, located approximately 10 km (6 mi) west of Russellville, Arkansas
- Grand Gulf Nuclear Station, located approximately 40 km (25 mi) south of Vicksburg, Mississippi
- James A. FitzPatrick Nuclear Power Plant, located approximately 13 km (8 mi) northeast of Oswego, New York
- Indian Point Energy Center, located approximately 39 km (24 mi) north of New York City, New York
- Pilgrim Nuclear Station, located approximately 6 km (4 mi) southeast of Plymouth, Massachusetts
- River Bend Station, located approximately 39 km (24 mi) northwest of Baton Rouge, Louisiana
- Waterford-3, located approximately 32 km (20 mi) west of New Orleans, Louisiana.

Entergy Nuclear's ROI was limited to the preceding seven sites for the following reasons (SERI 2005):

- NRC has approved the sites for nuclear plant construction and operation.
- Site infrastructures appropriate for nuclear plant operation are in place.
- Site characterization data have been collected and are available.
- Access to the sites is readily available.
- Programs, procedures, and arrangements have been established and are in place with State and local governmental agencies.
- Entergy liaisons with the local communities exist.
- Operational impact of the existing nuclear plants is documented.
- Site records document the presence of any radiological and non-radiological spills and contamination events on the sites.
- The sites and related facilities are controlled by Entergy.

Environmental review guidance promulgated by NRC for alternative nuclear plant sites recognizes there will be special cases for which the proposed site was not selected on the basis of a systematic site selection process (NRC 2000). One example cited in the guidance is when an existing nuclear power plant site is proposed for the siting of a new nuclear plant.

The staff concludes that the criteria used to identify the ROI used in the ESP application were reasonable for consideration and analysis of potential ESP sites.

8.4.2 Applicant's Alternative Site Selection Process

Entergy Nuclear's process for selection of a preferred ESP site consisted of the following steps:

- An ROI was established. Based on the ROI, a set of potential sites was identified for consideration in the selection process.
- The initial set of sites was screened, using Entergy Nuclear's criteria, to further refine it to a listing of candidate sites warranting more detailed evaluation.

- Candidate sites were subjected to more detailed evaluation, using Entergy Nuclear's criteria, to arrive at a preferred site for an ESP application (SERI 2005).

8.4.2.1 Screening of Seven Sites to Four

First, Entergy Nuclear eliminated the Indian Point Energy Center site from further review because the population density in the vicinity of the site exceeds 500 persons per square mile (SERI 2005). Entergy Nuclear conducted an initial screening of the remaining six sites to reduce the potential ESP sites to a smaller subset of sites for detailed review. In conducting the initial screening, Entergy Nuclear (2001) used the screening criteria, the bases for screening criteria, and relative weighting factors for each criterion shown in Table 8-5.

The relative weighting factors were determined by Entergy Nuclear. Weights were assigned on a scale of 1 to 10 with 10 being most important and 1 least important. Each site was also qualitatively assigned a score by Entergy Nuclear for each criterion using a scale of 1 to 5 with 5 representing most favorable and 1 least favorable. After application of the scores and weighting factors, Entergy Nuclear ranked the six potential ESP sites in the following order of preference (Entergy Nuclear 2001):

(1) Grand Gulf Nuclear Station
(2) River Bend Station
(3) James A. FitzPatrick Nuclear Power Plant
(4) Waterford-3
(5) Arkansas Nuclear One
(6) Pilgrim Nuclear Station.

At this stage, Entergy Nuclear eliminated the Waterford-3 and Arkansas Nuclear One sites from further consideration because it wished "to gain ESP experience in a variety of technical and public acceptance environments, as well as to capitalize on two separate power markets" (SERI 2004a). Further consideration of the Pilgrim site, even though it had the lowest weighted score of the six sites, was driven by Entergy Nuclear's interest in ensuring regional diversity.

Entergy Nuclear determined that both the Waterford-3 and Arkansas Nuclear One sites are viable for new nuclear plants, but the two sites are currently viewed by Entergy Nuclear as less suitable than Grand Gulf and River Bend (Entergy Nuclear 2001).

Table 8-5. Initial Screening Criteria for Selecting an Early Site Permit Site

Initial Screening Criteria	Basis for Screening Criteria	Relative Weighting Factor
Seismic Evaluation	Probability of ground acceleration greater than 0.3 g	7.2
Demographic Changes	Total population in nearby areas from the year 2000 U.S. Census	6.1
Emergency Planning	Status of existing emergency plans	5.6
Exclusion Area	Available room for new nuclear generating units	6.1
Transmission Access	Potential for achieving required injection capacity and the cost of providing the capacity	8.2
Power Pricing	Expected price for power and ease of delivering power to the anticipated load center	9.1
Water Availability	Extent and ease to which water for plant use is available	7.1
Permitting/Licensing Status	Relative ease to which required permits and licenses for a new nuclear plant can be obtained	6.4
Plans for Existing Units	Compatibility of Entergy plans for existing nuclear units with new nuclear units	3.0
Spent Fuel Storage	Availability of onsite spent fuel storage	2.6
Public Acceptance	Perceived level of public acceptance of a new nuclear plant at each site	6.6

Source: Entergy Nuclear 2001

Given Entergy Nuclear's interest in ensuring regional diversity (i.e., sites in its two power markets), the staff concluded that the down-selection of the Waterford-3 and Arkansas Nuclear One sites is reasonable. The staff continued to review the Pilgrim alternative site because it permits an assessment of regional diversity. In the end, had there been concerns with the overall impacts of the preferred site, the staff would have reconsidered this step.

8.4.2.2 Screening of Four Sites to One

For the final screening of sites from four to one preferred site, Entergy Nuclear used a similar approach to the initial screening. Screening criteria and weighting factors were developed. Relative weights and scores for each criterion for each site were assigned by Entergy Nuclear (Entergy Nuclear 2001). In conducting the final screening, Entergy Nuclear used the screening criteria and relative weighting factors for each criterion shown in Table 8-6.

Table 8-6. Final Screening Criteria for Selecting an Early Site Permit Site

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Geology/Seismology	Vibratory ground motion, capable tectonic structures or sources, surface faulting and deformation, geologic hazards, and soil stability	3.77
Cooling System Requirements	Quantity of cooling water available and the ambient air temperature	3.27
Flooding	Flooding potential at the site	2.4
Nearby Hazardous Land Uses	NRC reactor site criteria in 10 CFR Part 100 and existing and projected hazards within 8 km (5 mi) of the site	3.35
Extreme Weather Conditions	Plant parameter envelope criteria regarding tornadoes, wind, and precipitation	2.36
Accident Effect-Related	NRC population criteria in 10 CFR 100.21, population density guidance in NRC Regulatory Guide 4.7 (NRC 1998), emergency planning characteristics, and short-term atmospheric dispersion characteristics	4.09
Surface-Water Radionuclide Pathway	Potential liquid pathway dose consequences including dilution capacity, existing radionuclides in the stream, and proximity to downstream consumptive users	2.5
Groundwater Radionuclide Pathway	Vulnerability of shallow groundwater resources to potential contamination	2.55
Air Radionuclide Pathway	Radionuclide pathways as a function of topographic effects and atmospheric dispersion	2.5
Air-Food Ingestion Pathway	Emission of radionuclides into the food chain via local crops and pastures	2.5

Table 8-6. (contd)

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Surface-Water-Food Radionuclide Pathway	Use of irrigation water by downstream users as a potential pathway for exposure	2.41
Transportation Safety	Increase of highway traffic safety risk as a result of fogging and ice caused by cooling towers	2.14
Disruption of Important Aquatic and Marine Species or Habitats	Construction-related impacts on aquatic and marine ecology	2.64
Bottom Sediment Disruption Effects	Short-term impacts on aquatic and marine resources resulting from dredging activities during construction	2.14
Disruption of Important Plant and Animal Species	Construction-related impacts on important species, their habitats, and terrestrial ecology	3.18
Dewatering Effect on Adjacent Wetlands	Impacts of construction related dewatering activities on area wetlands	2.77
Thermal Discharge Effects	Impacts of thermal discharges on migratory species, other important species and habitat, and water quality	3.64
Entrainment and Impingement Effects	Entrainment and impingement effect on marine organisms resulting from cooling water withdrawal and screening	3.23
Dredging and Disposal Effects	Environmental impacts related to maintenance dredging at the cooling water intake structure	2.36
Cooling Tower Drift Effects on Surrounding Areas	Impacts related to the emission and downwind deposition of cooling water salts	2.36
Socioeconomics	Socioeconomic impacts during construction of new nuclear power plants	2.0
Environmental Justice	Possible disproportionate adverse impacts on minority and low-income populations	1.95
Water Supply	Raw water consumption cost	3.7
Pumping Distance	Cost of construction associated with supplying a primary water source for the plant	3.05
Flood Mitigation	Cost of flood mitigation features and insurance	2.9

Table 8-6. (contd)

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Vibratory Ground Motion	Incremental construction cost to account for vibratory ground motion	4.0
Soil Stability	Incremental construction cost to account for soil stability	3.4
Railroad Access	Cost of constructing railroad spur	2.6
Highway Access	Cost of constructing roads to from plant site to nearby highway	2.8
Barge Access	Cost of constructing barge terminal	2.85
Transmission	Cost of transmission line to connect site to grid and necessary system upgrades	4.8
Topography	Land preparation cost related to the topography	2.55
Land Rights	Cost of acquiring land area and relocating existing structures	2.75
Labor Rates	Relative cost of labor	3.3

Source: Entergy Nuclear 2001

After applying the scores and weighting factors, Entergy Nuclear ranked the four potential ESP sites in the following order of preference (Entergy Nuclear 2001):

(1) Grand Gulf Nuclear Station
(2) James A. FitzPatrick Nuclear Power Plant
(3) River Bend Station
(4) Pilgrim Nuclear Station.

Accordingly, SERI submitted the ESP application for the Grand Gulf site as the preferred site. The staff concluded that SERI's overall site selection process for alternative sites is reasonable and the identification of the Grand Gulf ESP site is consistent with SERI's approach.

8.5 Evaluation of Alternative Sites

The three alternative sites examined in detail in this section are the River Bend Station near Baton Rouge, Louisiana; Pilgrim Nuclear Station near Plymouth, Massachusetts; and

James A. FitzPatrick Nuclear Power Plant near Oswego, New York. All three of the alternative sites have existing nuclear power plants that are owned and operated by Entergy Corporation. The staff visited each of the three alternative sites as well as the proposed Grand Gulf ESP site, and collected additional reconnaissance-level information about the alternative sites.

8.5.1 Evaluation of the River Bend Station Site

This section covers the staff's evaluation of the potential environmental impact of siting new nuclear units within the scope of the SERI PPE at the River Bend Station (River Bend) site.

8.5.1.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The River Bend site is located on over 1200 ha (3000 ac) along the east bank of the Mississippi River, about 6 km (4 mi) south of the town of St. Francisville, Louisiana. The area around the site and the vicinity remains largely agricultural with significant crop production and some industrial forestry. Similar in many respects to the Grand Gulf site, there is adequate land area available within the existing site boundary to house a generating facility based on the PPE. Because the potential site of the ESP facility would use a portion of the existing River Bend site, no land would be preempted for additional facilities built at this site (SERI 2005). The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The River Bend site is not affected by the Coastal Zone Management Act of 1972, as amended. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operation are expected to be SMALL.

Transmission Line Rights-of-Way

Five transmission lines exit the River Bend site in three separate rights-of-way. One 500-kV line runs due east from the site crossing mostly agricultural and forested land for 43 km (27 mi) to a substation near the junction of State Highways 959 and 63 (McKnight Crossing). Another 500-kV line runs south-southwest from the site, crosses the Mississippi River, and then runs across agricultural and forested land 46.9 km (29.3 mi) to a substation near Rosedale, Louisiana. Three lines (230 kV) run south-southeast for 18.1 km (11.3 mi) paralleling the Mississippi River and U.S. Highway 61, and then across lowlands and swamps to a substation near Irene, Louisiana. None of these transmission line rights-of-way cross any known protected land designations or special land uses. Section 3.3 details the regulatory procedure required to link new large generation to the grid. The issues that could result in potential impacts from construction and operations in these transmission line rights-of-way (i.e., physical and

ecological impacts) would be similar to those land-use impacts for construction and operations in the transmission line rights-of-way associated with the Grand Gulf ESP site. Therefore, the staff concludes that the land-use impacts of transmission system construction and continued operation would be SMALL.

8.5.1.2 Water Use and Quality

Water Use

The River Bend site is located adjacent to the Mississippi River downstream of the Grand Gulf ESP site where flows, rainfall, and floodplain characteristics are similar. Construction activities for a new nuclear unit or units at River Bend would have similar water usage impacts (i.e., physical and ecological impacts) as at the Grand Gulf ESP site. During operation, the consumptive use of water from the proposed mechanical draft cooling towers would be a very small fraction of the supply available in the river, even during record low flows. Therefore, the staff concludes that the impacts on water use and water supply at the River Bend site would be SMALL.

Water Quality

Construction activities of a new nuclear unit or units at the River Bend site would follow best management practices and have similar water-quality impacts as the Grand Gulf ESP site, and would be bounded by the operational impacts. The additional heat from blowdown water could be commingled with the discharge from the existing River Bend Station. This would increase the size of the thermal plume that currently exists. Thermal and chemical discharges to the Mississippi River would be regulated by the Louisiana Department of Environmental Quality via an NPDES permit issued to protect the environment. Since the combined discharge represents a very small fraction of the flow in the Mississippi River, the staff concludes that the impacts to water quality at the River Bend site would be SMALL.

8.5.1.3 Terrestrial Resources Including Endangered Species

Construction Impacts

Three general vegetation types are onsite: upland forests, bottomland hardwoods, and meadows and pastures. Following construction of the existing River Bend plant, remaining land cover for the three vegetation types were upland forests (347 ha (858 ac)), bottomland hardwoods (282 ha (697 ac)), and meadows and pastures (105 ha (259 ac)) (AEC 1974a), totaling 734 ha (1814 ac).

Impacts of the Alternatives

Construction of a new generating facility would likely remove the three vegetation types listed above in similar proportions as did construction of the existing units at the River Bend site, which were upland hardwood forests, 63.3 percent; bottomland hardwoods, 3.0 percent; and meadows and pastures, 33.7 percent (AEC 1974a). SERI (2005) denotes the total area that would be disturbed by construction of the Grand Gulf ESP facility to be 162 ha (400 ac). In Figure 2-5, however, SERI (2005) denotes the disturbed area to be 160 ha (395 ac). Construction of a new facility at the River Bend site would disturb roughly the same area. Of the 160 ha (395 ac), 101 ha (250 ac) of upland hardwood forest, 5 ha (12 ac) of bottomland hardwood forest, and 54 ha (133 ac) of meadows and pastures would be lost. These values account for 29, 2, and 51 percent of the upland forest, bottomland hardwood forest, and meadows and pastures remaining on the River Bend site. The combined loss of upland and bottomland hardwood forest would be about 106 ha (262 ac), or approximately 17 percent of the total available onsite, constituting a modest loss of forest habitat.

The potential impacts from construction, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices, such as silt fences to control sedimentation and water sprays to limit dust generation, would protect wetlands and other ecological resources in the site vicinity.

Five transmission lines in three separate rights-of-way, extending over a total length of 109 km (68 mi) (Section 8.5.1.1) and covering 417 ha (1031 ac) (NRC 1996), currently serve the River Bend Station. Land cover along these lines consists of pasture (43 percent), forest (38 percent), crops (15 percent), residential (2 percent), and water (2 percent) (AEC 1974a). It is assumed that these transmission lines would not have the capacity to carry the power generated by a new facility and that a transmission system upgrade, including new transmission lines and an additional right-of-way, would be needed. It is assumed that any additional right-of-way would be an expansion of the existing right-of-way (see Section 4.4.12). Consequently, a modest amount of forest habitat, up to 159 ha (392 ac), could be lost due to the expansion.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes the impacts on terrestrial ecological resources from construction of a new generating facility at the River Bend site and construction associated with possible expansion of the existing River Bend transmission line rights-of-way would be MODERATE.

Threatened and Endangered Species

The only Federally listed threatened or endangered terrestrial species that may occur in the River Bend area is the threatened Louisiana black bear (*Ursus americanus luteolus*) (FWS 2004a). The River Bend site is located adjacent to the Atchaflaya River Basin breeding sub-population of Louisiana black bears (FWS 1995). The proposed Atchaflaya River Basin Floodway critical habitat unit is located at least 16 km (10 mi) to the west of the River Bend site.

No occurrences of the bear are known within 16 km (10 mi) of the site (Table 8-7) (LNHP 2004a). Therefore, it appears unlikely the subspecies occurs on the River Bend site (SERI 2004d) and so would not be impacted by construction or operation of a new generating facility. None of the five River Bend transmission lines are located within 16 km (10 mi) of the Atchaflaya River Basin Floodway critical habitat unit. Consequently, critical habitat would not be impacted by expansion of the existing transmission line rights-of-way.

Table 8-7. Terrestrial Federally and State-Listed Species Occurring in the Vicinity of the River Bend Site

Scientific Name	Common Name	Status[a]	Distance from the River Bend Site[b]	Source
Mammals				
Mustela frenata	long-tailed weasel	S2-S4	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Sorex longirostris	southeastern shrew	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Spilogale putorius	eastern spotted skunk	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Ursus americanus luteolus	Louisiana black bear	FT/S2	>10 mi (16 km)	FWS 2004a; LNHP 2004a
Plants				
Actaea pachypoda	white baneberry	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Antennaria solitaria	single-head pussytoes	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Circaea lutetiana canadensis	intermediate enchanter's nightshade	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Deparia acrostichoides	silvery glade fern	S2	<3.2 km (2 mi)	LNHP 2004a
Dichanthelium clandestinum	deer-tongue witchgrass	S2	<3.2 km (2 mi)	LNHP 2004a
Dryopteris ludoviciana	southern shield wood-fern	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Eleocharis radicans	rooted spike-rush	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Magnolia pyramidata	pyramid magnolia	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Mimulus ringens	square-stemmed monkey-flower	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a

Table 8-7. (contd)

Scientific Name	Common Name	Status[a]	Distance from the River Bend Site[b]	Source
Pachysandra procumbens	Allegheny-spurge	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Physalis carpenteri	carpenter's ground-cherry	S1	<3.2 km (2 mi)	LNHP 2004a
Stewartia malacodendron	silky camelia	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Triphora trianthophora	nodding pogonia	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service under the Endangered Species Act, FT = Federal threatened (FWS 2004a). State status rankings developed by the Louisiana Natural Heritage Program, S1 = critically imperiled, S2 = imperiled, S3 = rare, S4 = secure (LNHP 2004a). Hyphenated state status ranks indicate a range in the status of the species based on insufficient data to make a determination.
(b) Distances provided by LNHP (2004a).

Three State-listed imperiled or critically imperiled terrestrial animal species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the River Bend site: the long-tailed weasel (*Mustela frenata*), southeastern shrew (*Sorex longirostris*), and eastern spotted skunk (*Spilogale putorius*) (Table 8-7) (LNHP 2004a). The long-tailed weasel is found in a wide variety of habitats, including farmland, woodlands, and swamps, with areas near water being preferred (Linzey and Brecht 2002a). The southeastern shrew occurs in a variety of habitats from fields to forests (Linzey and Brecht 2002b), as does the eastern spotted skunk (Pennington 2002). These three species are habitat generalists and could occur on the River Bend site and along its transmission line rights-of-way. Therefore, they could potentially be affected by construction of a new generating facility at the River Bend site and possible expansion of the existing transmission line rights-of-way.

There are three State-listed imperiled or critically imperiled terrestrial plant species known to occur within 3.2 km (2 mi) of the River Bend site: silvery glade fern (*Deparia acrostichoides*), deer-tongue witchgrass (*Dichanthelium clandestinum*), and carpenter's ground-cherry (*Physalis carpenteri*) (Table 8-7) (LNHP 2004a). Silvery glade fern occurs in damp woods (FNA 2004a). Deer-tongue witchgrass occurs in moist soils of woodland edges and clearings (Ernst Conservation Seeds 2004). Carpenter's ground-cherry occurs in mixed hardwood-loblolly pine (*Pinus taeda*) woods, southern mesophytic woods, and hardwood slope forest (LNHP 2004b). These three species are habitat generalists that could occur on the River Bend site and along its transmission line rights-of-way. Consequently, they could be adversely affected by construction of a new generating facility on the River Bend site and by possible expansion of the existing transmission line rights-of-way.

Ten additional State-listed imperiled or critically imperiled terrestrial plant species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the River Bend site: white baneberry (*Actaea pachypoda*), single-head pussytoes (*Antennaria solitaria*), intermediate enchanter's nightshade (*Circaea lutetiana canadensis*), southern shield wood-fern (*Dryopteris ludoviciana*), rooted spike-rush (*Eleocharis radicans*), pyramid magnolia (*Magnolia pyramidata*), square-stemmed monkey-flower (*Mimulus ringens*), Allegheny-spurge (*Pachysandra procumbens*), silky camelia (*Stewartia malacodendron*), and nodding pogonia (*Triphora trianthophora*) (Table 8-7) (LNHP 2004a). White baneberry occurs in deciduous forests (FNA 2004b). Single-head pussytoes grows in woods and woodland clearings (NearActica 2004). Intermediate enchanter's nightshade occurs in deciduous woodlands (Verburg 1998). Southern shield wood-fern occurs in swamps and wet woods (FNA 2004c). Rooted spike-rush occurs in stream alluvium and around lake margins, meadows, seeps, and bogs (FNA 2004d). Pyramid magnolia occurs in woods and on river bluffs (FNA 2004e). Square-stemmed monkey-flower occurs along stream banks, lake margins, and wet meadows (Missouriplants 2004). Allegheny-spurge occurs in riparian forest habitat (SERPIN 2004). Silky camelia inhabits the understory of wooded bluffs and ravine slopes and the open edges of transition zones (ecotones) between sand hills and creek swamps (GSRCORP 2004). Nodding pogonia occurs on rotten logs and in rich humus and leaf mold of low hammocks, hardwood and coniferous forests, woods along streams, edges of swamps, floodplain forests, and mountain slopes (LNHP 2004c). These ten species are habitat generalists that could occur on the River Bend site and along its transmission line rights-of-way. Consequently, they could be affected by construction of a new generating facility on the River Bend site and by possible expansion of the existing transmission line rights-of-way.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on threatened and endangered species from construction of a new generating facility on the River Bend site and possible expansion of the existing transmission line rights-of-way could range from SMALL to MODERATE.

Operation Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the River Bend site include those associated with cooling towers and transmission lines. The River Bend plant currently employs cooling towers, and more cooling towers would be added for one or more new nuclear units. The impacts of cooling tower drift and bird collisions for existing nuclear power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any information that would cause it to modify its earlier conclusion. On this basis, for the purposes of consideration of alternative sites, the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of one or more new nuclear units at the River Bend site would be negligible.

Impacts of the Alternatives

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 decibels (dBA) at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the River Bend site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat available into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the River Bend site would be minimal.

The cooling towers from one or more new nuclear units at the River Bend site would withdraw a small quantity of water relative to Mississippi River flows, and would discharge water back into the river at a temperature greater than ambient conditions. The amount of water withdrawn from the Mississippi River would represent only about 0.2 percent of the total flow and would not detectably alter shoreline habitat.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the River Bend site would present few new opportunities for bird collisions and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above rationale and the associated conclusions presented in GEIS (NRC 1996), the effects on bird collisions of transmission line operation for one or more new nuclear units at the River Bend site would be negligible.

The impacts usually associated with transmission line right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat, and similar impacts where rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in transmission line rights-of-way expanded for one or more new nuclear units at the River Bend site.

The staff reviewed the operation of one or more nuclear units at the River Bend site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Based on information provided by SERI, Entergy, and the NRC staff's

independent review, the staff concludes that the impacts of operation of one or more nuclear units at the River Bend site on terrestrial resources and threatened and endangered species would be SMALL.

8.5.1.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The aquatic resources at the River Bend site are associated with the Mississippi River and the watershed of Grants Bayou. The station is located on a terrace above the river's floodplain at approximately River Mile 262. Other water resources on the site within Grants Bayou watershed include Alexander Creek, West Creek, Alligator Bayou, and 19 small farm ponds, including Grassy Lake and a constructed wildlife management lake (AEC 1974a; NRC 1985).

The River Bend Station uses a closed-cycle cooling system that draws water from the Mississippi River and discharges it back into the river at a downstream location. The intake and discharge systems for the existing River Bend Station would be used for operation of a new facility, and minimal construction activities are anticipated in upgrading these facilities to handle discharges from the new unit(s). Any construction impacts, such as erosion and sedimentation into the water resources, could be mitigated using standard industrial procedures and best management practices.

Operation of the new unit(s) would have minimal impacts on the aquatic resources of the Mississippi River. Water withdrawn from the river for the cooling system would be a very small fraction of the supply available in the river, even during record low flows. Because of the use of closed-cycle cooling, incremental impacts from entrainment, impingement, and heat shock on aquatic resources would be negligible. The additional heat from blowdown water would be commingled with the discharge from the other units, resulting in a greater thermal plume in the area of the discharge.

The other water resources at the River Bend site are not anticipated to be affected by construction and operation of a new unit or units. West Creek was rerouted when the current facility was built and is used for collection of runoff water. Additional facilities at the site would increase runoff into the creek; however, the aquatic resources in this concrete channel are of a poor quality and have adapted to the changes in water flow from precipitation events. Impacts on Alligator Bayou would not be anticipated because the river access road connecting a new generation facility to the Mississippi River would not be changed.

The staff concludes that the overall impacts on aquatic resources from construction and operation of one or more new nuclear units and associated cooling towers at the River Bend site would be SMALL.

Threatened and Endangered Species

Table 8-8 lists the Federally and State-listed threatened and endangered aquatic species within 16 km (10 mi) of the River Bend site. The only Federally listed threatened or endangered aquatic species that could occur in the River Bend area is the endangered pallid sturgeon (*Scaphirhynchus albus*) (FWS 2004a). The River Bend site is adjacent to the shores of the Mississippi River within the known range of the pallid sturgeon. The species was designated as endangered throughout its entire range in 1990 (55 FR 36641; FWS 1993). Pallid sturgeon have not been caught in the vicinity of the River Bend site (River Mile 262). The closest and most recent catches have been at River Miles 229 and 314 (LDOTD 2003).

There are two State-listed imperiled or rare species that are known to occur within 16 km (10 mi) of the River Bend site. The bluntface shiner (*Cyprinella camura*) is an imperiled or rare fish found within the tributaries of the Mississippi River. The Louisiana Department of Wildlife and Fisheries lists the bluntface shiner as known to occur within 3.2 km (2 mi) of the River Bend site (LNHP 2004a); however, past studies of the aquatic resources from the onsite tributaries have not reported the fish (AEC 1974a; NRC 1985). The rainbow darter (*Etheostoma caeruleum*) is an imperiled or rare fish found within 16 km (10 mi) of the River Bend site. The rainbow darter is found in moderately swift runs and riffles of shallow tributaries of the Mississippi River. Neither the bluntface shiner nor the rainbow darter have been found on the River Bend site during past sampling programs (AEC 1974a; NRC 1985).

Table 8-8. Federally and State-Listed Threatened or Endangered Aquatic Species Reported within a 16-Kilometer (10-Mile) Radius of the River Bend Site

Scientific Name	Common Name	Status[a]	Distance from the River Bend Site[b]	Source
		Fish		
Cyprinella camura	bluntface shiner	S2-S3	<3.2 km (2 mi)	LNHP 2004a
Etheostoma caeruleum	rainbow darter	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Scaphirhynchus albus	pallid sturgeon	FE; S1	<3.2 km (2 mi)	LNHP 2004a; FWS 2004a

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service under the Endangered Species Act, FE = Federal endangered (FWS 2004a). State status rankings developed by the Louisiana Natural Heritage Program: S1 - critically imperiled, S2 = imperiled, S3 = rare (LNHP 2004a). Hyphenated state status ranks indicate a range in the status of the species based on insufficient data to make a determination.
(b) Distances provided by LNHP (2004a).

The staff concludes that the overall impacts on Federally and State-listed threatened and endangered aquatic species from one or more new nuclear units and associated cooling towers at the River Bend site would be SMALL.

8.5.1.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the River Bend site, the staff and Entergy Nuclear undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources. The staff conducted some local interviews with knowledgeable local officials. No new data were collected.[(a)] The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. Impacts from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. However, extensive work is planned on the existing roads, and new routes are being built to reduce existing bottlenecks in the regional highway system, so no physical impact on the existing road network is expected. It is expected that all construction activities would occur within the existing River Bend site. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new unit or units would be small incremental impacts associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. New units would produce noise from the operation of pumps, cooling tower fans, transformers, turbines, generators, and switchyard equipment, and traffic at the site would also be a source of noise. SERI states in its environmental report that any noise coming from the proposed Grand Gulf ESP site would be controlled in accordance with standard noise protection and abatement procedures (SERI 2005). By inference, this is also expected to apply to the River Bend site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to River Bend site (SERI 2005).

(a) Hurricanes Katrina and Rita in southern Louisiana displaced tens of thousands of people, which affected baseline socioeconomic conditions throughout the Gulf Coast states. Estimates in the DEIS have been affected, but no changes have been made to the text because of the uncertainty regarding to what extent the changes brought about by Katrina and Rita are permanent.

New units would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, new units would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the River Bend site. Offsite impacts would represent small incremental changes to offsite services supporting the construction activities. During station operations, noise levels would be managed to local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL.

Demography

The population base is considered to be the population of significant population centers within a 80-km (50-mi) radius of the River Bend site. The combined population of West Feliciana Parish, East Feliciana Parish and the East Baton Rouge Parish, West Baton Rouge Parish, and Pointe Coupee Parish was 494,000 (USCB 2004) and, in 1997, was projected to grow by approximately 15 percent to about 570,000 by 2020 (LPDC 1997). The estimated population within an 80-km (50-mi) radius of the River Bend site is 907,000 (NRC 2004b). Most (approximately 70 percent) of the construction workforce are expected to come from within the region, and those who might relocate to the region would represent a small percentage of the larger population base (Entergy Nuclear 2001). While part of the station operation workforce is also expected to relocate into the region, their numbers are small (about 2000 total new employees and family members during construction, and a smaller, unspecified number during operations) when compared to the total base population, and their locations of residence would probably be scattered throughout the region. Based on the information in the environmental report (SERI 2005) and the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001) prepared by Entergy Nuclear and the NRC staff's independent review, the staff concludes that the demographic impacts from construction and operation within an 80-km (50-mi) radius of the River Bend site would be SMALL.

Social and Economic Impacts

Economy

The River Bend site is located in one of the stronger economic areas in Louisiana. The Baton Rouge area is the primary economic driving force in the area within an 80-km (50-mi) radius of the River Bend site. In recent years, the regional economy has become more diversified, with major chemicals, papermills, and refining businesses; financial and health care components; and a growing high-tech business sector. The local economic development leaders consider an additional unit or units at the River Bend site to be highly compatible with the current economy and their economic plans for the parish (Scott 2004a). Regionally, the service sector now offers the most employment opportunities. Construction and operation of one or more new nuclear units at the River Bend site would be expected to add to the economic prosperity of the region, especially in West Feliciana Parish.

Based on the information provided by SERI and its own independently obtained information, the staff reviewed the impacts of construction and operation on the economy of the region and concludes that the impacts would be minor everywhere in the region except West Feliciana Parish, where the impact could be beneficial and significant. Although the economic impacts would be diffused over several local jurisdictions, employment in West Feliciana Parish would increase by 50 percent during the peak of construction. Much of the economic impacts likely would be felt in the larger economic bases of East Baton Rouge Parish and the city of Baton Rouge.

Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the River Bend site (Entergy Nuclear 2001). Entergy Nuclear is expected to be able to attract the necessary workforce for construction activities at the River Bend site because of its proximity to the major population center of Baton Rouge. The availability of construction workers for regular construction projects of longer duration is reported to be good. The number of construction workers employed within the five parishes nearest the River Bend site was estimated to be approximately 27,000 in 2002 (Louisiana Department of Labor 2003).

The addition of new units would require an increase in the operations workforce of 1160 employees. Approximately 454 permanent employees currently work at the River Bend site (SERI 2004c). In its site comparison study, Entergy Nuclear (2001) stated that it expected 30 percent of the construction labor force for the new units would relocate from outside the region. Some nuclear defense sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at River Bend.

Based on the information provided by Entergy Nuclear and the NRC staff's independent review, the staff concludes that construction labor would be readily available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of new nuclear units at the River Bend site. Some of the operations workforce would already be in the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to Louisiana and to the local governments in the region where sales take place and property taxes to the counties in which they own a residence. Sales and use taxes would be paid from the sales of construction materials and supplies purchased for the project and on expenditures of both the construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would occur in the region during construction. Corporate income taxes on profits would also be paid by those companies engaged in construction at the site.

There are two types of property taxes in Louisiana: tangible personal property taxes and real property taxes. Tangible personal property taxes would be paid by contractors during construction of the additional units. This tax is based on the value of property owned by the contractors that acquire taxable status in West Feliciana Parish during the construction period. Real property taxes are levied for the incremental increase in value to the entire site from the operation of the additional units. It is expected that West Feliciana Parish would be the only beneficiary of the these taxes. Property owned by Entergy currently accounts for 90 percent of the local tax base. The tax rate in West Feliciana Parish is the lowest in the state (70 mills); elsewhere in the state, tax rates generally range from 100 to 130 mills. In a few jurisdictions, tax rates as high as 200 mills are levied. For schools, the state reduces its funding allocation for education as the local jurisdictions provide more. In West Feliciana Parish, the state provides nothing, but the local district spends much more per student than the state average. Entergy Nuclear has a significant impact on the economic well being of West Feliciana Parish, with Entergy Nuclear paying over 80 percent of the property taxes between 1996 and 2000 (Housing Assistance Council 2002; Scott 2004a). The property tax base represented by a new nuclear facility on the Grand Gulf ESP site would represent nearly a doubling of the West Feliciana Parish tax base, but would have relatively little impact on adjacent parish finances.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the overall impacts from construction and operation on taxes collected through the income, sales and use, and property taxes would be barely noticeable, with the exception of West Feliciana Parish. The taxes paid, while substantial, are nevertheless a small sum when compared to the total amount of taxes collected by Louisiana and local governments in the region. Depending on the outcome of tax negotiations between Entergy

and the state of Louisiana on the amount of property taxes, the staff considers that the overall impacts of the property taxes collected in West Feliciana Parish would be significant and beneficial relative to the total amount of taxes the county currently collects through property taxes.

Summary of Social and Economic Impacts

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the overall impacts of construction and operation of new unit(s) at the River Bend site would be LARGE beneficial to SMALL beneficial in the parishes near the site.

Infractructure and Community Services

Transportation

The general area around the River Bend site is served by several major highways, including Interstate 10, Interstate 12, U.S. Highways 61 and 190, and State Route (SR) 10. Baton Rouge is about a 20-minute drive from the River Bend site on four-lane roads. Site access from the west side of the Mississippi River is currently limited, but a new bridge is expected to replace existing ferry service at St. Francisville. The principal road access to the River Bend site is via the River Bend Access Road and via Louisiana SR 965, which is a two-lane paved road.

The construction of a new power facility would require additions to the workforce. In addition, construction materials, wastes, and excavated materials would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations. However, five of the seven reactor types referred to in the SERI environmental report are generally smaller and modular in nature. Consequently, transportation of plant equipment could be less challenging and workforce requirements are expected to be less than those for the conventional nuclear plants.

The level-of-service designation on River Bend Access Road and Louisiana SR 965 would likely be degraded during the peak construction period for a new nuclear plant at the River Bend site. Louisiana SR 965 intersects U.S. Highway 61 approximately 2.6 km (1.6 mi) from the plant and River Bend Access Road intersects U.S. Highway 61 approximately 2.2 km (1.4 mi) from the plant. Because it is the principal route from the direction of Baton Rouge, portions of U.S. Highway 61 would receive significantly more traffic during plant construction.

Direct rail access and a barge slip (which would have to be dredged) are available to the River Bend site, so large equipment would not have to be offloaded and transported by road. The

Baton Rouge Metropolitan Airport and New Orleans International Airport serve the area. The airports in Baton Rouge and New Orleans provide regular freight and passenger jet services and are of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impacts of station operation employees on the transportation system would be less than that incurred during construction of the ESP facilities. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of U.S. Highway 61 may be affected by commuters to the plant site, particularly during shift changes. During new plant operation, the level-of-service designation on the access roads and U.S. Highway 61 may degrade to stable flow instead of the free flow indicated under a level-of-service "A" designation. This change in designation would indicate that the freedom to select speed is unaffected, but the freedom to maneuver is slightly diminished.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff's reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on the transportation infrastructure at the River Bend site would be noticeable (and temporary). Some of the local roads could have their level of service degraded during construction to the point where operations of individual drivers could be significantly affected by interactions with the rest of the traffic. This would be at level-of-service "C" or lower. Also, it is possible that, given the heavy loads carried by vehicles transporting construction materials to the River Bend site, some of the roads may need improvement to carry the additional load.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts of an operations workforce and related transportation impacts would be much less noticeable than during construction. There may be some minor congestion at shift changes and level of service may degrade.

Recreation

The River Bend site is an industrial site not used for recreation. Its current structures are not visually obtrusive from any vantage point because of the large size and wooded nature of the site. The existing units are well isolated from the river and from other vantage points. Any new units would not use a once-through cooling system, so cooling towers would be necessary. However, the River Bend site already has mechanical draft cooling towers, so additional cooling towers for the new reactors would not significantly change the existing appearance of the site that would affect any nearby recreation experience. Traditionally, visible plumes resulting from operation of cooling towers could cause a negative aesthetic effect. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.1.3, the aesthetic effects of new transmission lines are not likely to be significant. Based on the information provided by SERI, Entergy, and the NRC staff's independent review,

the staff concludes that no noticeable impacts on recreation in the vicinity of the River Bend site would result from construction and operation of a new generating facility at the site.

Housing

A 18.7 percent vacancy rate out of a total of 4485 housing units currently exists in West Feliciana Parish (USCB 2005b). However, given the proximity of the River Bend site to the Baton Rouge metropolitan area, which has 12,000 vacant housing units in East Baton Rouge Parish alone, housing for construction workers, most of whom will be coming from within the region, and the subsequent operations workforce is expected to be available (USCB 2005b). Sufficient housing is available in West Feliciana Parish and the Baton Rouge area to support the additional workforce that would be needed to operate a new generating facility at the River Bend site (Scott 2004a).

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impact of a construction and operations workforce on the demand for housing could be easily handled. This conclusion is based on the availability of approximately 840 vacant housing units in West Feliciana Parish, existing construction plans, and the proximity of the River Bend site to the larger Baton Rouge metropolitan area.

Public Services

Water Supply and Waste Treatment. West Feliciana Parish would have to upgrade some of its water distribution lines from 15 to 20 cm (6 in. to 8 in.) to accommodate growth, but plans for that upgrade already are in place. The Parish has a plentiful groundwater supply and a complete Parish-wide water distribution system. The Parish government regulates sewage treatment, but there are individual sewage districts (Scott 2004a).

Most of the construction workforce would come from within the region, so their demands on the water treatment and distribution systems are already accounted for. The station operating workforce, some of which would probably relocate into the region, would probably reside throughout the region; therefore, their presence would not particularly affect any one community or jurisdiction. Based on the NRC staff's independent review, the staff concludes that the impact of construction and operation on the water treatment and distribution systems would not be noticeable.

Police, Fire, and Medical Facilities. In the larger metropolitan area of West Feliciana Parish, East Feliciana Parish, East Baton Rouge Parish, and Baton Rouge, and in nearby St. Francisville, police, fire, and medical facilities would not be materially affected by an

increase in the construction workforce. It is anticipated that many of the workers who would be involved in construction at the River Bend site already live in the region and would commute to the site from their permanent residences. These workers already are being served by existing police, fire, and medical services and facilities.

Thirty percent of the resident construction workforce of 2835 (approximately 90 percent of the 3150 total workers) is anticipated to come from outside the region, resulting in an overall population increase of 2459 persons (Entergy Nuclear 2001). Because these workers would probably reside throughout the region, their presence would not particularly affect any one community or jurisdiction and is not expected to place inordinate demands on police, fire, and medical services and facilities. The impact of the operations workforce would likely be smaller, since the operations workforce is only 1160 (SERI 2005).

Based on the NRC staff's independent review, the staff concludes that the impact of construction and operations workforce on police, fire, and medical services facilities would not be noticeable. Most construction workers already live within the region. New operations workforce employees would live throughout the region, so there should be minimal new demands placed on these services and facilities by either construction or operations workers.

Social Services. A variety of emergency assistance, counseling, child and family services, and other social services are provided in each parish by the Louisiana Department of Social Services. During the construction phase at the River Bend site, there may be an increased demand for some social services.

Generally, construction and operation of a new generation facility at the River Bend site would be viewed as beneficial economically to the disadvantaged population segments served by the Louisiana Department of Social Services. The workforce associated with construction at the River Bend site would be relatively higher paid than other employment categories in the region. Construction and operation of new units should increase employment through the multiplier effect (see Section 4.5.3.1) and may enable the disadvantaged population to improve their social and economic position by moving up to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the parishes for food, services, etc., could, through the multiplier effect, increase the number of jobs available to the disadvantaged population.

Based on the NRC staff's independent review, the staff concludes that the demand for social and related services as a result of construction and operation of a new generation facility at the River Bend site likely would be insignificant. Construction and operation would have a beneficial economic impact on the economically disadvantaged population of the region, which should decrease the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this is considered manageable and limited.

Education

The West Feliciana Parish school system has just over 2000 students (NCES 2004b). There currently is no overcrowding in the system, and the system enjoys some of the lowest student teacher ratios in Louisiana, high standardized test performance, and excellent facilities (Scott 2004a). The extensive regional parochial school system is also considered to be strong. In the other parishes and cities of the region, it is anticipated that the construction and operations workforce would minimally affect school infrastructures because many construction workers already live within the region. Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the River Bend site (Entergy Nuclear 2001); most of the workforce would reside in the region already. Entergy Nuclear estimates that the population increase in the region during peak construction would be 2459, 759 of whom are likely to be children (Entergy Nuclear 2001). The operations workforce, while partly coming from outside and relocating into the region, would probably be distributed throughout the region, thereby placing little demand on school infrastructure.

It is anticipated that most of the construction workforce would come from within the area and would not relocate their families. Those construction and operations workers potentially relocating to the region would most likely reside throughout the region and, as a result, would not be in sufficient concentrated pockets to place an undue burden on the existing infrastructure. Based on the NRC staff's independent review, the staff concludes that the impact of the construction and operations workforce on education facilities in West Feliciana Parish and the area would be easily accommodated by the existing school systems and facilities.

Summary of Infrastructure and Community Services

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of one or more new nuclear units at the River Bend site would be SMALL to MODERATE adverse.

Summary of Socioeconomics

In summary, on the basis of information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts of the construction and operations at the River Bend site on socioeconomics would be SMALL, with the exceptions that the transportation impacts during construction likely would be adverse and MODERATE and that the impacts on the West Feliciana Parish economy and tax base likely would be beneficial and LARGE. Some of the increase in taxes may have to be used to improve local transportation infrastructure.

8.5.1.6 Historic and Cultural Resources

The footprint for a new generating facility at the River Bend site does not appear to have any historic properties located within areas likely to be affected by new construction and operations (AEC 1974a). In 1972, Gulf States Utilities Company commissioned an archaeological survey of portions of the planned River Bend Station. No archaeological deposits were encountered during that survey (Neuman 1972). In 1978, Gulf States Utilities commissioned two transmission line surveys. Prehistoric sites were identified within the right-of-way, but not within the plant boundaries (Neuman 1978a, 1978b). In 1982, personnel from Gulf States Utilities informed the Louisiana State Archaeologist's Office of the remains of a 19th century sugar mill within the plant boundaries. Testing and evaluation of the mill remains conducted in 1983 determined that the site was not eligible for listing on the National Register of Historic Places (Shuman and Orser 1984). Miscellaneous archaeological surveys conducted over the years in the area indicate that while sites may exist on the premises, either the sites are not eligible for listing on the National Register of Historic Places or are located away from areas where new construction would likely occur. Protective measures would be implemented if historic and/or cultural resources were discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would consult with him or her in assessing the discovery to determine if additional evaluation of the discovery is needed.

There are no significant differences between the Grand Gulf ESP site and the River Bend site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on historic and cultural resources at the River Bend site would be SMALL.

8.5.1.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the River Bend site, the staff used information from interviews with community leaders, U.S. Census Bureau, Housing Assistance Council, and local Internet websites. Sightly over half of the population of West Feliciana Parish is African-American. About 20 percent of the population live below the Federal poverty level (Housing Assistance Council 2002). The pathways through which the environmental impacts associated with the construction of new units at the River Bend site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, and the NRC staff's independent review, the staff concludes that the offsite impacts of construction and operation of new units at the River Bend site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

8.5.2 Evaluation of the Pilgrim Nuclear Power Station Site

This section covers the staff's evaluation of the potential environmental impact of siting new nuclear units within the scope of the SERI PPE at the Pilgrim Nuclear Station (Pilgrim) site.

8.5.2.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The Pilgrim site is located on 647 ha (1600 ac) along the coast of Cape Cod, about 10 km (6 mi) east southeast of the central business district in the town of Plymouth, Massachusetts. The area around the site and the vicinity has become increasingly urbanized since the existing facility was built, but the area also features coastal forest, cranberry farms, and access to Cape Cod recreational areas. The new facility would be situated on a bluff above and to the west-northwest of the existing Pilgrim unit. Because the site of the ESP facility would use a portion of the existing Pilgrim site, no land would be preempted for additional facilities built at this site (SERI 2005).

The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The Pilgrim site is significantly different from Grand Gulf in that it is located within the costal zone of Cape Cod and is subject to the Coastal Zone Management Act of 1972 (CZMA), as amended. Congress enacted the CZMA to address the increasing pressures of over-development upon the nation's coastal resources. At the Federal level, the National Oceanic and Atmospheric Administration administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by states is voluntary; however, the Commonwealth of Massachusetts has an approved coastal zone management program. The staff assumed that SERI would comply with all provisions of the CZMA as implemented in the Cape Cod region. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operations would be SMALL.

Transmission Line Rights-of-Way

The existing 345-kV transmission line runs south-southeast from the Pilgrim site, crossing Commonwealth Highway 3, then turning west and continuing another 0.8 km (0.5 mi) to a substation near Long Pond Road, covering 7.6 km (4.75 mi). This transmission line right-of-way traverses rural coastal forested lands. The existing right-of-way crosses land currently zoned residential (0.4 to 0.8 ha (1 to 2 ac)) (40,000 to 80,000 sq ft lots). From the substation at 7.6 km (4.75 mi) from the Pilgrim switchyard, rights-of-way exit to the north and to the south and traverse lands zoned for conservation and passive recreation. Section 3.3 discusses the regulatory procedure required to link new large generation to the grid. The issues that could result in potential impacts of construction and operation in these transmission line rights-of-way (i.e., physical and ecological impacts) would be similar to those land-use impacts of construction and operation in the transmission line rights-of-way and offsite areas associated with the Grand Gulf ESP site. However, the existence of zoning regulations and the higher density of inhabitants in proximity to the affected rights-of-way distinguish the Pilgrim site from the Grand Gulf ESP site. Therefore, the staff concludes that the land-use impacts of transmission system construction associated with a new ESP facility could range from SMALL to MODERATE. For transmission system operations, impacts would be SMALL.

8.5.2.2 Water Use and Quality

Water Use

The Pilgrim site is located adjacent to Cape Cod Bay. Construction activities for new nuclear units at Pilgrim would have similar water use impacts (i.e., physical and ecological impacts) to Grand Gulf and would be bounded by the operational impacts. During operation, the consumptive use of water from the cooling towers would be very small compared to the supply available in the ocean; however, there are concerns with Pilgrim's existing level of entrainment, which could increase. Cooling towers in a salt water environment use fewer cycles of concentration than would be required with a similar cooling tower using fresh water. Therefore, the intake flow rate of makeup water and discharge flowrate of blowdown water are expected to be higher than at Grand Gulf. The staff concludes that the impacts on surface-water use and water supply at the Pilgrim site would be SMALL given the water supply available.

Water Quality

Construction activities for new nuclear units sited at Pilgrim would follow best management practices and have similar water-quality impacts as the construction at Grand Gulf, which would be bounded by the operational impacts. The additional heat from the relatively small amount of blowdown water would be commingled with the discharge of the existing Pilgrim Station. This addition would marginally increase the size of the current thermal plume. Thermal and chemical discharges to Cape Cod Bay would be regulated by the Massachusetts Department of

Environmental Protection and EPA via an NPDES permit issued to protect the environment. Since the combined discharge represents a very small fraction of the water volume, the staff concludes that the impacts on water quality at the Pilgrim site would be SMALL.

8.5.2.3 Terrestrial Resources Including Endangered Species

Construction Impacts

The western portion of the Pilgrim site is largely undeveloped, consisting primarily of forest that has been harvested multiple times and was burned in 1957. The most extensive plant community on the Pilgrim site and in the surrounding region is oak-pine forest, which covers most of the western portion of the site. Small tracts of permanently moist soil support plant species not associated with oak and pine forest, such as stands of red maple (*Acer rubrum*). Small tracts of other forest communities are also found onsite, such as black locust (*Robinia pseudoacacia*). Only very small ponds and artificially created wetlands occur on the Pilgrim site (south of the plant), in contrast to bogs and lakes that are a common feature of the surrounding landscape (AEC 1974b).

It is assumed that a new generating facility would be located on the western portion of the Pilgrim site and would thus primarily affect the oak and pine forest habitat, and that the small ponds and artificial wetlands would not be affected. Consequently, the impacts on habitat from construction of a new generating facility on the Pilgrim site are expected to be minor.

Potential construction impacts, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices, such as silt fences to control sedimentation and water sprays to limit dust generation, should be adequate to protect wetlands and other ecological resources on and in the vicinity of the site.

One transmission line right-of-way, extending a total length of 8 km (5 mi) (AEC 1974b) and covering 70 ha (173 ac) (NRC 1996), currently serves the Pilgrim site. It traverses rural coastal forest and does not cross any land known to be designated for special uses such as wildlife refuges or state natural areas. It is assumed this transmission line would not have the capacity to carry the power that would be generated by a new generating facility, and that a transmission system upgrade including new transmission lines and an additional right-of-way would be needed. It is assumed that any additional right-of-way would be an expansion, or doubling, of the existing right-of-way. Although land cover details are unknown for the transmission line right-of-way, the terrestrial ecological impacts associated with the expansion would be expected to be small, given the relatively short length of the right-of-way.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that impacts on terrestrial ecological resources from construction of a new

generating facility at the Pilgrim site and construction associated with possible expansion of the existing Pilgrim transmission line right-of-way would be SMALL.

Threatened and Endangered Species

The Federally listed threatened or endangered terrestrial species that may occur in the vicinity of the Pilgrim site include one turtle, the Plymouth population of the redbelly turtle (*Chrysemys rubriventris bangsi*), and three birds: the roseate tern (*Sterna dougallii dougallii*), the Atlantic coast breeding population of the piping plover (*Charadrius melodus*), and the bald eagle (*Haliaeetus leucocephalus*) (Table 8-9) (FWS 2004b).

The redbelly turtle, a large, freshwater basking turtle of deep, coastal plain ponds, is restricted to approximately 17 ponds of varying sizes and one river site in Plymouth County, Massachusetts (FWS 1994; MNHESP 1995a). The current known range of the turtle overlaps the Pilgrim site (FWS 1994), and the species is known to occur within 3.2 km (2 mi) (Table 8-9) (MDFW 2004). Designated critical habitat for the species is located approximately 4.8 km (3 mi) to the southwest (FWS 1994). Therefore, the turtle could potentially occur on the Pilgrim site. Consequently, if construction of a new generating facility on the Pilgrim site were to affect the small ponds and wetlands and/or adjacent upland areas, which are typically important for egg laying and movement away from the ponds, it could potentially affect the species, if in fact the species is present.

Approximately 1.6 km (1 mi) of the Pilgrim transmission line right-of-way crosses critical habitat for the redbelly turtle (AEC 1974b; 45 FR 21828; FWS 1994). Within the critical habitat, the transmission line passes adjacent to a cranberry bog and otherwise crosses upland areas (FWS 1994). Expansion of the existing Pilgrim transmission line right-of-way could affect critical habitat via disturbance of vegetation and soils. Indirectly, this could adversely affect the species via destruction of basking, nesting, and overwintering areas around ponds and alteration of water quality resulting from erosion/siltation.

The Federally protected roseate tern is a colonial species that in Massachusetts prefers to nest along islands, coastal beaches, and inshore waters (MNHESP 1988a). The tern is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site (Table 8-9) (MDFW 2004) on Plymouth Bay (MNHESP 1988a). Because of this distance, it is not anticipated that construction of a new generating facility at the Pilgrim site would affect the tern. The Pilgrim transmission line right-of-way is located more than 3.2 km (2 mi) from this tern colony. Thus, it is not anticipated that expansion of the right-of-way would affect the tern. There is no proposed or designated critical habitat for the tern (52 FR 42064).

The Atlantic coastal breeding population of the piping plover in Massachusetts requires sandy coastal beaches for nesting that are relatively flat and free of vegetation (MNHESP 1990a). The plover is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) west of the Pilgrim

Table 8-9. Terrestrial Federally Listed and State-Listed Species Occurring in the Vicinity of the Pilgrim Site

Scientific Name	Common Name	Status[a]	Distance from the Pilgrim Site[b]	Source
Birds				
Ammodramus savannarum	grasshopper sparrow	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Charadrius melodus	piping plover (Atlantic coast population)	FT/ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Haliaeetus leucocephalus	bald eagle	FT/SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Pooecetes gramineus	vesper sparrow	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Sterna dougallii	roseate tern	FE/SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Reptiles				
Emydoidea blandingii	Blanding's turtle	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Pseudemys rubriventris bangsi	Plymouth redbelly turtle	FE/SE	<3.2 km (2 mi)	MDFW 2004; FWS 2004b
Moths and Butterflies				
Acronicta albarufa	barrens daggermoth	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Cicinnus melsheimeri	Melsheimer's sack bearer	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Erynnis persius persius	persius duskywing	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Hypomecis buchholzaria	Buchholz's gray	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Zanclognatha martha	pine barrens zanclognatha	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Damselflies				
Enallagma recurvatum	pine barrens bluet	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Plants				
Calamagrostis pickeringii	reed bentgrass	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004

Table 8-9. (contd)

Scientific Name	Common Name	Status[a]	Distance from the Pilgrim Site[b]	Source
Carex striata brevis	Walter's sedge	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Eupatorium leucolepis novae-angliae	New England boneset	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Isoetes acadiensis	acadian quillwort	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Lipocarpha micrantha	dwarf bulrush	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Ophioglossum pusillum	adder's-tongue fern	ST	<3.2 km (2 mi)	MDFW 2004
Rhynchospora inundata	inundated horn-sedge	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Rhynchospora nitens	short-beaked bald-sedge	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Rhynchospora torreyana	Torrey's beak-sedge	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Sphenopholis pensylvanica	swamp oats	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act, FE = Federal endangered, FT = Federal threatened (FWS 2004b). State status rankings developed by the Massachusetts Division of Fisheries and Wildlife (MDFW), SE = State endangered, ST = State threatened (MDFW 2004).
(b) Distances provided by MDFW (2004).

site (Table 8-9) (MDFW 2004) on Plymouth Bay (FWS 1996; MNHESP 1990a) where it likely nests within the roseate tern colony discussed above. Because of this distance, construction of a new generating facility at the Pilgrim site would not be expected to impact the plover. The Pilgrim transmission line is located more than 3.2 km (2 mi) from this plover colony. Thus, expansion of the existing Pilgrim transmission line right-of-way would also not be expected to impact the plover. There is no proposed or designated critical habitat for the Atlantic coastal breeding population of the piping plover (FWS 1996).

Bald eagles usually inhabit coastal areas, estuaries, and larger inland waters in Massachusetts (MNHESP 1995b). The bald eagle is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site (Table 8-9) (MDFW 2004). Year-round range occurs to the southwest of the Pilgrim site and an historical breeding site and winter range to the southeast (MNHESP 1995b). Because of this distance, construction of a new generating facility at the Pilgrim site

would not be expected to impact the eagle. The Pilgrim transmission line is located more than 3.2 km (2 mi) from the eagle areas noted above. Thus, expansion of the existing Pilgrim transmission line right-of-way would not be expected to impact the eagle. There is no proposed or designated critical habitat for the bald eagle in the area of the Pilgrim site.

Two State-listed threatened birds are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: the grasshopper sparrow (*Ammodramus savannarum*) and the vesper sparrow (*Pooecetes gramineus*) (Table 8-9) (MDFW 2004). The grasshopper sparrow (MNHESP 1986a) and vesper sparrow (NJDFW 2004c) are species of open fields. The only habitat on the Pilgrim site similar to open fields is grass meadow. However, because this habitat type appears to comprise less than 3 percent of the site (AEC 1974b), it is unlikely that the grasshopper or vesper sparrow exist onsite. It is also unlikely that these species exist along the Pilgrim transmission line right-of-way because it crosses coastal forest habitat (AEC 1974b). Thus, it is not anticipated that construction of a new generating facility at the Pilgrim site or expansion of the Pilgrim transmission line right-of-way would affect these two sparrow species.

One State-listed threatened turtle is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: Blanding's turtle (*Emydoidea blandingii*) (Table 8-9) (MDFW 2004). Blanding's turtle is primarily aquatic, preferring densely vegetated shallow ponds, marshes, or small streams (MNHESP 1987). Because small ponds (but no marshes and small streams) are found on the Pilgrim site (AEC 1974b), Blanding's turtle could occur there and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear if the right-of-way also crosses ponds, marshes, or small streams that could support Blanding's turtle.

Five State-listed threatened or endangered moths and butterflies are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: barrens daggermoth (*Acronicta albarufa*), Melsheimer's sack bearer (*Cicinnus melsheimeri*), Persius duskywing (*Erynnis persius persius*), Buchholz's gray (*Hypomecis buchholzaria*), and pine barrens zanclognatha (*Zanclognatha martha*) (Table 8-9) (MDFW 2004). All five species occur in open pitch pine (*Pinus rigida*)/scrub oak (*Quercus ilicifolia*) barrens (Wagner et al. 2003). Barrens daggermoth and Melsheimer's sack bearer also occur in scrub oak thickets (Wagner et al. 2003). Persius duskywing, Buchholz's gray, and pine barrens zanclognatha likely do not occur on the Pilgrim site, because pitch pine/scrub oak barrens are not known to occur there (AEC 1974b). However, barrens daggermoth and Melsheimer's sack bearer could potentially occur on the Pilgrim site, because oak forest and mixed saplings and pole-sized oak stands occur there (AEC 1974b). Thus, these two species could be directly affected by construction of a new generating facility on the Pilgrim site if present in the impact area or indirectly via destruction of host plants. Insufficient detail is available about plant communities to determine whether these five moths and butterflies could occur along the coastal forest-dominated Pilgrim transmission line right-of-way (AEC 1974b).

One State-threatened damselfly is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: pine barrens bluet (*Enallagma recurvatum*) (Table 8-9) (MDFW 2004). Pine barrens bluet appears to be restricted to ponds on the coastal plains (MNHESP 2003). Because small ponds are found on the Pilgrim site (AEC 1974b), pine barrens bluet could occur there and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear if it also crosses ponds on the coastal plains, marshes, or small streams that could support pine barrens bluet.

Only one State-listed threatened or endangered terrestrial plant species is known to occur within 3.2 km (2 mi) of the Pilgrim site: adder's tongue fern (*Ophioglossum pusillum*) (Table 8-9) (MDFW 2004). Adder's tongue fern in Massachusetts is found in ecologically diverse sites (boggy meadows, acidic fens [sphagnous areas with seeping groundwater], borders of marshes, wet fields, and moist woodland clearings) (MNHESP 1990b). Because small ponds and developed wetlands occur on the Pilgrim site, adder's tongue fern could occur there and, thus, could be affected by construction of a new generating facility. However, it is unclear whether the transmission line right-of-way also crosses wet habitats that could support adder's tongue fern.

Nine other State-listed threatened or endangered terrestrial plant species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the site: reed bentgrass (*Calamagrostis pickeringii*), Walter's sedge (*Carex striata brevis*), New England boneset (*Eupatorium leucolepis novae-angliae*), acadian quillwort (*Isoetes acadiensis*), dwarf bulrush (*Lipocarpha micrantha*), inundated horn-sedge (*Rhynchospora inundata*), short-beaked bald-sedge (*Rhynchospora nitens*), Torrey's beak-sedge (*Rhynchospora torreyana*), and swamp oats (*Sphenopholis pensylvanica*) (Table 8-9) (MDWF 2004). Seven of these species – Walter's sedge, New England boneset, acadian quillwort, dwarf bulrush, inundated horn-sedge, short-beaked bald-sedge, and Torrey's beak-sedge – occur along the shorelines of or within freshwater ponds (MDCNAP 2004a, 2004b; MNHESP 1986b, 1988b, 1988c, 1990c, 1993). Reed bentgrass occurs along the shorelines of coastal, nontidal, nonforested wetlands (MDCNAP 2004c). Swamp oats occur in a variety of wet places, including swamps (ODNR 2004). Because small ponds and developed wetlands occur on the Pilgrim site, these nine species could occur onsite and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear whether it also crosses wet habitats that could support these species.

Based on potential impacts on the Federally listed redbelly turtle and potential impacts on many of the State-listed species, the staff concludes the impacts on threatened and endangered species from construction of a new generating facility on the Pilgrim site and possible expansion of the existing transmission line right-of-way would be MODERATE to LARGE.

Operational Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the Pilgrim site include those associated with cooling towers and transmission lines. The Pilgrim plant currently employs a once-through cooling system, but cooling towers would be employed for a new nuclear unit(s). Uncertainty exists regarding the potential impacts of salt drift deposition on crops and ornamental vegetation and native plants from cooling towers that draw salt water with a salinity of over 30 ppt. The impacts of salt drift from cooling towers using fresh water were evaluated in the GEIS (NRC 1996) and were found to be of small significance for all plants. The EPA also concluded that impacts on crops and ornamental vegetation from salt drift from plants using estuarine/tidal makeup water would be minimal (EPA 2001). However, because of the uncertainty surrounding cooling towers that use salt water, it should be conservatively concluded that there could be damage to offsite vegetation resulting from salt drift from operation of cooling towers for the new nuclear unit(s) at the Pilgrim site.

The impacts associated with bird collisions with cooling towers for existing power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any new information that would cause it to modify its earlier conclusion. On these bases, for the purposes of consideration of alternative sites, the impacts of bird collisions with cooling towers resulting from operation of one or more new nuclear units at the Pilgrim site would be negligible.

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 dBA at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Pilgrim site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the Pilgrim site would be minimal.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the Pilgrim site would present few new opportunities for bird collisions, and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above

rationale and the associated conclusions presented in GEIS (NRC 1996), the effects of bird collisions with transmission lines for one or more new nuclear units at the Pilgrim site would be negligible.

The impacts usually associated with transmission line right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat and similar impacts where rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in the expanded transmission line right-of-way. However, it is unknown to what extent the redbelly turtle would be affected by increasing the area of right-of-way maintenance over the approximately 1.6-km (1-mi) segment of Pilgrim transmission line right-of-way that crosses critical habitat for the species. Nonetheless, it is likely that potential impacts on the redbelly turtle (e.g., mortality, destruction of basking, nesting, and overwintering areas around ponds) and its critical habitat (e.g., alteration of water quality resulting from erosion/siltation) from right-of-way maintenance would be less acute, although more long-term, than the construction impacts resulting from right-of-way widening. Therefore, potential impacts on the species from right-of-way maintenance in the expanded right-of-way could be minor to modest.

The staff reviewed the operation of one or more nuclear units at the Pilgrim site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Because of the potential for salt damage to vegetation from cooling tower drift and potential impacts on the Federally endangered redbelly turtle from transmission line right-of-way maintenance, the staff concludes that the impacts of operation of one or more nuclear units at the Pilgrim site on terrestrial resources and threatened and endangered species could range from SMALL to MODERATE.

8.5.2.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The staff does not expect that the aquatic resources near the Pilgrim site would be affected by the construction and operation of new nuclear unit(s) and associated cooling towers. The existing intake structure in Cape Cod Bay would be sufficient to withdraw water necessary for one or more ESP units using closed-cycle cooling. Discharges to Cape Cod Bay would not increase substantially over the discharges from the existing unit. Thus, issues with

impingement, entrainment, and heat shock from the current system are not expected to increase substantially for the operation of new nuclear unit or units. Current dredging activities for operation of the existing intake system would have to continue.

Since 1974, the licensee has identified approximately 68 species through programs on impingement and entrainment. Of these species, approximately 26 are of commercial or recreational value (EPA 2002). Winter flounder (*Pleuronectes americanus*) is one of the species that is important to the commercial and recreational industry in the vicinity of the Pilgrim Nuclear Station. In response to concerns from entrainment of winter flounder larvae, Entergy Nuclear and the Massachusetts Division of Marine Fisheries have been raising flounder in a hatchery and releasing them into Cape Cod Bay (Galya et al. 2003; Lawton 2000; NEI 2002). Operation of new nuclear unit(s) at the Pilgrim site would result in increased use of cooling water from Cape Cod Bay by approximately 20 percent over current Pilgrim Nuclear Station rates. This would increase entrainment of winter flounder larvae approximately proportional to the amount of water withdrawal. Increased production of hatchery flounder could be used to mitigate the anticipated increased in larval mortality resulting from the operation of new unit(s).

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts on aquatic ecological resources from construction of new nuclear unit(s) and associated cooling towers at the Pilgrim ESP site would be SMALL. However, the overall impacts on aquatic ecological resources from operation of new nuclear unit(s) and associated cooling towers at the Pilgrim ESP site, considering the potential for increased entrainment of winter flounder larval would be SMALL to MODERATE.

Threatened and Endangered Species

Federally listed threatened and endangered species are found within the vicinity of Cape Cod Bay (Table 8-10); however, construction and operation of new nuclear unit(s) are not expected to affect the species. National Oceanic and Atmospheric Administration (NOAA) Fisheries identified three species of sea turtles and two species of whales that are known to be seasonally located in waters off Massachusetts and may be present in the vicinity of the site (NMFS 2004). The sea turtles include loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and leatherback turtle (*Dermochelys coriacea*). The whales include North Atlantic right whale (*Eubalaena glacialis*) and humpback whale (*Megaptera novaeangliae*). No federally threatened or endangered species were identified at the Pilgrim site by the U.S. Fish and Wildlife Service (FWS 2004b).

One State-listed threatened species has been identified within the vicinity of the Pilgrim site (Table 8-10). The American brook lamprey (*Lampetra appendix*) are primitive jawless, eel-like fish and are a non-parasitic species of lamprey. They may grow as large as 0.2 m (8 in.). Their larvae live for 4 to 6 years in fine sediment of backwaters or freshwater streams. When they metamorphose into an adult, they stop feeding, spawn and die. While the American brook

Table 8-10. Aquatic Federally and State-Listed Species Occurring in the Vicinity of the Pilgrim Site

Scientific Name	Common Name	Status[a]	Distance from the Pilgrim Site[b]	Source[b]
Fish				
Lampetra appendix	American brook lamprey	ST	<3.2 km (2 mi)	MDFW 2004
Mammals				
Eubalaena glacialis	North Atlantic right whale	FE	16 km (10 mi)	NMFS 2004
Megaptera novaeangliae	humpback whale	FE	16 km (10 mi)	NMFS 2004
Reptiles				
Caretta caretta	loggerhead turtle	FT	16 km (10 mi)	NMFS 2004
Dermochelys coriacea	leatherback turtle	FE	16 km (10 mi)	NMFS 2004
Lepidochelys kempii	Kemp's ridley turtle	FE	16 km (10 mi)	NMFS 2004

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act, FE = Federal endangered, FT = Federal threatened. State status rankings developed by the Massachusetts Division of Fisheries and Wildlife (MDFW), ST = State threatened (MDFW 2004).
(b) Distances provided by MDFW (2004) and U.S. National Marine Fisheries Service (NMSF 2004).

lamprey is found in the vicinity of the Pilgrim site, it is not found on the site. Operations and future construction are not likely to affect the streams within 16 km (10 mi) where the lamprey may be found.

The staff is unaware of any incidents involving threatened and endangered species and the operation of Pilgrim Nuclear Station. No sea turtles or whales have been impinged or entrained at the Pilgrim Nuclear Station, nor have any of these species been observed in the vicinity of the station since biological monitoring began in 1973 (Entergy Services 2005). The additional intake flow as a result of new nuclear unit(s) at the Pilgrim site is unlikely to increase the probability of impingement of sea turtles and whales. Based on information provided by SERI and the NRC staff's independent review, the staff concludes that the overall impacts on threatened and endangered aquatic species from construction and operation of new nuclear unit(s) and associated cooling towers at the Pilgrim site would be SMALL.

8.5.2.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the Pilgrim site, Entergy Nuclear undertook a "reconnaissance" survey of the site using readily obtainable data from the Internet or published sources. The staff conducted local interviews with knowledgeable local officials. No new data were collected. The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. The impacts expected from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impact such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Some of these roadways, such as the Pilgrim access road and Massachusetts Route 3A with which it connects, could require some minor repairs or upgrading (such as patching and filling potholes) to allow safe transport of these materials and equipment. However, no extensive work is planned for the existing roads. It is expected that all construction activities would occur within the existing Pilgrim site. Offsite areas that would support construction activities (for example borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impact on those facilities from construction of the new unit(s) would be small and incremental and associated with their normal operation.

Potential impacts from station operation would include noise, odors, exhausts, thermal emissions, and visual intrusions. There would be a significant visual intrusion because the existing site does not have cooling towers and cooling towers would be proposed for any new units. The new unit(s) would produce noise from the operation of pumps, cooling tower fans, transformers, turbines, generators, and switchyard equipment, and traffic associated with construction and operation of the new unit(s) would also produce noise. SERI states that any noise coming from the proposed Grand Gulf ESP site would be controlled in accordance with standard noise protection and abatement procedures (SERI 2005). By inference, this is also expected to apply to the Pilgrim site. Regulations concerning noise limits can be found in 310 CMR 7.10: Noise, the Commonwealth of Massachusetts Air Pollution Control Regulations. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to and from the Pilgrim site (SERI 2005).

The new unit(s) would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited short-term basis. During normal plant operation, the new unit(s) would not use a significant quantity of chemicals that could generate odors exceeding odor threshold values. Appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the Pilgrim site. Offsite impacts would represent small incremental changes to offsite services supporting the construction activities. During station operations, noise levels would be managed by complying with local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should help minimize production of

odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL to MODERATE.

Demography

The population base is considered to be the population of significant population centers within a 80-km (50-mi) radius of the Pilgrim site. The combined population of the Boston Metropolitan Statistical Area is over six million people (USCB 2004). The 2000 U.S. Census reported the population within the five counties nearest the Pilgrim site (Plymouth, Barnstable, Suffolk, Norfolk, and Middlesex Counties) to be about 3.5 million, and the Massachusetts Institute for Social and Economic Research middle population projection series projected the counties to grow by approximately 6 percent to 3.7 million by 2020 (MISER 2004).

Entergy Nuclear (Entergy Nuclear 2001) assumed that 75 percent of the resident construction workforce of 2835 is expected to already live in the region, and the projected 2000 people who might relocate to the region would represent a small percentage of the larger population base. While an unknown percentage of the station operation workforce would be expected to relocate into the region, the increase is a small percentage of the total base population, and they would probably reside throughout the region. Based on the information in the SERI environmental report (SERI 2005), the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001), and the NRC staff's independent review, the staff concludes that the demographic impacts within an 80-km (50-mi) radius of the region resulting from construction and operation would be SMALL.

Social and Economic Impacts

Economy

The Pilgrim site is located in the town of Plymouth in Plymouth County, which is much smaller than the Boston metropolitan area, approximately 64 km (40 mi) to the north. This part of Massachusetts is growing quickly, in part because of the suburbanization of Boston and the fact that the Cape Cod Commission acts as a strong constraint on growth on nearby Cape Cod. Tourism is a primary economic driving force in the Plymouth County area, with about 10,000 to 15,000 people living in summer rental housing. About 3500 people are employed in the tourism industry out of 13,300 employed in the county. Other effects of tourism include $80 million in payroll, State tax payment of about $17 million, and local tax payments of about $15 million (TIA 2003). In recent years, the regional economy has become more diversified and includes major businesses, financial and health care components, and a growing "high-tech" sector. Local industrial parks are reportedly fully occupied (Scott 2004b). The local economic development leaders consider construction and operation of additional unit(s) at the Pilgrim site to be incompatible with the current tourism-based economy and their economic plans for the

county (Scott 2004b). Regionally, the service sector now offers the most employment opportunities. Construction and operation of new reactors at the Pilgrim site would decrease the availability of housing in Plymouth County, where new housing and growth control are already issues.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff reviewed the impact of station construction and operation on the regional economy and concludes that the impact would not be noticeable in most of the region except for Plymouth County, where the impact could be either beneficial or adverse and significant, depending on how other economic sectors (most noticeably tourism) are affected. The magnitude of the economic impact would be diffused in the larger economy in the Boston metropolitan area. With the smaller economic bases of Plymouth County, the economic impact would be more noticeable.

Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the Pilgrim site (Entergy Nuclear 2001). SERI is expected to be able to attract the necessary workforce for construction activities at the Pilgrim site because of its proximity to the major population center of Boston. In 2003, the construction industry employed over 10,500 workers in Plymouth County and over 85,000 in the Boston Labor Market Area (Massachusetts Division of Career Centers and Division of Unemployment Insurance 2004).

The addition of the proposed new unit(s) would require an increase in the operations workforce of 1160 employees. A total of 569 permanent employees currently work at the Pilgrim site (SERI 2004c), plus numerous additional contractor employees during outages. In its site comparison study, Entergy Nuclear stated that it expected 25 percent of the construction labor force for the new unit(s) would relocate from outside the region (Entergy Nuclear 2001). Some nuclear defense sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at Pilgrim.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that there would be little impact on the availability of construction and operating workers. Construction labor would be available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of the nuclear unit(s) at the Pilgrim site. Much of the operations workforce likely would relocate to the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to Massachusetts and the local governments in the region where sales take place and property taxes to the counties in which they own a residence. Sales and use taxes would be paid from the sales of construction materials and supplies purchased for the project and on expenditures of both the

construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would occur in the region during construction. Corporate income taxes on profits would also be paid by those companies engaged in construction.

There are two types of property taxes in Massachusetts. The first is the tangible personal property taxes paid by contractors during construction of the additional unit(s). This tax is based on the value of property owned by the contractors that acquire taxable status in the town of Plymouth during the construction period. The second is the real property taxes levied for the incremental increase in value to the entire site from the operation of the additional unit(s). It is expected that the town of Plymouth would be the only beneficiary of the these taxes. Entergy Nuclear Generation Company currently has a significant but declining impact on the economic well-being of Plymouth County. Entergy Nuclear Generation Company is reportedly the second largest taxpayer in Plymouth with the existing Pilgrim plant having a negotiated value of $125 million under a payment-in-lieu-of-taxes agreement that declines after 2008 (SERI 2004c). The current value of property owned by Entergy Nuclear Generation Company is about one third the assessed value for the industrial property and 1.7 percent of the $7.3 billion local assessed value in the municipality of Plymouth (Commonwealth of Massachusetts Department of Revenue 2004). While the value of new unit(s) would be subject to negotiations of a payment-in-lieu-of-taxes agreement, the assessed value of a new plant would be in the vicinity of $1 billion, thus increasing the municipal total assessed values by about 14 percent. At the 2004 commercial rate of 11.81 mills (Town of Plymouth 2005), the estimated tax bill for the property would be $11.8 million per year. Local officials believe that the value of other property, especially that related to tourism, might decline in value if a new plant were built (Scott 2004b), thereby offsetting at least some of this increase. The level of taxes paid would depend on the outcome of tax negotiations between Entergy and the local officials on the amount of property taxes, but could noticeably increase the property taxes collected in Plymouth County.

Summary of Social and Economic Impacts

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on social and economic resources from construction and operation of new nuclear unit(s) at the Pilgrim site would be MODERATE adverse resulting from the physical and social demands, for example, to MODERATE beneficial resulting from economy and tax base, for example.

Infrastructure and Community Services

Transportation

The general area around the Pilgrim site is served by several major highways, but site access from the south side of Plymouth is crowded (Scott 2004b). The principal road access to the Pilgrim site is via Power House Road from Massachusetts Highway 3A, both of which are winding, low-speed, two-lane paved roads that pass through wooded areas.

The construction of new power unit(s) would require significant additions to the workforce. In addition, construction materials, wastes, and excavated materials would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations. In addition, the level of service would significantly degrade. There are no current plans to upgrade either road. No direct rail access is available to the Pilgrim site, so large equipment would have to be offloaded and transported by road and/or barge. Pilgrim has an onsite barge slip that can be used for the transport of large loads, thereby reducing some of the burden on road access.

The Providence Regional Airport in Providence, Rhode Island, and Logan International Airport in Boston serve the area. These airports provide regular freight and passenger jet services and are of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impact of station operation employees on the transportation system would be less than that incurred during construction of the ESP facilities. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of Massachusetts Highway 3A may be affected by commuters to the plant site, particularly during shift changes. During new plant operation, the level of service on Massachusetts Highway 3A and Power House Road would degrade, but not as significantly as during construction.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff's reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on transportation infrastructure would significantly degrade their level of service during construction. Also, it is possible that, given the heavy loads carried by vehicles transporting construction materials to the Pilgrim site, some of the roads may need repair to carry the additional load.

Recreation

The Pilgrim site is clearly an industrial site. However, while its current structures are not visually obtrusive from any vantage point, the Pilgrim site is quite visible to recreational boaters

and from the residential neighborhoods on highlands along the shoreline to the south of the existing facilities. Any new facilities would not be able to take advantage of once-through cooling, so cooling towers would be necessary and would be visually obvious. Traditionally, visible plumes generated by the operation of cooling towers could cause a negative aesthetic effect. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.2.3, the aesthetic effects of new transmission lines are not likely to be significant.

Housing

The 2000 U.S. Census reported that over 13,100 housing units out of about 181,500 in existence in Plymouth County in April 2000 were vacant; this amounts to a 7.3 percent vacancy rate (USCB 2004). However, over 8900 units, or 4.7 percent of the total number of units, were considered seasonal or vacation property (mostly summer residences, and most of which likely would be vacant in early April), meaning that the "true" number of vacant houses was considerably lower in Plymouth County. Low vacancy rates are currently a challenge during plant outages at the existing Pilgrim plant (Scott 2004b). Given the proximity of the Pilgrim site to the Boston metropolitan area, housing for construction workers, most of whom will be coming from within the region, and the operations workforce is expected to be available, although not in Plymouth itself. The ability of the Plymouth area to supply additional housing for construction workers is limited (Scott 2004b).

Public Services

Water Supply and Waste Treatment. Plymouth County has a municipal water supply system that serves the town of Plymouth and a 269-km^2 (104-mi^2) area. Permitted groundwater wells supply this system. Water supply needs in the intermediate term can be met, but there is little excess capacity (Scott 2004b).

Most of the construction workforce would come from within the region, so they already are accounted for in the demand placed on the regional water systems. The station operating workforce, while relocating to the region, would probably reside throughout the area, so they would not affect any one community or jurisdiction. Based on the NRC staff's independent review, the staff concludes that the impact of construction and operation on water supply treatment facilities would not be noticeable.

Police, Fire, and Medical Facilities. In the larger metropolitan area of Boston and in Plymouth itself, police, fire, and medical facilities would not be materially affected by an increase in the construction workforce. It is anticipated that many of the construction workers will already live in the region and would commute to the Pilgrim site. As a result, these workers already are being served by existing services and facilities.

It is anticipated that an unknown percentage of the operations workforce and their families will come from outside the region. Most likely they would reside throughout the region (although possibly not in Plymouth because of its limited availability of housing) and would not concentrate in any one place or jurisdiction. Should this occur, there should not be inordinate demands placed on police, fire, and medical services and facilities.

Based on the NRC staff's independent review, the staff concludes that the impacts of construction and operations workforce on police, fire, and medical services and facilities would be easily handled by existing capabilities. Most construction workers already live within the region. New operations workforce employees would reside throughout the region. As a result, there should be minimal new demands placed on these services and facilities by either construction or operations workers.

Social Services. Social services in the Commonwealth of Massachusetts are provided in each county by the Massachusetts Department of Social Services, and a variety of other public and private social service agencies. During the construction phase at the Pilgrim site, there may be an increased demand for social services.

Generally, construction and operation of new nuclear unit(s) at the Pilgrim site would be viewed as beneficial economically to the disadvantaged population segments served by Massachusetts Department of Social Services. The construction workforce associated with the Pilgrim site would be relatively higher paid than other employment categories in the region. Construction and operation of new unit(s) should increase employment through the multiplier effect (see Section 4.5.3.1), projected by Entergy Nuclear at 1260 jobs during the construction period (Entergy Nuclear 2001), and may enable the disadvantaged population to improve their social and economic position by advancing to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the counties for food, services, etc., could, through the multiplier effect, increase the number of jobs that could be filled by members of the disadvantaged population. This would have a beneficial economic impact on the economically disadvantaged population of the region, which should decrease the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this is considered manageable and limited in extent.

Education

The Plymouth school system has just over 8750 students (Massachusetts Department of Education 2004a). There currently is significant overcrowding in the system (Scott 2004b), and the system is ranked slightly below the median (i.e., 188 out of 320) of Massachusetts school districts in spending (Massachusetts Department of Education 2004b). In the other counties and cities of the region, it is anticipated that the construction and operations workforce would affect school infrastructure minimally. The reasons are that many construction workers already live within the region. Entergy Nuclear estimates that the number of persons added to the

region during construction would be 2000, 610 of whom are likely to be children (Entergy Nuclear 2001), and most of whom would not be attending Plymouth schools. The operations workforce, while coming from outside and relocating into the region, would probably reside throughout the region, thus placing little demand on school infrastructure as a result.

Summary of Infrastructure and Community Services

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of new nuclear unit(s) at the Pilgrim site would be MODERATE.

Summary of Socioeconomics

In summary, based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the socioeconomic impacts of construction and operation of new reactors on the region surrounding the Pilgrim site would be SMALL, except in Plymouth County. In Plymouth County, the exceptions are as follows: the impacts on the tax base of the town of Plymouth during operations would be beneficial and MODERATE; the impacts on the economy of Plymouth County may be either beneficial or adverse, depending on how other sectors of the economy react, and up to MODERATE in extent; local transportation and housing availability are likely to be adversely affected and the effect is likely to be MODERATE.

8.5.2.6 Historic and Cultural Resources

The area at the Pilgrim site where new reactors would be built and operated does not appear to be the location of any historic properties (AEC 1974b). Previous archaeological surveys indicate that while sites may exist on the premises, either the sites are not eligible for listing on the National Register of Historic Places or they are located away from likely areas of new construction. Protective measures would be put in place in the event that historic or archaeological materials are discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would conduct an assessment of the discovery to determine if additional work is needed.

No significant differences exist between the Grand Gulf ESP site and the Pilgrim site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts on historic and cultural resources at the Pilgrim site would be SMALL.

8.5.2.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the Pilgrim site, the staff used information from the U.S. Census Bureau and local interviews. There is a very limited minority population in Plymouth County. This population is concentrated in the vicinity of Brockton (NRC 2004b) and makes up only about 12 percent of the total population (USCB 2004). The pathways through which the environmental impacts associated with the construction of one or more additional new nuclear units at the Pilgrim site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, and the NRC staff's independent review, the staff concludes that the offsite impact of construction and operation of new unit(s) at the Pilgrim site to minority and low-income populations would be not be evident. At the 2000 U.S. Census, Plymouth County had a lower percentage of low-income persons (6.6 percent) than did Massachusetts (9.9 percent), which in turn had a lower percentage than the nation (12.4 percent). However, there are a few low income block groups concentrated in Brockton and also one centered on the East Wareham-Onset area (USCB 2005a). No adverse and disproportionately high impacts were identified. Impacts in the region would be SMALL.

8.5.3 Evaluation of the FitzPatrick Nuclear Power Plant Site

This section covers the staff's evaluation of the potential environmental impacts of siting one or more new nuclear units within the scope of the SERI PPE at the James A. FitzPatrick Nuclear Plant site (FitzPatrick).

8.5.3.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The FitzPatrick site is located on 360 ha (900 ac) along the shore of Lake Ontario, about 11 km (7 mi) east-northeast of Oswego, New York. The area around the site and the vicinity is known as Nine Mile Point and is shared with the Nine Mile Point Nuclear Station. In the past, the land in the vicinity of the existing FitzPatrick plant was farmed, but it has been fallow since initial construction of the plant and is now second-growth forest and brush. The new ESP facility

would be situated next to or just east of the existing plant. Because the site of the ESP facility would use a portion of the existing FitzPatrick site, no land would be preempted for additional facilities (SERI 2005).

The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The FitzPatrick site is different from Grand Gulf in that it is located within the costal zone of Lake Ontario and is subject to the Coastal Zone Management Act of 1972. Congress enacted the CZMA to address the increasing pressures of over-development upon the nation's coastal resources. At the Federal level, the National Oceanic and Atmospheric Administration administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary, however, the state of New York has an approved coastal zone management program. The staff assumed that SERI would comply with all provisions of the CZMA as implemented in the Lake Ontario region. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operations would be SMALL.

Transmission Line Rights-of-Way

The existing 345-kV transmission line right-of-way runs east-southeast from the FitzPatrick site, crossing rural forested and agricultural lands for approximately 112 km (70 mi), to a substation just north of Utica, New York. The existing transmission line right-of-way does not cross any land known to be protected or designated for special uses. Section 3.3 discusses the regulatory procedure required to link new large electrical generation facilities to the grid. The issues that could result in potential impacts of construction and operation in this transmission line right-of-way (i.e., physical and ecological impacts) would be similar to those land-use impacts of construction and operation in the transmission line rights-of-way associated with the Grand Gulf ESP site. However, the potentially affected right-of-way crosses land that is more densely populated than the Grand Gulf rights-of-way, therefore, the likelihood of conflicting uses may be greater. The staff assumed that zoning regulations also would be in place that may affect what activities can occur in the affected right-of-way. Therefore, the staff concludes that land-use impacts of transmission system construction associated with a new ESP facility could range from SMALL to MODERATE. For transmission system operations, impacts would be SMALL.

8.5.3.2 Water Use and Quality

Water Use

The FitzPatrick site is located adjacent to Lake Ontario. Construction activities for new nuclear unit(s) at the FitzPatrick site would have similar water usage impacts (i.e., physical and ecological impacts) as the construction at Grand Gulf and would be bounded by the operational impacts. During operation, the consumptive use of water from the cooling towers would be very small compared to the supply available in the lake. Therefore, the staff concludes that the impacts on water use and water supply at the FitzPatrick site would be SMALL.

Water Quality

Construction of new nuclear unit(s) at the site would follow best management practices and have similar water-quality impacts as the construction at Grand Gulf, and would be bounded by the operational impacts. The additional heat from the relatively small amount of blowdown water would be commingled with the discharge of the existing FitzPatrick Plant. This would marginally increase the size of the current thermal plume. Thermal and chemical discharges to Lake Ontario would be regulated by the New York State Department of Environmental Conservation via a State Pollutant Discharge Elimination System permit issued to protect the environment. Since the combined discharge represents a very small fraction of the water volume, the staff concludes that the impacts on water quality at the FitzPatrick site would be SMALL.

8.5.3.3 Terrestrial Resources Including Endangered Species

Construction Impacts

The FitzPatrick site's coastal zone is a transitional area between northern boreal forest and northeastern hardwood forest. The two ecosystems present in this coastal zone are wetlands and upland areas. The climax community is a deciduous forest with an extensive herbaceous ground cover. Much of the original mature forest land was cleared in the past for farming, and a great deal of farm land has since been abandoned. Consequently, the uplands are mostly second-growth communities in a variety of successional stages. Wetlands are attributable to relatively impermeable glacial till soils where perched groundwater lies at or near ground surface at least seasonally or during particularly wet years. Wetlands are, therefore, generally transitional and include shallow ponds, shrub swamps, wood swamps, and intermittently wet bottomland-like forests (NMPC 1983).

The FitzPatrick facility occupies the majority of the northwest quarter of the site. The northeast quarter and southern half of the site consist of forest, old fields, and remnant orchard trees.

These sections of the site also contain numerous freshwater forested/shrub wetlands, freshwater emergent wetlands, and freshwater ponds (Cowardin et al. 1979), totaling from about 24 to 32 ha (60 to 80 ac), representing an estimated 8 to 12 percent of the site. These wetlands range in size from 0.4 to 10 ha (1 to 24 ac), are widely scattered across the northeast quarter and the southern half of the site, and are part of the U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory Database (FWS 2004c).

It is assumed that a new generating facility would be located in the northeast quarter or southern half of the site. In either of these areas, forests and old fields would be affected. Wetlands would also likely be affected because of their relatively uniform distribution across the northeast quarter and southern half of the site. Consequently, habitat impacts from construction of a new generating facility on the site would be expected to be substantial.

The potential impacts from construction, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices such as silt fences to control sedimentation and water sprays to limit dust generation would protect wetlands and other ecological resources in the vicinity.

One transmission line right-of-way, extending for a distance of 112 km (70 mi) (Section 8.5.3.1) and covering 400 ha (988 ac) (NRC 1996), currently serves the FitzPatrick plant. Land cover along the transmission line right-of-way consists of forest (63 percent); cropland and pasture (29 percent); wetlands (8 percent); and recreational areas, residential areas, and highways (less than one percent) (AEC 1973). It is assumed this transmission line right-of-way would not have the capacity to carry the power generated by a new facility and that a transmission system upgrade, including new transmission lines and an additional right-of-way, would be needed. It is assumed any additional right-of-way would involve an expansion, or doubling, of the existing right-of-way. Consequently, a substantial amount of forest habitat, 252 ha (622 ac), could be lost because of the expansion, and a substantial amount of wetland habitat could be affected.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on terrestrial ecological resources from construction of a new generating facility at the FitzPatrick site and associated expansion of the transmission line right-of-way would be MODERATE to LARGE.

Threatened and Endangered Species

No terrestrial animal or plant species that are Federally listed as threatened, endangered, or proposed for listing, and no associated designated or proposed critical habitat are known to occur in the vicinity of the FitzPatrick site (NYDFWMR 2004; FWS 2004d). No State-listed threatened or endangered terrestrial animal or plant species are known to occur within 3.2 km (2 mi) of the FitzPatrick site (NYDFWMR 2004).

Six State-listed threatened or endangered bird species are known to occur beyond 3.2 km (2 mi) but less than 16 km (10 mi) from the FitzPatrick site: Henslow's sparrow (*Ammodramus henslowii*), black tern (*Chlidonias niger*), northern harrier (*Circus cyaneus*), sedge wren (*Cistothorus platensis*), least bittern (*Ixobrychus exilis*), and pied-billed grebe (*Podilymbus podiceps*) (Table 8-11) (NYDFWMR 2004). Henslow's sparrow breeds and migrates in open fallow and grassy fields, sedge meadows, and pastures (NJDFW 2004a). The black tern breeds in inland marshes and sloughs with fairly dense marsh vegetation and pockets of open water (University of Michigan 2004). Northern harriers nest and feed in wet meadows, grasslands, abandoned fields, and coastal and inland marshes (MNHESP 1990d). The sedge wren inhabits wet meadows, freshwater marshes, bogs, and the drier portions of salt or brackish coastal marshes throughout the year (NJDFW 2004b). The least bittern inhabits freshwater marshes (MNHESP no date). The pied-billed grebe nests in marshes, lakes, large ponds, and other wetlands that have an abundance of marsh vegetation. They winter in open lakes and rivers, estuaries, and tidal creeks (MNHESP 1990e). Because forested wetlands are prevalent on the FitzPatrick site and along its transmission line right-of-way, the black tern, northern harrier, sedge wren, least bittern, and pied-billed grebe could occur there and could thus be affected by construction of a new generating facility and expansion of the existing right-of-way. Because old fields occur on the FitzPatrick site and cropland and pasture occur along the transmission line right-of-way, Henslow's sparrow could occur there and could thus be affected by construction of a new facility and expansion of the right-of-way.

All the above avian species, except for the black tern, have been reported in studies at the neighboring Nine Mile Point Nuclear Station (NMPNS), its transmission line right-of-way, and the Heritage Station site (a natural gas-fired combined-cycle generating facility located on Lake Ontario about 3.2 km (2 mi) southwest of NMPNS, which exhibits comparable wetland types and edaphic conditions) as potentially occurring in the general area. However, it is unlikely that any of these species nest on the NMPNS site, based on available habitat (Constellation Energy 2004). Further, these species do not appear in the results of a 1979 field survey of the NMPNS Unit 2 environs that included the FitzPatrick site (NMPC 1983). It, therefore, appears unlikely these species would use the FitzPatrick site for nesting.

Four State-listed threatened or endangered terrestrial plant species are known to occur beyond 3.2 km (2 mi) but less than 16 km (10 mi) from the FitzPatrick site: creeping sedge (*Carex chordorrhiza*), giant pine-drops (*Cypripedium arietinum*), little-leaf tick-trefoil (*Desmodium ciliare*), and swamp smartweed (*Polygonum setaceum interjectum*) (Table 8-11) (NYDFWMR 2004). Creeping sedge is a wetland obligate in the northeastern United States and is known to occur in wet sphagnum bogs (USGS 2004). Giant pine-drops occurs in damp

Table 8-11. Terrestrial State-Listed Species Occurring More than 3.2 Kilometers (2 Miles) but Less than 16 Kilometers (10 Miles) from the FitzPatrick Site

Scientific Name	Common Name	Status[(a)]
Birds		
Ammodramus henslowii	Henslow's sparrow	ST
Chlidonias niger	black tern	SE
Circus cyaneus	northern harrier	ST
Cistothorus platensis	sedge wren	ST
Ixobrychus exilis	least bittern	ST
Podilymbus podiceps	pied-billed grebe	ST
Plants		
Carex chordorrhiza	creeping sedge	ST
Cypripedium arietinum	giant pine-drops	SE
Desmodium ciliare	little-leaf tick-trefoil	ST
Polygonum setaceum interjectum	swamp smartweed	SE

(a) Status rankings developed by the New York State Division of Fish, Wildlife, and Marine Resources, SE = State endangered, ST = State threatened (NYDFWMR 2004).

or mossy woods or bogs, in conifer, hardwood, and mixed forests, and in forested wetlands (MDCNAP 2004d). Little-leaf tick-trefoil occurs in shrub succession areas with disturbed sands (NearActica 2005). Swamp smartweed occurs on the open shores of natural lakes and less frequently in swamp forests (ODNR 1998). Because forests and forested wetlands are prevalent on the FitzPatrick site and along its transmission line right-of-way, creeping sedge, giant pine-drops, and swamp smartweed could occur there and could thus be affected by construction of a new generating facility and expansion of the existing right-of-way. It appears unlikely that little-leaf tick-trefoil would occur on the FitzPatrick site or along its transmission line right-of-way because shrub succession areas are not known from there.

Surveys were conducted in 1991 and 1999 for State-listed threatened and endangered plant species at the Heritage Station site and none were found. Constellation Energy (2004) considers the results of these surveys to indicate that these plant species are unlikely to occur on the NMPNS site because the habitat types present are essentially the same. It is assumed the results of the Heritage site surveys would also apply to the neighboring FitzPatrick site.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on threatened and endangered species from construction of a new generating facility on the FitzPatrick site and possible expansion of the existing transmission line right-of-way would be SMALL.

Operation Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the FitzPatrick site include those associated with cooling towers and transmission lines. The FitzPatrick plant currently employs a once-through cooling system, but cooling towers would be employed for a new nuclear unit(s). The impacts of cooling tower drift and bird collisions for existing power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any new information that would cause it to modify its earlier conclusions. On these bases, for the purposes of consideration of alternative sites, the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of one or more new nuclear units at the FitzPatrick site likely would be negligible.

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 dBA at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the FitzPatrick site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the FitzPatrick site would be minimal.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the FitzPatrick site would present few new opportunities for bird collisions, and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above rationale and the associated conclusions presented in GEIS (NRC 1996), the effects of bird collisions with transmission lines for one or more new nuclear units at the FitzPatrick site would be negligible.

The impacts usually associated with transmission right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat,

and similar impacts where transmission line rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in transmission line rights-of-way expanded for one or more new nuclear units at the FitzPatrick site.

The staff reviewed the operation of one or more nuclear units at the FitzPatrick site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts of operation of one or more nuclear units at the FitzPatrick site on terrestrial resources and threatened and endangered species would be SMALL.

8.5.3.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The aquatic resources near the FitzPatrick site would not be expected to be affected by the construction and operation of a new nuclear facility and associated cooling towers. The existing FitzPatrick intake structure in Lake Ontario would be sufficient for additional water withdrawals for proposed cooling towers. This system includes an acoustic deterrent system on the intake structure to discourage fish from approaching the inflow region, an approach that is considered best available technology for discouraging impingement of aquatic organisms. Intake and discharge flow to Lake Ontario would not increase substantially because the new facility would use closed-cycle cooling. Impingement, entrainment and heat shock from the current system are not expected to increase substantially for the operation of new nuclear units. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts on aquatic ecological resources from construction and operation of one or more new nuclear units and associated cooling towers at the FitzPatrick site would be SMALL.

Threatened and Endangered Species

No Federally listed or proposed threatened and endangered species are found within the vicinity of the FitzPatrick site. The FWS and NOAA Fisheries did not identify any Federally listed threatened or endangered species, except for the occasional transient individual, in the vicinity of the FitzPatrick site (FWS 2004d; NMFS 2004).

The New York State Division of Fish, Wildlife, and Marine Resources (2004) has listed three species of fish that are listed as endangered that might be in the region of the FitzPatrick site: lake sturgeon (*Acipenser fulvescens*), deepwater sculpin (*Myoxocephalus thompsoni*), and round whitefish (*Prosopium cylindraceum*) (Table 8-12). Mature adult lake sturgeon average between 0.9 to 1.5 m (3 to 5 ft) in length and 4.5 to 36 kg (10 to 80 lbs) in weight. They have a torpedo-shaped body and a sharp, cone-shaped snout. The top and side bony plates (called scutes) are the same color as the dull grey body. Lake sturgeon spawn in the spring from May to June in areas of clean, large rubble such as along windswept rocky shores of islands and in rapids in streams. Lake sturgeon are bottom feeders, eating leeches, snails, clams, other invertebrates, small fish, and even algae. The cause for the decline of lake sturgeon in Lake Ontario is uncertain. The New York Department of Environmental Conservation has been trying to reestablish populations of lake sturgeon in selected tributaries of Lake Ontario (NYSDEC 2003b).

Table 8-12. State-Listed Threatened or Endangered Aquatic Species Reported Within a 16-Kilometer (10-Mile) Radius of the FitzPatrick Site

Scientific Name	Common Name	Status[a]	Distance from the River Bend Site[b]	Source
Fish				
Acipenser fulvescens	lake sturgeon	SE	16 km (10 mi)	NYDFWMR 2004
Myoxocephalus thompsoni	deepwater sculpin	SE	16 km (10 mi)	NYDFWMR 2004
Prosopium cylindraceum	round whitefish	SE	16 km (10 mi)	NYDFWMR 2004

(a) Status rankings developed by the New York State Division of Fish, Wildlife, and Marine Resources, SE = State endangered, ST = State threatened (NYDFWMR 2004).

The deepwater sculpin ranges from 0.05 to 0.12 m (2 to 4.7 in.) in length, and is New York's largest sculpin species. The fish has a long, tapered body, a blunt snout and a flat head. The deepwater sculpin spawns year round and is usually found in deep, cold water. It was abundant in Lake Ontario until 1980, after which the population declined to the point where it was considered extirpated from the lake until it was collected in the late 1990s. The cause of the sculpins' population decline is unknown but may be related to competition and predation with alewives (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*) (NYSDEC 2003a).

Round whitefish are a medium-sized fish, averaging 0.2-0.3 m (8-12 in.) in length. The shape of the fish is long and tubular with a nearly round midsection (hence its name). Round whitefish are bottom feeders, and they eat a variety of invertebrates, small fish, and fish eggs. Round whitefish spawn in the fall (November-December) over gravel shoals of lakes or at river mouths (NYSDEC 2003c).

None of these State-listed endangered fish species have been reported in the extensive lake sampling and impingement monitoring efforts at FitzPatrick, nor at the nearby Nine Mile Point Nuclear Station and Oswego Steam Station. The lake sampling efforts were conducted through the 1970s until 1981. The impingement and entrainment studies have been conducted through 1997 (Constellation Energy 2004).

Based on the information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impact on threatened and endangered aquatic species from construction and operation of one or more new nuclear units and associated cooling towers at the FitzPatrick site would be SMALL.

8.5.3.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the FitzPatrick site, Entergy undertook a "reconnaissance" survey of the site using readily obtainable data from the Internet or published sources. The NRC staff did the same and also conducted some local interviews with knowledgeable local officials. No new data were collected. The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. The impacts expected from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. However, extensive work is planned to the existing roads or railways, and new routes are being built to reduce existing bottlenecks in the regional highway system, so no physical impacts on the existing road net are expected. It is expected that all construction activities would occur within the existing FitzPatrick site. Offsite areas that would support construction activities (borrow pits, quarries, and disposal sites, for example) are expected to be already permitted and operational. Impacts on those facilities from construction of the new unit(s) would be a small incremental impact associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. The new unit(s) would produce noise from the operation of pumps, cooling

tower fans, transformers, turbines, generators, and switchyard equipment, and noise from traffic. New York regulations or guidelines regarding noise limits were revised February 2, 2001 (NYSDEC 2001). SERI states in its environmental report (SERI 2005) that any noise coming from the Grand Gulf site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this is also expected to apply to the FitzPatrick site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the ESP site (SERI 2005).

The new unit(s) would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions are in compliance with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the new unit(s) would not use significant quantities of chemicals that could generate odors that exceed olfactory threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the FitzPatrick site. Offsite impacts would represent small incremental changes to offsite services that support the construction activities. During station operations, noise levels would be managed to local ordinances. Air quality permits would be required for operation of the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL.

Demography

The population base potentially affected is considered to be the population of significant population centers within 80 km (50 mi) of the FitzPatrick site. The population of Oswego County is about 122,000 (USCB 2004). The estimated population within 80 km (50 mi) of the FitzPatrick site is slightly over 943,000 (NRC 2004b). The populations of the 10 counties within 80 km of the FitzPatrick site are projected to decline by approximately 6 percent by the year 2030 (NYSIS 2002).

Most (70 percent) of the estimated resident construction workforce of 2835 is expected to come from within the region, and those who might relocate to the region (up to 2360 people) would represent a small percentage of the larger population base (Entergy Nuclear 2001). While some of the station operation workforce is expected to relocate into the region, their numbers are small (an unknown percentage of 1160 new operating employees and their families) when compared to the total base population, and their locations of residence would probably be distributed throughout the region. Based on the information in SERI's environmental report (SERI 2005), the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001)

prepared by Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the demographic impacts within an 80-km (50-mi) radius of the FitzPatrick site attributable to construction and operation would be SMALL.

Social and Economic Impacts

Economy

The FitzPatrick site is located in an economic area of New York that is in the process of reinvention and renewal that is organized around clusters of businesses in energy, health care, manufacturing, and outdoor recreation. The Syracuse labor market area (Oswego, Onodaga, Cayuga, and Cortland Counties) had an unemployment rate of 5.3 percent in August 2004, while the unemployment rate in Oswego County was somewhat higher at 7.7 percent (NYSDOL 2004). The economy within the an 80-km (50-mi) radius of the FitzPatrick site is diverse and mature, with major manufacturing employment in paper and primary metals and service companies in many sectors. The Oswego area has lost several major manufacturing plants over the past few years (for example, Néstle in 2003), and community leaders are now working hard to replace these jobs and further diversify the local economy. The local economic development leaders consider additional nuclear unit(s) at the FitzPatrick site to be highly compatible with the current economy and their economic plans for the county (Scott 2004b). Regionally, the service sector now offers the most employment opportunities. The construction and operation of one or more new nuclear units at the FitzPatrick site would be expected to add to the prosperity of the region, especially Oswego County.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff reviewed the impacts of station construction and operation on the economy of the region and concludes that the impacts would only be significant in Oswego County where the impacts could be positive and noticeable. Much of the economic impacts would be diffused in the larger economic bases of the central New York region. With the smaller economic base of Oswego County, the economic impacts would be more noticeable.

Entergy Nuclear estimates it would take 3150 construction workers 5 years to build one or more new nuclear units at the FitzPatrick site (Entergy Nuclear 2001). SERI is expected to be able to attract the necessary workforce for construction activities at the site because of its proximity to the major population center of Syracuse, with additional workers available in the Watertown, Utica-Rome, and Rochester areas. The availability of craft workers for regular construction projects of longer duration is reported to be good. In the year 2002, about 12,500 construction workers were employed in the Syracuse labor market area, with several thousand more located within an 80-km (50-mi) radius of the FitzPatrick ESP site (NYSDOL 2004).

The addition of new unit(s) would require an increase in the operations workforce of approximately 1160 employees. Currently, approximately 700 permanent employees work at

the FitzPatrick site (SERI 2004c). In its site comparison study, Entergy Nuclear did not state what percentage of the operations labor force for the new unit(s) would relocate from outside the region (Entergy Nuclear 2001). Some defense nuclear sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at the new FitzPatrick reactors.

Construction labor would be readily available from within the region, and there should be little problem recruiting the required labor skills to enable construction of the nuclear unit(s) at the FitzPatrick site. Some of the operations workforce likely would already be in the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to New York and the local governments in the region where sales take place, and property taxes to the counties and school districts in which they own a residence. Sales and use taxes would be applied to the sales of construction materials and supplies purchased for the project and to purchases made by the construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would be made in the region during construction. During operations, the current plant generates about $150,000 per year in sales and use taxes (Oswego County Business Magazine 2001). Corporate income taxes on profits would also be paid by companies engaged in construction at the site.

New York has no personal property tax (Empire State Development 2002), so no tax would be paid by companies on the value of equipment used during construction of any new nuclear unit at the site. The local property tax impact is the real property taxes levied for the incremental increase in value to the entire site from the operation of the additional unit(s). The increase in value would depend on how the eventual agreements on assessed value are reached. It is expected that Oswego County, the town of Scriba, and the Mexico School District would be the only beneficiaries of the these taxes. Entergy Nuclear FitzPatrick, LLC currently has a significant impact on the tax revenue of governmental entities in Oswego County, paying $436,000 to the town of Scriba (out of a budget of roughly $4.2 million), $2.9 million to Oswego County (out of $50 million total property taxes and payments in lieu of taxes and $150 million total revenues raised), and $3.9 million to the Mexico School District (out of $9.1 million from local sources and $31.7 million total from 2001 to 2002) (SERI 2004c; Constellation Energy 2004; Oswego County 2004; NYSED 2004).

Based on the information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts from construction and operation of taxes collected through the income, sales and use, and property taxes would be noticeable in Oswego County, Mexico School District, and town of Scriba, but not noticeable elsewhere. The taxes paid, while substantial, are nevertheless a small sum when compared to the total amount of taxes collected by New York and local governments in the 80-km region surrounding the site. Depending on

the outcome of tax negotiations between Entergy and the state of New York on the amount of property taxes, the staff considers the overall impacts of the property taxes collected in Oswego County would be significant and beneficial relative to the total amount of taxes the county collects through property taxes.

Summary of Social and Economic Impacts

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on social and economic resources from construction and operation of new nuclear unit(s) at the FitzPatrick site would be MODERATE beneficial to SMALL beneficial.

Infrastructure and Community Services

Transportation

The general area around the FitzPatrick site is served by several major highways, including Interstate 90, Interstate 81, and State Highway 481. Oswego is about a 10-minute drive from the site on good, straight, two-lane roads. The principal road access to the FitzPatrick site is via County Roads 1 and 1A (Lake Road), which is a two-lane paved road.

The construction of new reactors would require additions to the workforce. In addition, construction material, waste, and excavated material would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations.

Although neither state nor local governments have level-of-service information for county roads in the state of New York, a capacity analysis of area intersections was performed as part of the application for Certification of a Major Generating Facility Under Article X of the New York State Public Service Law for the proposed natural gas-fired Heritage Station, approximately two miles west of the neighboring Nine Mile Point nuclear site. In the study, the average count for the segment of County Road 1A from County Road 1 to Lakeview Road was 4900 in 1995. Level-of-service ratings of the approaches for the two intersections closest to the Nine Mile Point site along County Road 1A for peak use hours ranged from "A" to "C," with one approach having an "F" rating; however, the majority of approaches carried an "A" or "B" rating (Constellation Energy 2004). The level-of-service designation on nearby county roads would likely be degraded (as individual users are significantly affected by interactions with the traffic stream) during the peak construction period for new nuclear reactors at the FitzPatrick site.

Direct rail access is available from CSX Corporation to the FitzPatrick site, so large equipment and bulk deliveries could be sent via that mode of transportation. There is also a barge slip at the site that could be used for large equipment

The Oswego County Airport and the Syracuse-Hancock International Airport serve the area. The airport in Syracuse provides regular freight and passenger jet services and is of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impacts of station operation employees on the transportation system would be less than that incurred during construction of the ESP units. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of County Road 1, County Road 1a, and New York State Route 104 may be affected by commuters to the plant site, particularly during shift changes. No level-of-service or traffic count information appear to be readily available for these roads in the vicinity of the FitzPatrick site. County Road 1 was recently upgraded. Route 104 to New Haven and the town of Mexico is due to be upgraded in 2007 to remove current congestion (Scott 2004b). A degraded level of service indicates that the freedom to select speed or freedom to maneuver is diminished.

Based on a review of information provided by SERI, Entergy Nuclear, and its own reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on the transportation infrastructure at the FitzPatrick site would be noticeable but temporary. Some of the local roads could have their level of service degraded during construction. Much of the Oswego County road network has been improved for heavy trucks; however, if heavy loads are carried by vehicles transporting construction materials to the FitzPatrick site, some of the roads may need additional repair. The impacts of the operations workforce and related transportation impact likely would be less. There may be some minor congestion at shift changes.

Recreation

The FitzPatrick site is clearly an industrial site with nearby lake and state park recreation. The Nine Mile Point reactor site (nearby) already has cooling towers, so new towers would not create much of a change. Traditionally, visible plumes generated by the operation of cooling towers could cause a negative aesthetic effect on recreation. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.3.3, the aesthetic effects of new transmission lines are not likely to be significant. Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impact of construction and operation on aesthetics in the vicinity of the FitzPatrick site would not be significant.

Impacts of the Alternatives

Housing

Of the 3150 construction workers needed to build one or more new nuclear units at the FitzPatrick site, Entergy Nuclear expects that virtually all would be available from the major nearby population centers of Syracuse, Watertown, Utica-Rome, and Rochester (Entergy Nuclear 2001). A 13.8 percent vacancy rate out of a total 52,800 housing units existed in Oswego County at the 2000 U.S. Census (USCB 2004). The housing market in the Oswego area has been "soft" since about 1993 (Scott 2004b). Given the proximity of the FitzPatrick site to the Oswego metropolitan area, housing for any additional construction workers, most of whom will be coming from within the region, and the operations workforce is expected to be available. During operations, Oswego County and the Oswego area could easily support additional housing (Scott 2004b).

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts of a construction and operations workforce on the demand for housing and housing availability would be a modest positive development in what is currently a soft housing market. The conclusion is based on approximately 7300 vacant housing units in Oswego County, existing construction plans, and the proximity of the FitzPatrick site to the larger Syracuse metropolitan area.

Public Services

Water Supply and Waste Treatment. There are 29 public water districts in Oswego County. These districts cover the cities of Fulton and Oswego and the towns of Central Square, Cleveland, Mexico, Phoenix, Pulaski, Sandy Creek, and Lacona, as well as portions of the surrounding towns. The total population served is over 50,870, which is over 40 percent of the total population of the county (the remainder use private wells). These districts obtain their water from a variety of sources, including directly from Lake Ontario, local wells, and water purchased from the Onondaga County Water Authority. The main water sources for the public water districts are Lake Ontario and a variety of groundwater aquifers and associated springs (Oswego County Department of Planning and Community Development 2000). While there are districts close to their capacity, in general the decline of manufacturing in the county and several additions to capacity over the years mean that substantial excess capacity is available.

Most of the construction workforce would come from within the region, so they are already accounted for in the demands being placed on the local water systems. The station operating workforce, while relocating to the region, would probably reside throughout the region, so they would not particularly affect any one community or jurisdiction. Based on the NRC staff's independent review, the staff concludes there would be no noticeable impact of construction and operation on water supply treatment facilities.

Police, Fire, and Medical Facilities. In the larger area of Oswego County, and the towns of Texas, Mexico, Syracuse, and in nearby Oswego itself, police, fire, and medical facilities would not be affected materially by an increase in the construction workforce. Many of the construction workers are anticipated to live in the region already and would commute to the FitzPatrick site. As a result, these workers are being served by existing police, fire, and medical services and facilities already.

An unknown percentage of the approximately 1160 operations workers and their families is anticipated to come from outside the region. Most likely they would reside throughout the region and would not concentrate as a group in any one place or jurisdiction. Should this occur, there should not be any significant additional demands placed on these services and facilities.

Social Services. A variety of social services in New York are provided in each county by the New York Department of Family Assistance, Office of Mental Health, Office for the Prevention of Domestic Violence and others (New York State Citizen Guide 2005). During construction at the FitzPatrick site, there may be an increased demand for some social services.

Generally, construction and operation of one or more new nuclear units at the FitzPatrick site would be viewed as beneficial economically to the disadvantaged population segments served by the New York Department of Social Services. The new workforce that would be associated with the FitzPatrick site would be relatively higher paid than workers in other employment categories in the region. Construction and operation of new unit(s) should increase employment, through the multiplier effect (see Section 4.5.3.1) and may enable the disadvantaged population to improve their social and economic position by moving up to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the counties for goods and services could, through the multiplier effect, increase the number of jobs that could be filled by members of the disadvantaged population. Noticeable new demand for social and related services as a result of construction and operation of the new facility is unlikely. Construction and operation would have a beneficial impact on the economically disadvantaged population of the region, which should lessen the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this increased demand is considered manageable and limited.

Education

The 10 Oswego County school systems have just over 25,300 students, and private schools enroll another 460 students (NCES 2004a). The school districts for the city of Oswego and the town of Mexico in particular have taken advantage of recently conferred payments in lieu of taxes on the existing FitzPatrick and Nine Mile Point nuclear plants to upgrade facilities. There currently is no overcrowding in the systems, and the Oswego and Mexico school systems enjoy some of the lowest teacher-to-student ratios in the state of New York, high standardized test performance (top 10 in New York State), and excellent facilities (Scott 2004b). In the other

counties and cities of the region, it is anticipated that the construction and operations workforce would minimally impact school infrastructure. The reasons are that many construction workers already live within the region. Entergy Nuclear estimates that new population drawn to the region during construction would be 2360 persons (Entergy Nuclear 2001), 661 of whom are likely to be children. The unknown percentage of the operations workforce moving from outside and relocating into the region would probably be distributed throughout the region, thus placing little demand on school infrastructure as a result.

It is anticipated that most of the construction workforce would come from within the area and would not relocate their families. Those construction and operations workers potentially relocating to the region would most likely reside throughout the region and, as a result, would not be in sufficiently concentrated groups to place an undue burden on the existing infrastructure.

Summary of Infrastructure and Community Services

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of new nuclear unit(s) at the FitzPatrick site would be SMALL to MODERATE.

Summary of Socioeconomics

In summary, based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the socioeconomic impacts of the construction and operations on the region surrounding the FitzPatrick ESP site would be SMALL with the following exceptions. The impacts on the economy of Oswego County would be MODERATE beneficial, and the impacts on the tax bases of the three nearest taxing jurisdictions would be MODERATE beneficial to SMALL beneficial during construction and MODERATE beneficial during operations. The impacts on transportation near the plant during construction would likely be MODERATE adverse during construction. Some additional transportation upgrades may be necessary.

8.5.3.6 Historic and Cultural Resources

The footprint for proposed new reactors at the FitzPatrick site does not appear to have any historic properties located within areas that are likely to be affected by new construction and operation. Previous investigations indicate that no historic properties exist on the site (AEC 1973). Protective measures would be implemented in the event that historic or archaeological materials are discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State

Historic Preservation Officer and would consult with him or her in conducting an assessment of the discovery to determine if additional work is needed.

There are no significant differences between the Grand Gulf ESP site and the FitzPatrick site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts would be SMALL.

8.5.3.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the FitzPatrick site, the staff used information from U.S. Census Bureau (USCB 2004), SERI (2005), Entergy Nuclear (2001), interviews with local officials (Scott 2004b), and the NRC staff's independent review of local conditions. The Oswego County area has relatively few minority residents (3.5 percent of the population), and no concentrations of minority residents. Concentrations of minority residents within 80 km are mostly found at some distance from the FitzPatrick site, in the Syracuse and Rome-Utica areas. There are two (non-minority) low-income census block groups within the city of Oswego, but no others in the county (NRC 2004b). The pathways through which the environmental impacts associated with the construction of one or more new nuclear units at the FitzPatrick site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, interviews, and the NRC staff's independent review, the staff concludes that the offsite impacts of construction and operation of one or more new units at the FitzPatrick site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

8.5.4 Generic Impacts Consistent Among Alternative Sites

In evaluating the alternative sites, the staff found certain impact categories would not vary among sites, and, as a result, would not affect the evaluation of whether an alternative site is environmentally preferable to the proposed site. These areas include air quality; nonradiological and radiological effects on members of the public, workforce, and biota; postulated accidents; and hydrological alterations. As a result, the impacts of these five areas are not evaluated as part of the site-specific alternatives analysis. Instead they are discussed generically in the following subsections.

8.5.4.1 Air Quality Impacts

Some minor impacts on air quality are likely to occur during construction at the Grand Gulf ESP site or any of the alternative ESP sites. The impacts will result from fugitive dust emissions from general construction activities. Elevated ambient air quality levels might also result from the automotive emissions of workforce traffic and emissions from construction equipment. These impacts, which are discussed in Section 2.3.2, are not likely to vary significantly among the Grand Gulf ESP site and the three alternative sites. In its environmental report, SERI (SERI 2005) stated with respect to construction at the proposed ESP site that "...controls would be initiated to keep air emissions within applicable government standards during construction." Although the environmental report does not address the impacts of construction at the alternative sites on air quality, the staff would expect SERI to make a similar commitment for construction at any site. Controls discussed include dust emission controls, burning controls, and engine emission controls.

Air quality at the Grand Gulf ESP site, the FitzPatrick Nuclear Power Plant, and the River Bend Station alternative sites is good. None of these sites is in an area that is designated as in nonattainment of National Ambient Air Quality Standards for any of the criteria air pollutants (40 CFR Part 81). The staff concludes that the impacts of construction activities on air quality at these sites would be SMALL because of the limited duration of the construction activities and the use of best management practices to limit dust and emissions.

The area around the Pilgrim Nuclear Station alternative site is designated nonattainment for both the 1-hour and 8-hour ozone standards. Ozone is associated with emissions from vehicles. Federal agencies are required by 40 CFR Part 93 to prepare a written conformity analysis where the total of direct and indirect emissions caused by a proposed Federal action would exceed established threshold emission levels in a nonattainment area. Estimation of direct and indirect emissions is beyond the scope of reconnaissance-level information. For the purpose of evaluating alternative sites, the staff assumes that the construction workforce for the Pilgrim Nuclear Station alternative site would come from the local area because of the relatively large population of the area. Consequently, construction of the ESP facility at the Pilgrim Nuclear Station site would not result in a large increase in vehicle emissions in the area. On this basis, the staff concludes that the impacts of construction at the Pilgrim Nuclear Station site would also be SMALL.

The air quality impacts from operating the ESP facility at the proposed site or at any of the alternative sites would be limited to those resulting from operation of wet cooling towers, such as visible plumes, and pollutant emissions from periodic operation of auxiliary boilers and generators. The impacts, which are discussed in Section 5.2 of this EIS, would be similar at the four sites. SERI would require approval under the existing Federal, State, or local air quality laws and regulations.

8.5.4.2 Nonradiological Health Impacts

Nonradiological health impacts from construction of the proposed unit(s) on the construction workers at all the alternative sites would be similar to those evaluated in Section 4.8. The impacts would include noise, odor, vehicle exhaust, and dust emissions. Plant construction would be in compliance with all applicable State regulations regarding fugitive dust emissions and air pollution control. Two out of three of the alternative sites (River Bend Station and FitzPatrick Nuclear Power Plant) are in rural areas, and construction impacts would be minimal on the surrounding population. For the third site, Pilgrim Nuclear Station, mitigative actions can be taken to minimize the impacts of construction on the population. The staff concludes that health impacts on construction workers and the public resulting from the construction of the new unit(s) at any of the alternative sites would be SMALL.

Occupational health impacts on operational employees would be the same for all the alternative sites. Thermophilic microorganisms would not be a concern at alternative sites for any facilities using either type of cooling towers. Health impacts on workers from noise would be similar among the sites. Noise would be monitored and controlled in accordance with applicable U.S. Occupational Safety and Health Administration regulations. The staff concludes that the occupational health impacts on construction or operations employees of proposed unit(s) at any of the alternative sites are expected to be SMALL.

With respect to transmission systems, the potential exists for impacts on members of the public from operation of the transmission system in terms of electrical shock, electromagnetic field (EMF) exposure, noise, and aesthetics. The impacts at the alternative sites would be similar to that evaluated in Section 5.8. The staff expects that all transmission lines, either constructed or used as part of an existing nuclear site, would meet standards established by the most current version of the National Electrical Safety Code (IEEE 2001).

8.5.4.3 Radiological Health Impacts

Exposure pathways for gaseous and liquid effluents from the proposed new unit(s) at the Grand Gulf ESP site would be similar for the alternative locations. Gaseous effluent pathways would include external exposure to the airborne plume, external exposure to contaminated soil, inhalation of airborne activity, and ingestion of contaminated agricultural products. Liquid effluent pathways would include ingestion of aquatic foods, ingestion of drinking water, external exposure to shoreline sediments, and external exposure to water through boating and swimming.

Radiation Doses and Health Impacts on Members of the Public

Section 5.9 provides an estimate of doses to the maximally exposed individual (MEI) and the general population for the Grand Gulf ESP site during routine operations for both the liquid effluent and gaseous effluent pathways. The same bounding liquid and gaseous effluent releases would be used to evaluate doses to the MEI and the population at each alternative site. However, there would be differences in the estimated doses at each of the sites. The differences would be caused by the use of site-specific atmospheric and water dispersion data, different exposure pathways, and site-specific population data used in the dose calculations.

Section 4.9 shows that the estimated dose to the MEI (occupational workers during construction) at the Grand Gulf ESP site would be well within the design objectives of 10 CFR Part 50, Appendix I. Considering the differences in pathways analyzed, atmospheric and water dispersion factors, and population size, doses estimated to the MEI for the alternative sites would also be expected to be well within the design objectives in Appendix I of 10 CFR Part 50. Population doses within 80 km (50 mi) of those alternative sites that are closer to major population centers (such as Pilgrim Nuclear Station) would be higher than for the Grand Gulf ESP site; however, the dose would still be small compared to the population dose from natural background radiation.

Based on the evaluation submitted by SERI (2005) and the NRC staff's independent evaluation, the staff concludes that annual doses to the public from the proposed system would be well within regulatory limits, and there would be no observable health impacts on the public from construction and normal operation of one or more nuclear units at the Grand Gulf ESP site or at any of the alternative sites. Therefore, the staff concludes that radiation doses and resultant health impacts from operation of the proposed new reactors at the alternative sites are expected to be SMALL.

Occupational Doses to Workers

Occupational doses would be approximately the same for workers at nuclear facilities at any of the alternative sites. The same (accumulated) annual occupational dose estimates of 1.5 person-Sv (150 person-rem) would be expected for all the proposed units regardless of the site location. The advanced reactor design proposed for construction and operation at the ESP site would result in less annual occupational exposure than that received by workers at currently operating reactors. The staff concludes that the occupational radiation doses from operation of the proposed ESP facility at the alternative sites would be SMALL.

Impacts on Biota

Table 5-9 provides the annual whole body dose estimates to surrogate biota species for the proposed new unit(s) at the Grand Gulf ESP site. The estimated doses to the biota were well within the guidance developed by the International Commission on Radiological Protection (ICRP 1977, 1991), the International Atomic Energy Agency (IAEA 1992), and the National Council on Radiation Protection and Measurements (NCRP 1991). The staff reviewed the available information relative to the radiological impact on biota, other than man, and performed an independent estimate of dose to the biota. The staff concludes that no measurable radiological impacts on populations of biota would be expected from the radiation and radioactive material released to the environment as a result of the routine operation of the proposed facility, or of operation at any of the alternative sites. The staff also concludes that impacts on biota of radiation doses from the operation of new reactors at the alternative sites would be SMALL.

8.5.4.4 Postulated Accidents

A suite of design basis accidents (DBAs) has been considered for new nuclear unit(s) at the Grand Gulf ESP site. The evaluation involved calculation of doses for specified periods at the exclusion area and low population zone boundaries, and comparison of those doses with doses based on regulatory limits and guidelines. Similar analyses have not been conducted for the alternative sites. Had such evaluations been conducted, the differences in the results would only have resulted from meteorological conditions and the distances to the site boundaries. The release characteristics would have been the same at all sites.

For the Grand Gulf ESP site, the doses for each accident sequence considered were well below the corresponding regulatory limits and guidelines. The Grand Gulf ESP site and the three alternative sites have similar climatological settings (mid-latitude, non-tropical, gently rolling terrain) and are sufficiently similar that it is highly unlikely that differences in local meteorological conditions would be sufficient to cause doses from DBAs for new nuclear unit(s) at any of the alternative sites to exceed regulatory limits or guidelines. Similarly, because each of the alternative sites is located at a nuclear reactor site, it is unlikely that differences in distances to the exclusion area and low population boundaries would be sufficient to cause doses from DBAs for new nuclear units at any of the alternative sites to exceed regulatory limits or guidelines. Therefore, the staff concludes that for the purposes of consideration of alternative sites, the impacts of DBAs at each of the alternative sites are SMALL.

A detailed analysis of the potential consequences of severe accidents for the postulated plants has been conducted for the Grand Gulf ESP site. Similar analyses have not been conducted for the alternative sites. Had such evaluations been conducted, subtle differences in the results would result from site-specific factors such as meteorological conditions, population distribution, and land-use distribution. The release characteristics would have been the same at all sites.

The probability-weighted consequences estimated for severe accidents for new nuclear units at the Grand Gulf ESP site are well below the consequences estimated for severe accidents at current generation reactors (see Section 5.10). For the purposes of license renewal, the staff has determined the probability-weighted consequences of severe accidents is SMALL for all existing plants (10 CFR Part 51, Subpart B, Table B-1). On this basis, the staff concludes that, for the purposes of consideration of alternative sites, the impacts of severe accidents at each of the alternative sites would be SMALL.

8.5.4.5 Hydrological Alterations

Construction of any major industrial facility would alter the local patterns of surface water runoff and groundwater recharge. Detailed designs are not available for an ESP facility at the alternative sites. However, because of hydrologic changes associated with the currently operating facilities and best management practices at these sites, the staff concludes that the incremental impacts on local hydrology would be small.

Facilities at the three alternative sites would use major water bodies as the source of makeup water and the sink for blowdown water. As at the Grand Gulf ESP site, a new nuclear facility at the River Bend site would rely on the Mississippi River for cooling water. New nuclear facilities at the Pilgrim or FitzPatrick sites would rely on the Atlantic Ocean and Lake Ontario, respectively, for cooling water needs. These water bodies are so vast compared to the water fluxes associated with a nuclear plant that any changes to the flow patterns of the water bodies would be small and localized. Therefore, the staff concludes that the impacts of hydrological alterations to surface water of these alternative sites would be small.

Consumptive water use of groundwater for facility water needs other than cooling (e.g., potable, demineralized) could affect the water table at the site. The staff concludes that if the potential impacts on groundwater were significant, these groundwater needs could be eliminated by treating water from the surface water sources instead of using groundwater.

Based on the above discussion, the staff concludes that the impacts of hydrological alterations, from construction and operation of a new nuclear facility at one of the alternative sites is generic and would be SMALL.

8.5.4.6 Ecological Impacts

Impacts on terrestrial flora and fauna may result from exposure to EMFs (see Section 5.4.1.7). The conclusion presented in the GEIS for license renewal (NRC 1996) was that the impacts of EMFs on terrestrial flora and fauna were of small significance at operating nuclear power plants, and these included transmission systems with variable numbers of power lines. Since 1997, over a dozen studies have been published that looked at cancer in animals that were exposed to

EMFs for all of, or most of, their lives. These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2005). Thus, the incremental EMF impact posed by the possible addition of new transmission lines for a new generating facility at any of the alternative sites would be considered minimal.

8.6 Summary of Alternative Site Impacts

Entergy Nuclear selected three sites where Entergy Corporation currently owns and operates nuclear power plants as alternative sites to the proposed Grand Gulf ESP site. The three sites selected for detailed review are:

- River Bend Station, located approximately 39 km (24 mi) northwest of Baton Rouge, Louisiana
- Pilgrim Nuclear Station, located approximately 6 km (4 mi) southeast of Plymouth, Massachusetts
- James A. FitzPatrick Nuclear Power Plant, located approximately 13 km (8 mi) northeast of Oswego, New York.

8.6.1 Summary of Alternative Site Construction Impacts

The staff's characterizations of the environmental impacts of constructing new nuclear generating plants within the scope of the SERI PPE at the three alternatives sites are provided in Table 8-13.

8.6.2 Summary of Alternative Site Operation Impacts

The staff's characterizations of the environmental impacts of operating new nuclear generating plants within the scope of the SERI PPE at the three alternatives sites are provided in Table 8-14.

Table 8-13. Characterization of Construction Impacts at the Alternative Early Site Permit Sites

Impact Category	River Bend	Pilgrim	FitzPatrick
Land use			
Site and vicinity	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	SMALL	SMALL to MODERATE	SMALL to MODERATE
Air quality	SMALL	SMALL	SMALL
Water-related			
Water use	SMALL	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL
Ecological			
Terrestrial ecosystems	MODERATE	SMALL	MODERATE to LARGE
Aquatic ecosystems	SMALL	SMALL	SMALL
Threatened and endangered species	SMALL to MODERATE	MODERATE to LARGE	SMALL
Socioeconomic			
Physical	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	SMALL to MODERATE[a]	MODERATE[b]	SMALL to MODERATE[c]
Historic and cultural resources	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL
Nonradiological health impacts	SMALL	SMALL	SMALL
Radiological health impacts	SMALL	SMALL	SMALL

(a) Most of the adverse impact would be related to effects on transportation.
(b) Most of the adverse impact would be related to effects on transportation and housing.
(c) Most of the adverse impact would be related to effects on transportation near the plant.

Table 8-14. Characterization of Operational Impacts at the Alternative Early Site Permit Sites

Impact Category	River Bend	Pilgrim	FitzPatrick
Land use			
Site and vicinity	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	SMALL	SMALL	SMALL
Air quality	SMALL	SMALL	SMALL
Water-related			
Water use	SMALL	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL
Ecological			
Terrestrial ecosystems[(a)]	SMALL	SMALL to MODERATE	SMALL
Aquatic ecosystems	SMALL	SMALL to MODERATE	SMALL
Threatened and endangered species	SMALL	SMALL to MODERATE	SMALL
Socioeconomic			
Physical	SMALL	SMALL to MODERATE	SMALL
Demography	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	SMALL to MODERATE	MODERATE[(b)]	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL
Nonradiological health impacts[(a)]	SMALL	SMALL	SMALL
Radiological health impacts	SMALL	SMALL	SMALL
Impacts of postulated accidents	SMALL	SMALL	SMALL

(a) Electromagnetic field health effects are indeterminate.
(b) Most of the adverse impact would be related to effects on transportation.

8.7 References

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

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits, Standard Design Certifications, and Combined Licenses for Nuclear Power Plants."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

40 CFR Part 50. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

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

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