8.0 Environmental Impacts of Alternatives to Operating License Renewal

This chapter examines the potential environmental impacts associated with denying the renewal of the operating licenses (OLs) (i.e., the no-action alternative); the potential environmental impacts from electric generating sources other than McGuire Nuclear Station, Units 1 and 2 (McGuire); the possibility of purchasing electric power from other sources to replace power generated by McGuire and the associated environmental impacts; the potential environmental impacts from a combination of generating and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by McGuire Units 1 and 2. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC's) three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B:

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

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

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

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[(a)] with the additional impact category of environmental justice.

8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act (NEPA) specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS) (10 CFR 51, Subpart A, Appendix A[4]). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the OLs for McGuire, and Duke Energy Corporation (Duke) would then decommission McGuire when plant operations cease. Replacement of

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

McGuire electricity generation capacity would be met by (1) demand-side management and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than McGuire, or (4) some combination of these options.

Duke will be required to comply with NRC decommissioning requirements whether or not the OLs are renewed. If the McGuire OLs are renewed, decommissioning activities may be postponed for up to an additional 20 years. If the OLs are not renewed, Duke would conduct decommissioning activities according to the requirements in 10 CFR 50.82.

The environmental impacts associated with decommissioning under both license renewal and the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the GEIS, Chapter 7 of this Supplemental Environmental Impact Statement (SEIS), and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586 dated August 1988.[(a)] The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

The environmental impacts for the socioeconomic, historic and archaeological resources, and environmental justice impact categories are summarized in Table 8-1 and discussed in the following paragraphs.

- Socioeconomic. When McGuire ceases operation, there will be a decrease in employment and tax revenues associated with the closure. Employment (primary and secondary) impacts and impacts on population would occur over a wide area.

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

Impact Category	Impact	Comment
Socioeconomic	SMALL to MODERATE	Decrease in employment, higher-paying jobs, and tax revenues
Historic and Archaeological Resources	SMALL	Land occupied by Units 1 and 2 would likely be retained by Duke
Environmental Justice	SMALL to MODERATE	Loss of employment opportunities and social programs

(a) The NRC staff is currently supplementing NUREG-0586 for reactor decommissioning. In October 2001, the staff issued draft Supplement 1 to NUREG-0586 dealing with decommissioning of nuclear power reactors (NRC 2001a) for public comment. The staff is currently finalizing the draft Supplement for publication as a final document.

Employees working at McGuire reside in a number of North Carolina counties including Mecklenburg, Lincoln, Gaston, Iredell, Catawba, Cabarrus, and Rowan (Duke 2001a).

Tax-related impacts would occur in Mecklenburg County as well as the town of Huntersville within Mecklenburg County. In 1998, Duke paid property taxes for McGuire Nuclear Station to Mecklenburg County in the amount of $8,100,866 (Duke 2001a). This payment represented approximately 2 percent of total property tax revenues in Mecklenburg County and 1 percent of total revenues from all sources for Mecklenburg County. Duke also pays property taxes for McGuire to the town of Huntersville in the amount of $333,333 per year (Duke 2001a). In 1999, this payment represented approximately 7 percent of total property tax revenues and 4 percent of total revenues from all sources for the town of Huntersville.

The no-action alternative would result in the loss of the taxes attributable to McGuire as well as the loss of plant payrolls 20 years earlier than if the OLs were renewed. Given the relatively low percentage of revenue in Mecklenburg County and the town of Huntersville derived from McGuire, the property tax revenue would have a SMALL to MODERATE impact on the ability of the two jurisdictions to provide public services such as schools and road maintenance.

There would also be an adverse impact on housing values and the local nearby economy if McGuire were to cease operations.

Duke employees working at McGuire currently contribute time and money toward community involvement, including schools, churches, charities, and other civic activities. It is likely that with a reduced presence in the community following decommissioning, community involvement efforts by Duke and its employees in the region would be less.

- Historic and Archaeological Resources. The potential for future adverse impacts to known or unrecorded cultural resources at McGuire following decommissioning will depend on the future use of the site. Following decommissioning, the site would likely be retained by Duke for other corporate purposes. Eventual sale or transfer of the site, however, could result in adverse impacts to cultural resources if the land-use pattern changes dramatically. Notwithstanding this possibility, the impacts of this alternative on historic and archaeological resources are considered SMALL.

- Environmental Justice. Current operations at McGuire have no disproportionate impacts on the minority and low-income populations of Mecklenburg and surrounding counties, and no environmental pathways have been identified that would cause disproportionate impacts. Closure of McGuire would result in decreased employment opportunities and tax revenues in Mecklenburg County and surrounding counties, with possible negative

and disproportionate impacts on minority or low-income populations. Because McGuire is located in a relatively urban area with extensive employment opportunities, the environmental justice impacts under the no-action alternative are considered SMALL to MODERATE.

Impacts for all other impact categories would be SMALL, as shown in Table 9-1. In some cases, impacts associated with the no-action alternative would be positive. For example, closure of McGuire would eliminate any impingement and entrainment of fish and shellfish and also eliminate any negative impacts resulting from thermal discharges to Lake Norman.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by McGuire assuming that the OLs for Units 1 and 2 are not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- coal-fired generation at the McGuire site and at an alternate greenfield[(a)] site (Section 8.2.1)
- natural-gas-fired generation at the McGuire site and at an alternate greenfield site (Section 8.2.2)
- nuclear generation at the McGuire site and at an alternate greenfield site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at McGuire is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for McGuire are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an Annual Energy Outlook. In its *Annual Energy Outlook 2002*, EIA projects that combined-cycle[(b)] or combustion turbine technology fueled by natural gas is likely

(a) A greenfield site is assumed to be an undeveloped site with no previous construction.
(b) 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.

to account for approximately 88 percent of new electric generating capacity through the year 2020 (DOE/EIA 2001a). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet baseload[(a)] requirements. Coal-fired plants are projected by EIA to account for approximately 9 percent of new capacity during this period. Coal-fired plants are generally used to meet baseload requirements. Renewable energy sources, primarily wind, geothermal, and municipal solid waste units, are projected by EIA to account for the remaining 3 percent of capacity additions. EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. Combined-cycle plants are projected by EIA to have the lowest generation cost in 2005 and 2020, followed by coal-fired plants and then wind generation (DOE/EIA 2001a).

EIA projects that oil-fired plants will account for very little new generation capacity in the United States through the year 2020 because of higher fuel costs and lower efficiencies (DOE/EIA 2001a).

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States through the year 2020 because natural gas and coal-fired plants are projected to be more economical (DOE/EIA 2001a). In spite of this projection, a new nuclear plant alternative for replacing power generated by McGuire is considered in Section 8.2.3. Since 1997, the NRC has certified three new standard designs for nuclear power plants under the procedures in 10 CFR 52 Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), and the AP600 Design (10 CFR 52, Appendix C). The submission to the NRC of these three applications for certification indicates continuing interest in the possibility of licensing new nuclear power plants. NRC has established a New Reactor Licensing Program Office to prepare for and manage future reactor and site licensing applications (NRC 2001b).

8.2.1 Coal-Fired Generation

The coal-fired alternative is analyzed for both the McGuire site and an alternate greenfield site. The staff assumed construction of four 600-megawatt electric [MW(e)] units, which is consistent with Duke's environmental report (ER) for McGuire (Duke 2001a). This assumption will slightly overstate the impacts of replacing the 2258 MW(e) from McGuire Units 1 and 2.

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the McGuire ER (Duke 2001a). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only

(a) A baseload plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for baseload generation; i.e., these units generally run near full load.

20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

Coal and lime or limestone for a coal-fired plant sited at McGuire would most likely be delivered by railroad. McGuire is served by an existing rail line. Lime[(a)] or limestone is used in the scrubbing process for control of sulfur dioxide emissions. Rail delivery would also be the most likely option for delivering coal and lime/limestone to an alternate inland greenfield site for the coal-fired plant. Barge delivery of coal and lime/limestone is potentially feasible only for a coastal site. A coal slurry pipeline is also a technically feasible delivery option; however, the associated cost and environmental impacts make a slurry pipeline an unlikely transportation alternative. Construction at an alternate site could necessitate the construction of a new transmission line to connect to existing lines and a rail spur to the plant site.

The coal-fired plant is assumed to utilize tangentially fired, dry-bottom boilers and consume bituminous, pulverized coal with an ash content of approximately 10 percent by weight (Duke 2001a, p. 8-34). Annual coal consumption would be approximately 5.76 million MT/yr (6.35 million tons/yr) (Duke 2001a). The McGuire ER assumes a heat rate[(b)] of 2.7 J fuel/J electricity (9364 Btu/kWh) and a capacity factor[(c)] of 0.8. After combustion, 99.9 percent of the ash (approximately 572,000 MT/yr [630,000 tons/yr]) would be collected and disposed of at the plant site. In addition, approximately 304,000 MT/yr (335,000 tons/yr) of scrubber sludge would be disposed of at the plant site (Duke 2001a).

8.2.1.1 Once-Through Cooling System

For purposes of this SEIS, the staff assumed that a coal-fired plant located at the McGuire site would use the existing once-through system as a source of cooling. An alternate greenfield site could use either a closed-cycle or a once-through cooling system.

The overall impacts of the coal-fired generating system are discussed in the following sections and summarized in Table 8-2. The extent of impacts at an alternate site would depend on the location of the particular site selected.

(a) In a typical wet scrubber, lime (calcium hydroxide) or limestone (calcium carbonate) 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 out and is removed in sludge form.

(b) Heat rate is a measure of generating station thermal efficiency. In English units, it is generally expressed in British thermal units (Btu) per net kilowatt-hour (kWh). It is computed by dividing the total Btu content of fuel burned for electric generation by the resulting net kWh generation.

(c) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

Table 8-2. Comparison of Environmental Impacts of Coal-Fired Generation Using Once-Through Cooling at McGuire and an Alternate Greenfield Site

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE to LARGE	Uses unused portion of McGuire site for plant, infrastructure, and waste disposal. Additional offsite land would also likely be needed. Additional offsite land impacts for coal and limestone mining.	MODERATE to LARGE	Uses up to 1000 ha (2460 ac) for plant, infrastructure, and waste disposal; additional land impacts for coal and limestone mining; possible impacts for transmission line and rail spur.
Ecology	MODERATE to LARGE	Uses undeveloped areas at McGuire site plus some offsite land. Potential habitat loss and fragmentation and reduced productivity and biological diversity.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality	SMALL	Uses existing once-through cooling system	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Air Quality	MODERATE	Sulfur oxides • 5757 MT (6346 tons) Nitrogen oxides • 7196 MT/yr (7932 tons/yr) Particulates • 288 MT/yr (317 tons/yr) of total suspended particulates which would include 192 MT/yr (212 tons/yr) of PM_{10} Carbon monoxide • 1439 MT/yr (1586 tons/yr) Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials – mainly uranium and thorium	MODERATE	Potentially same impacts as the McGuire site, although pollution control standards may vary.
Waste	MODERATE	Total waste volume would be approximately 900,000 MT/yr (1 million tons/yr) of ash, spent catalyst, and scrubber sludge requiring approximately 307 ha (760 ac) for disposal during the 40-year life of the plant.	MODERATE	Same impacts as McGuire site; waste disposal constraints may vary.
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.	SMALL	Same impact as McGuire site.

Table 8-2 (contd)

	McGuire Site			Alternate Greenfield Site	
Category Impact	**Impact**	**Comment**		**Impact**	**Comment**
Socio-economics	MODERATE to LARGE	During construction, impacts would be MODERATE. Up to 2500 workers during the peak of the 5-year construction period, followed by reduction from current McGuire work force of 1345 to 250. Tax base preserved. Impacts during operation would be SMALL. Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts associated with trains trips to and from the plant would be MODERATE to LARGE.		MODERATE to LARGE	Construction impacts depend on location, but could be LARGE if plant is located in a rural area. Mecklenburg County and the town of Huntersville would experience loss of Units 1 and 2 tax base and employment with potentially MODERATE impacts. Impacts during operation would be SMALL. Transportation impacts associated with construction workers could be MODERATE to LARGE. For rail transportation of coal and lime/limestone, the impact is considered MODERATE to LARGE. For barge transportation, the impact is considered SMALL.
Aesthetics	MODERATE	Exhaust stacks will be visible from nearby local parks and the Cowan's Ford Wildlife Refuge. Rail transportation of coal and lime/limestone would have a MODERATE aesthetic impact. Noise impact from plant operations would be MODERATE.		MODERATE to LARGE	Impact would depend on the site selected and the surrounding land features. If needed, a new transmission line or rail spur could have a LARGE aesthetic impact. Rail transportation of coal and lime/limestone would have a MODERATE aesthetic impact. Barge transportation of coal and lime/limestone would have a SMALL aesthetic impact. Noise impact from plant operations would be MODERATE.

Table 8-2 (contd)

Category Impact	McGuire Site Impact	McGuire Site Comment	Alternate Greenfield Site Impact	Alternate Greenfield Site Comment
Historic and Archeological Resources	SMALL	Some construction would affect previously developed parts of McGuire site; cultural resource inventory should minimize any impacts on undeveloped lands.	SMALL	Alternate location would necessitate cultural resource studies.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 1095 operating jobs at McGuire could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at alternate site vary depending on population distribution and makeup at site. Mecklenburg County and the town of Huntersville would lose tax revenue which could have a SMALL to MODERATE impact on minority and low-income populations.

- **Land Use**

The existing facilities and infrastructure at the McGuire site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the coal-fired replacement plant alternative would use the existing once-through cooling system, switchyard, offices, and transmission line rights-of-way. Some additional land beyond the current McGuire site boundary may be needed to construct a new coal-fired plant while the existing nuclear Units 1 and 2 continue to operate.

The coal-fired generation alternative would necessitate converting a significant quantity of land to industrial use for the plant, coal storage, and landfill disposal of ash, spent selective catalytic reduction catalyst (used for control of nitrogen oxide emissions), and scrubber sludge. It is unlikely that there would be enough land within the present boundary of the existing McGuire site to dispose of all waste products in landfills. Disposal of ash and scrubber sludge over a 40-year plant life would require approximately 307 ha (760 ac). Additional land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be affected for mining the coal and disposing of the waste to support a 1000-MW(e) coal plant during its operational life (NRC 1996). A replacement coal-fired plant for McGuire Units 1 and 2 would be 2400-MW(e) and would affect proportionately more land. Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for McGuire Units 1 and 2. In the GEIS, the staff estimated that approximately 400 ha (1000 ac) would be affected for mining the uranium and processing it during the operating life of a 1000 MW(e) nuclear power plant (NRC 1996).

The impact of a coal-fired generating unit on land use at the McGuire site is best characterized as MODERATE to LARGE. The impact would definitely be greater than the alternative of renewing the OLs.

In the GEIS, the staff estimated that a 1000-MW(e) coal-fired plant would require approximately 700 ha (1700 ac) (NRC 1996). Duke believes that this acreage would be sufficient for a 2400-MW(e) coal-fired generation alternative at an alternate site (Duke 2001a). Additional land could be needed for a transmission line and for a rail spur to the plant site. Depending particularly on transmission line and rail line routing requirements, this alternative would result in MODERATE to LARGE land-use impacts.

- **Ecology**

Locating a coal-fired plant at the McGuire site would alter ecological resources because of the need to convert most of the currently unused land at the site to industrial use for the plant, coal storage, and ash and scrubber sludge disposal. However, some of this land would have been previously disturbed. Additional offsite land would likely be needed for disposal of waste products.

Siting a coal-fired plant at McGuire would have a MODERATE to LARGE ecological impact that would be greater than renewal of McGuire OLs.

At an alternate site, the coal-fired generation alternative would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity.

Use of cooling makeup water from a nearby surface water body could have adverse aquatic resource impacts. If needed, construction and maintenance of a transmission line and a rail spur would have ecological impacts. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE.

- **Water Use and Quality**

The coal-fired generation alternative at the McGuire site is assumed to use the existing once-through cooling system, which would minimize incremental water use and quality impacts. Surface water impacts are expected to remain SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

The staff assumed that a coal-fired plant at McGuire would follow the current practice of obtaining process and fire-protection water from Lake Norman and potable water from the

Charlotte-Mecklenburg Utilities Department (Duke 2001a). The six groundwater wells that supply limited special uses at the McGuire site would also likely continue to be used. Use of groundwater for a coal-fired plant at an alternate site is a possibility. Groundwater withdrawal at an alternate site could require a permit. Some erosion and sedimentation would likely occur during construction (NRC 1996).

For a coal-fired plant located at an alternate greenfield site, the impact on the surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. The impacts would be SMALL to MODERATE.

- **Air Quality**

The air-quality impacts of coal-fired generation vary considerably from those of nuclear generation due to emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

Mecklenburg County is in the Metropolitan Charlotte Interstate Air Quality Control Region (40 CFR 81.75). Mecklenburg County is in compliance with the national ambient air quality standards for particulate matter, carbon monoxide, nitrogen dioxide, lead, sulfur dioxide, and ozone (40 CFR 81.334).

A new coal-fired generating plant located at the McGuire site would likely need a prevention of significant deterioration (PSD) 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 set forth in 40 CFR 60 Subpart D-a. The standards establish limits for particulate matter and opacity (40 CFR 60.42a), SO_2 (40 CFR 60.43a), and NO_x (40 CFR 60.44a).

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR 51 Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. Mecklenburg County is classified as attainment or unclassified for criteria pollutants.[(a)]

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 results from man-made air pollution. In addition, the EPA issued a new

(a) Existing criteria pollutants under the Clean Air Act are ozone, carbon monoxide, particulates, sulfur dioxide, lead, and nitrogen oxide. Emission standards for criteria pollutants are set out at 40 CFR Part 50.

regional haze rule in 1999 (64 FR 35714; July 1,1999 [EPA 1999]). The rule specifies that for each mandatory Class I Federal area located within a state, the state must establish goals that provide for reasonable progress towards 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 coal-fired power station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. However, the mandatory Class I Federal areas closest to the McGuire site are the Linville Gorge Wilderness Area approximately 116 km (72 mi) northwest, the Shining Rock Wilderness Area approximately 179 km (111 mi) west, and the Great Smokey Mountains National Park approximately 236 km (147 mi) west (40 CFR 81.422).

In 1998, the EPA issued a rule requiring 22 eastern states, including North Carolina, to revise their state implementation plans to reduce nitrogen oxide emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone (40 CFR 50.9). The total amount of nitrogen oxides that can be emitted by each of the 22 states in the year 2007 ozone season (May 1 through September 30) is set out at 40 CFR 51.121(e). For North Carolina, the amount is 149,708 MT (165,022 tons). Any new coal-fired plant sited in North Carolina would be subject to this limitation. For South Carolina, the amount is 111,656 MT (123,105 tons).

Impacts for particular pollutants are as follows:

Sulfur oxides. Duke states in its ER that an alternative coal-fired plant located at the McGuire site would use wet scrubber technology utilizing lime/limestone for flue gas desulfurization (Duke 2001a).

A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchase or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally. Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative.

Duke estimates that by using the best technology to minimize SO_2 emissions, the total annual stack emissions would be approximately 5757 MT (6346 tons) of SO_2 (Duke 2001a).

Nitrogen oxides. Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

Duke estimates that by using low-NO_x burners with overfire air and selective catalytic reduction, the total annual NO_x emissions for a new coal-fired power plant would be approximately 7196 MT (7932 tons) (Duke 2001a). This level of NO_x emissions would be greater than the OL renewal alternative.

Particulates. Duke estimates that the total annual stack emissions would include 288 MT (317 tons) of filterable total suspended particulates (particulates that range in size from less than 0.1 micrometer [μm] up to approximately 45 μm). The 288 MT (317 tons) would include 192 MT (212 tons) of PM_{10} (particulate matter having an aerodynamic diameter less than or equal to 10 μm). Fabric filters or electrostatic precipitators would be used for control (Duke 2001a). In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative.

During the construction of a coal-fired plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process.

Carbon monoxide. Duke estimates that the total carbon monoxide emissions would be approximately 1439 MT (1586 tons) per year (Duke 2001a). This level of emissions is greater than the OL renewal alternative.

Hazardous air pollutants including mercury. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000b). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain

segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000b). Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the Clean Air Act for which emission standards for hazardous air pollutants will be issued (EPA 2000b).

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant released roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Carbon dioxide. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

Summary. The GEIS analysis 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 SO_x and NO_x emissions as potential impacts (NRC 1996). Adverse human health effects from coal combustion such as cancer and emphysema have been associated with the products of coal combustion. The appropriate characterization of air impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Siting a coal-fired generation plant at a site other than McGuire would not significantly change air-quality impacts, although it could result in installing more or less stringent pollution-control equipment to meet applicable local requirements. Therefore, the impacts would be MODERATE.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction catalyst, and scrubber sludge. Four 600-MW(e) coal-fired plants would generate approximately 900,000 MT (1 million tons) of this waste annually. The ash and scrubber sludge would be disposed of onsite, accounting for approximately 307 ha (760 ac) of land area over the 40-year plant life. There would not be sufficient space on the existing McGuire site for this quantity of waste. Spent selective catalytic reduction catalyst would be regenerated or disposed of offsite.

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

In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (EPA 2000a). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) EPA has identified eleven documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 percent to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (4) EPA identified gaps in state oversight of coal combustion wastes. Accordingly, EPA announced its intention to issue regulations for disposal of coal combustion waste under subtitle D of the Resource Conservation and Recovery Act.

Construction-related debris would be generated during construction activities.
For all of the preceding reasons, the appropriate characterization of impacts from waste generated from burning coal is MODERATE; the impacts would be clearly noticeable but would not destabilize any important resource.

Siting the coal-fired plant at a site other than McGuire would not alter waste generation, although other sites might have more constraints on disposal locations. Therefore, the impacts would be MODERATE.

- **Human Health**

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

The staff stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates from a coal-fired plant, but does not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, the EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal are characterized as SMALL.

- **Socioeconomics**

Construction of the coal-fired alternative would take approximately 5 years**.** The staff assumed that construction would take place while McGuire Units 1 and 2 continued operation and would be completed by the time the units permanently cease operations. The work force would be expected to vary between 1200 and 2500 workers during the 5-year construction period (NRC 1996). These workers would be in addition to the approximately 1345 workers employed at McGuire. During construction of the new coal-fired plant, communities near McGuire would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered because McGuire is in a relatively urban area and workers could commute to the site from many communities. After construction, the nearby communities would be impacted by the loss of the construction jobs. Duke estimates that the completed coal plant would employ approximately 250 workers (Duke 2001a).

If the coal-fired replacement plant were constructed at the McGuire site and Units 1 and 2 decommissioned, there would be a loss of approximately 1095 permanent high-paying jobs (1345 for the two nuclear units down to 250 for the coal-fired plant), with a commensurate reduction in demand on socioeconomic resources and contribution to the regional economy. The coal-fired plants would provide a new tax base to offset the loss of tax base associated with decommissioning of the nuclear units. For all of these reasons, the appropriate characterization of nontransportation socioeconomic impacts for an operating coal-fired plant constructed at the McGuire site would be MODERATE; the socioeconomic impacts would be noticeable but would be unlikely to destabilize the area.

During the 5-year construction period for the replacement coal-fired units, up to 2500 construction workers would be working at the site in addition to the 1345 workers at Units 1 and 2. The addition of these workers could place significant traffic loads on existing highways near McGuire. Such impacts would be MODERATE to LARGE.

For transportation related to commuting of plant operating personnel, the impacts are considered SMALL. The maximum number of plant operating personnel would be approximately 250. The current work force for McGuire Units 1 and 2 is approximately 1345. Therefore, traffic impacts associated with plant personnel commuting to a coal-fired plant would be expected to be SMALL compared to the current impacts from Unit 1 and 2 operations.

McGuire is served by an existing rail spur. Coal would likely be delivered by rail trains of approximately 115 cars each. Each open-top rail car holds about 90 MT (100 tons) of coal. Additional rail cars would be needed for lime/limestone delivery. In all, approximately 690 trains per year would deliver the coal and lime/limestone for the four units. An average of roughly 26 train trips per week on the rail spur would be needed, because for each full train delivery there would be an empty return train. On several days per week, there could be four trains per day using the rail spur to the site. Socioeconomic impacts associated with rail transportation, such as delays at rail crossings, would likely be MODERATE to LARGE.

Construction of a replacement coal-fired power plant at an alternate site would relocate some socioeconomic impacts but not eliminate them. The communities around McGuire would experience the impact of McGuire operational job loss, and Mecklenburg County and the town of Huntersville would lose tax base. These losses would have SMALL to MODERATE socioeconomic impacts, given the relatively low proportion of the tax base in these jurisdictions attributable to McGuire (see Section 8.1). Communities around the new site would have to absorb the impacts of a large, temporary work force (up to 2500 workers at the peak of construction) and a permanent work force of approximately 250 workers. The staff stated in the GEIS that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the peak construction work force would need to move to the area to work (NRC 1996). Alternate greenfield sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be LARGE. Transportation-related impacts associated with commuting construction workers at an alternate site are site dependent, but could be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would also be site-dependent but can be characterized as SMALL to MODERATE.

Coal and lime/limestone would likely be delivered by rail, although barge delivery is feasible for an alternate coastal location. Socioeconomic impacts associated with rail transportation would likely be MODERATE to LARGE.

- **Aesthetics**

The four coal-fired power plant units could be as much as 60 m (200 ft) tall and be visible in daylight hours offsite. The four exhaust stacks would be as much as 185 m (600 ft) high (Duke 2001a). The stacks would likely be highly visible in daylight hours for distances up to

16 km (10 mi). The stacks would be visible from a number of local parks and wildlife refuges in the vicinity of McGuire including the Cowan's Ford Waterfowl Refuge, Blythe Landing County Park, Ramsey Creek Park, and Jetton Road Park. The plant units and associated stacks would also be visible at night because of outside lighting. The Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). Visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting, provided the lighting meets FAA requirements, and appropriate use of shielding. Overall, the addition of the coal-fired units and the associated exhaust stacks at the McGuire site would likely have a MODERATE aesthetic impact.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the 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. The incremental noise impacts of a coal-fired plant compared to existing McGuire Units 1 and 2 operations are considered to be MODERATE.

At an alternate greenfield site, there would be an aesthetic impact from the buildings and exhaust stacks. There would be an aesthetic impact that could be LARGE if construction of a new transmission line and/or rail spur is needed. 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. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the rail route, the impacts of noise on residents in the vicinity of the facility and the rail line is considered MODERATE. Noise associated with barge transportation of coal and lime/limestone would be SMALL. Noise and light from the plant would be detectable offsite. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with locating at an alternate site can be categorized as MODERATE to LARGE.

- **Historic and Archaeological Resources**

At the McGuire site or an alternate site, 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 adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the McGuire site or an alternate greenfield site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the McGuire site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of McGuire would result in a decrease in employment of approximately 1095 operating employees. Resulting economic conditions could reduce employment prospects for minority or low-income populations. However, McGuire is located in a relatively urban area with many employment possibilities. Overall, impacts are expected to be SMALL to MODERATE.

Impacts at other sites would depend upon the site chosen and the nearby population distribution. If a replacement coal-fired plant were constructed at an alternate site, Mecklenburg County and the town of Huntersville would experience a loss of property tax revenue, which could affect their ability to provide services and programs. However, because the tax revenue attributable to McGuire is a relatively small percentage of total tax revenue for each jurisdiction, the impacts to minority and low-income populations are expected to be SMALL to MODERATE.

8.2.1.2 Closed-Cycle Cooling System

The environmental impacts of constructing a coal-fired generation system at an alternate greenfield site using closed-cycle cooling with cooling towers are essentially the same as the impacts for a coal-fired plant using the once-through system. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences. Although minor differences exist for closed-cycle cooling systems, the staff's findings regarding the environmental impacts of coal-fired generation with once-through cooling remain bounding.

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Greenfield Site with Closed-Cycle Cooling System Utilizing Cooling Towers

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial ecology from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation from cooling towers.
Groundwater Use and Quality	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Aesthetics	Introduction of cooling towers and associated plumes. Natural draft towers could be up to 158 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high and also have an associated noise impact.
Historic and Archaeological Resources	No change
Environmental Justice	No change

8.2.2 Natural-Gas-Fired Generation

The environmental impacts of the natural-gas-fired alternative are examined in this section for both the McGuire site and an alternate greenfield site. For the McGuire site, the staff assumed that the plant would use the existing once-through cooling system.

The McGuire site is located within 3 km (2 mi) of the Williams Transco interstate natural gas pipeline; however, a new pipeline would likely be needed to supply the gas capacities required for a replacement baseload gas-fired plant at the McGuire site (Duke 2001a). Additionally, Duke states in its ER (Duke 2001a) that in the winter it may become necessary for a replacement natural-gas-fired plant to operate on fuel oil due to lack of gas supply. Operation with oil would result in more stack emissions.

If a new natural-gas-fired plant were built elsewhere to replace McGuire, a new transmission line could need to be constructed to connect to existing lines. In addition, construction or upgrade of a natural gas pipeline from the plant to a supply point where a firm supply of gas would be available could be needed. One potential source of natural gas is liquefied natural gas (LNG) imported to either the Cove Point facility in Maryland or the Elba Island facility in Georgia. Both facilities are expected to be reactivated in 2002 (DOE/EIA 2001a). The LNG imported to either facility would need to be vaporized and transported to the plant location via pipeline.

The staff assumed that a replacement natural-gas-fired plant would use combined-cycle combustion turbines (Duke 2001a). The following additional assumptions are made for the natural-gas-fired plant (Duke 2001a):

- five 482-MW(e) units, each consisting of two 172-MW combustion turbines and a 138-MW heat recovery boiler
- natural gas with an average heating value of 56 MJ/kg (23,882 Btu/lb) as the primary fuel
- use of low-sulfur number 2 fuel oil as backup fuel
- heat rate of 2 J fuel/J electricity (6800 Btu/kWh)
- capacity factor of 0.8
- gas consumption of 3.2 billion m^3/yr (113 billion ft^3/yr).

Unless otherwise indicated, the assumptions and numerical values used throughout this section are from the McGuire ER (Duke 2001a). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the natural-gas-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a natural-gas-fired plant).

8.2.2.1 Once-Through Cooling System

The overall impacts of the natural gas generating system are discussed in the following sections and summarized in Table 8-4. The extent of impacts at an alternate site will depend on the location of the particular site selected.

Table 8-4. Summary of Environmental Impacts of Natural-Gas-Fired Generation Using Once-Through Cooling at McGuire and an Alternate Greenfield Site

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE to LARGE	20 ha (50 ac) for powerblock, roads, and parking areas. Additional impact for construction of an underground gas pipeline.	MODERATE to LARGE	60 ha (150 ac) for power-block, offices, roads, switchyard, and parking areas. Additional land possibly impacted for transmission line and/or natural gas pipeline.
Ecology	MODERATE to LARGE	Uses undeveloped areas at McGuire plus land for a new gas pipeline.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and possible transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality	SMALL	Uses existing once-through cooling system	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body.
Air Quality	MODERATE	Sulfur oxides • 31 MT/yr (34 tons/yr) Nitrogen oxides • 469 MT/yr (517 tons/yr) Carbon monoxide • 437 MT/yr (482 tons/yr) PM_{10} particulates • 260 MT/yr (287 tons/yr) Some hazardous air pollutants	MODERATE	Same emissions as McGuire site.
Waste	SMALL	Minimal waste product from fuel combination.	SMALL	Minimal waste product from fuel combination.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Impacts considered to be minor.

Table 8-4 (contd)

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Socio-economics	MODERATE	During construction, impacts would be MODERATE. Up to 1200 additional workers during the peak of the 3-year construction period, followed by reduction from current McGuire work force of 1345 to 150; tax base preserved. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.	MODERATE	During construction, impacts would be MODERATE. Up to 1200 additional workers during the peak of the 3-year construction period. Mecklenburg County and the town of Huntersville would experience loss of McGuire tax base and employment associated with Units 1 and 2 with potentially MODERATE impacts. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.
Aesthetics	MODERATE	MODERATE aesthetic impact. Exhaust stacks will be visible from nearby local parks and the Cowan's Ford Wildlife Refuge. Noise impact from plant operations would be MODERATE.	MODERATE to LARGE	Impact would depend on the site selected and the surrounding land features. If needed, a new transmission line or rail spur could have a LARGE aesthetic impact. Noise impact from plant operations would be MODERATE.

Table 8-4 (contd)

Impact Category	McGuire Site Impact	McGuire Site Comment	Alternate Greenfield Site Impact	Alternate Greenfield Site Comment
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively managed.	SMALL	Same as McGuire site; any potential impacts can likely be effectively managed.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of 1195 operating jobs at McGuire could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts at alternate site vary depending on population distribution and makeup at site. Mecklenburg County and the town of Huntersville would lose tax revenue which could have SMALL to MODERATE impacts on minority and low-income populations.

- **Land Use**

For siting at McGuire, existing facilities and infrastructure would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that the natural-gas-fired replacement plant alternative would use the existing once-through cooling system, switchyard, offices, and transmission line right-of-way. At McGuire, the staff assumed that approximately 20 ha (50 ac) would be needed for the plant and associated infrastructure. There would be an additional land use impact if construction of a new natural gas pipeline to the plant site is needed.

For construction at an alternate greenfield site, the staff assumed that 45 ha (110 ac) would be needed for the plant and associated infrastructure (NRC 1996). Additional land could be impacted for construction of a transmission line and/or natural gas pipeline to serve the plant. 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). Proportionately more land would be needed for a natural-gas-fired plant replacing the 2258 MW(e) from McGuire Units 1 and 2. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for McGuire Units 1 and 2. NRC staff states in the GEIS (NRC 1996) that approximately 400 ha (1000 ac) would be affected for mining the uranium and processing it during the

operating life of a 1000-MW(e) nuclear power plant. Overall, land-use impacts at both McGuire and an alternate greenfield location would be MODERATE to LARGE.

- **Ecology**

  At the McGuire site, there would be ecological land-related impacts for siting of the gas-fired plant. If needed, there would also be significant ecological impacts associated with bringing a new underground gas pipeline to the site. Ecological impacts at an alternate site would depend on the nature of the land converted for the plant and the possible need for a new transmission line and/or gas pipeline. Construction of a transmission line and a gas pipeline to serve the plant would be expected to have temporary ecological impacts. Ecological impacts to the plant site and utility easements could include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. At an alternate site, the cooling makeup water intake and discharge could have aquatic resource impacts. Overall, the ecological impacts are considered MODERATE to LARGE at either location.

- **Water Use and Quality**

  Each of the natural-gas-fired units would include a heat-recovery boiler from which steam would turn an electric generator. Steam would be condensed and circulated back to the boiler for reuse. A natural-gas-fired plant sited at McGuire is assumed to use the existing once-through cooling system.

  The staff assumed that a gas-fired plant located at McGuire would follow the current practice of obtaining process and fire-protection water from Lake Norman and potable water from the Charlotte-Mecklenburg Utilities Department (CMUD) (Duke 2001a). The six groundwater wells that supply limited special uses at the McGuire would also likely continue to be used and impacts would, therefore, be SMALL.

  For alternate sites, the impact on the surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the State. A natural-gas-fired plant sited at an alternate site may use groundwater. For a natural-gas-fired plant at an alternate site, the impacts on groundwater would vary depending upon site-specific characteristics, including competitive uses in the aquifer and plant design. Withdrawal from groundwater aquifers would also be regulated by the State. Therefore, impacts to groundwater would range from SMALL to MODERATE.

Water-quality impacts from sedimentation during construction of a natural-gas-fired plant was characterized in the GEIS as SMALL (NRC 1996). NRC staff also noted in the GEIS that operational water quality impacts would be similar to, or less than, those from other generating technologies.

Overall, water-use and quality impacts at an alternate greenfield site are considered SMALL to MODERATE.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions but in lesser quantities than the coal-fired alternative.

A new gas-fired generating plant located at the McGuire site would likely need a PSD permit and an operating permit under the Clean Air Act. A new combined-cycle natural gas power plant would also be subject to the new source performance standards for such units at 40 CFR 60, Subparts D-a and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_x.

The EPA has various regulatory requirements for visibility protection in 40 CFR 51 Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act. Mecklenburg County is classified as attainment or unclassified for criteria pollutants.

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 results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 FR 35714; July 1,1999 [EPA 1999]). The rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards 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 natural-gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. However, the closest mandatory Class I Federal areas to the McGuire site are the Linville Gorge Wilderness Area located approximately 116 km (72 mi) northwest, the Shining Rock Wilderness Area located approximately 179 km (111 mi) west, and the Great Smokey Mountains National Park located approximately 236 km (147 mi) west (40 CFR 81.422).

In 1998, the EPA issued a rule requiring 22 eastern states, including North Carolina, to revise their state implementation plans to reduce nitrogen oxide emissions. Nitrogen oxide emissions contribute to violations of the national ambient air quality standard for ozone (40 CFR 50.9). The total amount of nitrogen oxides which can be emitted by each of the 22 states in the year 2007 ozone season (May 1 through September 30) is set out at 40 CFR 51.121(e). For North Carolina, the amount is 149,708 MT (165,022 tons) and for South Carolina, the amount is 111,674 MT (123,105 tons). Any new natural-gas-fired plant sited in North Carolina or South Carolina would be subject to these limitations.

Duke projects the following emissions for the natural-gas-fired alternative (Duke 2001a):

- sulfur oxides - 31 MT/yr (34 tons/yr)
- nitrogen oxides - 469 MT/yr (517 tons/yr)
- carbon monoxide - 437 MT/yr (482 tons/yr)
- PM_{10} particulates - 260MT/yr (287 tons/yr).

A natural-gas-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). Natural-gas-fired power plants were found by EPA to emit arsenic, formaldehyde, and nickel (EPA 2000b). Unlike coal-and oil-fired plants, EPA did not determine that regulation of emissions of hazardous air pollutants from natural-gas-fired power plants should be regulated under Section 112 of the Clean Air Act.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process.

The preceding emissions would likely be the same at McGuire or at an alternate greenfield site. Impacts from the above emissions would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural gas-generating plant sited at McGuire or at an alternate greenfield site is considered MODERATE.

- **Waste**

There will be small amounts of solid-waste products (i.e., ash) from burning natural gas fuel. In the GEIS the staff concluded that waste generation from gas-fired technology would be

minimal (NRC 1996). Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation at an operating gas-fired plant would be largely limited to typical office wastes; impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities. Overall, the waste impacts would be SMALL for a natural-gas-fired plant sited at McGuire or at an alternate greenfield site.

In the winter, it may become necessary for a replacement baseload natural-gas fired plant to operate on fuel oil due to lack of gas supply. Combustion of No. 2 fuel oil generates minimal waste products. Overall, the waste impacts associated with fuel oil combustion at a combined cycle plant are expected to be SMALL.

- **Human Health**

In the GEIS, the staff identified cancer and emphysema as potential health risks from 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 risks. NO_x emissions from any plant would be regulated. For a plant sited in North Carolina, NO_x emissions would be regulated by the North Carolina Department of Environment and Natural Resources. Human health effects are not expected to be detectable or sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural-gas-fired alternative sited at McGuire or at an alternate greenfield site are considered SMALL.

- **Socioeconomics**

Construction of a natural-gas-fired plant would take approximately 3 years. Peak employment could be up to 1200 workers (NRC 1996). The staff assumed that construction would take place while Units 1 and 2 continue operation and would be completed by the time they permanently cease operations. During construction, the communities immediately surrounding the McGuire site would experience demands on housing and public services that could have MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from more distant cities. After construction, the communities would be impacted by the loss of jobs. The current McGuire work force (1345 workers) would decline through a decommissioning period to a minimal maintenance size. The new natural-gas-fired plant would replace the nuclear plant tax base of McGuire or provide a new tax base at an alternate greenfield site and provide approximately 150 permanent jobs. Siting at an alternate greenfield site would result in the loss of the nuclear plant tax base in Mecklenburg County and the town of Huntersville and associated employment, with potentially SMALL to MODERATE socioeconomic impacts.

In the GEIS, the staff concluded that socioeconomic impacts from constructing a natural-gas-fired plant would not be very noticeable and that the small operational work force would have the lowest socioeconomic impacts of any nonrenewable technology (NRC 1996). Compared to the coal-fired and nuclear alternatives, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations work force would mitigate socioeconomic impacts.

Transportation impacts associated with construction personnel commuting to the plant site would depend on the population density and transportation infrastructure in the vicinity of the site. The impacts can be classified as MODERATE for siting at McGuire or at an alternate greenfield site. Impacts associated with operating personnel commuting to the plant site would be SMALL.

Overall, socioeconomic impacts resulting from construction of a natural-gas-fired plant at McGuire would be MODERATE. For construction at an alternate greenfield site, socioeconomic impacts would also be MODERATE.

- **Aesthetics**

The turbine buildings and stacks (approximately 60 m [200 ft] tall) would be visible during daylight hours from offsite. The gas pipeline compressors also would be visible. Noise and light from the plant would be detectable offsite. At the McGuire site, these impacts would result in a MODERATE aesthetic impact.

At an alternate greenfield site, the buildings and stacks would be visible offsite. If a new transmission line is needed, the aesthetic impact could be as much as LARGE. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with a replacement natural-gas-fired plant at an alternate greenfield site are categorized as MODERATE to LARGE, with site-specific factors determining the final categorization.

- **Historic and Archaeological Resources**

At both McGuire and an alternate greenfield site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the McGuire site or an alternate greenfield site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of

potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, or other rights-of-way). Impacts to cultural resources can be effectively managed under current laws and regulations and kept SMALL.

- **Environmental Justice**

  No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement natural-gas-fired plant were built at the McGuire site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of McGuire would result in a decrease in employment of approximately 1195 operating employees, possibly offset by general growth in the immediate area. Resulting economic conditions could reduce employment prospects for minority or low-income populations. Overall, impacts are expected to be SMALL to MODERATE.

  Impacts at an alternate greenfield site would depend upon the site chosen and the nearby population distribution. If a replacement natural-gas-fired plant were constructed at an alternate site, Mecklenburg County and the town of Huntersville would experience a loss of property tax revenue which would affect their ability to provide services and programs. However, since these revenues are a relatively small portion of total tax revenue (see Section 8.1), the overall impacts to minority and low-income populations would be SMALL to MODERATE.

8.2.2.2 Closed-Cycle Cooling System

The environmental impacts of constructing a natural-gas-fired generation system at an alternate greenfield location using a closed-cycle cooling system with cooling towers are essentially the same as the impacts for a natural-gas-fired plant using once-through cooling. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences. Although minor differences exist for closed-cycle cooling systems, the staff's findings regarding the environmental impacts of natural-gas-fired generation with once-through cooling remain bounding.

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), and the AP600 Design (10 CFR 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been

submitted to the NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. In addition, recent volatility in prices of natural gas and electricity have made new nuclear power plant construction more attractive from a cost standpoint. Consequently, construction of a new nuclear power plant at the McGuire site using the existing once-through cooling system and at an alternate greenfield site using both closed- and open-cycle cooling are considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime.

Table 8-5. Summary of Environmental Impacts of Natural-Gas-Fired Generation with Closed-Cycle Cooling Utilizing Cooling Towers at an Alternate Greenfield Site

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial ecology from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation from cooling towers.
Groundwater Use and Quality	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Aesthetics	Introduction of cooling towers and associated plumes. Possible noise impact from operation of cooling towers.
Historic and Archaeological Resources	No change
Environmental Justice	No change

The NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs at the McGuire site or at an alternate greenfield site. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect replacement of McGuire Units 1 and 2, which have a capacity of 2258 MW(e). The environmental impacts associated

with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR 51 Subpart A, Appendix B is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using once-through cooling is presented in Section 8.2.3.1 and using closed-cycle cooling in Section 8.2.3.2.

8.2.3.1 Once-Through Cooling System

The overall impacts of the nuclear generating system are discussed in the following sections. The impacts are summarized in Table 8-6. The extent of impacts at an alternate greenfield site will depend on the location of the particular site selected.

- **Land Use**

  The existing facilities and infrastructure at the McGuire site would be used to the extent practicable, limiting the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing cooling system, switchyard, offices, and transmission line rights-of-way. A replacement nuclear power plant at McGuire would require approximately 200 ha (500 ac), some of which may be previously undeveloped land. Some additional land beyond the current site boundary may be needed to construct a new nuclear power plant while the existing McGuire units continue to operate.

Table 8-6. Summary of Environmental Impacts of New Nuclear Generation Using Once-Through Cooling at McGuire and an Alternate Greenfield Site

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE	Requires approximately 200 ha (500 ac) for the plant	MODERATE to LARGE	Requires approximately 200 to 400 ha (500 to 1000 ac) for the plant. Possible additional land if a new transmission line is needed.
Ecology	MODERATE	Uses undeveloped areas at current McGuire Nuclear Station site plus additional offsite land. Potential habitat loss and fragmentation and reduced productivity and biological diversity on offsite land.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity.

Table 8-6 (contd)

Impact Category	McGuire Site Impact	McGuire Site Comment	Alternate Greenfield Site Impact	Alternate Greenfield Site Comment
Water Use and Quality	SMALL	Uses existing once-through cooling system	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amounts of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as McGuire site
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as McGuire
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1.	SMALL	Same impacts as McGuire site.
Socio-economics	MODERATE to LARGE	During construction, impacts would be MODERATE to LARGE. Up to 2500 workers during the peak of the 5-year construction period. Operating work force assumed to be similar to McGuire Nuclear Station. Mecklenburg County and town of Huntersville tax base preserved. Transportation impacts associated with commuting construction workers could be MODERATE to LARGE. Transportation impacts during operation would be SMALL.	MODERATE to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Mecklenburg County and the town of Huntersville would experience loss of tax base and employment with MODERATE impacts. Transportation impacts associated with commuting construction workers could be MODERATE to LARGE. Transportation impacts during operation would be SMALL to MODERATE.

Table 8-6 (contd)

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Aesthetics	SMALL to MODERATE	No exhaust stacks or cooling towers would be needed. Daytime visual impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	SMALL to LARGE	Similar to impacts at McGuire site. Potential LARGE impact if a new transmission line is needed.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively managed.	SMALL	Any potential impacts can likely be effectively managed.
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction.	SMALL to MODERATE	Impacts will vary depending on population distribution and makeup at the site. Mecklenburg County and the town of Huntersville would lose tax revenue which could have a SMALL to MODERATE impact on minority and low-income populations.

There would be no net change in land needed for uranium mining because land needed for the new nuclear plant would offset land needed to supply uranium for fuel for the existing McGuire Units 1 and 2.

The impact of a replacement nuclear generating plant on land use at the McGuire site is best characterized as MODERATE. The impact would be greater than the OL renewal alternative.

Land-use requirements at an alternate greenfield site would be approximately 200 to 400 ha (500 to 1000 ac) plus the possible need for a new transmission line (NRC 1996). In addition, it may be necessary to construct a rail spur to an alternate site to bring in equipment during construction. Depending particularly on transmission line routing, siting a new nuclear plant at an alternate greenfield site could result in MODERATE to LARGE land-use impacts.

- **Ecology**

  Locating a replacement nuclear power plant at the McGuire site would alter ecological resources because of the need to convert land to an industrial use. Some of this land, however, would have been previously disturbed.

  Siting at the McGuire site would have a MODERATE ecological impact that would be greater than renewal of the Unit 1 and 2 OLs.

  At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Use of cooling water from a nearby surface water body could have adverse aquatic resource impacts. If needed, construction and maintenance of the transmission line would have ecological impacts. Overall, the ecological impacts at an alternate greenfield site would be MODERATE to LARGE.

- **Water Use and Quality**

  The replacement nuclear plant alternative at the McGuire site is assumed to use the existing cooling system, which would minimize incremental water-use and quality impacts. Surface-water impacts are expected to remain SMALL; the impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

  The staff assumed that a replacement nuclear plant located at the McGuire site would follow the current practice of obtaining process and fire-protection water from Lake Norman and potable water from the CMUD (Duke 2001a). The six groundwater wells that supply limited special uses at the McGuire site would also likely continue to be used. Therefore, the impacts of a replacement nuclear plant on groundwater would be SMALL.

  For alternate sites, the impact on the surface water would depend on the discharge volume and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water would be regulated by the state of North Carolina. Overall, the impacts would be SMALL to MODERATE.

  For a nuclear power plant at an alternate site, the impacts on groundwater would vary depending upon site-specific characteristics, including competitive uses in the aquifer and plant design. Withdrawal from groundwater aquifers would also be regulated by the State. Therefore, impacts to groundwater would range from SMALL to MODERATE.

- **Air Quality**

  Construction of a new nuclear plant at the McGuire site or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with diesel generators. These emissions would be regulated. Emissions from a plant sited in North Carolina would be regulated by the North Carolina Department of Environment and Natural Resources. Overall, emissions and associated impacts are considered SMALL.

- **Waste**

  The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR 51 Subpart A, Appendix B, Table B-1. In addition to the impacts shown in Table B-1, construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts are considered SMALL.

  Siting the replacement nuclear power plant at a site other than the McGuire site would not alter waste generation. Therefore, the impacts would be SMALL.

- **Human Health**

  Human health impacts for an operating nuclear power plant are set out in 10 CFR 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts are considered SMALL.

  Siting the replacement nuclear power plant at a site other than the McGuire would not alter human health impacts. Therefore, the impacts would be SMALL.

- **Socioeconomics**

  The construction period and the peak work force associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantified data, the staff assumed a construction period of 5 years and a peak work force of 2500. The staff assumed that construction would take place while the existing McGuire units continue operation and would be completed by the time McGuire permanently ceases operations. During construction, the communities surrounding the McGuire site would experience demands on housing and public services that could have MODERATE to LARGE impacts. These impacts would be tempered by construction workers commuting to

the site from more distant communities and the fact that McGuire is located in a relatively urban area. After construction, the communities would be impacted by the loss of the construction jobs.

The replacement nuclear units are assumed to have an operating work force comparable to the 1345 workers currently working at McGuire Units 1 and 2. The replacement nuclear units would provide a new tax base to offset the loss of tax base associated with decommissioning of McGuire. The appropriate characterization of nontransportation socioeconomic impacts for operating replacement nuclear units constructed at the McGuire site would be SMALL.

During the 5-year construction period, up to 2500 construction workers would be working at the McGuire site in addition to the 1345 workers at Units 1 and 2. The addition of the construction workers could place significant traffic loads on existing highways, particularly those leading to the McGuire site. Such impacts would be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would be similar to current impacts associated with operation of McGuire and are considered SMALL.

Construction of a replacement nuclear power plant at an alternate site would relocate some socioeconomic impacts, but would not eliminate them. The communities around McGuire would still experience the impact of McGuire Units 1 and 2 operational job loss and the loss of tax base with potentially MODERATE impacts. The communities around the new site would have to absorb the impacts of a large, temporary work force (up to 2500 workers at the peak of construction) and a permanent work force of approximately 1345 workers. In the GEIS, the staff noted that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction work force would need to move to the area to work (NRC 1996). The McGuire site is not considered a rural site. Alternate sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at a rural site could be LARGE. Transportation-related impacts associated with commuting construction workers at an alternate greenfield site are site dependent, but could be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would also be site dependent, but can be characterized as SMALL to MODERATE.

- **Aesthetics**

The containment buildings for a replacement nuclear power plant sited at McGuire and other associated buildings would likely be visible in daylight hours, especially from the north. Visual impacts could be mitigated by landscaping and selecting a color for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding. No exhaust stacks would be needed. No cooling towers would be needed, assuming use of the existing once-through cooling system.

Noise from operation of a replacement nuclear power plant would potentially be audible offsite in calm wind conditions or when the wind is blowing in the direction of the listener. Mitigation measures, such as reduced or no use of outside loudspeakers, can be employed to reduce noise level and keep the impact SMALL to MODERATE.

At an alternate site, there would be an aesthetic impact from the buildings. There would also be a significant aesthetic impact if a new transmission line were needed. Noise and light from the plant would be detectable offsite. The impact of noise and light would be mitigated if the plant is located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with locating at an alternative site can be categorized as SMALL to MODERATE; however, the impact could be LARGE if a new transmission line is needed to connect the plant to the power grid.

- **Historic and Archaeological Resources**

At both the McGuire site and an alternate site, 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 adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction at the McGuire site or another site, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL.

- **Environmental Justice**

No environmental pathways or locations have been identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement nuclear plant were built at the McGuire site. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. After completion of construction, it is possible that the ability of the local government to maintain social services could be reduced at the same time as diminished economic conditions reduce employment prospects for minority and low-income populations. Overall, however, impacts are expected to be SMALL.

Impacts at an alternate greenfield site would depend upon the site chosen and the nearby population distribution. If a replacement nuclear plant were constructed at an alternate site, Mecklenburg County and the town of Huntersville would experience a loss of property tax revenue, which could affect their ability to provide services and programs. However, because the tax revenue attributable to McGuire is a relatively small percentage of total tax revenue for each jurisdiction, the impacts to minority and low-income populations are expected to be SMALL to MODERATE.

8.2.3.2 Closed-Cycle Cooling System

The environmental impacts of constructing a nuclear power plant at an alternate greenfield site using closed cycle cooling with cooling towers are essentially the same as the impacts for a nuclear power plant using once-through cooling. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences. Although minor differences exist for closed-cycle cooling systems, the staff's findings regarding the environmental impacts of a nuclear power plant with once-through cooling remain bounding.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Sited at an Alternate Greenfield Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	10 to 12 additional ha (25 to 30 ac) required for cooling towers and associated infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial ecology from cooling tower drift. Reduced impact to aquatic ecology.
Surface Water Use and Quality	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the state of North Carolina. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation from cooling towers.
Groundwater Use and Quality	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Aesthetics	Introduction of cooling towers and associated plume. Natural draft towers could be up to 158 m (520 ft). Mechanical draft towers could be up to 30 m (100 ft) high and also have an associated noise impact.
Historic and Archaeological Resources	No change
Environmental Justice	No change

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the McGuire Units 1 and 2 OLs. Duke currently purchases power from other generators. Overall, North Carolina is a net importer of electricity.

Duke includes future power purchases in its Annual Plan (Duke 2001b). The Plan indicates how Duke will meet customers' energy needs through existing generation, customer demand-side options, short-term purchase power transactions, and new generating resources constructed by Duke. The 2001 Plan shows power purchases of 1144 MW for the summer of 2002, gradually decreasing to 121 MW in the summer of 2007 (Duke 2001b). Duke purchases additional capacity in the short-term power market as necessary.

Imported power from Canada or Mexico is unlikely to be available for replacement of McGuire capacity. In Canada, 62 percent of the country's electricity capacity is derived from renewable energy sources, principally hydropower (DOE/EIA 2001b). Canada has plans to continue developing hydroelectric power, but the plans generally do not include large-scale projects (DOE/EIA 2001b). Canada's nuclear generation is projected to increase by 1.7 percent by 2020, but its share of power generation in Canada is projected to decrease from 14 percent currently to 13 percent by 2020 (DOE/EIA 2001b). EIA projects that total gross U.S. imports of electricity from Canada and Mexico will gradually increase from 47.9 billion kWh in year 2000 to 66.1 billion kWh in year 2005 and then gradually decrease to 47.4 billion kWh in year 2020 (DOE/EIA 2001b). On balance, it is unlikely that electricity imported from Canada or Mexico would be able to replace the McGuire capacity.

If power to replace McGuire Nuclear Station capacity were to be purchased from sources within the United States or a foreign country, the generating technology likely would be one of those described in this SEIS and in the GEIS (probably coal, natural gas, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the purchased electrical power alternative to renewal of the McGuire OLs. Thus, the environmental impacts of imported power would still occur, but would be located elsewhere within the region, nation, or another country.

8.2.5 Other Alternatives

Other generation technologies are discussed in the following subsections.

8.2.5.1 Oil-Fired Generation

The EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States through the year 2020 because of higher fuel costs and lower efficiencies (DOE/EIA 2001a). Oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. In Section 8.3.11 of the GEIS, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 48 ha (120 ac) (NRC 1996). Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

8.2.5.2 Wind Power

Most of North Carolina is in a wind power Class 1 region (average wind speeds at 10-m (30-ft) elevation of 0 to 4.4 m/s (9.8 mph). Class 1 has the lowest potential for wind energy generation (DOE 2001a). Wind turbines are economical in wind power Classes 4 through 7 (average wind speeds of 5.6 to 9.4 m/s [12.5 to 21.1 mph] [DOE 2001a]). Aside from the coastal areas and

exposed mountains and ridges of the Appalachians, there is little wind energy potential in the East Central region of the U.S. for current wind turbine applications (Elliott et al. 1986). Wind turbines typically operate at a 30-35 percent capacity factor compared to 90 - 95 percent for a baseload plant (NWPPC 2000). Nine offshore wind power projects are currently operating in Europe, but have not been developed in the U.S. The European plants together provide approximately 90 MW, which is far less than the electrical output of McGuire (British Wind Energy Association 2002). For the preceding reasons, the staff concludes that locating a wind-energy facility on or near the McGuire site or offshore would not be economically feasible given the current state of wind energy generation technology.

8.2.5.3 Solar Power

Solar technologies use the sun's energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. Solar power technologies, photovoltaic and thermal, cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. The average capacity factor of photovoltaic cells is about 25 percent (NRC 1996), and the capacity factor for solar thermal systems is about 25 percent to 40 percent (NRC 1996). Energy storage requirements limit the use of solar-energy systems as baseload electricity supply.

There are substantial impacts to natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high—14,000 ha (35,000 ac) per 1000 MW(e) for photovoltaic (NRC 1996) and approximately 5700 ha (14,000 ac) per 1000 MW(e) for solar thermal systems (NRC 1996). Neither type of solar electric system would fit at the McGuire site, and both would have large environmental impacts at a greenfield site.

The McGuire site receives approximately 4 to 5 kWh of direct normal solar radiation per square meter per day compared to 7 to 8 kWh of solar radiation per square meter per day in areas of the western United States such as California, which are most promising for solar technologies (DOE/EIA 2000). Because of the natural resource impacts (land and ecological), the area's relatively low rate of solar radiation, and high cost, solar power is not deemed a feasible baseload alternative to renewal of McGuire OLs. Some onsite generated solar power, e.g., from rooftop photovoltaic applications, may substitute for electric power from the grid. Implementation of solar generation on a scale large enough to replace McGuire Units 1 and 2 would likely result in LARGE environmental impacts.

8.2.5.4 Hydropower

North Carolina has an estimated 1458 MW of undeveloped hydroelectric resource (INEEL 1997). This amount is less than needed to replace the 2258 MW(e) capacity of McGuire. As

stated in Section 8.3.4 of the GEIS, hydropower's percentage of U.S. generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern 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). Replacement of McGuire generating capacity would require flooding more than this amount of land. Due to the relatively low amount of undeveloped hydropower resource in North Carolina and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace McGuire Units 1 and 2, the staff concludes that local hydropower is not a feasible alternative to renewal of the McGuire Unit 1 and 2 OLs. Any attempts to site hydroelectric facilities large enough to replace McGuire Units 1 and 2 would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal technology is not widely used as baseload generation due to the limited geographical availability of the resource and immature status of the technology (NRC 1996). As illustrated by Figure 8.4 in the GEIS, geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. There is no feasible eastern location for geothermal capacity to serve as an alternative to McGuire Units 1 and 2. The staff concludes that geothermal energy is not a feasible alternative to renewal of the McGuire Units 1 and 2 OLs.

8.2.5.6 Wood Waste

A wood-burning facility can provide baseload 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 barrier to the use of wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to renewing the McGuire Units 1 and 2 OLs.

8.2.5.7 Municipal Solid Waste

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

Growth in the municipal waste combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive waste disposal alternative such as landfills; (2) the 1994 Supreme Court decision (*C&A Carbone, Inc. v. Town of Clarkstown*), which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (DOE/EIA 2001c).

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 2001c).

Currently there are approximately 102 waste to energy plants operating in the U.S. These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e) per plant (Integrated Waste Services Association 2001). The staff concludes that generating electricity from municipal solid waste would not be a feasible alternative to replace the 2258 MW(e) baseload capacity of McGuire and, consequently, would not be a feasible alternative to renewal of the McGuire Units 1 and 2 OLs.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the staff stated 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 baseload plant such as McGuire (NRC 1996). For these reasons, such fuels do not offer a feasible alternative to renewal of the McGuire Units 1 and 2 OLs.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. These are commercially available today at a cost of approximately $4500 per kW of installed capacity (DOE 2002). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations. DOE has a performance target that by 2003, two second-generation fuel cell technologies using molten carbonate and solid oxide technology, respectively, will be commercially available in sizes up to approximately 3 MW at a cost of $1000 to $1500 per kW of installed capacity (DOE 2002). For comparison, the installed capacity cost for a natural-gas-fired combined-cycle plant is on the order of $500 to $600 per kW (NWPPC 2000). As market acceptance and manufacturing capacity increase, natural-gas-fueled fuel cell plants in the 50- to 100-MW range are projected to become available (DOE 2002). At the present time, however, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Fuel cells are, consequently, not a feasible alternative to renewal of the McGuire OLs.

8.2.5.10 Delayed Retirement

Duke Power's 2001 Annual Plan includes a list of Duke generating facilities projected to be retired (Duke 2001b). Through the year 2008, Duke projects that 23 generating units with a total capacity of 584 MW will be retired (Duke 2000). Delayed retirement of these 23 units would not come close to replacing the 2258 MW(e) capacity of McGuire Nuclear Station. For this reason, delayed retirement of Duke generating units would not be a feasible alternative to renewal of the McGuire OLs.

8.2.5.11 Utility-Sponsored Conservation

Duke has developed residential, commercial, and industrial programs to reduce both peak demands and daily energy consumption. These programs are commonly referred to as demand-side management (DSM). These DSM savings are part Duke's long-range plan for meeting projected demand, and thus are not available offsets for McGuire capacity.

Duke currently has two residential DSM programs (Duke 2001b). The effects of the DSM programs are captured in the customer load forecast in the Duke Annual Plan (Duke 2001b). The water heater program allows a customer to be billed at a lower rate for all water heating energy consumption in exchange for allowing Duke to control the water heater. The air conditioning control program allows customers to receive billing credits during July through October in return for allowing Duke to interrupt electric service to their central air conditioners. The special needs energy product loan program provides loans to low-income customers for heat pumps, central air conditioning systems, and energy efficiency measures such as insulation, tune-ups of heating and air conditioning systems, and sealing of duct systems. The two residential programs are reflected in Duke's plan for meeting customer loads (Duke 2001b).

Duke also operates two programs for commercial and industrial customers to provide a source of interruptible capacity (Duke 2001b). Participants in the standby generator control program contractually agree to transfer electrical loads from Duke to their standby generators when requested by Duke. Participating customers receive payments for capacity and/or energy based on the amount of capacity and/or energy transferred to their generating units. Participants in the interruptible power service program agree to reduce their electrical loads to specified levels when requested by Duke. The two programs are not reflected in Duke's customer load forecast because load control contribution depends upon actuation (Duke 2001b).

The staff concludes that additional DSM, by itself, would not be sufficient to replace the 2258 MW(e) capacity of McGuire Units 1 and 2 and that it is not a reasonable replacement for renewing the OLs.

8.2.6 Combination of Alternatives

Even though individual alternatives to McGuire Units 1 and 2 might not be sufficient on their own to replace McGuire capacity due to the small size of the resource or lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost-effective.

As discussed in Section 8.2, McGuire Units 1 and 2 have a combined average net capacity of 2258 MW(e). For the natural gas combined-cycle alternative, Duke assumed five 482-MW units in its ER as potential replacements for the two McGuire units.

There are many possible combinations of alternatives. Table 8-8 contains a summary of the environmental impacts of an assumed combination of alternatives consisting of 1928 MW(e) of combined-cycle natural-gas-fired generation at the McGuire site using the existing once-through cooling system and at an alternate greenfield location using closed-cycle cooling, 165 MW(e) purchased from other generators, and 165 MW(e) gained from additional DSM measures. The impacts associated with the combined-cycle natural-gas-fired units are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. While the DSM measures would have few environmental impacts, operation of the new gas-fired plant would result in increased emissions and environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region, nation, or another country as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in Table 8-8. The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of McGuire OLs.

Table 8-8. Summary of Environmental Impacts for an Assumed Combination of Generating and Acquisition Alternatives

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	MODERATE to LARGE	24 ha (40 ac) for powerblock, roads, and parking areas. Possible additional impact for construction of an underground gas pipeline.	MODERATE to LARGE	58 ha (144 ac) for power-block, offices, roads, and parking areas. Additional impact for construction of an underground natural gas pipeline and a transmission line.
Ecology	MODERATE to LARGE	Uses undeveloped areas at McGuire site plus land for a new gas pipeline.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity; impacts to terrestrial ecology from cooling tower drift.

Table 8-8 (contd)

	McGuire Site			Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**		**Impact**	**Comment**
Water Use and Quality	SMALL	Uses existing once-through cooling system.		SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body. Discharge of cooling tower blowdown will have impacts.
Air Quality	MODERATE	Sulfur oxides • 25 MT/yr (28 tons/yr) Nitrogen oxides • 375 MT/yr (414 tons/yr) Carbon monoxide • 350 MT/yr (386 tons/yr) PM_{10} particulates • 208 MT/yr (230 tons/yr) Some hazardous air pollutants		MODERATE	Same as siting at McGuire.
Waste	SMALL	Small amount of ash produced.		SMALL	Small amount of ash produced.
Human Health	SMALL	Impacts considered to be minor.		SMALL	Impacts considered to be minor.
Socioeconomics	MODERATE	During construction, impacts would be MODERATE. Up to 1200 additional workers during the peak of the 3-year construction period, followed by reduction from current McGuire Units 1 & 2 workforce of 1345 to approximately 120; tax base preserved. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.		MODERATE	Construction impacts depend on location, but could be significant if location is in a rural area. Mecklenburg County and the town of Huntersville would experience loss of tax base and employment with potentially MODERATE impacts. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.

Table 8-8 (contd)

	McGuire Site		Alternate Greenfield Site	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Aesthetics	MODERATE	MODERATE aesthetic impact from plant and stacks.	MODERATE to LARGE	MODERATE impact from plant, stacks, and cooling towers and associated plumes. Additional impact that could be LARGE if a new transmission line is needed.
Historic and Archaeological Resources	SMALL	Any potential impacts can likely be effectively managed.	SMALL	Any potential impacts can likely be effectively managed.
Environmental Justice	SMALL to MODERATE	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of approximately 1225 operating jobs at McGuire could reduce employment prospects for minority and low-income populations.	SMALL to MODERATE	Impacts vary depending on population distribution and makeup at site. Mecklenburg County and the town of Huntersville would lose tax revenue which could have SMALL to MODERATE impacts on minority and low-income populations.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action, renewal of the McGuire OLs are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high-level waste (HLW) and spent fuel disposal, for which a single significance level was not assigned). The alternative actions, i.e., no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

The no-action alternative would require replacing electrical generating capacity by (1) demand-side management and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than McGuire Units 1 and 2, or (4) some combination of these options, and would result in decommissioning McGuire Units 1 and 2. For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of McGuire Units 1 and 2. The impacts of purchased electrical power would still occur, but would occur elsewhere. Alternative technologies are not

considered feasible at this time and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the OLs for McGuire Units 1 and 2.

The staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

8.4 References

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

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

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

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

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

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

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

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