# Applicant's Environmental Report
# Operating License Renewal Stage

# McGuire Nuclear Station

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# Introduction

Duke Energy Corporation (Duke) submits this Environmental Report (ER) as part of Duke's application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Units 1 and 2 of the McGuire Nuclear Station (McGuire). The Duke application is a combined application to renew the licenses for Catawba Nuclear Station, Units 1 and 2, and McGuire Nuclear Station, Units 1 and 2 for twenty years beyond the end of the current licenses. In compliance with applicable NRC requirements, this ER analyzes potential environmental impacts associated with renewal of the McGuire licenses. A separate ER is submitted as part of the application to analyze potential environmental impacts associated with the renewal of the Catawba licenses. This ER is designed to assist the NRC Staff in preparing the McGuire-specific Supplemental Environmental Impact Statement required for license renewal.

The McGuire ER complies with 10 CFR § 54.23, which requires license renewal applicants to submit a supplement to the Environmental Report which complies with requirements of Subpart A of 10 CFR Part 51. This Report also addresses the more detailed requirements of NRC environmental regulations in 10 CFR §§ 51.45 and 51.53, as well as the underlying intent of the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq*. For major federal actions, NEPA requires preparation of a detailed statement that addresses their significant environmental impacts, adverse environmental effects that cannot be avoided should the proposal be implemented, alternatives to the proposed action, and any irreversible and irretrievable commitments of resources associated with implementation of the proposed action.

The NRC Regulatory Guide *Supplement 1 to Regulatory Guide 4.2 - Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses* [Reference 1] was used as guidance on the format and content in the preparation of this ER. The level of information provided on the various topics and issues in this ER is commensurate with the extent of the analysis provided for the particular topic or issue.

Based upon the evaluations discussed in this ER, Duke has concluded that no significant environmental impacts are associated with the renewal of the McGuire operating licenses. No major plant refurbishment activities have been identified as being necessary to support the continued operation of McGuire beyond the end of the existing operating licenses. Although normal plant maintenance activities may later be performed for economic and operational reasons, no significant environmental impacts associated with such refurbishments are expected.

The Application to Renew the Operating Licenses of McGuire Nuclear Station, Units 1 and 2, and Catawba Nuclear Station, Units 1 and 2, assumes throughout that licensed activities are now conducted, and will continue to be conducted, in accordance with the facilities' current licensing bases (e.g., use of low enriched uranium fuel only). Any changes made to the current licensing basis of McGuire Nuclear Station, Units 1 and 2 or Catawba Nuclear Station, Units 1 and 2 during the staff review of this Application will be made in accordance with the Atomic Energy Act of 1954, as amended, and with Commission regulations.

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## Acronyms and Abbreviations

| | |
|---|---|
| CMUD | Charlotte-Mecklenburg Utility Department |
| CFR | Code of Federal Regulations |
| $CO_2$ | Carbon Dioxide |
| DPEM | Duke Power Environmental Manual |
| EPA | U.S. Environmental Protection Agency |
| EPRI | Electric Power Research Institute |
| FERC | Federal Energy Regulatory Commission |
| FES | Final Environmental Statement |
| FR | Federal Register |
| GEHS | Group Environment, Health and Safety, Duke Power |
| GEIS | Generic Environmental Impact Statement |
| GL | Generic Letter |
| HLW | High Level (Radioactive) Waste |
| IPE | Individual Plant Examination |
| IPEEE | Individual Plant Examination of External Events |
| IRP | Integrated Resource Plan |
| ISFSI | Independent Spent Fuel Storage Installation |
| LOCA | Loss of Cooling Accident |
| LWR | Light Water Reactor |
| MSA | Metropolitan Statistical Area |
| msl | mean sea level |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NESC | National Electric Safety Code |
| $NO_x$ | Nitrogen Oxides |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| NRR | (Office Of) Nuclear Reactor Regulation |
| NSAC | Nuclear Safety Analysis Center |
| NSD | Nuclear Station Directive |
| NUREG | U. S. Nuclear Regulatory Commission Document |
| O&M | Operation and Maintenance |

## Acronyms and Abbreviations (continued)

| | |
|---|---|
| $PM_{2.5}$ | Particulate Matter (particulate matter with a nominal size of less than 2.5 microns) |
| PIP | Problem Investigation Process |
| PRA | Probabilistic Risk Assessment |
| SAMA | Severe Accident Mitigation Alternative |
| SAMG | Severe Accident Management Guidelines |
| SCR | Selective Catalytic Reduction |
| NCDENR | North Carolina Department of Environment and Natural Resources |
| NCWRC | North Carolina Wildlife Resource Commission |
| SHPO | State Historic Preservation Office |
| SNF | Spent Nuclear Fuel |
| SRP | (NRC) Standard Review Plan |
| UFSAR | Updated Final Safety Analysis Report |
| USFWS | United States Fish and Wildlife Service |
| VOC | Volatile Organic Compounds |

## UNITS

| | |
|---|---|
| ft | Feet |
| gpm | Gallons per minute |
| gal/min | Gallons per minute |
| ha | Hectares |
| kg | Kilograms |
| km | Kilometers |
| kV | Kilovolts |
| MW | Megawatts |
| MW(e) | Megawatts, electric |
| MW(t) | Megawatts, thermal |
| m | Meters |
| mgd | Million Gallons per Day |
| $m^3$ | Cubic meters |
| ug/l | Micrograms/liter |
| mg/l | Milligrams/liter |
| m/s | Meters/second |
| NPDES | National Pollution Discharge Elimination System |
| ry | Reactor year |
| $^{o}C$ | Degrees Celsius |
| $^{o}F$ | Degrees Fahrenheit |
| $\mu$m | Micron ($1 \times 10^{-6}$ meter) |

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# 1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

For license renewal reviews, the NRC has adopted the following definition of purpose and need:

> "The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized Federal (other than NRC) decision makers.[1]"

McGuire Nuclear Station is located geographically near the center of a highly industrialized region of the Carolinas. McGuire Nuclear Station has a generation capacity of 2258 megawatts (net) base load power. McGuire supplies a large portion of the power generated on the Duke system at a low-cost. This low cost generation of electricity is a valuable service to the industrial, commercial, wholesale and residential customers of Duke Energy and contributes to the economic growth and prosperity in the Piedmont region of North and South Carolina.

The proposed action is to extend the operating licenses for McGuire Nuclear Station, Units 1 and 2 for a period of twenty (20) years past the current operating license expiration dates. For McGuire Unit 1 (Facility Operating License NPF-9), the requested renewal would extend the existing license expiration date from midnight June 12, 2021, until midnight June 12, 2041. For McGuire Unit 2 (Facility Operating License NPF-17), the requested renewal would extend the existing license expiration date from midnight March 3, 2023, until either midnight March 3, 2043 or midnight 40 years from the date of the issuance of the renewed operating license for Unit 2, whichever is earlier.

The environmental reviews performed in connection with this Application cover operation for a period of sixty years. As reflected in the requested revisions to the license expiration dates, Duke recognizes the legal limits associated with the term of renewed operating licenses. Nonetheless, Duke requests that the NRC staff complete its environmental reviews such that 60-years of operation are evaluated.

1 Section 1.3 of the NRC Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants, NUREG-1437 [Reference [1]].

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# 2.0 SITE AND ENVIRONMENTAL INTERFACES

The information in this chapter is provided to describe the overall character of the site and the local environment. The level of information provided is commensurate with the extent of the analyses provided in Chapter 4.0 Environmental Consequences of the Proposed Action.[2]

## 2.1 Site Location

The McGuire plant site is located in northwestern Mecklenburg County, North Carolina, 17 miles north-northwest of Charlotte, North Carolina. The site is approximately 5 miles west of Interstate I-77. Huntersville, North Carolina, the nearest town, is located approximately 6 miles to the east. The site is located at Latitude 35 degrees-25 minutes-59 seconds North and at Longitude 80 degrees-56 minutes-55 seconds West. The location of the site is shown on Figure 2-1.

McGuire is located approximately 30 miles north north east of the Catawba Nuclear Station. Catawba is located approximately 18 miles southwest of Charlotte, North Carolina, as shown on Figure 2-2.

## 2.2 Site Description

The McGuire site lies near the center of a region known as the Piedmont Geologic Province. The Piedmont is a northeast trending zone from Georgia through Virginia that varies in width from about 80 to 120 miles. Rolling hills and numerous small streams and rivers marks the region. The plant site area varies in elevation from 650 to 800 feet above mean sea level (msl). The McGuire plant has a 2500-foot radius Exclusion Zone.

The McGuire site is bounded to the west by the Catawba River and to the north by the 32,510 acre Lake Norman as shown on Figure 2-2. Lake Norman is impounded by Duke Power's Cowans Ford Dam hydroelectric station, which is located immediately west of the site and on the Catawba River channel. North Carolina highway NC 73 is located on the south side of the site. The plant structures and facilities that directly support the plant are located north of highway NC 73. The plant switchyards, the site landfill, and the site garage are located south of NC 73. The access railroad and the two access roads for the plant enter the site from the south along NC Highway NC 73. The plant, major buildings and other features associated with McGuire are shown on
Figure 2-3.

2 *Supplement 1 to Regulatory Guide 4.2 Preparation of Supplemental Environmental Reports For Applications to Renew Nuclear Power Plant Operating Licenses* [Reference 1].

## 2.3 General Site Environment

The general area around McGuire is shown on Figure 2-2. The region surrounding the McGuire plant is typical of the Piedmont region. Located near the major urban center of Charlotte, near major transportation routes (I-77 and I-85), and Lake Norman, the area around the McGuire plant is experiencing rapid change from a rural to a suburban environment.

State parks, national parks, and national forests located within 50 miles of McGuire are shown on Figure 2-4. Within 6 miles of McGuire are five parks owned by Mecklenburg County. Also located within 6 miles of McGuire are the Cowans Ford Wildlife Refuge and the Cowans Ford Waterfowl Refuge. The Mecklenburg County Park and Recreation Department manages the Cowans Ford Wildlife Refuge. The North Carolina Wildlife Resources Commission manages the Cowans Ford Waterfowl Refuge. These parks and refuges are shown on Figure 2-5.

The only Native American lands with 50 miles of McGuire are the three sections of the Catawba Indian Reservation, located in York County, South Carolina. These are shown on Figure 2-6.

## 2.4 Population

The population in the region near McGuire consists of both small towns and communities as well as larger cites and towns. The population densities for the 20 mile and 50 mile radii from McGuire are listed in the table below.

**Table 2-1 Population Densities**

| Radial Distance From McGuire | 2000 Census Population | Population Density (Population/square mile) |
|---|---|---|
| 20 miles | 781,783 | 622 |
| 50 miles | 2,309,976 | 294 |

These values show that the area near McGuire would be classified as a high population area, based on the criteria in Appendix C of the GEIS. The largest nearby population centers are Charlotte, Gastonia, Kannapolis, Hickory, Statesville, and Concord. The population of these and other civil divisions is presented in Table 2-2.

**Table 2-2 Populations of Major Civil Divisions Near McGuire Nuclear Station**

| | 2000 Population | |
|---|---|---|
| **Cabarrus County** | 131,063 | |
| Concord | 55,977 | |
| Kannapolis | 36,910 | Note 1 |
| **Catawba County** | 141,685 | |
| Conover | 6,604 | |
| Hickory | 37,222 | Note 1 |
| Newton | 12,560 | |
| **Gaston County** | 190,365 | |
| Belmont | 8,705 | |
| Bessemer | 5,119 | |
| Cherryville | 5,361 | |
| Gastonia | 66,277 | |
| High Shoals | 729 | Note 1 |
| Kings Mountain | 9,693 | Note 1 |
| Lowell | 2,662 | |
| Mount Holly | 9,618 | |
| Stanley | 3,053 | |
| **Iredell County** | 122,660 | |
| Mooresville | 18,823 | |
| Statesville | 23,320 | |
| **Lincoln County** | 63,780 | |
| Lincolnton | 9,965 | |
| **Mecklenburg County** | 695,454 | |
| Charlotte | 540,828 | |
| Cornelius | 11,969 | |
| Davidson | 7,139 | |
| Huntersville | 24,960 | |
| Matthews | 22,127 | |
| Mint Hill | 14,922 | |
| Pineville | 3,449 | |
| **Rowan County** | 130,340 | |
| Salisbury | 26,462 | |

Note 1: City or town lies in more than one county. Population for entire city or town presented.

Source: North Carolina State Data Center, Public Law 94-171 Redistricting Data for North Carolina, 2000 Census, Table 2. Population for Counties and Places, 1990 and 2000.

## 2.5 Aquatic Environment

The following sections describe the aquatic environment adjacent to the McGuire plant.

### 2.5.1 Lake Norman – General Description

Lake Norman is North Carolina's largest man-made lake and extends 34 miles in length between Lookout Shoals Lake and Mountain Island Lake. Lake Norman was formed from the impoundment of the Catawba River and achieved full pond in 1964. [Reference 2].

Duke Power's Marshall Steam Station is located on the western shore of Lake Norman, approximately 16 miles upstream from McGuire. Lake Norman serves as the cooling water source for McGuire Nuclear Station.

Lookout Shoals Lake, Mountain Island Lake, and Lake Norman are part of the Catawba-Wateree Project, and are owned and operated by Duke Power, a division of Duke Energy and licensed by the Federal Energy Regulatory Commission (FERC) as FERC Project 2232. The Catawba-Wateree Project consists of 11 lakes on the Catawba River, which are operated for hydroelectric power. Lake Norman is the largest in the Catawba chain of lakes. The major tributaries for Lake Norman are the Catawba River, Lyle Creek, and Buffalo Shoals Creek [Reference 3].

**Table 2-3 Lake Norman Summary Information**

| | |
|---|---|
| Full Pond Elevation | 760 feet (mean sea level) |
| Maximum Drawdown (FERC) | 25 feet |
| Maximum Drawdown (NRC) | 15 feet |
| Full Pond Surface Area | 32,500 acres |
| Full Pond Volume | $1.09 \times 10^6$ acre-feet |
| Shoreline Length | 520 miles |
| Mean Depth | 33 feet |
| Maximum Depth | 120 feet |
| Drainage Area | 1800 square miles |
| Annual Mean Flow (at Cowans Ford Dam) | 2670 cubic feet-second |

In addition to serving the needs of the McGuire, Marshall, and Cowans Ford power plants, Lake Norman is a source of municipal drinking water for several cites in the region. The North Carolina Department of Environment and Natural Resources (NCDENR) and the FERC are responsible for permitting withdrawals from Lake Norman for drinking water.

Lake Norman experiences extensive recreational use by fishermen, boaters, skiers and swimmers.

### 2.5.2 Lake Norman – Water Quality and Aquatic Resources

Lake Norman supports highly variable and diverse communities of phytoplankton and zooplankton. Duke conducts annual monitoring of selected water quality parameters and biota as part of the NPDES permit requirements for McGuire. This monitoring includes data on operations at McGuire and data on water chemistry, phytoplankton, zooplankton, and fisheries in Lake Norman.

Duke has a long history of working cooperatively with a variety of different partners or stakeholders. Duke fishery biologists meet annually with the biologists from the NC Wildlife Resources Agency to discuss the fishery programs on Lake Norman, like the ones described later in this section, and other reservoirs on the Catawba River. These annual meetings, as well as ongoing dialogue, are extremely effective in the exchange of information and data, as well as the sharing of resources for monitoring the fish populations in Lake Norman.

Basinwide water quality planning is a non-regulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. The NCDENR Division of Water Quality prepares Basinwide water quality plans for each of the seventeen major river basins in the state. Each basinwide plan is revised at five-year intervals. These plans are prepared by the Division of Water Quality and their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the Catawba River basin was completed in 1995. The Catawba River Basinwide Water Quality Plan, December 1999 [Reference 3] found Lake Norman to be fully supportive of all uses.

Unless otherwise referenced, the information in the following sections is from the most recent available monitoring data [Reference 4].

### 2.5.3 Lake Norman - Water Chemistry

Lake Norman exhibits thermal and oxygen dynamics similar to other Southeastern reservoirs of comparable size, depth, flow conditions, and trophic status. Based on annual mean chlorophyll concentrations, Lake Norman is classified as oligo-mesothrophic.

### 2.5.4 Lake Norman - Aquatic Resources

Phytoplankton Community

Lake Norman continues to support highly variable (spatial and seasonal) and diverse phytoplankton communities. In 1999, chlorophyll *a* concentrations at all sample locations were generally within ranges reported during previous years. Lake Norman continues to be classified (Myxophycean index) as oligo-mesotrophic based on long term, annual mean chlorophyll concentrations. Lake-wide mean chlorophyll *a* concentrations in February and May 1999 were the lowest observed for these months since the monitoring program was initiated in 1987. These depressed phytoplankton densities were most likely associated with the record low rainfall during these months, and thus reduced nutrient input. As in past years, the 1999 maximum chlorophyll *a* concentrations were most often observed uplake (above the highway NC 150 bridge), while comparatively low concentrations were recorded downlake (below the highway NC 150 bridge). The maximum 1999 chlorophyll volume of 14.42 ug/l was well below the NC State Water Quality Standard of 40 ug/l.

Ten classes comprising 76 genera and 135 species, varieties, and forms of phytoplankton were identified in samples collected in 1999. Cryptophytes were dominant at most sampling locations in February and March 1999, while diatoms were dominant in November. Although its noteworthiness, if any, will not be known until subsequent years' monitoring is completed, a shift in community composition was observed in August 1999 when diatoms, not the normal green algae, dominated the phytoplankton community. Although speculative, the lack of rainfall and subsequent runoff is thought to contribute to this shift in the phytoplankton community on a lake-wide basis. The 1999 phytoplankton total was the fifth highest number of individual taxa recorded since monitoring began. In 1999, five previously unrecorded taxa were identified.

Zooplankton Community

The zooplankton community, like the phytoplankton community, is highly diverse with seasonal and spatial variability. Although epilimnetic zooplankton densities during May and August of 1999 followed ranges from previous years, in February 1999, a downlake station (below the highway NC 150 bridge) zooplankton density was the lowest recorded during the monitoring program history for this station during the month. Additional variability is evidenced by the fact that the November 1999 densities at a midlake and an uplake location were the highest ever observed during the monitoring program at these locations and during this month.

One hundred and eight zooplankton taxa have been recorded from Lake Norman since monitoring began in 1987. Copepods, primarily immature forms, dominated zooplankton standing crops through most of 1999. Cladocerans comprised the majority of zooplankton densities in August while rotifers were most numerous in February. Since

monitoring began in 1987, copepods and rotifers generally peak in May, while cladocerans demonstrate much more year-to-year variability. Four previously unreported taxa of zooplankton were identified in 1999.

Benthic macroinvertebrates

Benthic macroinvertebrates, with the exception of *Corbicula*, are not currently sampled on Lake Norman. The information that does exist was collected between 1977-1984 in association with the McGuire 316(a) demonstration [Reference 5]. These data showed that benthos at sublittoral locations was dominated by chironomids, chaoborids, *Corbicula, Hexagenia,* and oligochaetes. At the profundal mixing-zone and control sampling locations, oligochaetes, chironomids, and chaoborids were dominant.

Ongoing benthic macroinvertebrate studies on Lake Norman are limited to the *Corbicula* monitoring program (since 1989) in front of the intake structures at McGuire Nuclear Station. The population numbers in this location vary considerably from year to year, with March densities tending to be higher than July and November samples. The mean seasonal total densities are generally in the range of 1000-3500 clams/$m^2$. The *Corbicula* population is apparently dominated by juvenile clams, clams not yet capable of reproduction, as adults usually comprise 10% or less of the samples.

Fisheries Community

The Lake Norman littoral fish community, measured as mean total biomass, generally ranges from 30-40 kg/1000 meters of shoreline electrofished with a historical trend of decreasing biomass from uplake to downlake. Sunfish (*Lepomis spp*.) and carp (*Cyprinus carpio*) comprise the majority of the biomass at all shoreline locations. Generally, the biomass of Lake Norman's littoral fish community is somewhat lower than other Catawba River reservoirs and probably, at least in part, related to low phosphorus levels and low benthic populations.

The monitoring of the Lake Norman pelagic fish community involves the assessment of forage fish population parameters, in accordance with the NPDES permit for McGuire Nuclear Station. Using mobile side-scan and down-looking hydroacoustic surveys of Lake Norman in November 1998 and September 1999, forage fish densities in the six zones ranged from 925-9,815 fish/ha in 1998 and 3,547-11,368 fish/ha in 1999. The estimated lake-wide forage fish population was estimated at 92,216,000 in 1998 and 75,062,000 in 1999. These values are higher than the 65,451,9000 estimate in 1997, but lower than the estimates from 1993 to 1996. Forage fish populations on Lake Norman, as well as most reservoirs, are highly variable with fluctuations influenced by, but not limited to, such environmental parameters as nutrient input, phytoplankton/zooplankton densities, food source competition, winter water temperatures, and the predator base. Other pelagic fish like striped bass are not monitored.

Although hydroacoustics were used to estimate forage fish numbers, purse seining must be employed to determine the species composition. Purse seine samples collected in 1998 were dominated by threadfin shad (*Dorosoma petenense)* which composed 99.95% of the catch with gizzard shad (*Dorosoma cepedianum)* comprising the remaining 0.05%. The September 1999 sample percentages were 99.2% threadfin shad, 0.3% gizzard shad, and 0.5% alewife (*Alosa aestivalis*). Data from the September 2000 samples show the forage fish composition to be 85.6% threadfin shad, 0.22 % gizzard shad, and 14.2 % alewife. The alewife is apparently one of several new fish species becoming established in Lake Norman.

A Lake Norman creel survey conducted from March 1994 through February 1995 by Duke yielded an estimated catch of 751,823 fish that weighed a total of 90,867 kg (200,361 lb.). Crappie (black crappie-*Pomoxis nigromaculatus* and white crappie-*Pomoxis annularis*) accounted for 72% of the harvest by number and 49% by weight. Largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), and sunfish (*Lepomis spp*.) were next in numbers harvested, approximately 7% each. Following crappie, the most abundant fish caught by weight, were largemouth bass-13 %, striped bass (*Morone saxatilis*)- 13%, and blue catfish (*Ictalurus furcatus*)- 12%.
The fish health assessment index (FHAI) is an autopsy-based field procedure involving observation and gross evaluation of various organs, structures, and blood. Duke uses this procedure to assist in the evaluation of wild populations of largemouth bass. Higher FHAI scores indicate relatively poorer health. Lake Norman-wide scores averaged 22, 20, 20, and 25 in 1993, 1996, 1998, and 2000 respectively. These numbers are representative, of or better, than the other Catawba River reservoirs**.**

In the past several years, four species of fish, some of which were apparently introduced by fishermen, were found in fishery sampling as well as in the angler's creel survey. Some, if not all of these species, could have a potential impact on the Lake Norman fish community. These introduced species are:

1. Blue catfish, stocked in 1966 by the NC Wildlife Resources Commission, have within the past 8-10 years become much more abundant and have reached the size where a significant sport and commercial fishery has developed. No data on the blue catfish population size and food habits is available, but there is anecdotal evidence that they may be having a predatory impact on apparently declining fish species like such as the snail bullhead (*Ictalurus brunneus*), white catfish (*Ictalurus catus*), and flat bullhead (*Ictalurus platycephalus*).
2. White perch (*Morone americana*), first documented in 1998, have now increased in numbers where they are routinely caught by anglers. No evidence exists as to the size of the population or the age-structure. These fish utilize zooplankton as

juveniles before becoming piscivorous as adults where they presumably are dependent on the lake's shad (*Dorosoma spp*.) community.

3. The alewife is the most recent known addition to the Lake Norman forage fish community, having first been collected in 1999 purse seining. These fish are documented in the scientific literature to compete with other fish species for zooplankton, but their impact on the lake's overall fish community is not known.

4. Spotted bass (*Micropterus punctulatus*) were first collected by electrofishing in 2000 from the extreme lower end of the lake near the Cowans Ford Dam. Fishermen have and continue to periodically report catches of spotted bass, but the status of the population is unknown.

## 2.6 Terrestrial Environment

Forests cover the majority of the land area in the region near McGuire, with pasture, cropland, and residential development each contributing significant proportions of total land-use. The shoreline of Lake Norman is developed with both vacation and permanent residences, along with campgrounds, boat launch areas, marinas, golf courses, and small retail establishments. No permanent residences are located within the McGuire 2500 foot radius Exclusion Zone. The Exclusion Area and site land cover is shown on Figure 2-7.

The site harbors typical Piedmont plant communities such as pine, pine-mixed hardwoods, mixed hardwoods, bottomland mixed hardwoods, and wetlands. Cecil sandy loam is the predominant soil of the site with some Monacan clay loam found along the Catawba River. The rarer and more basic Mecklenburg and Iredell soils, which often support prairie plant species are absent from the project area.

The McGuire Exclusion Zone contains approximately 450 acres (182.4 ha) of surface area. Of this total area, there is approximately 291 acres of land. The remainder of the Exclusion Area includes portions of Lake Norman and the McGuire Discharge Canal.

Within the Exclusion Zone there is approximately 145 acres of non-forested land. This non-forested land consists largely of generation and maintenance facilities, parking lots, roads, storage yards, and mowed grass. Included in this area is the 32.9 acre (13.3 ha) Standby Nuclear Service Water Pond and a 10.2 acre (4.1 ha) Wastewater Collection Basin.

Young and mid-aged mixed hardwood-pine and pine-mixed hardwood communities dominate the majority of the 102 acres (41.0 ha) of the Exclusion Zone not occupied by plant structures or facilities.

The approximately 102 forested acres (41.3 ha) of the Exclusion Zone as well as the sections of the transmission line rights-of-way outside the Exclusion Zone, does not provide significant terrestrial habitat because of the small acreage involved. However, the approximately 700 acre (283.3 ha) McGuire site has acres of food plots to benefit wildlife, including strip plots in rights-of-way, that attract deer (*Odocoileus virginianus*) and other wildlife, including songbirds, a variety of mice and voles, raptors, gray fox (*Urocyon cinereoargenteus*), raccoon (*procyon lotor*), opossum (*Didelphis virginiana*), etc. Food plots include sorghum, sunflowers, rye, clover, and wheat. A selective mowing program is also practiced to further enhance wildlife values.

Below is a brief accounting of several species of charismatic fauna on/near the McGuire site:

1. White tail deer frequent the site and their numbers have increased exponentially since McGuire has been operating. There are many reasons for this increase in population size, not only near McGuire but across the Carolinas, but fragmentation of large tracts of forest and more desirable grazing lands and associated crops are certainly contributors.

2. Wild turkeys (*Meleagris gallapavo*) were released on the McGuire site in 1996 and these birds, from an initial stocking of ~15 birds, are commonly observed frequenting the food plots, rights-of-way, and the bottomland hardwood areas around McGuire. Young turkeys are also being observed which suggests that the flock is increasing in population.

3. Canada geese (*Branta canadensis*) numbers around McGuire as well as NC and SC in general, are expanding. Year round access to a constant supply of food in agricultural settings, yards, golf courses, etc. explains why many of the birds in this area are non-migratory. The McGuire site borders the Cowans Ford Waterfowl Refuge on Mountain Island Lake and the geese, and to a lesser extent other waterfowl and birds, travel from the McGuire site to the refuge and vice versa.

4. Although not within the McGuire exclusion area or associated with any of the McGuire transmission line rights-of way or adjacent property, a great blue heron (*Ardeaherodias*) rookery exists on a Davidson Creek island in Lake Norman approximately 3 miles ( 7.8 km) north of McGuire. This heronry contains approximately 30 nests each year and is protected under the NC Wildlife Resources Commission- Colonial Waterbird Nesting Area program. Entry onto the island is prohibited from April 1-August 31 each year.

5. Muskrats (*Ondatra zibethicus)*, osprey (*Pandion haliaetus*), various salamanders, and various aquatic snakes and turtles have commonly been observed in marshy lowland areas and near open water.

Bald eagles (*Haliaeetus leucocephalus*), state and federally classified as threatened, are occasionally observed along Lake Norman, but sightings are rare and there are no known nesting sites in the vicinity of McGuire. With the exception of the bald eagle, there are no federally or state-listed species known within the McGuire site exclusion area or along associated transmission lines. Additionally, no areas designated by the U.S. Fish and Wildlife Service as critical habitat for threatened/endangered species exist at McGuire or in adjacent site properties.

The 668-acre (270 ha) Cowans Ford Wildlife Refuge (owned and operated by Mecklenburg County Parks and Recreation Department) and the Cowans Ford Waterfowl Refuge (managed by NC Wildlife Resources Commission) are located south of McGuire along the shores of Mountain Island Lake. These areas, as well as adjacent lands, are lined with bottomland hardwood forests and other habitats that support nearly 200 species of birds, 54 which are neotropical migrants. Because of this rich avian diversity, the lands from Cowans Ford to Mt. Island Lake have been officially designated as Important Bird Areas (IBA) by the National Audubon Society. Additionally, wildlife such as wild turkey (*Meleagris gallopavo*), numerous raptor species, white-tail deer (*Odocoileus virginianus*), and red fox (*Vulpes vulpes*), to name a few, use these IBA properties and the properties around McGuire to move freely along the Catawba River corridor.

Duke has an effective working relationship with the NC Natural Heritage staff and with personnel of the US Fish and Wildlife Service. Duke and these agencies communicate about pertinent heritage data (state as well as federally listed species), new findings, and special habitats. The database of the NC Natural Heritage Program is used in the Duke electric transmission process of establishing/reviewing rights-of-way vegetation management programs.

## 2.7 Historic and Archeological Resources

### 2.7.1 Cultural Background

The area around McGuire has been inhabited since prehistoric times. Aboriginal groups including the Catawba Indians were in the area until settlement by Europeans displaced the groups. The Catawba Indian reservation is currently located near Rock Hill, South Carolina. Archaeological study of the area has been limited; however, several archaeological sites have been located within a 3.1 mi (5.0-km) radius of the McGuire facility. The sites are described in the state's files as consisting primarily of lithic scatter.

Settlement of Mecklenburg County by Europeans began in the 1740s. The county was formed from a portion of Anson County in 1763 and named after Charlotte, Princess of Mecklenburg and wife of King George III. Portions of the county eventually became Union, Lincoln, Rutherford, Cleveland and Gaston counties. The current county boundaries were established in 1842.

The area around McGuire included several large plantations during the pre-Revolutionary and Revolutionary War period. These plantations produced a wide variety of products that were shipped to Charleston, South Carolina and Pennsylvania. Due to its proximity to rapidly growing Charlotte, the area is becoming increasingly developed in residential housing.

### 2.7.2 Historic and Archaeological Resources at the McGuire Site

**Archaeological:** No known archaeological sites are located at McGuire. No records exist that indicate the site has been surveyed. Little, if any, of the site has not been disturbed during the course of construction of the facility and its operation. There are several archaeological sites located within 3.1 mi (5.0 km) of the site. These sites are described as consisting of lithic scatter and have not been recommended as eligible for the National Register of Historic Properties (NRHP) as of February 4, 2000.

**Historical:** No known historic sites are located at McGuire. No records exist that indicate the site has been surveyed. There are no structures existing on the site that are 50 years old or older. The only area of known historical interest at the facility is the General Davidson Memorial.

**General Davidson Memorial:** During construction of McGuire, a forgotten historic marker commemorating the death of Brigadier General William Lee Davidson at Cowans Ford was discovered. Cowans Ford and the location of Davidson's death are presently inundated. Davidson, a distant relative of John Davidson of Rural Hill plantation, was killed as the volunteer militia he led attempted to slow British General Cornwallis' crossing of the Catawba River. General Davidson's body was interred at night in the

Hopewell Church graveyard, located about 5 mi (8 km) away. Duke incorporated this marker, as well as a new marker provided by the North Carolina Department of Archives and History, into a public area adjacent to McGuire. The markers were dedicated in 1971 and are still maintained by Duke. Figure 2-8 shows the location of this monument.

### 2.7.3 Historic and Archaeological Resources Near the McGuire Site

While there are no NRHP eligible sites located at McGuire, there are several NRHP eligible sites located within a 3.1-mi (5.0-km) radius of the facility. Site numbers and descriptions are from the North Carolina Department of Archives and History site files.

- **Rural Hill Plantation** (Site Number MK1479): Rural Hill Plantation is located approximately 2.8 mi (4.6 km) from McGuire. Major John Davidson (1735-1832) constructed the Rural Hill Plantation house in 1788. At that time, Davidson's estate consisted of approximately 5,000 acres of land. The Georgian-style home he constructed was destroyed by fire in 1886. The site now contains the original detached kitchen (now modified into a modern residence), foundation stones and piers for porch columns from the main house, a smokehouse, ash house, well house, crib, grainery, two schoolhouses and a family cemetery. The Charlotte-Mecklenburg Historic Properties Commission designated Rural Hill Plantation as eligible for the NRHP in 1987.

- **Holly Bend** (Site Number MK9): Holly Bend is located approximately 3.0 mi (4.9 km) from McGuire. Robert Davidson, son of Major John Davidson, built Holly Bend between 1795 and 1800 on 420 acres (170 hectares) of land provided by his father. The two-story structure was found to be significant due to the quality of interior trim in the home. Holly Bend was listed in the NRHP in 1972.

- **Ingleside** (Site Number MK1471): Ingleside is located approximately 2.3 mi (3.7 km) from McGuire. Dr. William Speight McLean Davidson (1818–1873), the first professionally trained physician in the area and the grandson of Major John Davidson, built the home in the 1850s. The home was built in the Italianate Style and has been described as the finest example of its kind in Mecklenburg County. The Charlotte-Mecklenburg Historic Properties Commission designated Ingleside as eligible for the NRHP in 1976.

In addition to the three sites above, eleven other historic structures are identified in the state's files within a 3.1-mi (5.0-km) radius of McGuire. None of these sites have been identified as eligible for the NRHP as of February 2000.

**Figure 2-1 Location of McGuire**

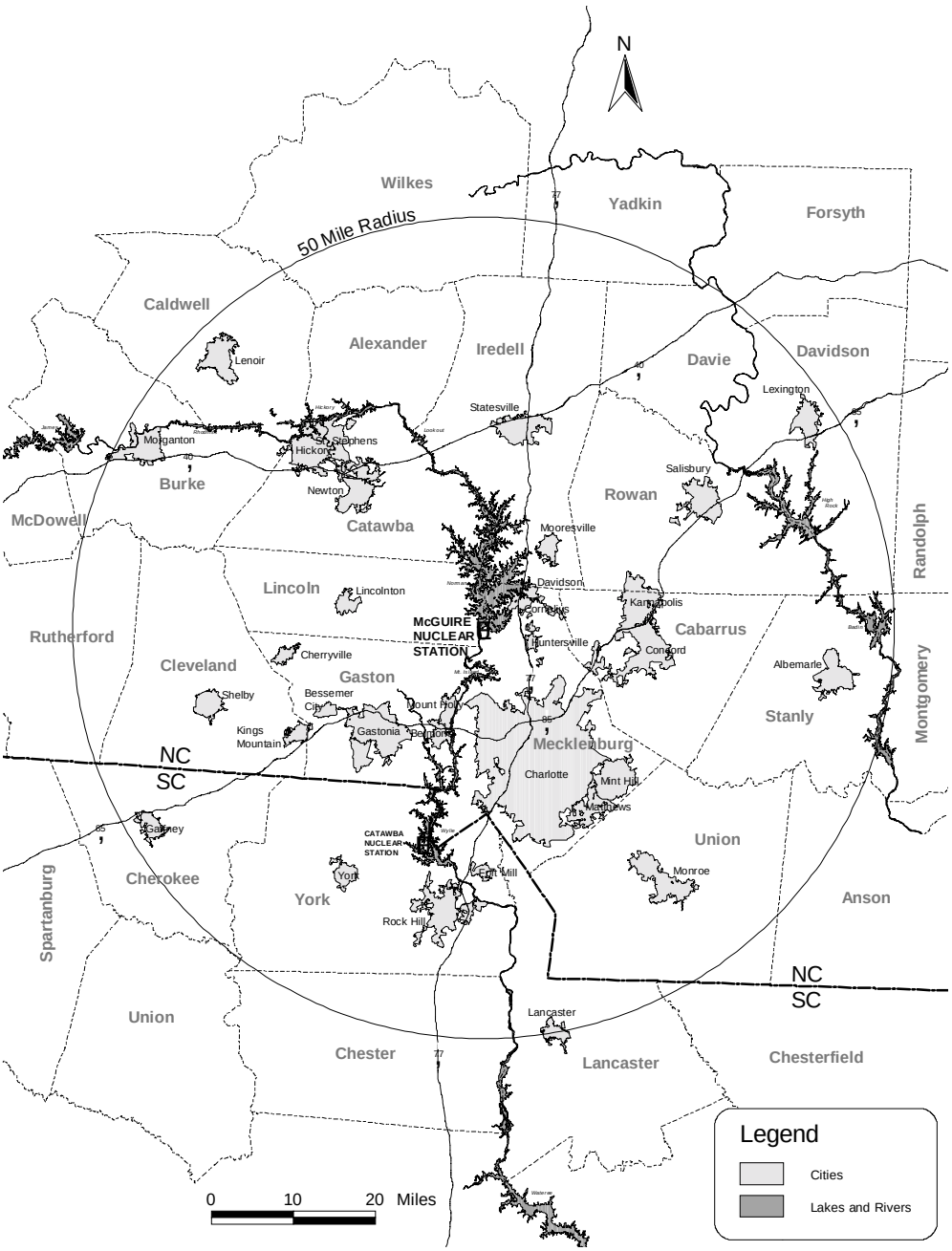


**Figure 2-2 General Area near McGuire**

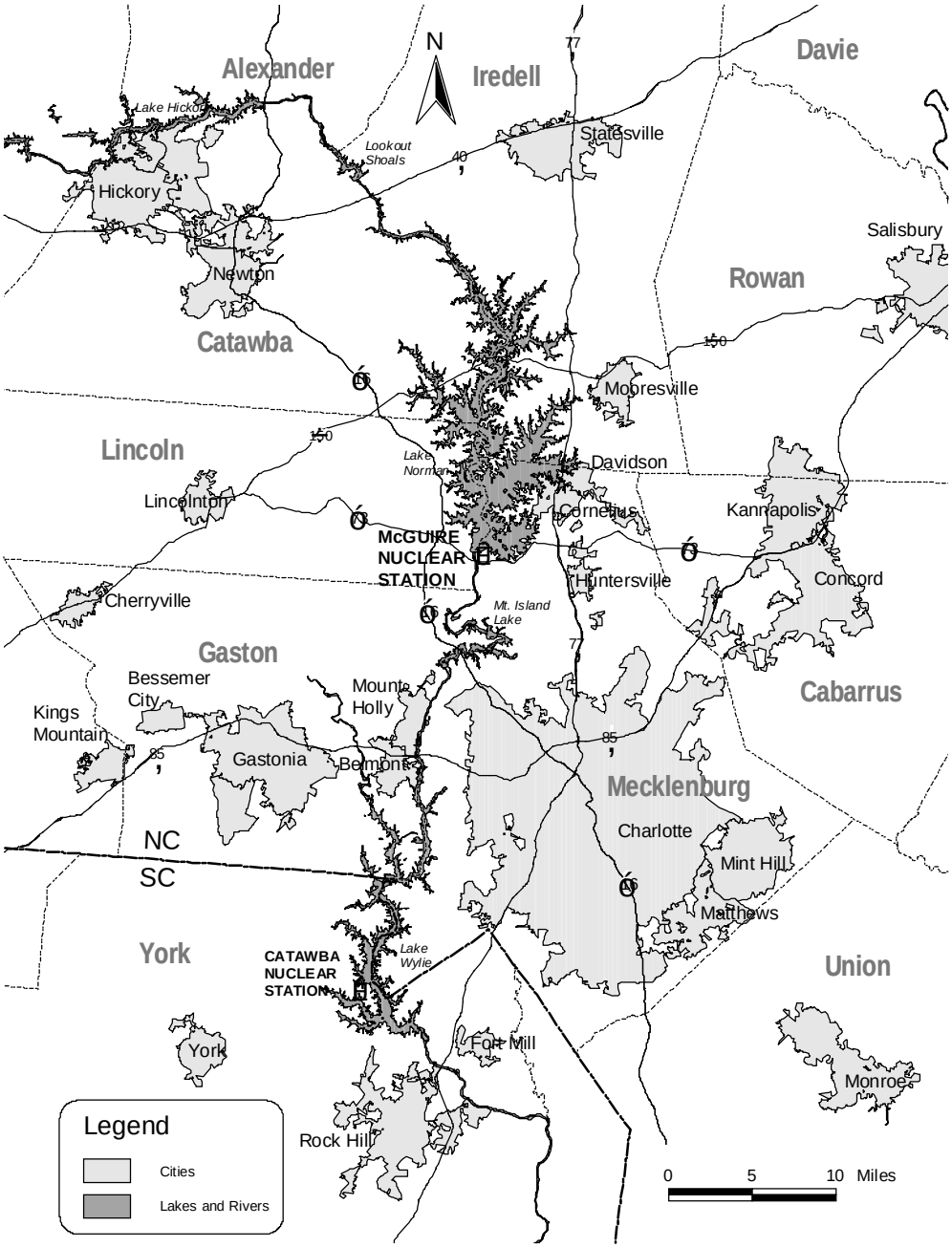


**Figure 2-3 McGuire Exclusion Zone and Features**

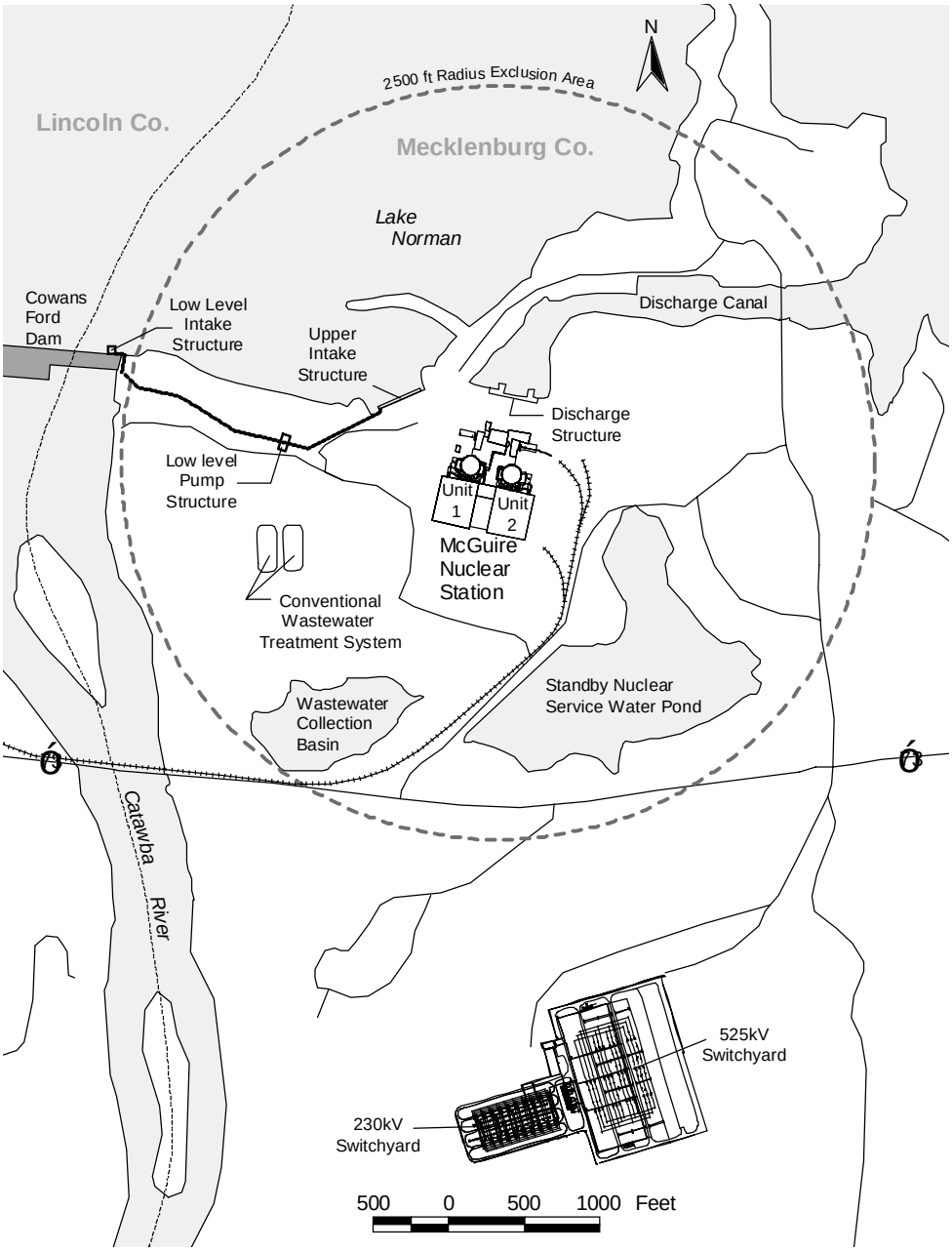


**Figure 2-4 50 Mile Radius – State and Federal Lands**

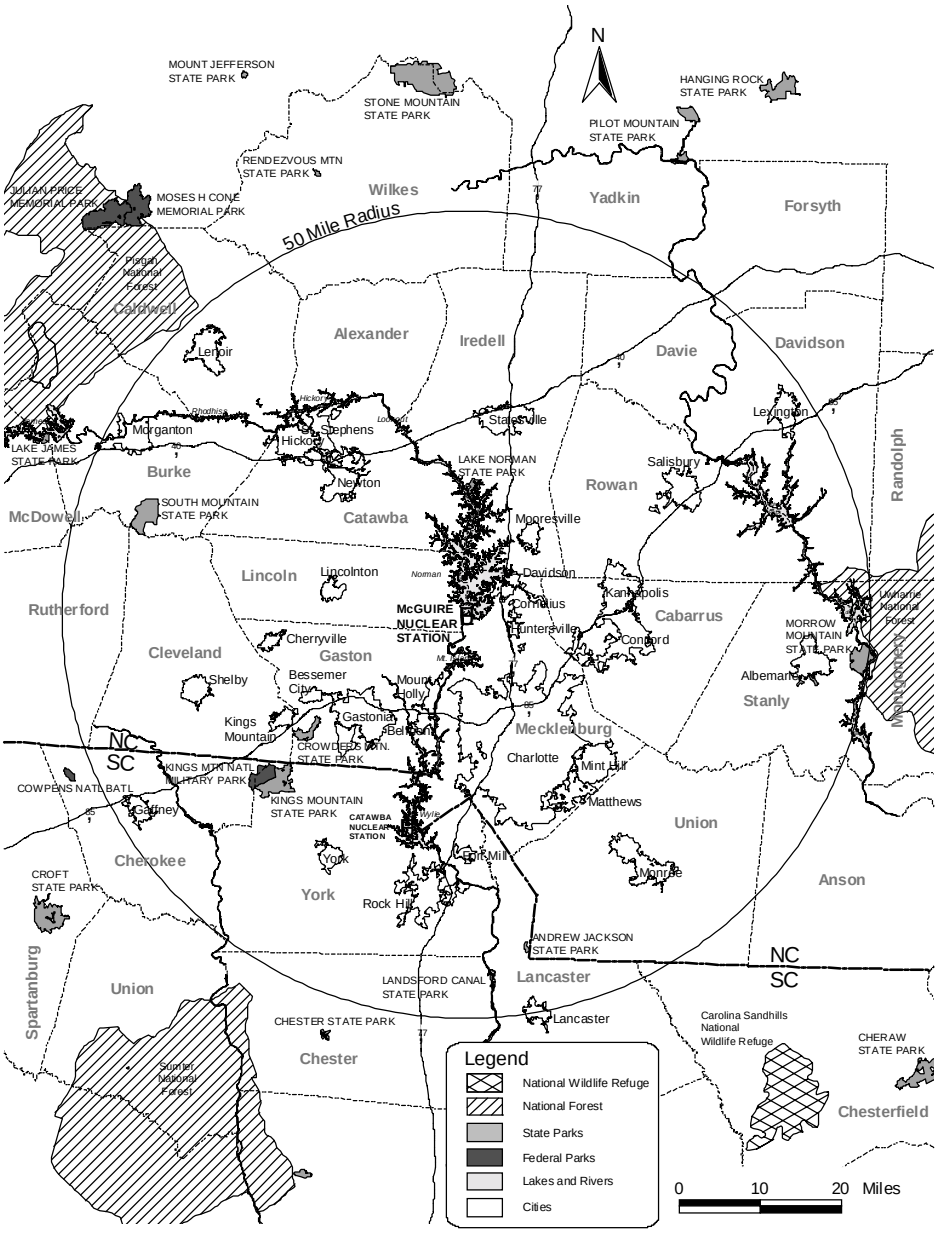
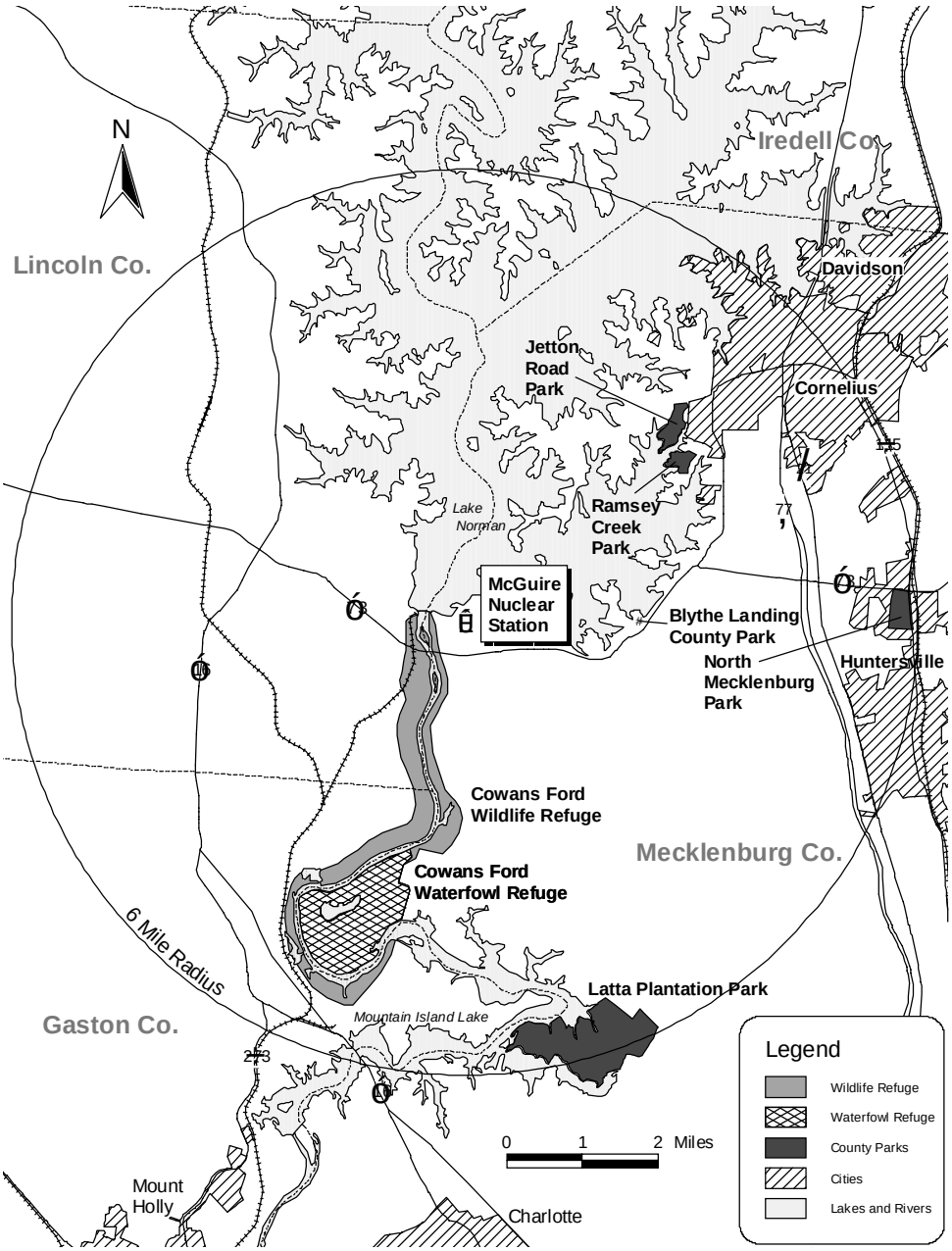
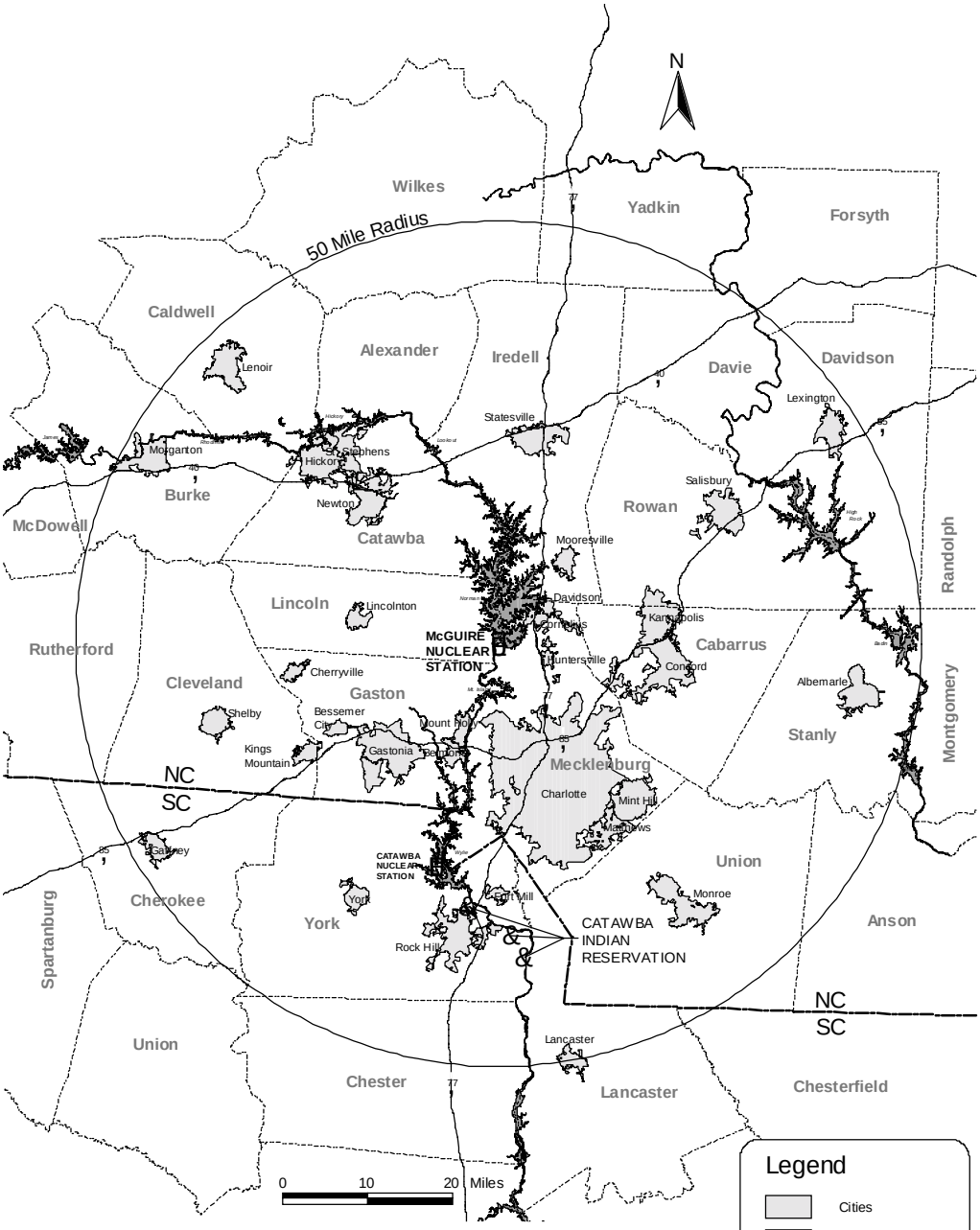


**Figure 2-5 Parks and Wildlife Refuges – 6 Mile Radius**



## Figure 2-6 50 Mile Radius - Native American Lands




The Catawba Indian Reservation is the only Native American Land within 50 miles of McGuire Nuclear Station.

**Figure 2-7 McGuire Site Land Cover**

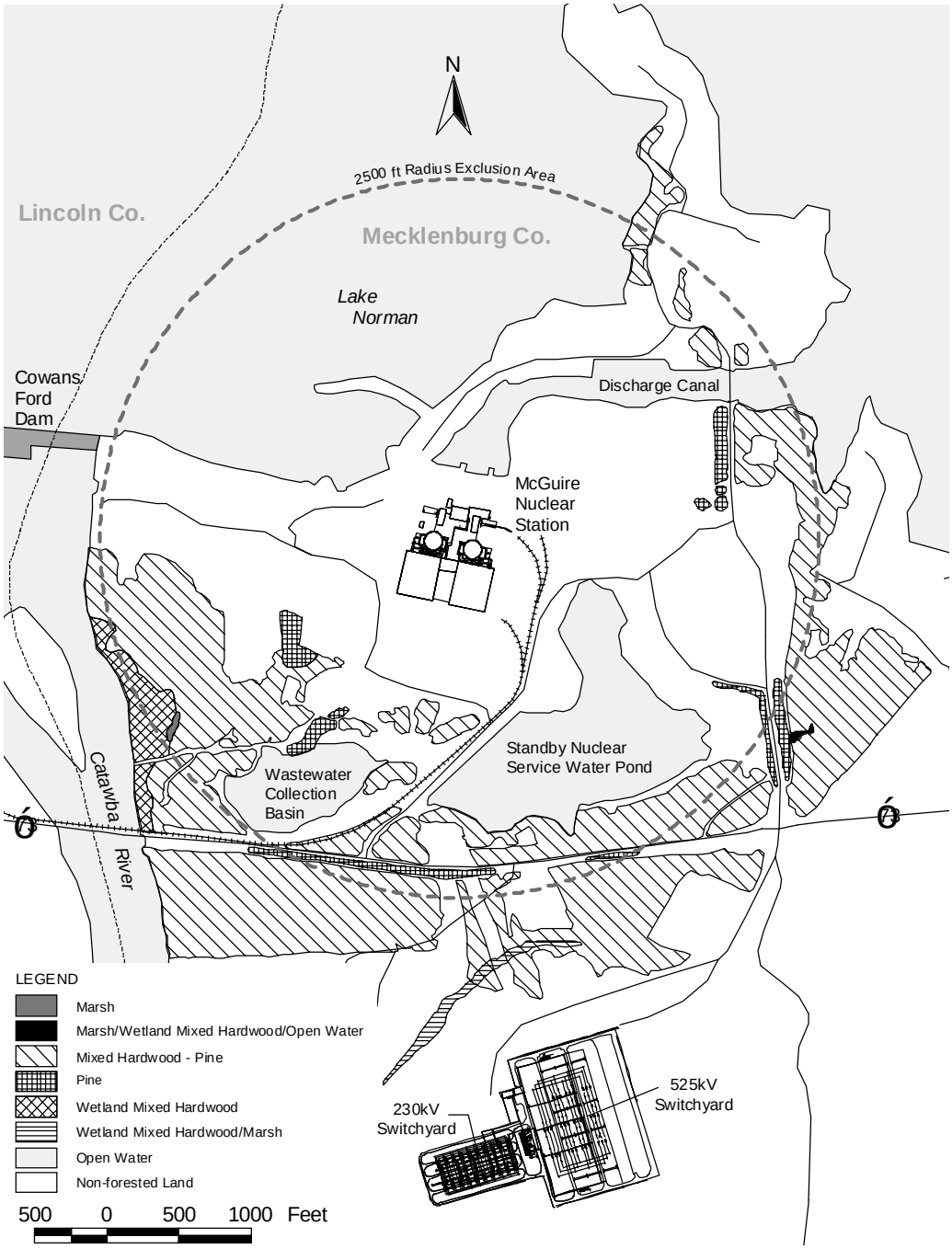
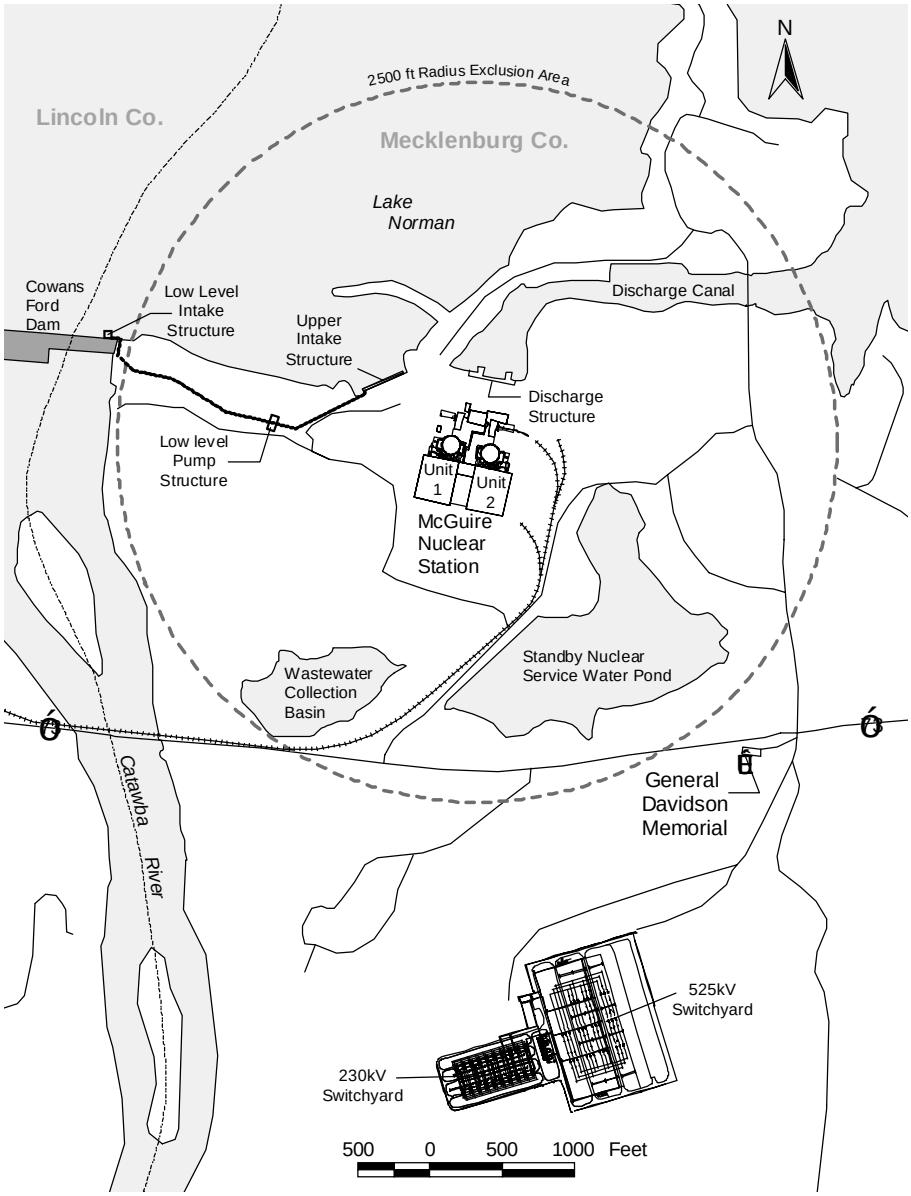


**Figure 2-8 General Davidson Monument Location**



# 3.0 THE PROPOSED ACTION

**Description of the Proposed Action**

The proposed action is to renew the existing facility operating license for each unit of McGuire Nuclear Station for an additional twenty (20) years beyond the expiration of the current operating licenses.

For McGuire Unit 1 (Facility Operating License NPF-9), the requested renewal would extend the existing license expiration date from midnight June 12, 2021, until midnight June 12, 2041. For McGuire Unit 2 (Facility Operating License NPF-17), the requested renewal would extend the existing license expiration date from midnight March 3, 2023, until either midnight March 3, 2043 or midnight 40 years from the date of the issuance of the renewed operating license for Unit 2, whichever is earlier.

There are no changes related to license renewal with respect to operation of the McGuire units that would significantly affect the environment, including station effluents that affect the environment, during the period of license renewal. The Application to Renew the Operating Licenses of McGuire Nuclear Station, Units 1 and 2, and Catawba Nuclear Station, Units 1 and 2, assumes throughout that licensed activities are now conducted, and will continue to be conducted, in accordance with the facilities' current licensing bases (e.g., use of low enriched uranium fuel only). Any changes made to the current licensing basis of McGuire Nuclear Station, Units 1 and 2 or Catawba Nuclear Station, Units 1 and 2 during the staff review of this Application will be made in accordance with the Atomic Energy Act of 1954, as amended, and with Commission regulations.

## 3.1 General Plant Description

The McGuire plant has two units. Each unit has a separate Reactor Building, Turbine Building, and switchyard. The following buildings and features are common to both units: Service Building, Auxiliary Building, Intake Structures (Upper Level and Lower Level), Discharge Structure and Discharge Canal, Standby Nuclear Service Water Pond, and Independent Spent Fuel Storage Installation (ISFSI). In addition to these buildings and features, there are additional office buildings and other facilities at the site used for support staff at McGuire and for other Duke functions. The plant features are shown on Figure 3-1.

Each generating unit is designed to operate at core power levels up to 3411 MW(t), which corresponds to a net electrical output of approximately 1129 MW(e). All core physics and core thermal-hydraulic information are based on the reference core design of 3411 MW(t).

Unit 1 began commercial operation in December 1981. Unit 2 began commercial operation in March 1984.

### 3.1.1 Reactor and Containment Systems

Both units of the McGuire Nuclear Station utilize a pressurized water reactor as the nuclear steam supply system, and a four-loop reactor coolant system. Westinghouse Electric Corporation supplied the nuclear steam supply system for each unit. Babcock & Wilcox International provided replacement steam generators.

Each fuel core has a thermal power level of 3411 megawatts and is composed of fuel rods made of low-enriched (up to 4.75 weight percent) uranium dioxide in the form of ceramic pellets contained in zirconium alloy fuel rods (tubes fitted with welded end caps). These fuel rods are grouped and supported into assemblies.

McGuire has several different fuel designs being used for the production of electricity. The Mark-BW design has a maximum fuel assembly burnup of 55,000 megawatt-days/metric tons of uranium (MWd/MTU) and a maximum licensed fuel pin burnup of 60,000 MWd/MTU. For the Westinghouse Robust Fuel Assembly design, there is no maximum fuel assembly burnup limit; however, this burnup value would be limited by the maximum licensed fuel pin burnup limit of 60,000 MWd/MTU.

The mechanical control rods consist of clusters of stainless steel-clad silver-indium-cadmium alloy absorber rods that are inserted into Zircaloy guide tubes within the fuel assembly [Reference 6].

The nuclear steam supply system for each unit is housed in a separate freestanding steel containment structure within a reinforced concrete shield building. The containment employs the ice condenser pressure-suppression concept. A common auxiliary building is located adjacent to the Unit 1 and 2 containment structures. The auxiliary building houses the radioactive waste treatment facilities, components of the engineered safety features, and various related auxiliary systems for each unit.

Each unit has a separate fuel handling facility, including the spent fuel pool and new fuel storage facilities [Reference 6]. Both new and spent fuel are stored in the fuel pool and transferred to and from the containment via the fuel transfer tube. Spent fuel is handled and stored under water. New fuel may also be stored dry in the new fuel storage facilities.

The current status of the fuel storage facilities at McGuire are briefly described below:

**Spent Fuel Pool Status**
There are two spent fuel pools at McGuire, one each for Unit One and Unit Two. The Unit 1 Spent Fuel Pool has a capacity to store 1,463 assemblies and currently has an inventory of 951 assemblies. The Unit 2 Spent Fuel Pool has a total capacity of 1463 assemblies with a current inventory of 1117 assemblies.

**Dry Storage**
An independent spent fuel storage installation (ISFSI) has been added at McGuire in order to expand the storage capacity, and the initial loading of spent fuel into dry storage will take place in the year 2001 from the Unit Two Spent Fuel Pool. Phase One of the McGuire ISFSI will utilize the Transnuclear TN-32 storage system. This system is comprised of bolted metal canisters each holding 32 spent fuel assemblies that are placed vertically on the ISFSI storage pad. The McGuire facility has a storage pad sized to accommodate 92 canisters of this design representing a capacity of 2944 fuel assemblies.

### 3.1.2 Cooling and Service Water Systems

The steam and power conversion systems for each unit are designed to remove heat energy from the reactor coolant, deliver it in the form of steam to the turbine-generator, and convert it to electric energy. Lake Norman is used as the source of water for cooling and process water for McGuire.

Water is used to both moderate and cool the reactor. The water is circulated through the reactor vessel and core by four centrifugal pumps in a closed loop system. Water heated by the reactor is pumped to four steam generators. The heated water is then circulated through the steam generators where its heat is transferred to the secondary system to produce saturated steam. The closed feedwater cycle condenses the steam and heats feedwater for return to the steam generators.

The steam produced in the steam generators is used to drive a turbine-generator, consisting of a tandem (single shaft) arrangement of a double-flow, high-pressure turbine and three identical double-flow, low-pressure turbines, which rotate a directly coupled generator at 1800 revolutions per minute. The low-pressure turbine exhaust steam is condensed in a once-through surface type deareating condenser of conventional shell and tube design. The main condenser for each unit is a single pass, three shell, surface type deaerating condenser. The main condensers are of conventional shell and tube design with steam on the shell side and circulating water on the tube side. Non-condensable gases removed from the condensers are vented to atmosphere through the Main Condenser Evacuation System and are continuously monitored for radiation.

Cooling water is drawn from Lake Norman and pumped through condenser tubes, condensing the steam on the shell side of the condenser. The condensate (water condensed from the steam) is then pumped back to the steam generators to be heated for another cycle.

The condensers are equipped with a mechanical system for cleaning the interior of condenser tubes to prevent the fouling of condenser heat transfer surfaces. Cleaning of these tubes is necessary to avoid a reduction of thermal efficiency and a corresponding increase in waste heat rejection to the cooling water. The mechanical cleaning system injects sponge rubber balls into the condenser inlet water boxes where they disperse and flow with the water through the condenser tubes to achieve a scrubbing of the tube inner surfaces. The sponge balls are collected by a strainer in the condenser discharge water pipe and pumped back for reinjection into the inlet water boxes. This method of cleaning condenser tubes does not use any chemical treatment of the lake water.

The average daily withdrawal from Lake Norman for the cooling water and other service water systems is 2530 mgd. The average daily discharge to Lake Norman from McGuire is approximately 2530 mgd. Approximately 1.08 mgd from the Conventional Waste Water Treatment system and from the Waste Water Collection basin is discharged to the Catawba River.

#### 3.1.2.1 CONDENSER CIRCULATING WATER SYSTEM

The Condenser Circulating Water System (CCW) is designed to use water from Lake Norman to remove rejected heat from the main and feedwater pump turbine condensers and other selected plant heat exchangers. The system also serves as the normal supply for the Conventional Low Pressure Service Water System and the Fire Protection System jockey pumps and a secondary supply for the Nuclear Service Water System. The CCW system consists of an upper level intake and a low level intake. The location of the Upper Level Intake Structure and the Lower Level Intake Structure is shown on Figure 3-1.

#### 3.1.2.2 INTAKE CONFIGURATION

The Upper Level Intake Structure is located in a man-made embayment, approximately 2400 feet east of Cowans Ford Dam. The upper level intake structure withdraws water from between elevation 715 feet and 745 feet.

The Low Level Intake Structure is located near the base of the dam and withdraws water from between elevation 654 feet and 670 feet. The Low Level Intake Cooling Water System is designed to take cool water from the lower levels of Lake Norman and mix it with the warmer water at the condenser circulating water intake structure during times of high lake water temperature. The Containment Ventilation Cooling Water System and

the Nuclear Service Water System can also be supplied with water from the Low Level Intake Cooling Water System.

Water may be pumped at a rate of 2000 cfs (cubic feet per second) from the low level intake to the forebay of the upper level intake, where mixing occurs with water withdrawn by the upper level intake.
The mixed water is then pumped into the CCW system at flow rates up to a maximum of 4350 cfs. The low level intake is also used to supply to the Nuclear Service Water System during normal plant operation, at a rate of 44 cfs for both units.

#### 3.1.2.3 CONDENSER COOLING WATER PUMP OPERATION

Eight condenser circulating water pumps (four per unit) provide flow to the two main condensers (one per unit). Four (per unit) main condenser circulating water pumps, mounted on the upper level intake structure, discharge into four pipes. These pipes then combine into two pipes and finally into one before splitting into three pipes and entering the Turbine Building. Each of these three divides into two smaller pipes before entering the condenser water boxes. On the outlet side of each condenser water box, these two pipes combine to form one larger pipe, and discharge the condenser cooling water into the discharge canal.

The temperature of the upper level intake water and the need to regulate the discharge temperature determines the quantities and source of cooling water. From late fall to early spring, surface waters will supply the entire condenser cooling water demand, and only three upper intake CCW pumps per unit are operated. As intake temperatures increase, the additional CCW pumps are placed into service. During the warmest months, cooler, hypolimnetic water can be withdrawn through the low level intake, as required, to maintain the required discharge temperature.

The upper level intake withdraws water between elevation 715 feet and 745 feet. There are sixteen openings (two bays for each CCW pump, eight bays per unit). Two traveling screens are provided for each condenser circulating water pump bay making a total of 16 screens. The traveling screens have 3/8-inch openings. Differential pressure switches, located in each bay, monitor the pressure drop across the screens and generate a computer alarm at a specified differential pressure across the screen. Automatic or manual operation of the Intake Screen Backwash System can be initiated by the Control Room or locally at the intake structure. Historically, the screens are manually rotated and cleaned weekly. The backwash water and debris removed from the screens is collected in a refuse removal trench, which drains into a debris retention basket.

#### 3.1.2.4 DISCHARGE CONFIGURATION

The condenser cooling water is discharged to Lake Norman through a 0.6 mile long discharge canal. This canal has an average depth of 40 feet when Lake Norman is at full

pond. Heated effluent from the canal mixes initially with surface waters of the main lake before stabilizing vertically and spreading.

#### 3.1.2.5 OPERATIONAL DATA

The condenser cooling water temperature increase (ΔT) from condenser inlet to condenser outlet is related to flow and intake water temperature. During the winter, when the upper level intake water temperatures are the coolest, the ΔT's reaches a maximum of 24.7 °F. Condenser cooling water ΔT's decline to 15.5 °F in the summer, when the warmest upper level intake water temperatures and the highest flow rates occur. The monthly NPDES thermal discharge limitations are 95 °F for the months October to June and 99 °F for the months July through September.

McGuire Units 1 and 2 had a combined annual capacity factor of 95.5% in 2000. The monthly average discharge temperature ranged from 69.8° F in January to 98.2° F in August. The operation of McGuire during the period of the extended license is expected to be similar to recent performance.

### 3.1.3 Radioactive Waste Treatment Processes (Gaseous, Liquid, and Solid)

The Waste Gas System is designed to collect, filter, monitor, store, and release as necessary, the gaseous effluent from processed reactor coolant. The Liquid Waste Recycle System and the Liquid Waste Monitor and Disposal System include capability for collection, storage, treatment, monitoring, disposal and recording of liquid wastes. Radioactive materials in liquid and gaseous effluents are reduced to levels as low as reasonably achievable below the plant's specified discharge limits. Solid radioactive wastes are stored, packaged and shipped off-site for ultimate disposition at an NRC licensed storage facility.

#### 3.1.3.1 Gaseous Waste Processing Systems and Effluent Controls

The design objective of the Waste Gas System is to keep levels of radioactive material in gaseous effluents to unrestricted areas within applicable discharge limits and as low as reasonably acheivable. This design objective is in accord with 10 CFR Part 50 and 10 CFR Part 20 requirements concerning station operation. The term "as low as practicable" used above is addressed in 10 CFR Part 50 which says "...as low as practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety...." Numerical guidance on design objectives is set out in 10 CFR Part 50, Appendix I.

The Waste Gas (WG) System is designed to remove fission gases from radioactive contaminated fluids and contain these gases in holdup tanks indefinitely. Storage and subsequent decay of these gases serves to eliminate the need for regularly scheduled discharge of these radioactive gases from the system into the atmosphere during normal plant operation. Fission gases are removed from other systems to the maximum extent possible, and contained in the WG system. As a result of the finite storage volume of the system, the inflow to the WG system of gases which cannot be processed and removed (primarily nitrogen) must be kept to an absolute minimum.

Although the WG system is designed to eliminate regular atmospheric discharge of waste gases, release of radioactive gas may become necessary at times. Therefore, the WG system includes provisions to sample and isolate each of the decay tanks. Low activity gases that might accumulate from operations such as plant shutdown or pressurizer relief tank discharges can be disposed of by discharge from a decay tank to the atmosphere after decay. Controls are provided to make certain that these releases are made within the established Technical Specification Limits.

Finally, the WG system provides a reduction in the fission gas concentration in the reactor coolant to a low residual level, which functions to reduce the escape of radioactive gases during maintenance operations or through unavoidable equipment leaks. The design is based on continuous operation of the nuclear steam supply system, assuming that fission products associated with 1% of the core power generation are available for

leakage from the fuel into the coolant through defects in the cladding. This condition is assumed to exist over the full life of the plant.

#### 3.1.3.2 Liquid Waste Processing Systems and Effluent Controls

The design objective of the liquid waste systems is to keep levels of radioactive material in liquid effluents to unrestricted areas as low as reasonably achievable. This design objective is consistent with 10 CFR Part 50 and 10 CFR Part 20 requirements that the station be operated accordingly. The term "as low as practicable" used above is addressed in 10 CFR Part 50 which says "...as low as practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety..." This objective is met in the design of the liquid waste systems by providing sufficient capacity and recycle capability to assure that levels of radioactive materials in liquid effluents are as low as practicable.

All radioactive and potentially radioactive liquids generated in the plant are collected, segregated and processed. Most reactor or primary grade liquids are recycled. All non-reactor grade liquids are processed and disposed of in accordance with NRC regulations. The liquids are categorized into two broad groups, recyclable and non-recyclable. These wastes are collected in the Auxiliary Building for processing by filtration, demineralization or recycle evaporation.

The recyclable liquids consist mainly of Primary System fluids, which are collected and fed to Recycle Evaporators. After processing, the distillate is added to the Reactor Makeup Storage System and the concentrates are pumped to the Boric Acid Storage Tank.

The nonrecyclable liquids consist mainly of liquid from Auxiliary Building floor drains, Hot Lab sinks, equipment drains, shower and laundry water. These wastes are sampled and analyzed to determine the level of treatment needed. Filtration and/or demineralization are used as necessary to reduce chemical content or radioactivity before discharge.

The liquid waste holdup total capacity is approximately 390,000 gallons. The actual liquid waste generated is reported in the McGuire Annual Effluent Report.

The Off Site Dose Calculation Manual (ODCM) prescribes the effluent release rate that will ensure that the concentration of radioactive liquid effluents released from the site to unrestricted areas is less than 10 times the effluent concentrations of 10 CFR Part 20, Appendix B Table 2. In addition, the ODCM provides calculations or the radiation monitor alarm/trip set points that define the relationship between the measured effluent activity, the maximum allowable effluent activity, and the effluent flow rate needed to

ensure that the instantaneous release rate is not exceeded and ,thereby, that the associated Selected Licensee Commitments are met.

#### 3.1.3.3 SOLID WASTE PROCESSING AND HANDLING

The purpose of the Nuclear Solid Waste Disposal System is to contain solid radioactive waste materials as they are produced in the station, and to provide for their storage and preparation for eventual shipment to an NRC or Agreement State Licensed offsite disposal facility. The Nuclear Solid Waste Disposal System is designed to handle the following:

1. Spent radioactive resin generated by resin replacement in the various station systems demineralizers.

2. Contaminated filter elements removed from various station systems.

3. Miscellaneous solid materials which become contaminated.

4. Contaminated oil.

The system is capable of safely accommodating all input volumes, forms, and radiation levels associated with normal operation of the station, including anticipated operational occurrences. Contaminated oils and sludges can be pumped to a processing area for solidification, or shipped to a vendor for processing.

Solid radioactive waste that is generated is divided into two categories. These include wet solid wastes (spent demineralizer resins) and dry active wastes (rubber gloves, plastic bags, contaminated clothing, rags and tools).

Tanks accumulating spent resins from Reactor Water Purification Systems are capable of accommodating 60 days waste generation at a normal generation rate. Tanks accumulating spent resins from other sources and tanks accumulating filter sludges are capable of accommodating at least 30 days waste generation at a normal generation rate.

Storage for solidified wastes is provided to accommodate at least 30 days of waste generation at normal generation rates. Storage areas for dry active wastes and packaged contaminated equipment are capable of accommodating at least one full offsite shipment.

The typical low level wastes presently and routinely generated from McGuire Nuclear Station consist of primary and secondary resins, filter media, contaminated trash, and noncompactible trash (contaminated hardware) etc. 10 CFR Part 61 waste classification system establishes three categories for waste acceptable for disposal at a near-surface burial facility. This classification system is based on potential radiological hazard and

determined by the concentration of specific radionuclides, which are set forth in Table 1 and Table 2 of Section 61.55. Class A waste contains the lowest concentration of radionuclides and must meet only minimum waste form requirements. Class B and C wastes contain higher concentration and must meet specified waste form and stability requirements. In addition to the stability requirement, Class C waste must also require additional measures at the disposal facility to protect against inadvertent intrusion.

**Low Level Waste Disposal**

There are different options to dispose of the low level wastes generated from McGuire. Class A wastes, such as secondary resin, dry active wastes, contaminated hardware, etc., are usually processed at a waste processing facility for volume reduction or segregation prior to disposal at a licensed facility, such as Barnwell, SC or Envirocare of Utah. Class B or C wastes are usually sent directly to Barnwell, SC for disposal.

North Carolina withdrew from the Southeast Compact, and is not a member of any compact at the present time. North Carolina may choose to join any other compact in the future or may develop its own low level waste burial facility. McGuire has been allowed to dispose of waste at Barnwell since July 1, 2000. The Barnwell site is located in the state of South Carolina and is the current host site for the Atlantic Compact. The Atlantic Compact consists of three states, New Jersey, Connecticut, and South Carolina, and has established a system to accept the out-of-compact waste from fiscal year 2001 through 2008. McGuire's waste is considered as out of compact waste, the same as any other non-compact member's waste. After fiscal year of 2008, the Barnwell site will not be allowed to receive any waste from outside the compact.

McGuire has been aggressively reducing volume and minimizing both solid and liquid wastes for several years and plans to continue to do so in the future.

### 3.1.4 Transportation of Radioactive Materials

All solid wastes are transported by truck, as soon as practical after loading, to the Low Level Radioactive Waste Interim Storage Facility, to a waste processor, or to an NRC or Agreement State licensed offsite disposal facility. In the case of evaporator concentrates, solidified liners may be temporarily stored in the solidified liner storage bunker if transportation is not immediately available. Locations in the station where solid wastes are stored during the handling process include the filter storage bunker, solidified liner storage bunker, the shielded storage bunker, and the Low Level Radioactive Waste Interim Storage facility. All shipments of solid wastes meet the applicable requirements of 10 CFR 71, Department of Transportation regulations, and applicable State regulations.

### 3.1.5 Non-radioactive Waste Systems

#### 3.1.5.1 SOLID WASTE

Non-radioactive solid wastes generated at McGuire are disposed of either in the on-site landfill or one of several off-site Mecklenburg County landfills. Wastes such as asbestos, empty paint containers and oil-contaminated materials are disposed of in the on-site lined landfill which is permitted by the North Carolina Department of Environment and Natural Resources - Solid Waste Section. General trash such as cafeteria wastes and office waste are collected and transported off-site to a Mecklenburg County landfill. Construction waste such as wood and concrete are transported off-site by Duke personnel to a county construction and demolition debris landfill. Items such as aluminum cans, office paper, cardboard, asphalt and scrap metal are collected and sent to a local recycler.

#### 3.1.5.2 LIQUID WASTE

Non-radioactive liquid wastes are produced as a result of plant operation, maintenance and housekeeping activities. Most of these wastes come from system drainage/leakage, water treatment activities, housekeeping/cleaning wastes, stormwater runoff and floor and yard drains. These wastes are sampled and treated according to the Site's NPDES (National Pollutant Discharge Elimination System) Permits that are issued by NCDENR (North Carolina Department of Environment and Natural Resources). Sanitary wastes are treated off-site by Charlotte Mecklenburg Utilities Department.

#### 3.1.5.3 GASEOUS WASTE

Non-radioactive gaseous releases come from operation of emergency diesel generators and site painting activities. These releases are regulated and permitted by Mecklenburg County Environmental Protection - Air Quality Section.

### 3.1.6 Maintenance, Inspection, and Refueling Activities

Various programs and activities currently exist at McGuire to maintain, inspect, test, and monitor the performance of plant equipment. These programs and activities include, but are not limited to, those implemented to:

- meet the requirements of 10 CFR Part 50, Appendix B (Quality Assurance), Appendix R (Fire Protection), Appendices G and H, Reactor Vessel Materials;
- meet the requirements of 10 CFR 50.55a, American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection and Testing requirements;
- meet the requirements of 10 CFR §50.65, the Maintenance Rule, including the Civil/Structural Monitoring Program; and
- meet the Chemistry Control Program.

Additional programs include those implemented to meet the Technical Specification surveillance requirements, those implemented in response to NRC generic communications – Flow Accelerated Corrosion, Boric Acid Corrosion, Service Water Monitoring, and various periodic maintenance, testing, and inspection procedures.

Many of these programs and activities are performed during the operation of the units. Others are performed during refueling outages, which typically occur every 18-24 months and are typically scheduled to last approximately 30-40 days.

### 3.1.7 Power Transmission Systems

Two switchyards are used to connect the McGuire plant transmission lines to the transmission system. These switchyards, a 230 kV for Unit 1 and a 525 kV switchyard for Unit 2, are located south of highway NC 73, as shown on Figure 3-2.

Each McGuire unit generates power at 24 kV. The generator feeds the power to independent half-size unit step-up transformers located in the transformer yard south of the Turbine Building. After a voltage transformation from 24 kV to 230 kV, the power from Unit 1 is transmitted over two separate and independent overhead transmission lines to a common 230 kV Switching Station. Similarly, after a voltage transformation from 24 kV to 525 kV, the power from Unit 2 is transmitted over two separate and independent overhead transmission lines to a common 525 kV switching station.

The 230 kV Switching Station is located south of the nuclear station and is tied into the Duke Energy 230 kV network by seven double circuit overhead lines. The 525 kV Switching Station is located east of the 230 kV Switching Station and is tied into the Duke Energy 525 kV network by four single circuit overhead lines [Reference 6].

#### 3.1.7.1 UNIT 1 TRANSMISSION LINES

After a voltage transformation from 24 kV to 230 kV, the power from Unit 1 is transmitted over two separate and independent overhead transmission lines to a common 230 kV Switching Station.

There are two separate overhead transmission line circuits between Unit 1 and the 230 kV Switching Station that tie it to the 230 kV Transmission Network, as shown on Figure 3-2. Each line is 230 kV, three-phase with an average length of 4,000 ft. from the transformer yard to the switching station structure. The 230 kV transmission lines are designed to meet the National Electrical Safety Code 7th Edition heavy loading conditions.

#### 3.1.7.2 UNIT 2 TRANSMISSION LINES

Similarly, after a voltage transformation from 24 kV to 525 kV, the power from Unit 2 is transmitted over two separate and independent overhead transmission lines to a common 525 kV switching station.

There are two separate overhead transmission line circuits between Unit 2 and the 525 kV Switching Station that tie it to the 525 kV Transmission Network, as shown on Figure 3-2. Each line is 525 kV, three-phase with an average distance of 3300 ft. from the transformer yard to the switching station structure. The 525 kV transmission lines are designed to meet the National Electric Safety Code 7th Edition heavy loading condition.

### 3.1.8 Transmission Line Right-of Way Maintenance Practices

Duke's right-of way (ROW) vegetation management program is an integrated program utilizing a combination of mechanical clearing and herbicides. This program is used on the McGuire rights-of-way, as well as on other transmission line ROW's in the Duke system.

The low-volume herbicides Duke uses are predominately Arsenal® and Accord® with Garlon 4A® for stump treatments and basal applications, and Krenite® with Accord® or Arsenal® in specific situations. Each of these products has been evaluated for safety and environmental concerns. After initially treating the ROW with Arsenal® and Accord®, the ROW is on a 3- year rotation (approximate period of rotation) with subsequent herbicide applications limited primarily to spot treatment of only those trees that could grow into the transmission lines. Arsenal® (active ingredient imazapyr) is also approved for use in low-lying marshy areas and Accord® (active ingredient glyphosate) has a special use label for the same use application.

## 3.2 Refurbishment Activities

### 3.2.1 Plant Modifications or Refurbishments Required for License Renewal

10 CFR §51.53(c)(2) requires that a license renewal applicant's environmental report contain:

> "a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with Section 54.21 of this chapter. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment."

The objective of the review required by §54.21 is to demonstrate that the effects of aging will be managed such that the structure and component intended function will be

maintained consistent with the current licensing basis during the period of extended operations.

The review required by §54.21 is provided in the Technical Information portion of the Application [Reference 7]. Based on this review, no major plant refurbishment activities were identified as necessary to maintain the structure and component intended functions consistent with the current licensing basis during the period of extended operations.

Routine replacement of certain components will continue to be made that are in the bounds of normal plant maintenance. Modifications currently performed to improve operation of plant systems, structures, or components are reviewed for impact by station environmental management personnel during the planning stage for the modification. Site environmental management personnel will continue to perform these reviews on modifications proposed during the extended license period.

## 3.3 Programs and Activities for Managing the Effects of Aging

The review provided in the technical information portion of the Application [Reference 7] identifies existing programs and activities that will manage the effects of aging such that the structure and component intended functions will be maintained consistent with the current licensing basis during the period of extended operations.

In addition, the technical information portion of the Application identifies several existing and new aging management programs and activities that will be required for license renewal. All of these programs and activities are described in Appendix B of the Application. Minor enhancements to the existing programs and activities may be made prior to the period of extended operation. None of the existing aging management programs and activities, none of the enhancements to the existing aging management programs and activities, and none of the new programs and activities are expected to lead to significant environmental impacts.

## 3.4 Employment

The full time work force at McGuire consists of approximately 1300 persons. Duke has no plans to add additional full time workers at the plant during the period of the renewed license.

A typical single unit refueling outage has a duration of 30 to 40 days and occurs approximately every 18 to 24 months. The refueling outages are staggered so that both units are not in an outage at the same time. The refueling outages normally require an additional 1015 temporary workers (approximately) to be on-site. The number of temporary workers required on-site for normal plant outages during the period of the

renewed license is expected to be commensurate with the numbers of additional temporary workers used for past outages at McGuire.

Table 3-1 provides employee residence location information for full time McGuire employees.

## Table 3-1 Employee Residence Information - McGuire Nuclear Station Employees and Long Term Contractors Counties and Selected Cities

| | | |
|---|---|---|
| **Cabarrus County** | | **93** |
| | Concord | 44 |
| | Harrisburg | 14 |
| | Kannapolis | 31 |
| | Other Cites and Towns | 4 |
| **Catawba County** | | **121** |
| | Denver | 12 |
| | Catawba | 10 |
| | Conover | 10 |
| | Maiden | 28 |
| | Newton | 23 |
| | Sherrills Ford | 29 |
| | Other Cites and Towns | 9 |
| **Gaston County** | | **180** |
| | Belmont | 24 |
| | Dallas | 18 |
| | Gastonia | 32 |
| | Mount Holly | 35 |
| | Stanley | 55 |
| | Other Cites and Towns | 16 |
| **Iredell County** | | **155** |
| | Mooresville | 132 |
| | Statesville | 11 |
| | Other Cites and Towns | 12 |
| **Lincoln County** | | **305** |
| | Denver | 106 |
| | Iron Station | 50 |
| | Lincolnton | 125 |
| | Other Cites and Towns | 24 |
| **Mecklenburg County** | | **318** |
| | Charlotte | 189 |
| | Cornelius | 38 |
| | Davidson | 22 |
| | Huntersville | 60 |
| | Other Cites and Towns | |
| **Rowan County** | | **63** |
| | China Grove | 15 |
| | Mount Ulla | 10 |
| | Salisbury | 22 |
| | Other Cites and Towns | 16 |
| **Other North Carolina Counties** | | **48** |
| **South Carolina** | | **41** |
| **Other States** | | **21** |
| **Total** | | **1345** |

**Figure 3-1 McGuire Plant Features**

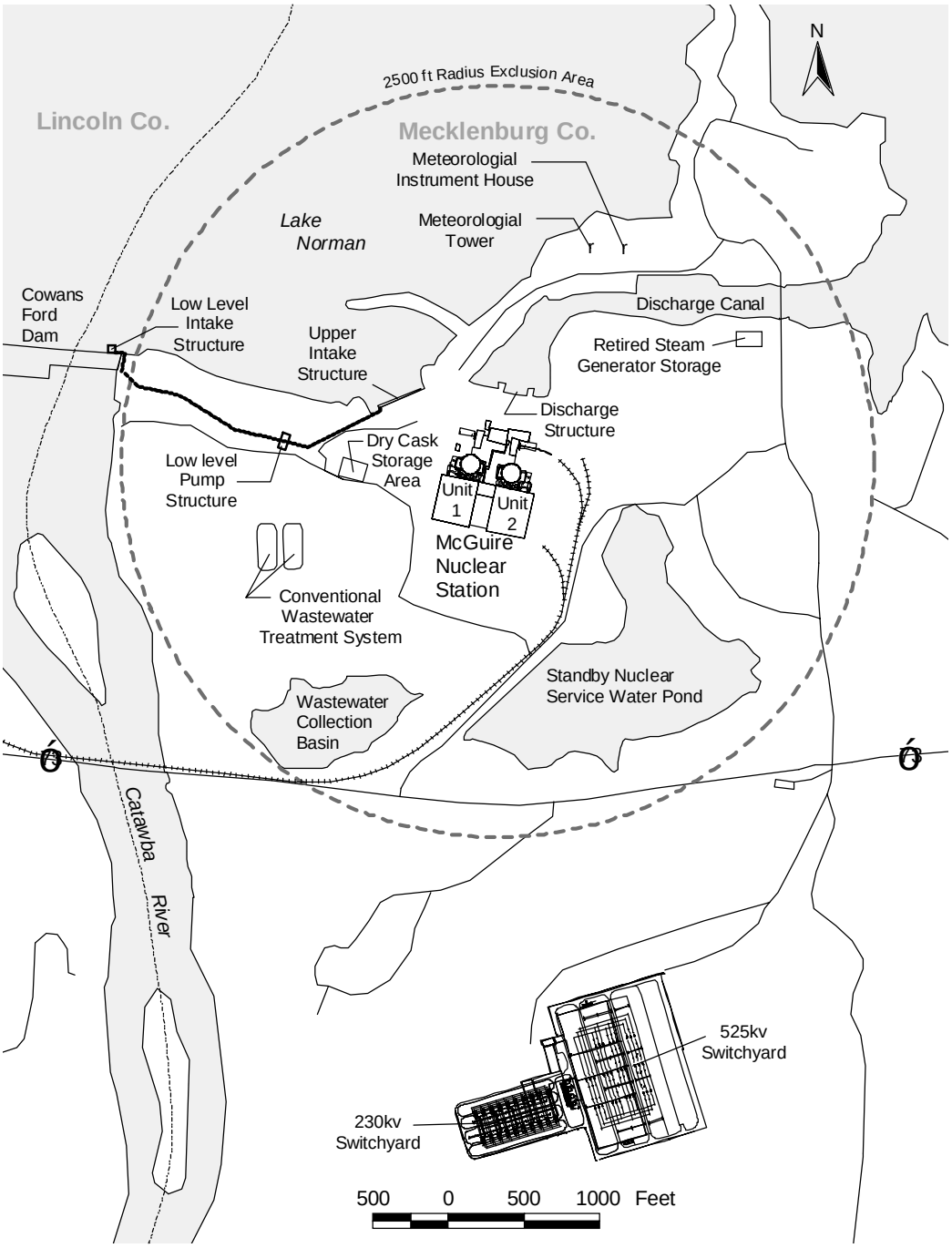
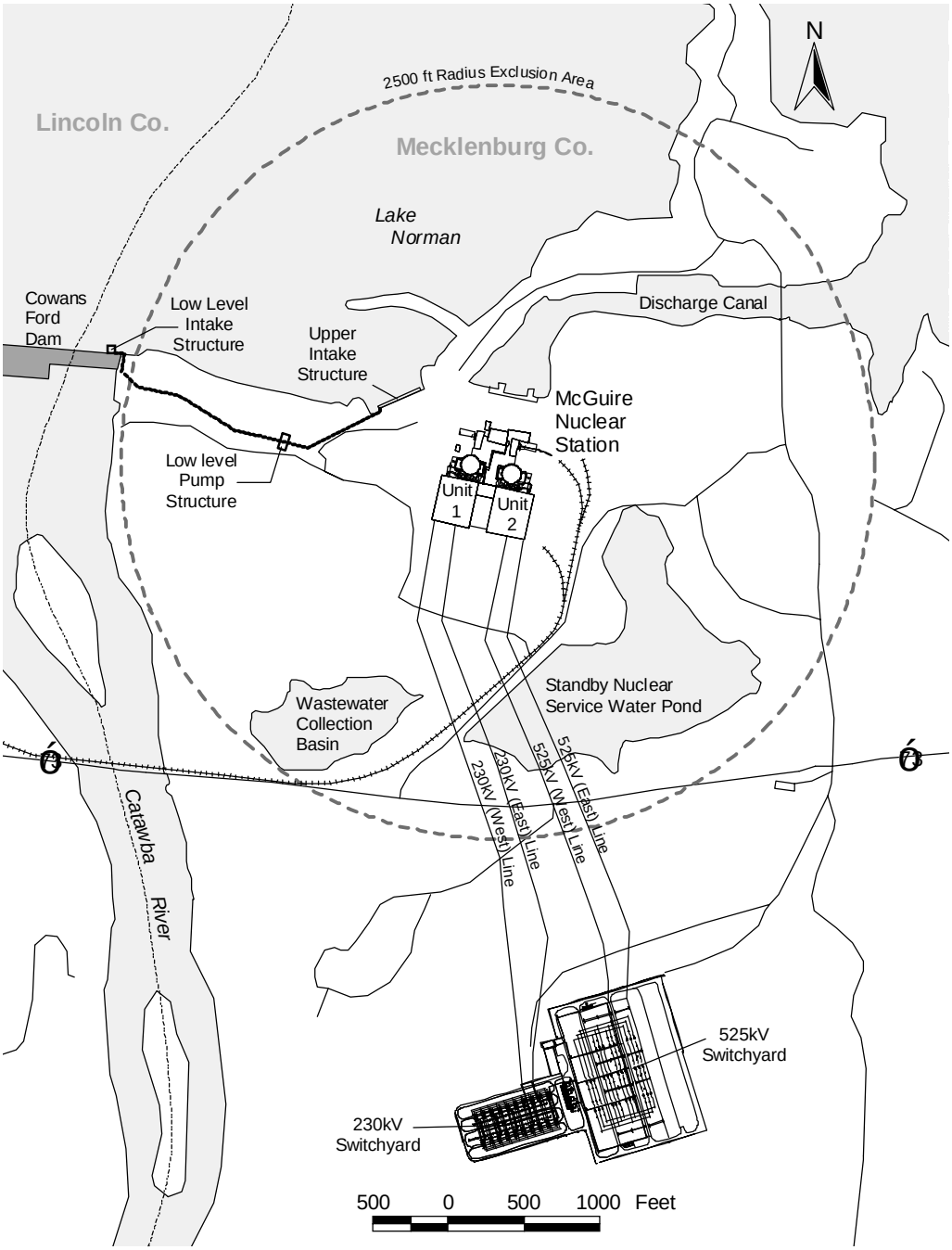


**Figure 3-2 McGuire Transmission Lines**



# 4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

**Discussion of GEIS Categories of Environmental Issues**

The Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS), NUREG-1437, summarizes the approach and findings of a systematic inquiry into the potential environmental consequences of renewing the licenses and operating individual nuclear power plants for an additional twenty years. The GEIS assesses 92 environmental issues relevant to license renewal.

The GEIS assigned one of the three following significance levels to these environmental issues:

> **Small:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> **Moderate:** Environmental effects are sufficient to alter noticeably but not to destabilize important attributes of the resource.
>
> **Large:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

As part of this evaluation performed in the GEIS, a determination was made whether the analysis in the GEIS could be applied to all plants and whether additional mitigation measures would be warranted. As a result of this determination, the issues were assigned to one of two Categories.[3] For issues assigned as Category 1, the generic analysis in the GEIS can be adopted in the plant specific review. For issues assigned as Category 2, additional plant-specific review is required.

3 Of the 92 environmental issues evaluated in the GEIS, 69 were designated as Category 1 and 21 were designated as Category 2. Two environmental issues were assigned as Category NA (not applicable). These issues are Electromagnetic fields (chronic effects) and Environmental Justice. Footnotes to Table 9.1, in the GEIS provide details on the category definition for these issues.

The specific requirements for Category 1 issues are:

**Category 1 Issues**
Category 1 issues are defined as those environmental issues whose analysis in the GEIS has shown that:

> (1) the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics;
>
> (2) a single significance level (i.e., small, moderate, or large) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel); and
>
> (3) mitigation of adverse impacts associated with the issue has been considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

Sixty-nine of the issues evaluated in the GEIS were assigned a Category 1 designation. These issues are identified in Appendix B to Subpart A of Part 51, Table B-1. 10 CFR § 51.53(c)(3)(i) states that the environmental report for the operating license renewal stage need not contain analyses of the environmental impacts of the license renewal issues identified as Category 1.

Eight Category 1 issues are related to refurbishment. These issues are not applicable to McGuire because no refurbishment activities have been identified. These issues are listed in Table 4-1.

Eleven Category 1 issues are specific to certain plants because of location, design of cooling system or other plant-specific conditions. These issues are not applicable to McGuire, based on the location and design of McGuire. These issues are listed Table 4-2.

The remaining Category 1 issues listed in Table B-1 were reviewed to determine if conclusions found in the GEIS for these issues were valid for McGuire. The review found that the conclusions found in the GEIS were valid for McGuire and that no new information existed for the issues that would invalidate the GEIS conclusions. A description of this review process is found in Chapter 5.0. These issues are listed in Table 4-3.

## Table 4-1 Category 1 Issues Related to Refurbishment

| |
|---|
| **Surface Water Quality, Hydrology, and Use (for all plants)** |
| Impacts of refurbishment on surface water quality |
| Impacts of refurbishment on surface water use |
| **Aquatic Ecology (for all plants)** |
| Refurbishment |
| **Ground-water Use and Quality** |
| Impacts of refurbishment on ground-water use and quality |
| **Land Use** |
| Onsite land use |
| **Human Health** |
| Radiation exposures to the public during refurbishment |
| Occupational radiation exposures during refurbishment |
| **Socioeconomics** |
| Aesthetic impacts (refurbishment) |

**Table 4-2 Category 1 Issues Not Applicable Based on Plant Location or Design**

| | |
|---|---|
| **Surface Water Quality, Hydrology, and Use (for all plants)** | |
| Altered salinity gradients | Not applicable due to plant location. |
| **Aquatic Ecology (for plants with cooling tower based heat dissipation systems)** | |
| Entrainment of fish and shellfish in early life stages | Not applicable. McGuire does not use cooling towers. |
| Impingement of fish and shellfish | Not applicable. McGuire does not use cooling towers. |
| Heat shock | Not applicable. McGuire does not use cooling towers. |
| **Ground-water Use and Quality** | |
| Ground-water quality degradation (Ranney wells) | Not applicable. McGuire does not use Ranney wells. |
| Ground-water quality degradation (saltwater intrusion) | Not applicable due to plant location. |
| Ground-water quality degradation (cooling ponds in salt marshes) | Not applicable due to plant location. |
| **Terrestrial Resources** | |
| Cooling tower impacts on crops and ornamental vegetation | Not applicable. McGuire does not use cooling towers. |
| Cooling tower impacts on native plants | Not applicable. McGuire does not use cooling towers. |
| Bird collisions with cooling towers | Not applicable. McGuire does not use cooling towers. |
| Cooling pond impacts on terrestrial resources | Not applicable. McGuire does not use cooling ponds. |

**Table 4-3 Category 1 Issues Applicable to McGuire**

| **Surface Water Quality, Hydrology, and Use (for all plants)** |
|---|
| Altered current patterns at intake and discharge structures |
| Altered thermal stratification of lakes |
| Temperature effects on sediment transport capacity |
| Scouring caused by discharged cooling water |
| Eutrophication |
| Discharge of chlorine or other biocides |
| Discharge of sanitary wastes and minor chemical spills |
| Discharge of other metals in waste water |
| Water use conflicts (plants with once-through cooling systems) |
| **Aquatic Ecology (for all plants)** |
| Accumulation of contaminants in sediments or biota |
| Entrainment of phytoplankton and zooplankton |
| Cold shock |
| Thermal plume barrier to migrating fish |
| Distribution of aquatic organisms |
| Premature emergence of aquatic insects |
| Gas supersaturation (gas bubble disease) |
| Low dissolved oxygen in the discharge |
| Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses |
| Stimulation of nuisance organisms (e.g., shipworms) |

**Table 4-3 Category 1 Issues Applicable to McGuire**

**(Continued)**

| |
|---|
| **Ground-water Use and Quality** |
| Ground-water use conflicts (potable and service water; plants that use <100 gpm) |
| **Terrestrial Resources** |
| Power line right-of-way management (cutting and herbicide application) |
| Bird collision with power lines |
| Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) |
| Floodplains and wetland on power line right of way |
| **Air Quality** |
| Air quality effects of transmission lines |
| **Land Use** |
| Power line right of way |
| **Human Health** |
| Microbiological organisms (occupational health) |
| Noise |
| Radiation exposures to public (license renewal term) |
| Occupational radiation exposures (license renewal term) |

**Table 4-3 Category 1 Issues Applicable to McGuire**

**(Continued)**

| |
|---|
| **Socioeconomics** |
| Public services: public safety, social services, and tourism and recreation |
| Public services, education (license renewal term) |
| Aesthetic impacts (license renewal term) |
| Aesthetic impacts of transmission lines (license renewal term) |
| **Postulated Accidents** |
| Design basis accidents |
| **Uranium Fuel Cycle and Waste Management** |
| Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste |
| Offsite radiological impacts (collective effects) |
| Offsite radiological impacts (spent fuel and high level waste disposal) |
| Non-radiological impacts of the uranium fuel cycle |
| Low-level waste storage and disposal |
| Mixed waste storage and disposal |
| On-site spent fuel |
| Nonradiological waste |
| Transportation |
| **Decommissioning** |
| Radiation doses |
| Waste management |
| Air quality |
| Water quality |
| Ecological resources |
| Socioeconomic impacts |

**Category 2 Issues**
For the Category 2 issues, the NRC analysis presented in the GEIS has shown that one or more of the Category 1 criteria cannot be met, and therefore, additional plant-specific review is required.

Twenty-one of the issues evaluated in the GEIS were designated as Category 2. The NRC's findings on the environmental impact of these issues are summarized in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. These twenty-one issues have been incorporated into the requirements listed in §51.53(c)(3)(ii).

Pursuant to §51.53(c)(3), renewal license applications are required to include the information detailed in paragraph §51.53(c)(2), subject to several conditions and considerations. The environmental report must contain an analysis of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal, and the impacts of operation during the renewal term, for those issues identified as Category 2 (plant-specific) issues in Appendix B to Subpart A of Part 51.

The impacts of the environmental issues that require analyses are discussed in proportion to their significance. In assessing the significance of environmental impacts, the following general definitions of significance level used in NUREG-1437 and codified in Appendix B to Subpart A of 10 CFR Part 51 are used.

- Small: For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
- Moderate: For the issue, environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
- Large: For the issue, environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

**Cumulative, Direct, and Indirect Impacts**
Environmental impacts, or effects, include direct effects, indirect effects, and cumulative effects. Each type of effect is to be considered in the assessment of environmental issues and is to be discussed in proportion to the significance of the impact attributed to license renewal (See Impact Findings above.) Definitions of the three types of effects are given in the Council on Environmental Quality regulations, 40 CFR Part 1508.

Cumulative impact is defined in 40 CFR §1508.7.

> *"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Direct and indirect effects are defined in 40 CFR 1508.8.

"Effects" include:

> *(1) Direct effects, which are caused by the action and occur at the same time and place.*
> *(2) Indirect effects, which are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable.*

These definitions were used in the analyses of the required issues. A discussion of the review for cumulative impacts from the combined operation of McGuire and Catawba is presented in Section 6.1.

**Mitigation of Adverse Effects**

When adverse environmental effects are identified, 10 CFR §51.45(c) requires consideration of alternatives available for reducing or avoiding these adverse effects. Any ongoing mitigation, if any, is identified and the potential for additional mitigation, if required, is discussed. The extent of the consideration of mitigation alternatives is proportional to the significance of the impact. The Council on Environmental Quality in its regulations at 40 CFR §1508.20 identifies five types of mitigative actions. These actions are:

> (1) Avoiding the impact altogether by not taking a certain action or parts of an action.
> (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
> (3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
> (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
> (5) Compensating for the impact by replacing or providing substitute resources or environments.

These categories of mitigative actions are used in accordance with 10 CFR §51.14(b).

**Issues Not Applicable to McGuire**
No analysis was performed for issues that are not applicable to McGuire due to plant design. The basis for Duke's determination that a certain issue is not applicable is set forth in the specific section.

**Issues Applicable to McGuire Related to Refurbishment**
As discussed in Section 3.2, Refurbishment Activities, the evaluation of structures and components as required by 10 CFR §54.21 did not identify any major plant refurbishment activities[4] or modifications necessary to support the continued operation of McGuire beyond the end of the existing operating licenses. Therefore, analysis of these issues is not required.

**Format of Category 2 Issue Review**
The review and analysis for the Category 2 issues are found in Sections 4.1through 4.21. The format for the review of the Category 2 issues is described below:

- **Issue** – a brief statement of the issue.
- **Description of Issue** – a brief description of the issue.
- **Findings from Table B-1, Appendix B to Subpart A -** The Finding(s) for the issue from Table B-1 - Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Appendix B to Subpart A, is presented.
- **Requirement -** The requirement from §51.53(c)(3)(ii) is restated.
- **Background** – For issues that are applicable to McGuire, an excerpt from the applicable section of the GEIS is provided as background. The specific section of the GEIS is referenced for the convenience of the reader. In most cases, background information is not provided for issues that are not applicable to McGuire.
- **Analysis of Environmental Impact -** An analysis of the environmental impact as required by §51.53(c)(3)(ii) is provided, taking into account information provided in the GEIS, Appendix B to Subpart A of Part 51, as well as current McGuire-specific information.
- **Conclusion -** The conclusion of the analysis is presented along with the consideration of mitigation alternatives as required by §51.45(c) and §51.53(c)(3)(iii).

4 GEIS, Appendix B, Table B.2 lists major refurbishment/replacement activities associated with license renewal.

## 4.1 Water Use Conflicts

### 4.1.1 Description of Issue

Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)

### 4.1.2 Findings from Table B-1, Appendix B to Subpart A

SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See §51.53(c)(3) (ii)(A).

### 4.1.3 Requirement [§51.53(c)(3) (ii)(A)]

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

### 4.1.4 Analysis of Environmental Impact

McGuire uses a once-through cooling system.[5] Therefore, this issue is not applicable to McGuire and analysis is not required.

### 4.1.5 Conclusion

McGuire uses a once-through cooling system. Therefore, this issue is not applicable to McGuire.

5 In a once-through cooling system, circulating water for condenser cooling is drawn from an adjacent body of water, such as a lake or river, passed through the condenser tubes, and returned at a higher temperature to the adjacent body of water. The waste heat is dissipated to the atmosphere, mainly by evaporation from the water body and, to a much smaller extent, by conduction, convection, and thermal radiation loss. [Reference 8]

## 4.2 Entrainment of Fish and Shellfish in Early Life Stages

### 4.2.1 Description of Issue

Entrainment of fish and shellfish in early life stages (for all plants with once-through and cooling pond heat dissipation systems)

### 4.2.2 Findings from Table B-1, Appendix B to Subpart A

The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See §51.53(c)(3)(ii)(B).

### 4.2.3 Requirement [§51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling[5] or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

### 4.2.4 Background

The impacts of fish and shellfish entrainment are small at many plants, but they may be moderate or even large at a few plants with once-through cooling systems. Further, ongoing restoration efforts may increase the numbers of fish susceptible to intake effects during the license renewal period, so that entrainment studies conducted in support of the original license may no longer be valid. For these reasons, the entrainment of fish and shellfish is a Category 2 issue for plants with once-through cooling [Reference 8, GEIS Section 4.2.2.1.2].

### 4.2.5 Analysis of Environmental Impact

As described in Section 3.1.2, condenser cooling water used at McGuire is withdrawn from two levels of Lake Norman. A lower level intake is located near the base of Cowans Ford Dam, while an upper intake is located in an embayment approximately 800 yards east of Cowans Ford Dam. These intakes are shown on Figures 3.4 and 3.5 of Reference 17.

On March 28, 1978, the North Carolina Department of Natural Resources and Community Development (NCDNRCD) issued the NPDES Permit No. NC0024382 for

McGuire Nuclear Station. This initial permit required, under Special Conditions paragraph E.1, that McGuire design an intake structure to reduce impingement and entrainment.

In October 1978, Duke completed the McGuire Nuclear Station 316(b) Predictive Study of Impingement and Entrainment [Reference 9]. That study concluded that the location, design, construction, and capacity of the McGuire Nuclear Station condenser cooling water intake structures minimize adverse environmental impacts, and those impacts which may occur are not expected to be detrimental to the Lake Norman aquatic ecosystem. In February 1984, the North Carolina Department of Natural Resources & Community Development notified Duke that they concurred with the conclusions of this study [Reference 10]. In accordance with Section 316(b) of the Clean Water Act, and the NPDES permit re-issued by the North Carolina Department of Natural Resources and Community Development (NCDNRCD) on Sept. 1, 1984. No additional studies or monitoring were required.

As required by the NPDES Permit NC0024392, an annual report is prepared and submitted to North Carolina Department of Environment and Natural Resources (NCDENR) presenting the results of environmental monitoring performed on Lake Norman. The report submitted in 1999 [Reference 11] summarizes:

> *Through consultation with NCWRC, the Lake Norman fisheries program continues to be reviewed and modified annually to address fisheries issues. Fisheries data continue to be collected through cooperative monitoring programs with the NCWRC for their assessment and management of Lake Norman Fisheries populations. Fisheries data to date indicate that the Lake Norman fishery is consistent with tropic status and productivity of the reservoir.*

McGuire has operated the once-through cooling system in a manner that has resulted in no significant adverse impacts on the aquatic communities of Lake Norman. This result is evidenced by the approved Section 316(b) demonstration and by periodic renewal of the NPDES permit.

### 4.2.6 Conclusion

Any impacts of entrainment at McGuire are small and will continue to be small. This result is evidenced by the approved Section 316(b) demonstration and by periodic renewal of the NPDES permit. Any impacts that do occur are not expected to be detrimental to Lake Norman's aquatic ecosystem. Therefore, consideration of mitigation measures to eliminate or reduce the level of adverse impacts is not warranted.

## 4.3 Impingement of Fish and Shellfish

### 4.3.1 Description of Issue

Impingement of fish and shellfish (for all plants with once-through and cooling pond heat dissipation systems)

### 4.3.2 Findings from Table B-1, Appendix B to Subpart A

The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See §51.53(c)(3)(ii)(B).

### 4.3.3 Requirement [§51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling[5] or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

### 4.3.4 Background

Aquatic organisms that are drawn into the intake with the cooling water and are too large to pass through the debris screens may be impinged against the screens. Mortality of fish that are impinged is high at many plants because impinged organisms are eventually suffocated by being held against the screen mesh or are abraded, which can result in fatal infection. Impingement can affect large numbers of fish and invertebrates (crabs, shrimp, jellyfish, etc.). As with entrainment, operational monitoring and mitigative measures have allayed concerns about population-level effects at most plants, but impingement mortality continues to be an issue at others. Consultation with resource agencies (GEIS Appendix F) reveals that impingement is a frequent concern at once-through power plants, particularly where restoration of anadromous fish may be affected. Impingement is an intake-related effect that is considered by EPA or state water quality permitting agencies in the development of the National Pollution Discharge Elimination System (NPDES) permits and 316(b) determinations. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through cooling systems. For this reason, the impingement of fish and shellfish is a Category 2 issue [Reference 8, GEIS Section 4.2.2.1.3].

### 4.3.5 Analysis of Environmental Impact

Condenser cooling water used at McGuire is withdrawn from two levels of Lake Norman. A lower level intake is located near the base of Cowans Ford Dam, while an upper intake is located in an embayment approximately 800 yards east of Cowans Ford Dam.

On March 28, 1978, the North Carolina Department of Natural Resources and Community Development (NCDNRCD) issued the NPDES Permit No. NC0024382 for McGuire Nuclear Station. This initial permit required, under Special Conditions paragraph E.1, that McGuire design an intake structure to reduce impingement and entrainment.

In October 1978, Duke completed the McGuire Nuclear Station 316(b) Predictive Study of Impingement and Entrainment [Reference 9]. That study concluded that the location, design, construction, and capacity of the McGuire Nuclear Station condenser cooling water intake structures minimize adverse environmental impacts, and those impacts which may occur are not expected to be detrimental to the Lake Norman aquatic ecosystem. In February 1984, the North Carolina Department of Natural Resources & Community Development notified Duke that they concurred with the conclusions of this study [Reference 10]. In accordance with Section 316(b) of the Clean Water Act, the NPDES permit re-issued by the North Carolina Department of Natural Resources and Community Development (NCDNRCD) on Sept. 1, 1984, accordingly, no additional studies or monitoring were required.

As required by the NPDES Permit NC0024392, an annual report is prepared and submitted to NCDENR presenting the results of environmental monitoring performed on Lake Norman. The report [Reference 11] submitted in 1999 summarizes:

> *Through consultation with NCWRC, the Lake Norman fisheries program continues to be reviewed and modified annually to address fisheries issues. Fisheries data continue to be collected through cooperative monitoring programs with the NCWRC for their assessment and management of Lake Norman Fisheries populations. Fisheries data to date indicate that the Lake Norman fishery is consistent with tropic status and productivity of the reservoir.*

McGuire has operated the once-through cooling system in a manner that has resulted in no significant adverse impacts on the aquatic communities of Lake Norman. This result is evidenced by the approved Section 316(b) demonstration and by periodic renewal of the NPDES permit.

### 4.3.6 Conclusion

The impacts of impingement at McGuire are small and will continue to be small. This result is evidenced by the approved Section 316(b) demonstration and by periodic renewal of the NPDES permit. Any impacts that do occur are not expected to be detrimental to Lake Norman's aquatic ecosystem. Therefore, consideration of mitigation measures to eliminate or reduce the level of adverse impacts is not warranted.

## 4.4 Heat Shock

### 4.4.1 Description of Issue

Heat shock (for all plants with once-through and cooling pond heat dissipation systems)

### 4.4.2 Findings from Table B-1, Appendix B to Subpart A

Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See §51.53(c)(3)(ii)(B).

### 4.4.3 Requirement [§51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling[5] or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(a) determinations and variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock.

### 4.4.4 Background

Based on the research literature, monitoring reports, and agency consultations, the potential for thermal discharges to cause thermal discharge effect mortalities is considered small for most plants. However, impacts may be moderate or even large at a few plants with once-through cooling systems. For example, thermal discharges at the Crystal River Nuclear Plant are considered by the agencies to have damaged benthic invertebrate and seagrass communities in the effluent mixing zone around the discharge canal; as a result, helper cooling towers have been installed to reduce the discharge temperatures. Because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions, this is a Category 2 issue for plants with once-through cooling systems [Reference 8, GEIS Section 4.2.2.1.4].

### 4.4.5 Analysis of Environmental Impact

As described in Section 3.1.2, condenser cooling water is withdrawn from two levels of Lake Norman. A lower level intake is located near the base of Cowans Ford Dam, while an upper intake is located in an embayment approximately 800 yards east of Cowans Ford Dam. These intakes are shown on Figures 3.4 and 3.5 of Reference 9. Discharge temperatures are controlled by the selective mixing of lower level and upper level waters in a dispersion box located between the outer trash racks and inner traveling screens, located at the Upper Intake Structure.

On March 28, 1978, the North Carolina Department of Natural Resources and Community Development (NCDNRCD) issued the NPDES Permit No. NC0024392 for

McGuire Nuclear Station. The permit was re-issued on September 1, 1984. A condition of the 1984 permit was for Duke to conduct a 316(a) Demonstration or demonstration of best available technology. Accordingly, Duke conducted a 316(a) Demonstration and submitted the demonstration to the NCDNRCD in June 1985 [Reference 5].

On October 18, 1985, the NCDNRCD acknowledged acceptance of the 316(a) Demonstration for McGuire Nuclear Station [Reference 12]. The NCDNRCD concluded that the effects of discharges from McGuire Nuclear Station were such that the protection and propagation of a balanced, indigenous, aquatic community in Lake Norman was assured and that interaction of the two thermal plumes of McGuire Nuclear Station and Marshall Steam Station did not occur. The NCDNRCD further stated that the demonstration confirmed that McGuire's existing NPDES thermal limits (established March 28, 1978) were sufficient to protect the aquatic environment of Lake Norman, and, as such, were approved.

McGuire currently is operating under thermal limits established in the NPDES permit renewal of February 1, 1990. Under Paragraph A(16) of that permit, annual aquatic environmental monitoring is conducted to assess any impacts of current thermal limits on the aquatic biota of Lake Norman. Results of these monitoring studies are submitted annually to the North Carolina Department and Environment and Natural Resources, formerly NCDNRCD.

### 4.4.6 Conclusion

McGuire has operated both the cooling system and the water intakes in a manner that has resulted in no significant adverse impacts on the aquatic communities of Lake Norman. The impacts from this issue are small. This result is evidenced by the approved Section 316(a) demonstration and by periodic renewal of the NPDES permit. No modification of the condenser cooling system is anticipated during continued operation. Therefore, consideration of mitigation measures to eliminate or reduce the level of adverse impacts is not warranted.

## 4.5 Ground-Water Use Conflicts (Plants Using >100 gpm of Ground-Water)

### 4.5.1 Description of Issue

Ground-water use conflicts (potable and service water, and dewatering: plants that use >100 gpm)

### 4.5.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users. See §51.53(c)(3)(ii)(C).

### 4.5.3 Requirement [§51.53(c)(3)(ii)(C)]

If the applicant's plant uses Ranney wells or pumps more than 100 gallons (total onsite) of ground water per minute, an assessment of the impact of the proposed action on ground-water use must be provided.

### 4.5.4 Background

Those nuclear plants that use groundwater may affect the utility of groundwater to neighbors. This impact could occur as a direct effect of pumping groundwater, thereby either lowering the water table and reducing the availability or inducing infiltration of water of lesser quality into the ground. Neighboring groundwater users could also be affected indirectly if construction or operation of the power plant were to disrupt the normal recharge of the groundwater aquifer. The impact to neighboring groundwater users is likely to be most significant at a site where water resources are limited. Groundwater usage impact may be important at those sites where a power plant's usage rate exceeds 0.0063 $m^3$/s (100 gpm). Lower usage rates are not expected to impact sole source or other aquifers significantly. [Reference 8, GEIS Section 4.8.1].

### 4.5.5 Analysis of Environmental Impact

McGuire uses water from Lake Norman for cooling and service water. Potable water for the plant and support buildings is supplied by the Charlotte-Mecklenburg Utilities Department water supply system. There are six groundwater wells are McGuire supplying certain low-volume uses. Additionally, there is a passive dewatering system for the Reactor Building and Auxiliary Buildings. The following sections describe the groundwater uses at McGuire.

**Groundwater Supply Wells**

There are six groundwater supply wells at the McGuire site. A brief description of these wells and their usage is presented in Table 4-4. As shown in this table, the total maximum groundwater usage from the groundwater supply wells is less than 100 gpm.

**Reactor Building and Auxiliary Building Dewatering System**

In addition to the groundwater supply wells described above, a dewatering system is used to reduce the hydrostatic pressures on the Reactor and Auxiliary Buildings. As described in the McGuire Updated Final Safety Analysis Report (UFSAR) Former Appendix 2B, Figure 2B-2, preconstruction groundwater levels were approximately 10 to 35 feet below plant yard grade. Reactor, Auxiliary and Turbine Building excavations in soil and weathered rock below plant yard grade were dewatered by eductor wellpoints located on the western, northern and eastern perimeter of the excavation. Excavations in rock below plant grade were dewatered by excavated sumps.

A permanent underdrain groundwater system is installed as shown on UFSAR Figure 2-62 and UFSAR Figure 2-63 to maintain the groundwater level below elevation 717.0 feet for the Reactor Building and elevation 712.0 feet for the Auxiliary Building. This system relies on gravity drainage and does not use pumps to maintain the groundwater elevation. The underdrain system consists of a grid of interconnected flow channels at the top of rock or top of fill concrete below the foundation slabs. The grid of flow channels drains the entire foundation of the Reactor Building, and Auxiliary Building complex except for deeper pits, which are designed for hydrostatic loads. Drilled holes through fill concrete into rock, at a maximum spacing of 8 feet on center, permit groundwater to flow from beneath the fill concrete slabs into the flow channels. All channels in the grid system drain by gravity to three sumps located in the Auxiliary Building (Sumps A and B, 10 ft. x 10 ft. x 15 ft. deep, and Sump C, 17 ft. x 17 ft. x 12 ft. deep).

Flow in this system was measured during construction and found to be 3-6 gallons per minute for all three sumps [Reference 13].

**Total Ground-Water Use at McGuire**

As shown in Table 4-4, the total groundwater use at McGuire is 65 to 68 gpm. The total groundwater-pumping rate at McGuire is below 100 gallons per minute.

**Table 4-4 Groundwater Use at McGuire**

| Well Location | Pumping Rate | Description of Use |
|---|---|---|
| Near Building 7405 (Environmental Center) – 1 well | 2 gpm | Supplies water to lab area (fisheries unit) – Well is in constant use. |
| Picnic Area/Security Training Area (South of NC 73) – 1 well | 10 gpm | Supplies water to restrooms. Security uses area during week. Occasional site use of picnic area. |
| Switchyard (South of NC 73) 1 well | 20 gpm | Supplies water to restroom, to water storage tank, and to landfill leachate pump seals on as-needed basis. |
| Lined Landfill Irrigation System 3 wells | 30 gpm | Three wells supply irrigation water to lined landfill. Use is approximately 30 minutes to 60 minutes daily during growing season. |
| **Total Pumping Rate for Groundwater Supply Wells** | **62 gpm** | |
| Total Groundwater Flow for Reactor Building and Auxiliary building Dewatering System | 3-6 gpm | |
| **Total** | **65 to 68 gpm** | |

As shown in the table above, the total maximum groundwater usage from the groundwater wells is 65 to 68 gpm. Note that the pumping rates listed in the table are maximum pumping rates. Since only one of the groundwater supply wells is in constant use, the average annual withdrawal rate would be less than presented in the table above.

### 4.5.6 Conclusion

The total groundwater-pumping rate at McGuire is below 100 gallons per minute. Therefore, this issue is not applicable to McGuire and no analysis of this issue is required.

## 4.6 Ground-Water Use Conflicts (Plants Using Cooling Towers Withdrawing Make-Up Water from a Small River)

### 4.6.1 Description of Issue

Ground-water use conflicts (plants using cooling towers withdrawing make-up water from a small river)

### 4.6.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other ground-water or upstream surface water users come on line before the time of license renewal. See §51.53(c)(3)(ii)(A).

### 4.6.3 Requirement [§51.53(c)(3)(ii)(A)]

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

### 4.6.4 Analysis of Environmental Impact

McGuire does not use cooling towers or cooling ponds. McGuire uses a once-through cooling system, therefore, this issue is not applicable to McGuire and analysis is not required.

### 4.6.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.7 Ground-Water Use Conflicts (Plants Using Ranney Wells)

### 4.7.1 Description of Issue

Ground-water use conflicts (plants using Ranney wells)

### 4.7.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, OR LARGE. Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C).

### 4.7.3 Requirement [§51.53(c)(3)(ii)(C)]

If the applicant's plant uses Ranney wells or pumps more than 100 gallons (total onsite) of ground water per minute, an assessment of the impact of the proposed action on ground-water use must be provided.

### 4.7.4 Analysis of Environmental Impact

McGuire does not use Ranney wells. Therefore, this issue is not applicable to McGuire and analysis is not required.

### 4.7.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.8 Degradation of Ground-Water Quality

### 4.8.1 Description of Issue

Ground-water quality degradation (cooling ponds at inland sites).

### 4.8.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See §51.53(c)(3)(ii)(C).

### 4.8.3 Requirement [§51.53(c)(3)(ii)(C)]

If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on ground-water quality must be provided.

### 4.8.4 Analysis of Environmental Impact

McGuire does not use cooling ponds. McGuire does have a Standby Nuclear Service Water Pond (SNSWP). The purpose of this pond is to provide an ultimate heat sink in the event of a loss of Lake Norman. In this function, the pond would supply cooling and service water to selected plant heat exchangers and other equipment required to bring the plant to a safe condition. The SNSWP has a volume of approximately 610 ac-ft. at a full pond surface area of approximately 34 acres. The pond is isolated from the plant service water during normal plant operations.

Since McGuire does not use cooling ponds, this issue is not applicable to McGuire and no analysis is required.

### 4.8.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.9 Impacts of Refurbishment on Terrestrial Resources

### 4.9.1 Description of Issue

Refurbishment impacts - Terrestrial Resources

### 4.9.2 Findings from Table B-1, Subpart A, Appendix A

SMALL MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See §51.53(c)(3)(ii)(E).

### 4.9.3 Requirement [§51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats.

### 4.9.4 Analysis of Environmental Impact

As noted in Section 3.2, no refurbishment activities have been identified for McGuire. Therefore this issue is not applicable to McGuire and no analysis is required.

### 4.9.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.10 Threatened or Endangered Species

### 4.10.1 Description of Issue

Impacts from refurbishment and continued operations on threatened or endangered species.

### 4.10.2 Findings from Table B-1, Appendix B to Subpart A

Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See §51.53(c)(3)(ii)(E).

### 4.10.3 Requirement [§51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act.

### 4.10.4 Background

It is not possible to reach a conclusion about the significance of potential impacts to threatened and endangered species at this time because (1) the significance of impacts on such species cannot be assessed without site- and project-specific information that will not be available until the time of license renewal and (2) additional species that are threatened with extinction and that may be adversely affected by plant operations may be identified between the present and the time of license renewal. This is a Category 2 issue. [Reference 8, GEIS Section 3.9]

### 4.10.5 Analysis of Impacts of the Proposed Action on Threatened or Endangered Species

A survey was performed on the area within the Exclusion Zone at McGuire and in the transmission line corridors to investigate the presence of threatened or endangered species in these areas. The results of this survey are contained in the report, *Biological Assessment for Endangered, Threatened, and Noteworthy Species, Wetlands, and Significant Natural Area in Association With McGuire Nuclear Station and Related Power Transmission Lines* [Reference 14], included as Attachment D. Fieldwork for this project began in June 2000 and continued into the autumn of 2000. The Exclusion Zone is shown on Figure 2-7. The transmission lines associated with McGuire are shown on Figure 3-2. These transmission lines consist of two 525-kV lines 3300 feet (1 km) long for a total of 6600 feet (2.0 km) and two 230-kV lines 4000 feet (1.2 km) long for a total

of 8000 feet (2.4 km). These lines and their rights-of-way, which are 500 feet (151.5 m) (525-kV) and 200 feet (60.6 m) (230-kV) wide, respectively, extend from the McGuire Nuclear Station reactor buildings to the McGuire Switching Station south of the Exclusion Area.

The findings of an inventory for endangered species, wetlands, and natural areas conducted in the summer and fall of 2000 are summarized below:

1. Six plant communities/habitat types were found within the Exclusion Area. The plant communities of the McGuire site have essentially recovered from construction disturbances. In 1963, 43 percent of the site was forested; presently, about 35 percent of the McGuire site is woodland.

2. Four wetlands composed of marsh and wetland mixed hardwood consisting of 8.6 acres (3.4 ha) now occur in the project area. One significant natural area dominated by middle-aged mixed hardwoods and a diverse understory of rich-site herbaceous species was found within the project area.

3. No federally- or state-listed species or critical habitat for such species was found within the McGuire Site Exclusion Area or along related power transmission rights-of-way.

### 4.10.6 Conclusion

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, there will be no impact to threatened and endangered species from refurbishment activities.

A survey of the plant site and the associated transmission line corridors found that no federal listed threatened and endangered species of plants or animals were found on the site. Therefore, there will be no impact from the continued operation of McGuire to threatened and endangered species.

## 4.11 Air Quality During Refurbishment (non-attainment and maintenance areas)

### 4.11.1 Description of Issue

Air quality during refurbishment (non-attainment and maintenance areas).

### 4.11.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage. See §51.53(c)(3)(ii)(F).

### 4.11.3 Requirement [§51.53(c)(3)(ii)(F)]

If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended.

### 4.11.4 Analysis of Environmental Impact

McGuire is located in Mecklenburg County, which includes the city of Charlotte. The county has been declared as an ozone maintenance area under EPA's reinstated one-hour ozone standard. Based on recent monitoring data, Mecklenburg County will be an ozone nonattainment area if the EPA's 8-hour standard is finalized.

Because of these ozone declarations, any new generation source within the county must meet New Source Review (NSR) standards with regard to pollutant emissions. Additionally, as part of the ozone issue, new North Carolina Clean Air Legislation is also geared towards reduction of mobile source emissions. No ozone causing pollutants are directly associated with the operation of the McGuire Station.

The only potential ozone impacts related to refurbishment would be due to increased vehicle traffic associated with additional plant workers on-site. As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, this issue is not applicable to McGuire and no analysis of the impact of this issue is required.

### 4.11.5 Conclusion

McGuire is located in Mecklenburg County, which includes the city of Charlotte. The county has been declared as an ozone maintenance area under EPA's reinstated one-hour ozone standard. There are no identified major refurbishment activities required for

license renewal at McGuire. Therefore, this issue is not applicable to McGuire and no analysis of the impact of this issue is required.

## 4.12 Impact on Public Health of Microbiological Organisms

### 4.12.1 Description of Issue

Microbiological organisms (public health) (plants using lakes or canals, or cooling towers, or cooling ponds that discharge to a small river).

### 4.12.2 Finding from Table B-1, Appendix B to Subpart A

These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See §51.53(c)(3)(ii)(G).

### 4.12.3 Requirement [§51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than $3.15x10^{12}$ $ft^3$/ year ($9x10^{10}m^3$/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

### 4.12.4 Background

Public health questions require additional consideration for the 25 plants using cooling ponds, lakes, canals, or small rivers because the operation of these plants may significantly enhance the presence of thermophilic organisms. The data for these sites are not now at hand and it is impossible to predict the level of thermophilic organism enhancement at any given site with current knowledge. Thus, the impacts are not known and are site-specific. Therefore, the magnitude of the potential public health impacts associated with thermal enhancement of *N. fowleri* cannot be determined generically. This is a Category 2 issue [Reference 8, GEIS Section 4.3.6].

### 4.12.5 Analysis of Environmental Impact

Lake Norman is a popular site for a variety of water-based recreational activities, including boating, fishing, water skiing, and swimming. All of these activities are dispersed throughout the lake, rather than being concentrated in certain areas. Swimming occurs from private boat docks and piers located around the lake shoreline and from boats anchored offshore.

The Catawba River, which was impounded to form Lake Norman, has an annual average flow rate of 2670 cubic feet per second (cfs) ($8.42 \times 10^{10}$ $ft^3$/yr) [Reference 17]. McGuire Nuclear Station uses Lake Norman as a source for condenser cooling water. The heated effluent from the condenser discharge enters Lake Norman through a discharge canal. This canal is 0.6 mile (1 km) long with an average depth of 40-ft (12.2

m). The heated effluent mixes initially in the canal with surface waters of the main lake before stabilizing vertically and spreading over the lake surface, ultimately dissipating its heat to the atmosphere.

No swimming or boating is allowed in the canal, although fishing is permitted from its banks. Boating, fishing, and water contact activities take place at the confluence of the canal and the lake. The closest privately owned dock is located outside of the 2500 foot exclusion zone and is approximately 495 feet from the confluence of the canal and the lake. See Figure 4-1.

The state agency responsible for public health is the North Carolina Department of Health and Human Services, Division of Public Health. Duke consulted with this agency as to whether there is a concern about the potential existence and concentration of *N. fowleri* in the receiving waters for the plant cooling discharge waters. By letter dated June 12, 2000, the Division of Public Health, summarized the agency's position and opinion regarding the risk to individuals utilizing Lake Norman for recreational activities [References 15 and 16] and concluded that:

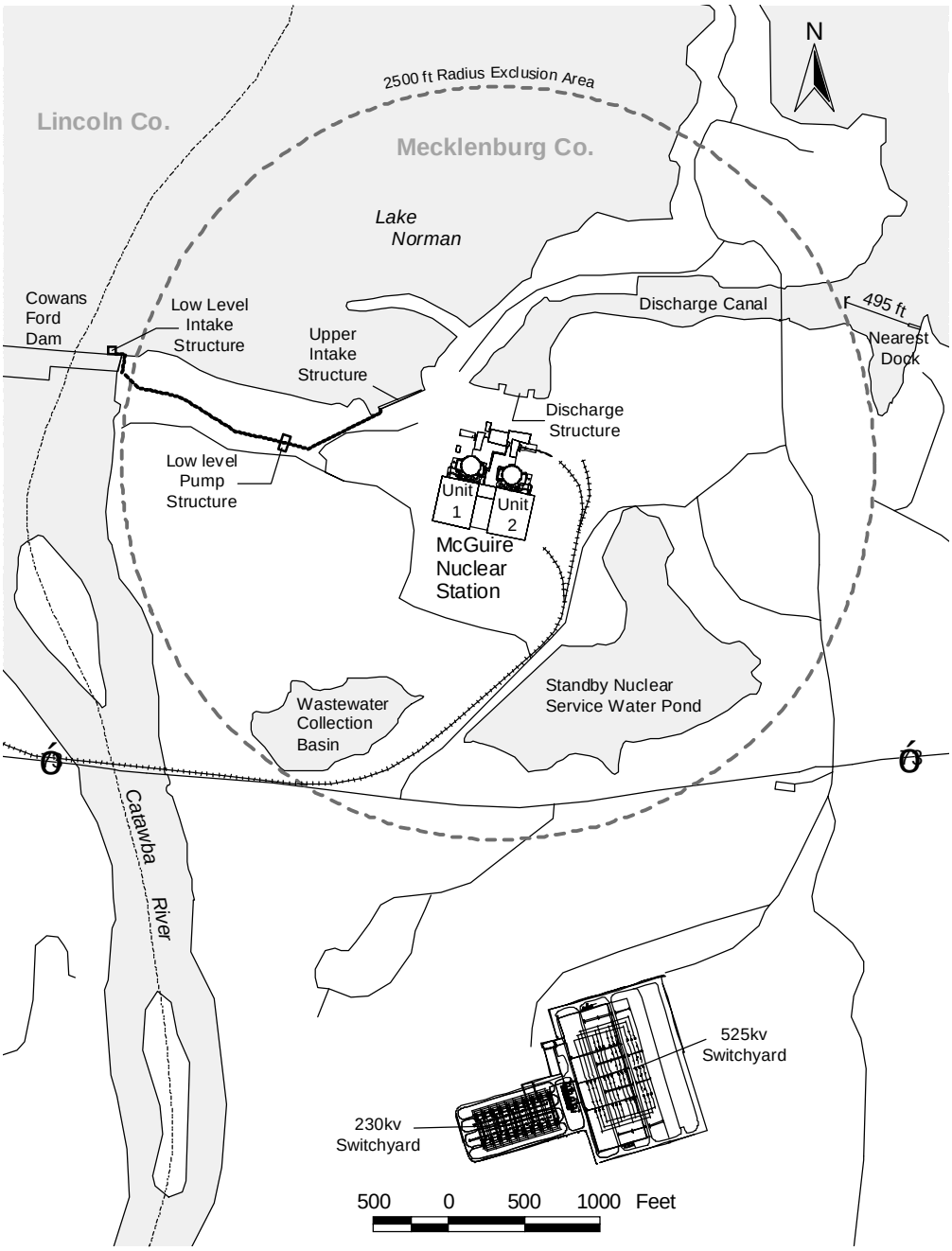
> "Based on discussions with the Centers for Disease Control and Prevention (CDC) that only a small percentage of cases of amebic meningoencephalitis have been associated with thermally enhanced waters, the rarity of the disease given the millions of swimming events in warm fresh water bodies in the United States, the low theoretical risk as shown in the attached report, and the lack of 'action levels', the North Carolina Department of Health and Human Services (NCDHHS) feels the risk to individuals utilizing Lake Norman for recreational activities is extremely low."

From the NCDHHS evaluation, Duke concludes that there has been no known impact of operation of McGuire on public health related to thermophilic microorganisms, and no such impact is likely to occur as a result of license renewal.

### 4.12.6 Conclusion

There has been no known impact of McGuire operation on public health related to thermophilic microorganisms to date. Consistent with the conclusion of the NCDHHS, Duke concludes that the public health impacts from thermophilic organisms is small and no mitigation is warranted.

**Figure 4-1 McGuire Discharge Area**



## 4.13 Electromagnetic Fields –Acute Effects

### 4.13.1 Description of Issue

Electromagnetic fields, acute effects (electric shock)

### 4.13.2 Findings from Table B-1, Subpart A, Appendix A

Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electrical shock potential at the site. See §51.53(c)(3)(ii)(H).

### 4.13.3 Requirements [51.53(c)3)(ii)(G)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code (NESC) for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

### 4.13.4 Background

The transmission line of concern is that between the plant switchyard and the intertie to the transmission system. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received operating licenses with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for reevaluation of this issue.

The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear power plants, is of small significance for transmission lines that are operated in adherence with NESC. Without review of each nuclear plant's transmission line conformance with NESC criteria, it is not possible to determine the significance of the electrical shock potential. This is a Category 2 issue [Reference 8, Sections 4.5.4 and 4.5.4.1].

### 4.13.5 Analysis of Environmental Impact

The transmission lines, which were constructed to connect McGuire with the transmission system, are those lines that run from the plant to the 230 kV and the 525 kV switchyards, located south of highway NC 73. These lines are located on property that is owned and controlled by Duke.

Each nuclear unit at McGuire generates power at 24 kV and supplies power from the generator through isolated phase bus to two generator power circuit breakers which feed two independent half-size unit step-up transformers located in the transformer yard south of the Turbine Building. After a voltage transformation from 24 kV to 230 kV, the power from Unit 1 is transmitted over two separate and independent overhead transmission lines to a common 230 kV Switching Station. Similarly, after a voltage transformation from 24 kV to 525 kV, the power from Unit 2 is transmitted over two separate and independent overhead transmission lines to a common 525 kV switching station.

The 230 kV and 525 kV Switching Stations are located approximately 4000 feet south of the McGuire station, across highway NC 73. These lines and the switchyards are shown on Figure 3-2.

The original design for these lines was to the 1973 National Electric Safety Code (NESC). Comparisons between the calculated 1973 NESC clearances and the present 1997 NESC clearances found that the 1973 NESC vertical clearance requirements were greater than the 1997 NESC vertical clearance requirements. Measured clearances from the sagged plan and profile of each bus line indicate that the designed clearances of these lines exceed the 1997 NESC vertical clearance requirements.

The transmission lines which connect Unit 1 to the 230 kV Switching Station, and which connect Unit 2 to the 525 kV Switching Station meet the clearance requirements of the most recent (1997) Edition of the National Electric Safety Code. There have been no changes to the design voltage of these lines.

Duke has an ongoing program that ensures maintenance and inspections are critical items that are performed at regular intervals. Aerial inspections of the McGuire 230kV and 525kV Bus Lines are completed via helicopter every six months.

The following general maintenance activities are completed on an as-warranted basis for all steel transmission line structures on the Duke system.

1. Only climb if aerial inspection indicates a need.

2. Inspect steel structures for excessive rust, loose bolts, bent or missing parts.

3. Inspect conductors and overhead ground wires for damage or deterioration and proper tension.

4. Check for proper phase-to-ground and phase-to-phase clearance.

5. Inspect clamps, armor rods and spacers for damage.

### 4.13.6 Conclusion

The transmission lines that connect McGuire plant to the Duke transmission system meet the requirements of the most recent (1997) Edition of the NESC. Vertical clearances for these lines meet or exceed the minimum requirements of the NESC. Therefore, pursuant to 10 CFR §51.53(c)(3)(ii)(H), it is not necessary to assess the impact of license renewal on the potential shock hazard from the transmission lines.

## 4.14 Housing Impacts

### 4.14.1 Description of Issue

Housing Impacts

### 4.14.2 Findings from Table B-1, Appendix B to Subpart A

Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See §51.53(c)(3)(ii)(I).

### 4.14.3 Requirement [§51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on housing availability…within the vicinity of the plant must be provided.

### 4.14.4 Housing Availability - Background

The impacts on housing are considered to be of small significance when a small and not easily discernible change in housing availability occurs, generally as a result of a very small demand increase or a very large housing market. Increases in rental rates or housing values in these areas would be expected to equal or slightly exceed the statewide inflation rate. No extraordinary construction or conversion of housing would occur where small impacts are foreseen.

The impacts on housing are considered to be of moderate significance when there is a discernible but short-lived reduction in available housing units because of project-induced in-migration. The impacts on housing are considered to be of large significance when project-related demand for housing units would result in very limited housing availability and would increase rental rates and housing values well above normal inflationary increases in the state.

Moderate and large impacts are possible at sites located in rural and remote areas, at sites located in areas that have experienced extremely slow population growth (and thus slow or no growth in housing), or where growth control measures that limit housing development are in existence or have been recently lifted. Because impact significance depends on local conditions that cannot be predicted at this time, housing is a Category 2 issue [Reference 8, GEIS Section 3.7.2].

### 4.14.5 Analysis of Environmental Impact

McGuire is located in northwestern Mecklenburg County, approximately 17 miles north-northwest of Charlotte, North Carolina [Reference 17]. As described in Section 2.3, McGuire is located in a high population area, the rapidly developing Charlotte metropolitan area. There are no prohibitions on the development of residential housing within Iredell, Mecklenburg, Gaston or Lincoln counties.

*Supplement 1 to Regulatory Guide 4.2,* provides the following guidance:

> Section 4.14.1 states that: "If there will be no refurbishment or if refurbishment involves no additional workers then there will be no impact on housing and no further analysis is required."
>
> Section 4.14.2 states that: "If additional workers are not anticipated there will be no impact on housing and no further analysis is required."

The McGuire site has approximately 1345 full time workers employed by Duke or site contractors during normal plant operations. As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Additionally, Duke does not anticipate that additional full time workers will be employed during the license renewal period. Therefore, no analysis is required for this issue.

### 4.14.6 Conclusion

Duke concludes that the impact on housing from the continued operation of McGuire will be small and that no mitigation is required. This conclusion is based on the following:

1. Duke does not anticipate an increase in employment during the license renewal period.
2. As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, there will not be an increase in outage workers over the number of workers required for plant outages. Likewise, there will not be an increase in the length of the typical plant outage.
3. The number of McGuire employees will continue to be a small percentage of the population in the adjacent counties during the period of the extended license.

## 4.15 Public Utilities: Public Water Supply Availability

### 4.15.1 Description of Issue

Public Services (public utilities)

### 4.15.2 Findings from Table B-1, Appendix B to Subpart A

An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See §51.53(c)(3)(ii)(I).

### 4.15.3 Requirement [§51.53(c)(3)(ii)(I)]

… [T]he applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

### 4.15.4 Public Water Supply - Background

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

In general, small to moderate impacts to public utilities were observed as a result of the original construction of the case study plants. While most locales experienced an increase in the level of demand for services, they were able to accommodate this demand without significant disruption. Water service seems to have been the most affected public utility.

Public utility impacts at the case study sites during refurbishment are projected to range from small to moderate. The potentially small to moderate impact at Diablo Canyon is related to water availability (not processing capacity) and would occur only if a water shortage occurs at refurbishment time.

Because the case studies indicate that some public utilities may be overtaxed during peak periods, the impacts to public utilities would be moderate in some cases, although most sites would experience only small impacts. This is a Category 2 issue. [Reference 8, GEIS Section 3.7.4.5]

### 4.15.5 Analysis of Impact of the Proposed Action on Public Water Supply

McGuire uses drinking water and sanitary sewer services provided by Charlotte-Mecklenburg Utility Department (CMUD). CMUD uses Lake Norman as a source of

water. The total water usage at McGuire from CMUD in 2000 was 18,869,048 gallons. Based on this figure, the average daily water use by McGuire of CMUD supplied water was 0.052 million gallons per day (mgd). Charlotte-Mecklenburg Utility Department estimates that the average annual system demand will be 163 mgd through the year 2030.

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, there will be no impact to public utilities from refurbishment activities.

There are no identified increases in demand of the water supplied by CMUD during the period of extended operation at McGuire. The current water use at McGuire, from water supplied by CMUD, is 0.03% of the average daily demand on the CMUD system.

Duke does not anticipate that additional workers will be employed during the period of extended operations. Therefore, there will be no impact to public utilities from additional plant workers.

### 4.15.6 Conclusion

License renewal operations will not cause any appreciable increased demand on the public water supply system. As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. There are no identified increases in demands on water supplied to McGuire by CMUD during the period of extended operation. Duke does not anticipate that additional workers will be employed during the period of extended operations. Therefore, impacts to public water supplies will continue to be small and no evaluation of mitigation measures is warranted.

## 4.16 Education Impacts from Refurbishment

### 4.16.1 Description of Issue

Public Services (effects of refurbishment activities upon local educational system)

### 4.16.2 Findings from Table B-1, Appendix B to Subpart A

Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See §51.53(c)(3)(ii)(I).

### 4.16.3 Requirement [§51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on … public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided.

### 4.16.4 Analysis of Environmental Impact

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore this issue is not applicable to McGuire and no analysis is required.

### 4.16.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.17 Offsite Land Use (Refurbishment)

### 4.17.1 Description of Issue

Off-site Land Use (effects of refurbishment activities)

### 4.17.2 Findings from Table B-1, Appendix B to Subpart A

Impacts may be of moderate significance at plants in low population areas. See §51.53(c)(3)(ii)(I).

### 4.17.3 Requirement [§51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on … land-use… within the vicinity of the plant must be provided.

### 4.17.4 Analysis of Environmental Impact

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, there will be no impacts from refurbishment activities and no analysis is required.

### 4.17.5 Conclusion

This issue is not applicable to McGuire and analysis is not required.

## 4.18 Offsite Land Use (License Renewal)

### 4.18.1 Description of Issue

Off-site Land Use (effects of license renewal)

### 4.18.2 Findings from Table B-1, Appendix B to Subpart A

Significant changes in land-use may be associated with population and tax revenue changes resulting from license renewal. See §51.53(c)(3)(ii)(I).[6]

### 4.18.3 Requirement [§51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on … land-use… within the vicinity of the plant must be provided.

### 4.18.4 Background

During the license renewal term, new land-use impacts could result from plant-related population growth or from the use of tax payments from the plant by local government to provide public services that encourage development.

However, as noted in Reference 1, Section 4.17.2, Table B-1 of 10 CFR Part 51 partially misstates the conclusion reached in Section 4.7.4.2 of NUREG-1437. NUREG-1437, Section 4.7.4.2 concludes that "population-driven landuse changes during the license renewal term at all nuclear plants will be small." Reference 1 further states that "Until Table B-1 is changed, applicants only need cite NUREG-1437 to address population-induced land-use change during the license renewal term." Therefore, the discussion will be limited to the land-use changes that may result from tax payments made by the plant to local governments.

The assessment of new tax-driven land-use impacts in the GEIS considered the following:

(1) the size of the plant's tax payments relative to the community's total revenues,
(2) the nature of the community's existing land-use pattern, and
(3) the extent to which the community already has public services in place to support and guide development.

In general, if the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license

6 As noted in Reference 1, Table B-1 of 10 CFR Part 51 partially misstates the conclusion reached in Section 4.7.4 of NUREG-1437. Section 4.4 concludes that "population-driven landuse changes during the license renewal term at all nuclear plants will be small."

renewal term would be small, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be moderate. This is most likely to be true where the community has no pre-established patterns of development (i.e., land use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be large. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past.

Based on predictions for the case study plants, it is projected that all new population-driven land-use changes during the license renewal term at all nuclear plants will be small because population growth caused by license renewal will represent a much smaller percentage of the local area's total population than has operations-related growth. Also, any conflicts between offsite land use and nuclear plant operations are expected to be small. In contrast, it is projected that new *tax-driven* land-use changes may be moderate at a number of sites and large at some others. Because land use changes may be perceived by some community members as adverse and by others as beneficial, the staff is unable to assess generically the potential significance of site-specific off-site land use impacts. This is a Category 2 issue [GEIS Section 4.7.4.2].

### 4.18.5 Analysis of Environmental Impact

The environmental impacts from this issue are from population-driven land use changes and from tax-driven land use changes.

**Population-Driven Land Use Changes**

Duke agrees with the GEIS Conclusion that new population-driven land use changes at McGuire during the license renewal term will be small. Duke does not anticipate that additional workers will be employed at McGuire during the period of extended operations. Therefore, there will be no adverse impact to the offsite land use from plant-related population growth.

**Tax-Driven Land Use Changes**

In 1998, McGuire Nuclear Station paid property taxes in the amount of $8,100,866. These taxes were paid to Mecklenburg County. For fiscal year 1998-1999, the general property tax revenues (current and prior taxes) for Mecklenburg County were $385,673,079 [Reference 18]. The total revenues for Mecklenburg County for fiscal year 1998-1999 were $760,190,762. The property taxes paid by McGuire represented 2.1% of

the property tax revenues, and 1.1% of the total revenues collected by Mecklenburg County for the period.

McGuire currently pays $333,333 a year to the Town of Huntersville, a part of an agreement for payments in lieu of annexation of the McGuire site by the Town of Huntersville. The payments will be made on an annual basis until the year 2027, when the agreement expires. The total revenues received in 1999 by the Town of Huntersville were $9,462,699, of which $4,832,573 were revenues from property taxes [Reference 19]. The payments made by McGuire represented 6.9% of the property tax revenues and 3.5% of the total revenues collected by the Town of Huntersville.

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, it is reasonable to assume that there will be no significant change in assessed value of McGuire during the period of license renewal. The relative importance of tax payments to Mecklenburg County would be unchanged during the period of license renewal.

GEIS Section 4.7.2 describes the importance of nuclear plant tax payments as a source of local government revenue. The levels of significance of these tax payments during the license renewal term are defined in GEIS 4.7.2.1. This section states that the significance level is considered small if new tax payments are less than 10 percent of the taxing jurisdiction's revenue.

The impacts from tax driven off-site land use changes will be small for the following reasons:

- The significance of tax payments made by McGuire to local governments will be continue to be small.
- The area around McGuire has pre-established land patterns of development, such as land use plans and controls. McGuire is located within the Town of Huntersville's planning zone.
- The area around McGuire has public services in place to support and guide development.

Therefore, the impact to tax-driven land use changes from the continued payment of property taxes at McGuire is small and no mitigation is required.

### 4.18.6 Conclusion

Duke agrees with the GEIS Conclusion that new population-driven land use changes at McGuire during the license renewal term will be small. Duke does not anticipate that

additional workers will be employed at McGuire during the period of extended operations. Therefore, there will be no adverse impact to the offsite land use from additional plant workers.

The impact to tax-driven land use changes from the continued payment of property taxes at McGuire is small and no mitigation is required

## 4.19 Transportation

### 4.19.1 Description of Issue

Public services, Transportation

### 4.19.2 Finding from Table B-1, Appendix B to Subpart A

SMALL, MODERATE, OR LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J).

### 4.19.3 Requirement [§51.53(c)(3)(ii)(J)]

All applicants shall assess the impact of the proposed project on local transportation during periods of license renewal refurbishment activities and during the term of the renewed license.

### 4.19.4 Background

Impacts to transportation during the license renewal term would be similar to those experienced during current operations and would be driven mainly by the workers involved in current plant operations [Reference 8, GEIS Section 4.7.3.2].

Based on past and projected impacts at the case study sites, transportation impacts would continue to be of small significance at all sites during operations and would be of small or moderate significance during scheduled refueling and maintenance outages. Because impacts are determined primarily by road conditions existing at the time of the project and cannot be easily forecast, a site specific review will be necessary to determine whether impacts are likely to be small or moderate and whether mitigation measures may be warranted. This is a Category 2 issue [Reference 8, GEIS Section 4.7.3.2].

### 4.19.5 Analysis of Environmental Impact

There currently are approximately 1345 workers employed at the McGuire site during normal plant operations (non-outage periods). The workers employed at McGuire primarily reside in Mecklenburg County and in adjoining counties.

There is an average of 1015 additional workers on site during plant outage periods. The plant outages last from 30 to 40 days and occur about every 18 to 24 months.

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Additionally, there are no identified increases in the total number of employees that will be on site during the term of the renewed license.

As shown in Table 3-1, the workers employed at McGuire reside in locations that are well distributed geographically. Therefore, with the exception of travel along NC73, the workers would travel to the plant along many different routes.

The North Carolina Department of Transportation (NCDOT), Statewide Planning Branch was contacted on this issue and asked to supply information on traffic counts near McGuire [Reference 20]. The NCDOT provided Average Annual Daily Traffic (AADT) count data and Level of Service (LOS) designations for the requested locations [Reference 21]. The AADT's and Level of Service (LOS) designation for roads in the vicinity of McGuire is shown on Figure 4-2.

As shown on Figure 4-2, the largest AADT's are south on NC16 to NC73, and then along NC 73 to SR2145. NC 16 is a major corridor for traffic to and from the Charlotte area. The portion of NC 73 between NC 16 and SR 2145 is a major corridor of travel to Interstate I-77.

Continued growth in population will likely occur in the areas adjacent to McGuire through the period of the extended license. This growth will necessitate increases in traffic capacity to accommodate the growth. Traffic planning for the region is conducted by the Mecklenburg-Union Metropolitan Planning Organization (MUMPO). The MUMPO maintains a 20 year planning horizon for transportation improvements in the region [Reference 22]. The most recent plan extends to the year 2020. This plan does not include improvements to the roads system near McGuire. The plan is reviewed and revised on a five year cycle.

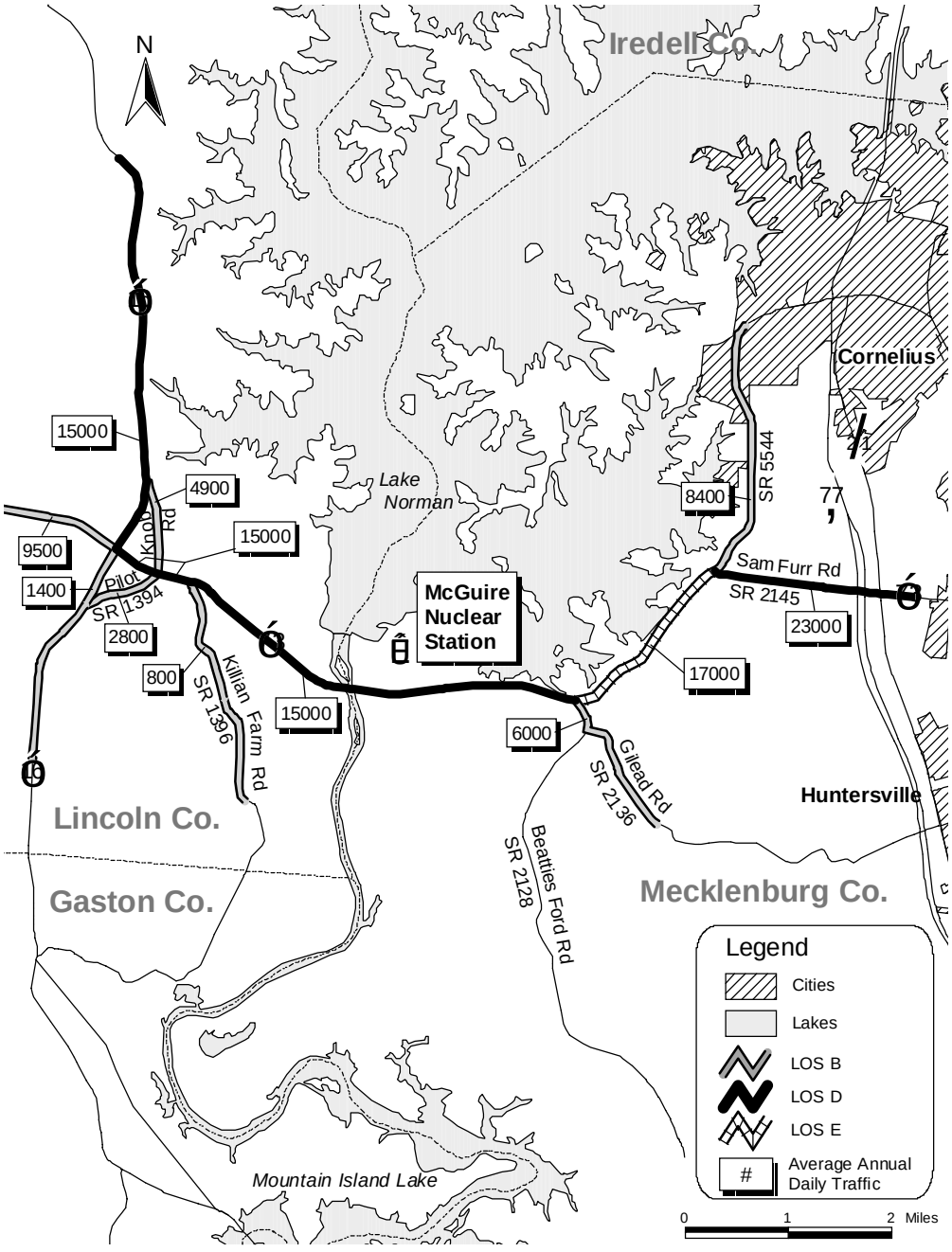
The McGuire site has taken the following steps to minimize the impacts to local traffic:

- The starting times for workers at the station has been staggered in order to minimize the impact of plant workers entering and leaving the site.
- Workers leaving the site and traveling east on NC 73 are requested to use the east entrance and those workers traveling west on NC 73 are requested to use the west entrance.
- Turn lanes have been added on NC 73 for plant traffic. Traveling east to west on NC 73, there are right turn lanes into the plant site at both entrances. Traveling west to east on NC 73 there is a left turn lane at the east plant entrance.

### 4.19.6 Conclusion

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Additionally, there are no identified increases in the total number of employees that will be on site during the term of the renewed license. Increases in traffic capacity will be required to accommodate the projected growth in the population in the areas adjacent to McGuire. The growth in population in the area near McGuire will not be attributed to increases in employment at McGuire, therefore, the impact of continued operation of McGuire on any future degradation in traffic service will be small and no mitigation measures are warranted.

**Figure 4-2 AADT's and LOS for Roads in Vicinity of McGuire**



## 4.20 Historic and Archaeological Properties

### 4.20.1 Description of Issue

Historic and Archaeological Resources

### 4.20.2 Finding from Table B-1, Appendix B to Subpart A

Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See §51.53(c)(3)(ii)(K).

### 4.20.3 Requirement [§51.53(c)(3)(ii)(K)]

All applicants shall assess whether any historic or archaeological properties will be affected by the proposed project.

### 4.20.4 Background

It is unlikely that moderate or large impacts to historic resources occur at any site unless new facilities or service roads are constructed or new transmission lines are established. However, the identification of historic resources and determination of possible impact to them must be done on a site-specific basis through consultation with the State Historical Preservation Office. The site-specific nature of historic resources and the mandatory National Historic Preservation Act consultation process mean that the significance of impacts to historic resources and the appropriate mitigation measures to address those impacts cannot be determined generically. This is a Category 2 issue [Reference 8, GEIS Section 3.7.7].

### 4.20.5 Analysis of Environmental Impact

Duke consulted with the North Carolina State Historic Preservation Office (SHPO) on this issue [Reference 23]. The SHPO responded that continued operation of the facility is not an undertaking likely to affect historic properties and that no further activity is required in order to comply with Section 106 of the National Historic Preservation Act [Reference 24].

No refurbishment activities have been identified as being necessary to support continued operation of McGuire beyond the end of the existing operating licenses. Therefore, there will be no impact on historic or archeological properties from refurbishment activities.

To ensure protection for archeological and cultural resources that may be encountered during land disturbing activities on site, the McGuire Nuclear Site Environmental Work

Practices (EWP Section # 3.1 LAND DISTURBING ACTIVITY) include the following requirement:

> If any archeological sites are identified during construction or other land disturbing activities, all disruptive activity in the site area shall be halted. The group performing the land disturbing activity shall contact EM (Site Environmental Management). EM will consult with Group EH&S and the State Historic Preservation Office to determine the appropriate steps to be taken prior to resuming the disturbance activity.

### 4.20.6 Conclusion

As noted in Section 3.2.1, there are no major refurbishment activities required for license renewal at McGuire. Therefore, there will be no impact on historic or archeological properties from refurbishment activities

The impact of continued operation of McGuire during the period of the renewed license on historic or archeological properties will be small and evaluation of mitigation measures is not warranted.

## 4.21 Severe Accident Mitigation Alternatives

### 4.21.1 Description of Issue

Severe accidents

### 4.21.2 Finding from Table B-1, Appendix B to Subpart A

SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See §51.53(c)(3)(ii)(L).

### 4.21.3 Requirement [§51.53(c)(3)(ii)(L)]

If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.

### 4.21.4 Background

The staff concluded that the generic analysis summarized in the GEIS applies to all plants and that the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts of severe accidents are of small significance for all plants. However, not all plants have performed a site-specific analysis of measures that could mitigate severe accidents. Consequently, severe accidents are a Category 2 issue for plants that have not performed a site-specific consideration of severe accident mitigation and submitted that analysis for Commission review. [Reference8, GEIS Section 5.5.2.5]

### 4.21.5 Analysis

Duke has performed a number of severe accident studies on McGuire and has implemented several plant enhancements to reduce the risk of severe accidents since the early 1980's [Reference 25]. Attachment K provides a report that summarizes the evaluation of severe accident mitigation alternatives for McGuire.

The results of the McGuire-specific analyses for severe accidents show that the total core damage frequency is estimated at 4.9E-05 per year (internal and external events) and the risk is estimated at 13.5 person-rem per year. This analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvements) in excess of $2,200 to $275,000 are not cost justified based on the total averted risk. Although risk assessment studies are subject to varying degrees of uncertainty in the

estimated core damage frequency, person-rem risk, and in the cost to implement alternatives, the results of Duke's analysis show that the cost of implementing any of the alternatives is as much as several orders of magnitude higher than the estimated total averted risk values. Therefore, no additional severe accident mitigation alternatives are cost-beneficial even when the uncertainties in the risk assessment process are considered.

### 4.21.6 Conclusion

For the current residual severe accident risk, a SAMA analysis has been performed using probabilistic risk assessments (PRA) techniques and making use of industry studies and NRC reports providing guidance on performing the cost-benefit analysis.

The environmental impacts of potential severe accidents are of small significance and additional measures to reduce such impacts would not be justified from a total averted risk perspective. Duke concludes that no additional severe accident mitigation alternative measures beyond those already implemented during the current license term are warranted for McGuire.

## 4.22 Environmental Justice

### 4.22.1 Description of Issue

Environmental Justice

### 4.22.2 Finding from Table B-1, Appendix B to Subpart A

"The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews."

### 4.22.3 Requirement

Other than the above referenced Finding, there is no requirement concerning environmental justice in 10 CFR Part 51.

### 4.22.4 Background

The following background information is from Reference 1.

> *Environmental justice was not reviewed in NUREG-1437. Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," issued on February 11, 1994, is designed to focus the attention of Federal agencies on the human health and environmental conditions in minority and low-income communities.*[7] *The NRC Office of Nuclear Reactor Regulation (NRR) is guided in its consideration of environmental justice by Attachment 4, "NRR Procedures for Environmental Justice Reviews," to NRR Office Letter No. 906, Revision 2, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues," September 21, 1999. NRR Office Letter No. 906 is revised periodically. The environmental justice review involves identifying off-site environmental impacts, their geographic locations, minority and low-income populations that may be affected, the significance of such effects and whether they are disproportionately high and adverse compared to the population at large within the geographic area, and if so, what mitigative measures are available, and which will be implemented. The NRC staff will perform the environmental justice review to determine whether there will be disproportionately high human heath and environmental effects on minority and low-income populations and report*

7 Minority categories are defined as Black/African American; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; other non-white; and Hispanic origin. Low-income is defined as being below the poverty level as defined by the Bureau of the Census.

*the review in its SEIS. The staff's review will be based on information provided in the ER and developed during the staff's site-specific scoping process.*

The NRC's Office of Nuclear Reactor Regulation (NRR) Office Letter No. 906, Revision 2 [Reference 26] contains a procedure for incorporating environmental justice into the licensing process. Duke used this process in conducting the review and analysis of this issue.

## 4.22.5 Analysis

### 4.22.5.1 Environmental Impacts from the Proposed Action

As noted above, the consideration of environmental justice is required to assure that federal programs and activities will not have "disproportionately high and adverse human health or environmental effects…on minority populations and low income populations…" Duke's analyses of the Category 2 issues defined in §51.53(c)(3)(ii) determined that there were no adverse impacts from the renewal of the McGuire license. Based on the review of these issues, no review for environmental justice is necessary. However, the following information is presented to assist the NRC review of this issue.

### 4.22.5.2 Description of Process Used in Duke Review - NRC Interim NRR Procedure for Environmental Justice Reviews

The NRR Office Letter No. 906, Revision 2, was developed to provide guidance to the NRC Office of Nuclear Reactor Regulation staff on conducting environmental justice reviews. The criteria in this reference were used to determine if there was a sufficiently large enough minority or low-income population in the area adjacent to McGuire to warrant an environmental justice review. This reference requires the staff to:

1. **Identify the environmental impact site(s)** - The NRR Procedure requires that the Staff, using input from the public scoping process and the evaluation of environmental impacts for the EIS, will determine the location of "environmental impact sites for all adverse human health or environmental impacts which are known to be significant or perceived as significant by groups and/or individuals." (Procedure, Section 3, page 4) The size of the impact sites will vary depending upon the nature of the impacts, and "should be consistent with the areas used to review environmental impacts in the EIS."
2. **Determine the geographic area to be used for the comparative analysis** - The geographic area is a larger area that encompasses all the environmental impact sites (for example, a county or group of counties).
3. **Determine the minority and low-income compositions within a geographic area** - The minority categories are defined as Black; American Indian, Eskimo, or Aleut; Asian

or Pacific Islander; other non-white; and Hispanic origin.[8] The low income composition is determined by using the percentage of households within the geographic area that are below the poverty level. For performing environmental justice reviews, low-income is defined as being below the poverty level as defined by the Census Bureau.

4. **Compare these values to minority and low-income population composition within the environmental impact site(s) –** The NRR Procedure requires the determination of the minority and low-income population in the geographic area using the most recent decennial census. An environmental justice review must be performed if either (a) or (b) is met:

(a) A minority population exists in an environmental impact site if (1) the percentage of minority of the total population within the environmental impact site exceeds the percentage of minority of the total population within the geographic area by 20 percentage points or more, or (2) if the percentage of minority of the total population within the environmental impact site is at least 50 percent.

(b) A low-income population is considered to be present if the percentage of households below the poverty level in an environmental impact site exceeds the percentage of households below the poverty level for the geographic area by 20 percentage points or more.

#### 4.22.5.3 Environmental Impact Site

Using the guidance in the NRR procedure, Duke has determined that no "environmental impact site" exists at or around McGuire Nuclear Station. Note that under the NRR Procedure, such impact sites must be designated for all adverse human or environmental impacts arising from the proposed action (here, license renewal) which are known to be significant. As illustrated by the results of Duke's review of the Category 2 issues defined in 10 CFR § 51.53(c)(3)(ii), there are no significant adverse human or environmental impacts arising from the renewal of McGuire's operating licenses.

Accordingly, no environmental impact sites need to designated for the purposes of an environmental justice review at McGuire.

However, to assist the NRC Staff in its review of this issue, Duke has provided a review of the minority and low-income populations within a 50-mile (80 km) radius of McGuire. This area was selected to be consistent with the NRR Procedure. There are 1602 block groups either partially or completely within the 50 mile radius (80 km) of McGuire.

8 Note that the values for the Hispanic populations may also be included in the values for the white, black, or minority populations. Therefore, total minorities include white Hispanics, black, and other minority populations.

#### 4.22.5.4 CENSUS INFORMATION

Data from the 2000 decennial census is available to the block group level for minority populations; the 1990 decennial census is the most recent source for income data at the block group (or even tract) level. Population and income information from the 1990 and 2000 census for block groups located in or partially in a 50 mile radius from McGuire were obtained from the US Census Bureau. There were 2,465 block groups within a 50-mile radius of McGuire in the 2000 census; there were 1,602 block groups within a 50-mile radius of McGuire in the 1990 census. The ARCVIEW Geographic Information System (GIS) was used to determine the census block groups located within the 50 mile (80 km) radius from McGuire, and to extract the minority and low-income population data from data files containing US Census Bureau data. The information for these block groups was then reviewed with respect to the NRR criteria for minority and low-income populations. Income data from the 2000 decennial census are scheduled to be released beginning June of 2002.

#### 4.22.5.5 MINORITY POPULATION REVIEW

Minorities consist of American Indian or Alaskan Native, Asian or Pacific Islander, Black, Other, and White Hispanics. 24.5% of the population within a 50 mile radius (80 km) of McGuire are minorities. As outlined in the NRR Procedure, minority populations exist when a block group is comprised of 20 percentage points more minorities than in the geographic area or more than 50% of the population consists of minorities.

Within the 50 mile radius, there are 284 block groups with minority populations that meet the definition outlined in the NRR Procedure. This represents 11.5% of the total number of block groups within the 50 mile radius. These populations are depicted in Figure 4-3. The majority of these block groups are located in urban areas associated with Charlotte, Gastonia, Statesville and Salisbury, North Carolina and Rock Hill, South Carolina.

There are no known environmental pathways by which these minority populations would be disproportionately and adversely affected by the renewal of the McGuire license.

#### 4.22.5.6 LOW INCOME POPULATION REVIEW

Low income households comprise 11% of all households located within a 50 mile radius (80 km) of McGuire. As outlined in the NRR Procedure, low income populations exist when the percentage of low income households within a block group is greater than 50% or is 20 percentage points greater than the 50 mile average.

Within the 50 mile radius, there are 88 low income block groups. This represents 5.5% of the total number of block groups within the 50 mile radius. These populations are depicted in Figure 4-4. The majority of these block groups are located in the urban areas of Charlotte and Gastonia, North Carolina and Gaffney, South Carolina.

There are no known environmental pathways by which these low income populations would be disproportionately and adversely affected by the renewal of the McGuire license.

### 4.22.6 Conclusion

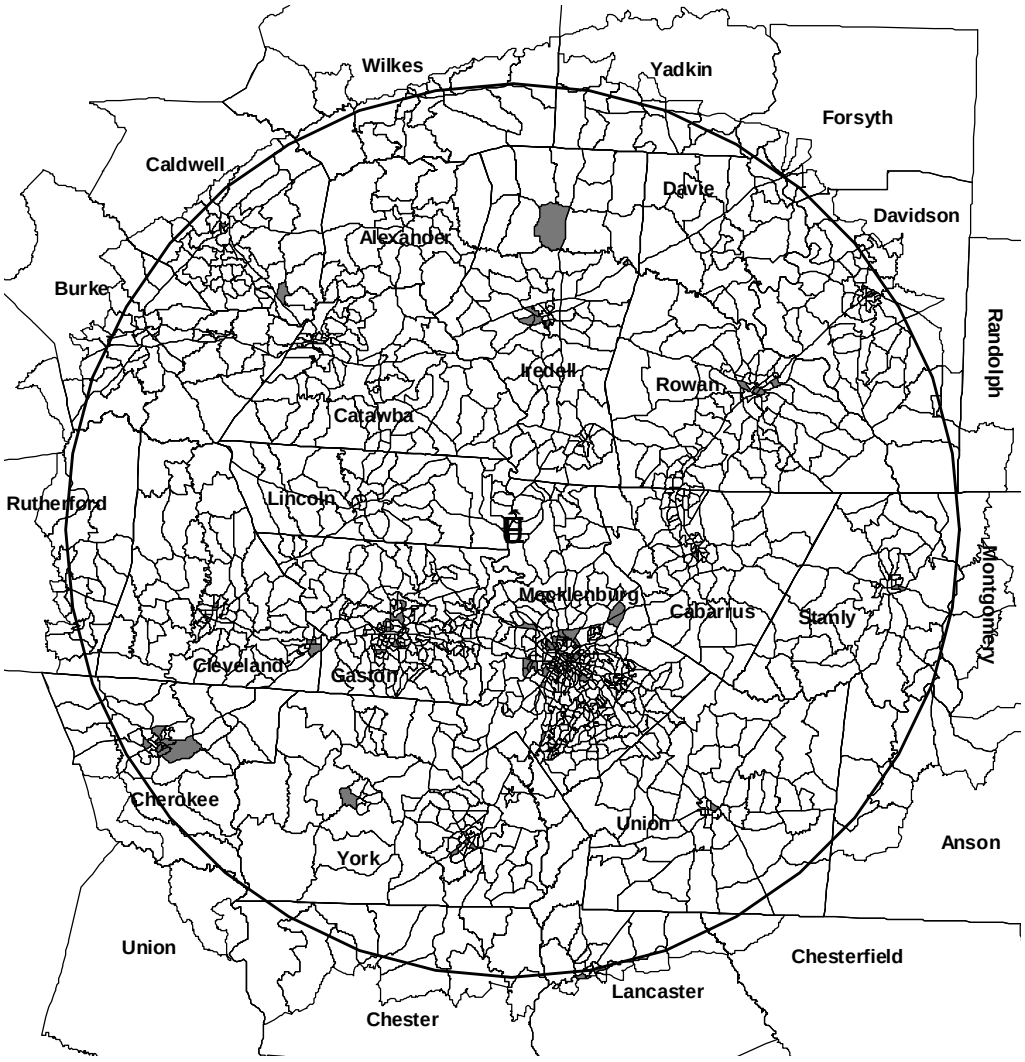
As part of its environmental assessment of this proposed action, Duke has determined that no significant off-site environmental impacts will be created by the renewal of the McGuire licenses. This conclusion is supported by the review performed of the Category 2 issues defined in §51.53(c)(3)(ii) presented in this ER.

As the NRR Procedure recognizes, if no significant off-site impacts occur in connection with the proposed action, then no member of the public will be substantially affected. Therefore, there can be no disproportionately high and/or adverse impacts or effects on any member of the public, including minority and low-income populations, resulting from the renewal of the McGuire licenses.

**Figure 4-3 Minority Population Review – 50 Mile Radius**

**Figure 4-4 Low Income Population Review**

**50-Mile Radius from McGuire**




★ McGuire Nuclear Station

Block groups meeting NRR criteria for Low Income population

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# 5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

## 5.1 Requirement [§51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

## 5.2 Definition of New and Significant

No definition of new and significant is provided in 10 CFR Part 51 or in the GEIS. Supplement 1 to Regulatory Guide 4.2 [Reference 1] does contain a definition of "new and significant." The description of "new and significant" is taken from Reference 1.

> **New and Significant Information**
> According to 10 CFR 51.53(c)(3)(iv), the environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware. An assessment of the significance of the new information should be provided in the ER. New and significant information is (1) information that identifies a significant environmental issue not covered in NUREG-1437 and codified in Appendix B to Subpart A of 10 CFR Part 51 or (2) information that was not considered in the analyses summarized in NUREG-1437 and which leads to an impact finding different from that codified in 10 CFR Part 51. The intent of 10 CFR 51.53(c)(3)(iv) is that an applicant need not present an analysis of Category 1 issues in the ER if it is unaware of new and significant information; however, the staff expects that the applicant will have a process in place that would result in the identification of new and significant information that exists concerning Category 1 issues and issues not listed in Appendix B to Subpart A of 10 CFR Part 51. This process should be briefly described. The process might include a systematic consideration of the Category 1 issues in view of ongoing monitoring programs, special studies and surveys, compliance with Federal, State, and local environmental regulations and programs, and consultations with Federal, State, and local environmental, natural resource, and land use agencies. An applicant who is not aware of new and significant information should state so in the ER [Reference 1].

In discussing the process that an applicant uses to become aware of new and significant information, Supplement 1 to Regulatory Guide 4.2 suggests:

> The process might include a systematic consideration of the Category 1 issues in view of ongoing monitoring programs, special studies and surveys, compliance with Federal, State, and local environmental

regulations and programs, and consultations with Federal, State, and local environmental, natural resource, and land use agencies.

Duke used this guidance in developing the process that was used to identify new and significant information.

## 5.3 Scope of Review

The scope of the review for new and significant information is:

1. A review of the environmental issues associated with the continued operation of McGuire, as currently licensed, during the period of the extended license. Environmental issues that arise from changes in the operations that change the current license would be evaluated as a part of the applicable license amendment application.
2. A review of environmental issues associated with continued operation of both the McGuire and Catawba nuclear stations, where a cumulative impact[9] might exist from the operation of both of these stations.

Environmental issues that are related to the operation of Cowans Ford Hydro Station or that are associated with the Catawba-Wateree FERC Project (Project 2232) are not considered in this evaluation.

## 5.4 Description of Review Process

Duke developed the process described below in order to ensure that issues related to the environmental impacts of license renewal for McGuire were properly reviewed prior to submittal of the Environmental Report and to ensure that new and significant information related to renewal of the McGuire licenses will be identified, reviewed, and addressed during the period of NRC review.

The following steps were used in this review process.

- **Review of the Table B-1 Issues** - These environmental issues were evaluated by knowledgeable personnel to verify that the GEIS conclusion was valid for impacts from these issues related to license renewal at McGuire and to determine if further review of these issues was needed. Further review would be required if the GEIS conclusion were found not to be valid for McGuire or if new and significant information were determined to exist for the issue.

9 Cumulative impacts are discussed further in Section 6.1.

- **Review of Compliance of Federal, State, and local environmental regulations and programs** - A review of compliance with applicable regulations was performed to ensure that McGuire is in compliance with these regulations.

- **Review of Existing and Special Monitoring Results**

Reports relevant to environmental monitoring near McGuire were reviewed to determine if there were issues, other than those identified in the GEIS, that need further evaluation. The reports reviewed were:

  - *Lake Norman: 1999 Summary Maintenance Monitoring Program, McGuire Nuclear Station: NPDES No. NC0024392*, Duke Power, December 1999 [Reference 11].
  - *McGuire Nuclear Station Units 1 and 2 Annual Radiological Environmental Operating Report 1999* [Reference 27].
  - *Catawba River Basinwide Water Quality Plan, NCDENR, Division of Water Quality, Water Quality Section, December 1999* [Reference 28].

- **Consultations with Federal, State, and local environmental, natural resource, and agencies** - Meetings and discussions with the federal, state, and county agencies listed below were conducted to determine if there are new and significant issues or information related to license renewal at McGuire. Duke provided copies of the GEIS and a description of the license renewal process to local, state and federal agencies. These agencies were requested to identify issues other than those listed in Table B-1 that should be addressed in the license renewal process. The agencies contacted were:
  - Mecklenburg County Department of Environmental Protection
  - North Carolina Department of Environment and Natural Resources, Division of Radiation Protection
  - North Carolina Department of Environment and Natural Resources ,Division of Water Quality
  - Natural Heritage Program, North Carolina Division of Parks and Recreation
  - North Carolina Wildlife Resources Commission
  - United States Fish and Wildlife Service

At the time of preparation of this report, only one agency has responded that they are aware of no "new and significant" information concerning environmental issues related to license renewal. The North Carolina Wildlife Resources Commission (NCWRC) notified Duke that the NCWRC was not aware of any "new and significant information" [Reference 29].

- **Review of Supplemental Environmental Impact Statement's (SEIS's) for other License Renewal Applications –** Draft and Final SEIS's for other license renewal applications were reviewed to determine if there were new issues identified for those plants that may be applicable to McGuire. The documents included in this review were:
    - *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 1 Regarding the Calvert Cliffs Nuclear Power Plant, Final Report October 1999.* [Reference 30]
    - *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 2 Regarding the Oconee Nuclear Station, Final Report, December 1999.* [Reference 31]
    - *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 3 Regarding Arkansas Nuclear One, Unit 1,Final Report, April 2001.* [Reference 32]
    - *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 4 Regarding Edwin I. Hatch Plant, Units 1 and 2 Nuclear One, Unit 1, Draft Report for Comment, September 2000.* [Reference 33]

- **Review of Environmental Issues Associated with Continued Operation of Both McGuire and Catawba -** A review of environmental issues associated with continued operation of both the McGuire and Catawba nuclear stations was performed to determine if cumulative impacts exist from the operation of both of these stations. This review examined the impacts associated with the Category 1 and Category 2 environmental issues listed in Table B-1. The review considered whether the significance of the impact would be different from that found in the GEIS, in this ER, or in the ER for Catawba [Reference 34], when considering the continued operation of McGuire and Catawba.

## 5.5 Results of the Review

The results of the review process described above did not identify any Category 1 issues where the GEIS conclusions were not valid for McGuire. This process did not identify any new issues that needed to be addressed in the license renewal process. Therefore, Duke is not aware of any new issues associated with license renewal at McGuire.

The review found that the continued operation of both McGuire and Catawba did not change the conclusions for the Category 1 issues found in the GEIS.

Additionally, this review found that the analyses of the Category 2 issues and the environmental justice review presented in this ER and in the Catawba ER are valid considering the continued operation of McGuire and Catawba.

This review did not identify any new issues that needed to be addressed in the license renewal process. Therefore, Duke is not aware of any new issues related to license renewal concerning the combined operation of McGuire and Catawba.

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# 6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

## 6.1 License Renewal Impacts

The environmental issues associated with the continued operation of McGuire Units 1 and 2 have been reviewed with the results presented below:

**Category 1 Issues** - The environmental issues listed as Category 1 in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 were reviewed by Duke. This review is described in Chapter 5 of this ER. The review of these issues found the conclusions of the review of environmental impacts described in the GEIS to be valid for environmental conditions at McGuire. No issues were identified as requiring additional review. Therefore, Duke adopts the findings codified in Table B-1 for these issues.

**Category 2 Issues** – The environmental issues listed as Category 2 in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 were reviewed by Duke. This review is described in Chapter 4 of this ER. This review found that issue(s) did not apply to McGuire or the impacts associated with continued operations of McGuire during the period of the extended license were small. A summary of the review is found in Table 6-1**.**

**Other Issues** – Duke has conducted a review to determine if there are issues relevant to license renewal at McGuire other than those issues codified in Table B-1. This review is described in Chapter 5 of this ER. This review was conducted in consultation with applicable local, state, and federal agencies. No new issues relevant to license renewal at McGuire were identified as a result of this review.

**Cumulative Impacts from Operation of McGuire and Catawba**

There are no specific requirements in 10 CFR Part 51 regarding the consideration of cumulative impacts in the Applicant's Environmental Report. *Supplement 1 to Regulatory Guide 4.2 Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses* [Reference 1] provides the following definition:

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The environmental issues associated with license renewal at McGuire Nuclear Station, Units 1 and 2 and at Catawba Nuclear Station, Units 1 and 2 were reviewed with consideration of cumulative impacts considering the location of the stations relative to each other. In both this ER and in the Catawba ER, a review of the Category 1 issues and a review for new and significant information were performed. Similarly, analyses for the Category 2 issues were performed for McGuire and Catawba. After completion of these reviews and analyses, an additional review was performed on the issues listed in Table B-1 to determine if there could be an environmental impact due to the continued operation of McGuire and Catawba that would require further evaluation.

None of the environmental issues listed in Table B-1, Appendix B to Subpart A of Part 51 were found to have adverse cumulative impacts resulting from the continued operation of McGuire and Catawba.

## 6.2 Mitigation

### 6.2.1 Requirement

*The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45 (c), for all Category 2 license renewal issues in Appendix B to subpart A of this part. No such consideration is required of Category 1 issues in Appendix B to subpart A of this part.* 10 CFR § 51.53 (c)(3)(iii)

### 6.2.2 Duke Response

As discussed in *Supplement 1 to Regulatory Guide 4.2 Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*, [Reference 1] when adverse environmental effects are identified, 10 CFR §51.45 (c) requires consideration of alternatives available for reducing or avoiding these adverse effects. Furthermore, Reference 1 states that "*Mitigation alternatives are to be considered no matter how small the adverse impact; however, the extent of the consideration should be proportional to the significance of the impact*."

As described in Section 6.1 and as shown in Table 6-1, the analysis of the Category 2 issues found the impacts to be small[10] for the applicable issues. For these issues, the current permits, practices, and programs that mitigate the environmental impacts of plant operations are adequate. This ER finds that no additional mitigation measures are sufficiently beneficial as to be warranted.

10 40 CFR §1508.27 defines ***Small:*** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

## Table 6-1 Category 2 Issues - Summary of Analyses and Mitigation Commitments

| **Surface Water Quality, Hydrology, and Use (for all plants)** | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Water use conflicts (Plants with cooling towers and cooling ponds) §51.53(c)(3)(ii)(A) | McGuire does not use cooling towers or cooling ponds. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |

| **Aquatic Ecology (for all plants with once-through and cooling pond heat dissipation systems)** | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Entrainment of fish and shellfish §51.53(c)(3)(ii)(B) | • Section 316(b) demonstration approved by NCDENR. McGuire operating conditions are unchanged since approval.<br>• Biological studies conducted to support 316(a) demonstration do not indicate need for additional mitigation measures. | None. |
| Impingement of fish and shellfish §51.53(c)(3)(ii)(B) | • Section 316(b) demonstration approved by NCDENR. McGuire operating conditions are unchanged since approval.<br>• Biological studies conducted to support 316(a) demonstration do not indicate need for additional mitigation measures. | None. |
| Heat shock §51.53(c)(3)(ii)(B) | • Section 316(a) demonstration approved by NCDENR. McGuire operating conditions are unchanged since approval.<br>• Biological studies conducted to support 316(a) demonstration do not indicate need for additional mitigation measures. | None. |

## Table 6-1 Category 2 Issues - Summary of Analyses and Mitigation Commitments (Continued)

| Ground-water Use and Quality | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Ground-water use conflicts (Plants Using >100 gpm of ground-Water) §51.53(c)(3)(ii)(C) | Groundwater use is less than 100 gallons per minute. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |
| Ground-water use conflicts (Plants Using Cooling Towers Withdrawing Make-Up water from a Small River) §51.53(c)(3)(ii)(D) | McGuire does not use cooling towers. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |
| Ground-water use conflicts (Ranney Wells) §51.53(c)(3)(ii)(C) | McGuire does not use Ranney wells. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |
| Degredation of Ground-Water Quality §51.53(c)(3)(ii)(D) | McGuire does not use cooling ponds. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |

| Terrestrial Resources | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Refurbishment Impacts on Terrestrial resources §51.53(c)(3)(ii)(E) | No major refurbishment activities identified. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |

## Table 6-1 Category 2 Issues - Summary of Analyses and Mitigation Commitments (Continued)

| Threatened or Endangered Species (for all plants) | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Threatened or Endangered Species §51.53(c)(3)(ii)(E) | No major refurbishment activities identified. No threatened or endangered species impacted by continued operations of McGuire. Consideration of mitigation is not required. | None. |

| Air Quality | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Vehicle Exhaust Emissions §51.53(c)(3)(ii)(F) | No major refurbishment activities identified. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |

| Human Health | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Microbiological (Thermophilic) Organisms §51.53(c)(3)(ii)(G) | The N C Department of Health and Human Services found that the risk to individuals utilizing Lake Norman for recreational activities is extremely low. Consideration of mitigation is not required. | None. |
| Electrical shock from induced currents §51.53(c)(3)(ii)(H) | Transmission lines meet NESC requirements. Duke has active program to ensure compliance with shock hazard clearances. Consideration of mitigation is not required. | None. |

## Table 6-1 Category 2 Issues - Summary of Analyses and Mitigation Commitments (Continued)

| Socioeconomics | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Housing Impacts<br>§51.53(c)(3)(ii)(I) | • No major refurbishment activities identified.<br>• Duke does not anticipate and increase in employment during period of extended license. Therefore, there will no additional impacts to housing due to continued operations of McGuire. | None. |
| Public Utilities: Public Water Supply Availability<br>§51.53(c)(3)(ii)(I) | • No major refurbishment activities identified.<br>• Small impact from continued operation. McGuire daily use of water, supplied by utility CMUD, is 0.057 mgd. In 1998, CMUD supplied 96,876 mgd to customers daily. | None. |
| Education Impacts from Refurbishment<br>§51.53(c)(3)(ii)(I) | No major refurbishment activities identified. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |
| Offsite land Use (effects of refurbishment activities)<br>§51.53(c)(3)(ii)(I) | No major refurbishment activities identified. Issue is not applicable to McGuire. Consideration of mitigation is not required. | None. |
| Offsite land Use (effects of license renewal)<br>§51.53(c)(3)(ii)(I) | • The significance of tax payments made by McGuire to local governments will continue to be small.<br>• The area around McGuire has preestablished land patterns of development, such as land use plans and controls. McGuire is located within the Town of Huntersville's planning zone.<br>• The area around McGuire has public services in place to support and guide development. | None. |

## Table 6-1 Category 2 Issues - Summary of Analyses and Mitigation Commitments (Continued)

| Socioeconomics (Continued) | | |
|---|---|---|
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Local transportation impacts §51.53(c)(3)(ii)(J) | • No major refurbishment activities identified.<br>• Continued Small impacts from operation. Current practices will be continued. These practices are:<br>1. The starting times for workers at the station has been staggered in order to minimize the impact of plant workers entering and leaving the site.<br>2. Workers leaving the site and traveling east on NC 73 are requested to use the east entrance and those workers traveling west on NC 73 are requested to use the west entrance.<br>3. Turn lanes have been added on NC 73 for plant traffic. Traveling east to west on NC 73, there are right turn lanes in to the plant site at both entrances. Traveling west to east on NC 73 there is a left turn lane at the east plant entrance. | None. |
| Historic and archaeological properties §51.53(c)(3)(ii)(K) | • No major refurbishment activities identified.<br>• Small impacts from continued operation. Site environmental work practices ensure protection for archeological and cultural resources that may be encountered during land disturbing activities on site | None. |
| **Postulated Accidents** | | |
| **Issue** | **Summary of Analysis** | **Mitigation Commitment** |
| Severe accident mitigation alternatives §51.53(c)(3)(ii)(L) | No impact from continued operation. No SAMA's found to be cost effective. | None. |

## 6.3 Unavoidable Adverse Impacts

### 6.3.1 Requirement [§51.45(b)(2)]

The applicant's report shall discuss any adverse environmental effects which cannot be avoided upon implementation of the proposed project.

### 6.3.2 Duke Response

In the Final Environmental Statement Related to the Proposed William B. McGuire Nuclear Station Units 1 & 2 [Reference 35] (FES-CP), the NRC evaluated the adverse environmental effects of plant construction and operation. This review found that the principal adverse impacts described by the FES-CP are associated with the following:

- Entrainment of fish and shellfish §51.53(c)(3)(ii)(B)
- Impingement of fish and shellfish §51.53(c)(3)(ii)(B)
- Heat shock §51.53(c)(3)(ii)(B)

These same issues are codified as Category 2 in Table B-1.

The analysis of the Category 2 issues found in Chapter 4, summarized in Table 6-1, and the assessment of new and significant information found in Chapter 5 did not identify any unavoidable adverse environmental impacts associated with the continued operation of McGuire Nuclear Station during the period of the extended license. The analyses of these issues found that the environmental impacts from continued operation of McGuire were small and that no mitigation was required. As a result of these reviews and analyses, Duke is not aware of any unavoidable adverse environmental impacts associated with the extended operation of McGuire.

## 6.4 Irreversible or Irretrievable Resource Commitments

### 6.4.1 Requirement [§51.45(b)(5)]

The applicant's report shall discuss any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

### 6.4.2 Duke Response

The Final Environmental Statement Related to the Proposed William B. McGuire Nuclear Station Units 1 & 2 [Reference 35] (FES-CP), prepared in connection with the issuance of the original operating licenses for McGuire, evaluated the irreversible and irretrievable commitment of resources associated with the construction and operation of McGuire.

The FES-CP evaluation found that the operation of McGuire would result in some irreversible and irretrievable commitment of resources in terms of local environmental impacts and consumption of materials. Similar types of materials, that cannot be recovered or recycled, will be used or consumed in normal operations of the plant during the period of the extended license.

The most significant irreversible and irretrievable commitments of resources involved in the proposed action is the additional fuel that would be used during the renewal period. McGuire Units 1 and 2 use approximately 63 fuel assemblies during a fuel cycle, which is typically 18 to 24 months. Duke anticipates that this would result in an additional 1638 fuel assemblies used at McGuire during the 20 year period of the extended license, based on an 18 month refueling cycle.

Other than those impacts previously evaluated by the FES, and the consumption of materials discussed above, there are no major refurbishment activities or changes in operation of McGuire during the continued operation that would irreversibly or irretrievably commit environmental components of land, water, and air.

## 6.5 Short-term Use Versus Long Term Productivity

### 6.5.1 Requirement [§51.45(b)(4)]

The applicant's report shall discuss the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.

### 6.5.2 Duke Response

The Final Environmental Statement Related to the Proposed William B. McGuire Nuclear Station Units 1 & 2 [Reference 35], prepared in connection with the issuance of the original operating licenses for McGuire, evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of McGuire. The period of operation for license extension will not change the short-term uses of the environment from the uses evaluated in the FES. The period of extended operations will postpone the availability of the site resources (land, air, water) during the period of the extended license, however, extending operations will not likely adversely affect the long term uses of the site.

There are no major refurbishment activities or changes in operation of McGuire planned for the license renewal period that would alter the evaluation of the FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

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# 7.0 ALTERNATIVES CONSIDERED

## 7.1 Introduction

The NRC regulations require that an applicant's environmental report discuss alternatives to a proposed action [§51.45(b)(3)]. The intent of this review is to enable the Commission to consider the relative environmental consequences of the proposed action as compared to the environmental consequences of other activities that also meet the purpose of the proposed action. In addition, this review addresses the environmental consequences of taking no action at all [Reference 8]. For the purposes of license renewal, there are only two alternatives that meet the purpose of the requirement: the decision not to renew the operating licenses or the renewal of the operating licenses. This section identifies the alternatives considered.

## 7.2 Proposed Action

The McGuire units generate 2258 MW(e) of electricity and operated at a 2000 capacity factor of 95.5%. The proposed action is the renewal of the operating licenses of each of the two McGuire units. This action would provide the opportunity for Duke to continue to operate McGuire through the term of the renewed licenses.

The review of the environmental impacts as required by §51.53(c)(3)(ii) was provided in (ER) Chapter 4.0. Based on these reviews, Duke has concluded that there would be no adverse impact to the environment from the continued operation of McGuire through the license renewal period.

## 7.3 No-action Alternative

The no-action alternative to the proposed action is a decision not to renew the original operating license for each of the two units of McGuire Nuclear Station. In the event that the operating licenses of McGuire are not renewed, it is expected that McGuire will continue to operate up to the end of the existing operating licenses, at which time plant operations would cease and decommissioning would begin. In an "obligation to serve" regulated environment, a decision not to seek a renewal license would necessitate the replacement of 2258 MW(e) with other sources of generation. The environmental impacts of the no-action alternative would be:

1. the environmental impacts from decommissioning the two McGuire units, and
2. the environmental impacts from a replacement power source.

The environmental impacts associated with decommissioning are discussed in the following section.

The environmental impacts associated with a replacement power source would be the impacts from the construction and operation of a source of replacement power at a new location (green field) or at the McGuire site (brown field). The environmental impacts of these various types of replacement power are discussed in Chapter 8.0.

## 7.4 Decommissioning Impacts

A nuclear power plant licensee is required to submit decommissioning plans within two years following permanent cessation of operation of a unit or at least five years before expiration of the operating license, whichever occurs first, pursuant to the requirements of §50.54(b).

The environmental impacts of the termination of operations and decommissioning are addressed in Section 8.4 of the GEIS [Reference 8]. The impacts of decommissioning would not be significantly different if decommissioning occurs after 40 years of operation or after 60 years of operation.

Duke has reviewed the environmental impacts of decommissioning of McGuire. These impacts are expected to be comparable to those environmental impacts described in the GEIS for impacts to: land use, water, air quality, ecological resources, human health, social and economic structure, waste management, aesthetics, and cultural resources. The following sections provide additional information on impacts to aquatic ecological resources and socioeconomics that would be associated with the termination of operations of the McGuire units.

**Aquatic Ecological Resources**

Impacts to aquatic resources resulting from the McGuire plant ceasing to operate would be:

- elimination of impingement and entrainment. However, as noted in ER Sections 4.2 and 4.3, the impacts of operating McGuire were evaluated and found not be detrimental to the Lake Norman aquatic ecosystem.
- elimination of thermal discharges. As noted in ER Section 4.4, the NPDES thermal limits (established March 28, 1978) are sufficient to protect the aquatic environment of Lake Norman, so there should be no significant impact if these discharges were to cease. The thermal discharges are a source of thermal refuge during the winter months for certain forage fish.

**Socioeconomics**

When McGuire ceases operation, there will be a decrease in the employment in the area. As noted in ER Section 3.4, the workforce employed at McGuire resides primarily in the adjacent counties. The impacts associated with the loss of these jobs would be

concentrated in the counties of Gaston, Iredell, Lincoln, and Mecklenburg. The loss of these jobs would be an adverse impact to the economies of these counties.

McGuire employees also contribute time and resources in community activities, such as schools, churches, community groups and civic activities. The loss of jobs would likely have an adverse impact on involvement with these activities.

As discussed in ER Section 4.18, the property taxes paid by McGuire represented 2.1% of the property tax revenues, and 1.1% of the total revenues collected by Mecklenburg County for the period 1998-1999. The payments made by McGuire represented 6.9% of the property tax revenues and 3.5% of the total revenues collected by the Town of Huntersville for 1999. The loss of the tax revenues would be an adverse impact to the economies of these counties.

## 7.5 Alternatives

As stated in NUREG-1437, Vol. 1, Section 8.1, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable" [Reference 8]. Accordingly, for the purposes of the review of alternative energy sources for McGuire, the following alternatives were not considered as reasonable replacement power:

- Wind
- Photovoltaic (PV) Cells
- Solar Thermal Power
- Hydroelectric Generation
- Geothermal
- Wood Waste (Biomass)
- Municipal Solid Waste (MSW)
- Energy Crops
- Delayed Retirement of Non-Nuclear Units
- Imported Power
- Conservation
- Combination of Alternatives

These technologies were eliminated as possible replacement power alternatives for one or more of the following reasons:

- High land-use impacts – Some of the technologies listed above (Wind, PV, Solar, Hydroelectric) would require a large area of land and would thus require a green

field siting plan. This would result in a greater environmental impact than continued operation of McGuire.

- Low capacity factors – Some of the technologies identified above (Wind, PV, Solar, Hydroelectric) are not capable of producing the nearly 2258 MW(e) of power at high capacity factors. These generation technologies are used as peaking power sources, as opposed to base load power sources, and for this reason are unlike resources.
- Geographic availability of the resource – Some of the technologies are not feasible because there is no feasible location in the Duke Service area.
- Emerging technology – Some of the technologies have not been proven as a reliable and cost effective replacement of a large generation facility. Therefore, these technologies are typically used with smaller (lower MW(e)) generation facilities.
- Availability – There is no assurance of the availability of imported power.

Current Duke planning strategies have established that combined cycle units (482 MW(e)) and conventional fossil units (600 MW(e)) are the only current viable supply side base load technologies. Duke believes that the 482 MW(e) combined cycle technology is the most economically attractive base load technology. However, for purposes of this review of alternatives to the proposed action, conventional coal-fired, oil and gas-fired combined cycle, gas-fired only combined cycle, and advanced light water nuclear reactor are considered to be currently available base load technologies considered to replace the McGuire generation capacity upon the termination of operation. The light water reactor option is only addressed as a green field option. The comparison of the environmental impacts of these technologies is discussed in detail in Chapter 8.0.

# 8.0 COMPARISON OF IMPACTS

For the purposes of the review of alternative energy sources, the following key assumptions have been made. These key assumptions are intended to simplify the evaluation, yet still allow the no-action alternative review to meet the intent of NEPA requirements and NRC environmental regulations.

- The goal of the proposed action (license renewal) is the production of 2258 MW(e) of base load generation. The alternatives that do not meet the goal are not considered in detail.
- The time frame for the needed generation is 2021 through 2043.
- Purchased power is not considered as a reasonable alternative because there is no assurance that the capacity or energy would be available. See Section 8.2.
- The annual capacity factor of McGuire Nuclear Station in 2000 was 95.5%. The capacity factor is targeted to remain at or near this value throughout the plant's operating life.

## 8.1 Comparison of Environmental Impacts for Reasonable Alternatives

As stated in the GEIS, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable" [Reference 8]. Below is a discussion of the supply side alternative energy technologies that Duke would likely utilize if the decision were made not to extend the license for McGuire. These alternatives are considered to be within the range of alternatives capable of meeting the goal of 2258 MW(e) as base load generation (replacement power for McGuire).

For the purposes of this comparison of impacts of alternatives to the proposed action, conventional coal-fired, oil and natural gas-fired combined cycle, natural gas-fired combined cycle, and advanced light water reactor are considered to be currently available conventional base load technologies that would be considered to replace McGuire generation upon its termination of operation. These sources are considered viable alternatives based upon current Duke planning strategies.

The environmental impacts discussed in this chapter are for the construction and operation of these generation facilities. Impacts are evaluated for a green field case (building on a new, pristine condition site) and a brown field case (constructing new generation on the existing McGuire site). The impacts discussed do not include the additional environmental impacts from obtaining and transporting the fuel sources associated with these facilities.

The continued operation of McGuire for the license extension period would result in less environmental impact than that of the replacement power that could be obtained from other reasonable generating sources, as described below, if the license renewal were not pursued.

### 8.1.1 Green Field Evaluation

#### 8.1.1.1 CONVENTIONAL COAL-FIRED UNITS

The United States currently has an abundant supply of low cost coal. For this reason, fossil-fired technology has been considered a reasonable alternative energy source. However, the Clean Air Act of 1990 has made it increasingly expensive to operate these types of facilities. A 600 MW(e) coal-fired unit has been identified as a probable standard size unit to be used. This alternative would require four 600 MW(e) coal units to adequately replace McGuire's generating capacity. The total generation from this selection is 2400 MW(e) and would only slightly overestimate the impacts from an exact replacement of McGuire's 2258 MW(e).

**Water Use and Quality**

A trade-off of water quality impacts would be associated with the addition of new base load coal units. A green field site would require the construction of a new intake structure to provide water needs for the facility. New base load coal units would likely utilize closed loop cooling towers to decrease the thermal impact to aquatic resources. However, evaporation from the cooling towers would be greater than the 1997 – 1999 annual average of 16,600 gpm of forced evaporation associated with McGuire's surface discharge [Reference 36]. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. There are no low-level radioactive waste discharges to surface water associated with a coal unit. The overall impacts are characterized as small to moderate.

**Waste**

The solid wastes generated by a conventional coal-fired plant would be flyash, bottom ash, Selective Catalytic Reduction (SCR) catalyst (used for Nitrogen Oxide ($NO_x$) control), and Sulfur Dioxide ($SO_2$) scrubber sludge/waste. A coal facility of this size would generate approximately 630,000 tons per year of ash. Approximately 90% of this would be flyash and 10 % would be bottom ash, dependent on the type of coal burned, the type of emission control equipment used, etc. The SCR process would generate approximately 8500 $ft^3$ of spent catalyst material per year. This catalyst material would have high concentrations of metals that are removed from the fly ash. A new coal-fired facility would also require scrubbers to be installed as $SO_2$ emissions control equipment. This would result in the generation of approximately 335,000 tons per year of scrubber sludge (based on a Year 2000 scrubber study conducted for Duke's 2320 MW(e) Belews Creek Steam Station). Scrubber waste disposal for Belews Creek is projected to require

70 acres of landfill per 5 years of operation. The overall impacts are characterized as moderate.

**Air Quality**

The largest environmental impact from this type of generation would result from the air emissions. A conventional coal-fired facility of this size would emit roughly 6,345 tons per year of $SO_2$, 7,932 tons per year of $NO_x$, 212 tons per year of particulate matter (PM) and 1,586 tons per year of carbon monoxide (CO). Assumptions and calculations for these emissions are provided in Table 8-1 and Table 8-2 respectively. Trace elements such as mercury, arsenic, chromium, beryllium, and selenium in the form of particulates and vapor would be emitted in small quantities. McGuire Nuclear Station is located in Mecklenburg County, which is at high risk of being an ozone non-attainment county. Green field siting of a conventional coal-fired plant would be targeted for an area within the Duke service area that is not classified by EPA or North or South Carolina as non-attainment.

The issue of "Global Warming" is an obstacle to the utilization of coal as a reliable and long term energy source. In a draft treaty developed December 10, 1997 in Kyoto, Japan, the United States agreed to reduce the emissions of greenhouse gases (including $CO_2$) to 7% below the 1990 levels. This reduction would be phased in between the years of 2008 and 2012. If this treaty is ratified and the legislation is passed that requires a reduction of this magnitude, the expanded use of coal as a reliable energy source may become impracticable due to restrictions on the levels of $CO_2$ emitted and the expected carbon taxes or emission caps. Other obstacles to the utilization of coal as a reliable and long term energy source are the new EPA 8 hour ozone standard (if implemented) and the State Implementation Plan (SIP) call (which is impacted by $NO_x$ emissions), the new EPA $PM_{2.5}$ (particulate matter with a nominal size of less than 2.5 microns), and Regional Haze rules (which are impacted by $SO_2$). The overall impacts are characterized as moderate.

**Land Use**

Use of a green field site for a conventional coal-fired plant would require fairly significant new land use. The Cope Power Plant in Orangeburg County, South Carolina, began operations in the late 1990s with the start-up of a single 385 MW unit. The site is ultimately planned for 1200 MW or slightly over half of the generating capacity of McGuire. The Cope site is built on a 3200 acre property owned by South Carolina Electric & Gas. The fenced plant portion of the site is 130 acres. However, significant disturbed lands, such as the ash-scrubber waste area, are located outside of the fenced area. In addition, a new green field site would create land-disturbing activities for new roads and rail, additional transmission right-of-way needs for electric transmission connections, etc. Thus, a coal-fired green field site would create significant land use needs and impacts. The NRC's License Renewal SEIS for Arkansas Nuclear One, Unit 1 [Reference32] estimates approximately 1700 acres would be needed for a 1000 MW(e)

coal fired facility. Duke believes that this acreage would be sufficient for a 2400 MW(e) conventional coal-fired plant. The overall impacts are characterized as moderate.

**Ecology**

Locating a conventional coal-fired plant at a green field site would alter the ecology. Impacts would include wildlife habitat loss, reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. Impacts from a new intake (impingement and entrainment) and discharge (waste heat to a receiving water body) would be created. These ecological impacts would vary depending upon the site selected; however, impacts would exceed those of McGuire license renewal. The overall impacts are characterized as moderate.

**Human Health**

A new conventional coal-fired power plant introduces small risks to workers and the public from activities such as mining and transportation of fuel and lime/limestone, handling and storage of chemicals, and from stack-emissions. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new conventional coal-fired plant would comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**

Construction of a green field coal-fired plant would take approximately 4 to 5 years. Construction would likely take place while the existing nuclear units continue operation and would be completed at the time McGuire would cease operations. Construction of a new coal-fired station of this size would employ a significant construction workforce, which would stimulate the local economy of the selected green field site. The surrounding communities would experience demands on housing and public services. After construction, the communities would be impacted by the loss of jobs; construction workers would leave and the coal-fired plant would provide approximately 250 new jobs.

Operational impacts could result in moderate socioeconomic benefits in the form of several hundred jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits will be less than those achieved through license renewal.

The size of the construction workforce for a coal-fired plant and plant-related spending impacts during construction could be substantial, particularly for a green field site in a rural location. Operational impacts, once the coal-fired replacement plants are constructed and the nuclear plant decommissioned, would result in an eventual net loss of approximately 1100 jobs (McGuire employs 1345 workers compared to a projected 250 for the coal-fired plant) to the regional economy. The overall impacts are characterized as moderate.

**Aesthetics**
The four power plant units, which could be approximately 60 m (200 ft) tall, would be visible over intervening trees for miles around. The four 180m (600ft) stacks could be visible at a distance of up to 16 km (10 mi). Visual impacts of stack emissions will be an additional factor not present with McGuire license renewal.

Coal-fired generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., induced-draft fans and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid waste disposal, and transportation related to coal and lime delivery. The overall impacts are characterized as moderate.

**Historic and Archaeological Resources**
The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at a green field site would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. This would be required for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, or other right-of-ways). These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**
A conventional coal-fired facility could be a potential replacement for McGuire's base load generation. However, significant air quality impacts would be associated with this alternative. The continued economic use of coal is uncertain due to "global warming" issues and other clean air issues. The environmental impacts from the construction and operation of a conventional coal-fired plant are summarized in Table 8-5. As shown in Table 8-5, the construction and operation of a new facility would result in greater environmental impacts than the impacts associated with the proposed action (license renewal). For these reasons, a conventional coal-fired plant would not be considered as the first choice if license renewal were not pursued for McGuire.

#### 8.1.1.2 OIL AND NATURAL GAS (COMBINED CYCLE)

This alternative would require five 482 MW(e) combined cycle units to replace McGuire's generating output. A 482 MW(e) combined cycle unit has been identified as a probable standard size unit to be used. The total generation from this selection is 2410 MW(e) and would only slightly overestimate the impacts from an exact replacement of McGuire's 2258 MW(e).

Fuel oil is not considered as a viable stand-alone fuel because it is not price competitive when natural gas is readily available. However, fuel oil as a back-up winter season fuel source is likely to insure adequate fuel supplies, especially where base load generation is required.

**Water Use and Quality**

Water quality impacts associated with base load oil and gas combined cycle units would be less than those for base load nuclear. A green field site would require the construction of a new intake structure to provide water needs for the facility. New base load combined cycle units would likely utilize closed loop cooling towers, which would lessen the thermal impact. Also, because water requirements for combined cycle generation are much less than for conventional steam electric generation, evaporation from combined cycle cooling towers would be less than the 1997 – 1999 annual average of 16,600 gpm of forced evaporation associated with McGuire's surface discharge [Reference 36]. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. There are no low-level radioactive waste discharges to surface water associated with a combined cycle unit. The overall impacts are characterized as small to moderate.

**Waste**

The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for $NO_x$ control. The SCR process would generate approximately 1500 $ft^3$ of spent catalyst material per year. The overall impacts are characterized as small.

**Air Quality**

The largest long-term environmental impact from operating this type of facility would be from the air emissions. The air emission values in the GEIS are based on burning oil throughout the year. Economically, it is not feasible to burn oil throughout the year. Fuel oil would likely be stored on-site as an emergency back-up fuel source, thus its use would likely be infrequent. Therefore, emissions from fuel oil are not considered in this analysis. The new 8 hour ozone standard, the $PM_{2.5}$ standard, Regional Haze rules, and the "Global Warming" issue, as previously discussed, would make it difficult to use oil as a primary fuel source. The emissions resulting from burning natural gas only would be 34.4 tons per year of $SO_2$, 517 tons per year of $NO_x$, 287 tons per year of particulate matter (PM) and 482 tons per year of carbon monoxide (CO). Assumptions and

calculations for these emissions are provided in Table 8-3 and Table 8-4, respectively. The overall impacts are characterized as small to moderate.

**Land Use**

Use of a green field site for an oil and gas-fired combined cycle plant would require fairly minimal new lands. A new site for the combined cycle generation alternative can be located on less than 200 acres. However, land-disturbing activities for new roads and rail, additional transmission right-of-way needs for electric transmission connections, natural gas and oil pipelines, etc. would be required.

In particular, the environmental impacts of providing both gas and fuel oil for a very large base load facility would be substantial. One obstacle to the consideration of combined cycle generation using natural gas is the availability of the gas. Based on current technology, a facility of this size would require in excess of 100 billion cubic feet per year of natural gas. If legislation is passed requiring the reduction of $CO_2$ levels, widespread conversion to natural gas will be required in order to meet these standards. Natural gas may not be available in the quantities that would be required to offset the $CO_2$ emissions from coal-fired generation. Present interstate natural gas pipeline systems in the Duke service area are not capable of supplying the quantities of gas required by this size station operating at an 95.5% capacity factor. A large, new base load combined cycle facility would require the addition of a new gas pipeline to this region, which would disturb significant acreage. Additionally, fuel oil for a large base load source would warrant the addition of an oil pipeline directly to the site from the nearest terminal. The overall impacts are characterized as moderate.

**Ecology**

Locating new combined cycle generation at a green field site would alter the ecology. On-site impacts would not likely be as significant as with coal-fired due to the smaller footprint requirement. However, ecological impacts created by new gas transmission needs could create significant off-site issues. Impacts would include wildlife habitat loss, reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. Impacts of a new intake (impingement and entrainment) and discharge (waste heat to a receiving water body) would be created. These ecological impacts would vary depending upon the site selected; however, impacts would exceed those associated with McGuire license renewal. The overall impacts are characterized as small to moderate.

**Human Health**

A new oil and natural gas fired combined cycle power plant introduces small risks to workers and the public. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new oil and natural gas fired combined cycle plant would

comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**

Construction of a green field combined cycle plant would take approximately two to three years. Construction would likely take place while the existing nuclear units continue operation and would be completed at the time McGuire would cease operations. Construction of a new combined cycle station of this size would employ a construction workforce of approximately 800, which would stimulate the local economy of the selected green field site. The surrounding communities would experience demands on housing and public services. After construction, the communities would be impacted by the loss of jobs; construction workers would leave and the plant would provide new jobs. However, long term job opportunities are less than for a coal-fired station and substantially less than with continued operation of McGuire.

Operational impacts could result in moderate socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits will be less than those achieved through license renewal.

The size of the construction workforce for a combined cycle plant and plant-related spending during construction could be substantial, particularly for a green field site in a rural location. Operational impacts, once the combined cycle replacement plant is constructed and the nuclear plants decommissioned, would result in an eventual net loss of approximately 1200 jobs to the regional economy (McGuire employs 1345 workers compared to a projected 150 for the combined cycle plant). The overall impacts are characterized as moderate.

**Aesthetics**

The five power plant units with their 200-ft stacks and large fuel oil storage tanks could be visible at a distance of several miles. Visual impacts of stack emissions will be an additional factor not present with the continued operation of McGuire. Combined cycle generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., combustion turbine units and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to ammonia handling, solid waste disposal, and transportation related to fuel oil delivery. The overall impacts are characterized as small to moderate.

**Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at a green field site would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. This would be required for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, and natural gas right-of-ways). These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**

An oil and natural gas-fired combined cycle facility would be a viable replacement for McGuire's base load generation. However, the air quality impacts would be far greater than the impacts from the continued operation of McGuire. As shown in Table 8-5, the construction and operation of a new green field facility of this type would result in greater environmental impacts than the impacts associated with the proposed action.

#### 8.1.1.3 NATURAL GAS (COMBINED CYCLE)

This alternative would require five 482 MW(e) combined cycle units to replace McGuire's generating output. A 482 MW(e) combined cycle unit has been identified as a probable standard size unit to be used. The total generation from this selection is 2410 MW(e) and would only slightly overestimate the impacts from an exact replacement of McGuire's 2258 MW(e).

Natural gas is the most economical of the base load generation technologies available at the time of this review. The economics of combined cycle technology are largely dependent on the price of natural gas, which is highly volatile.

**Water Quality**

Water quality impacts associated with a large base load natural gas combined cycle plant would be less than for base load nuclear. A green field site would require the construction of a new intake structure to provide water needs for the facility. New base load combined cycle units would likely utilize closed loop cooling towers, which would lessen the thermal impact. Also, because water requirements for combined cycle generation are much less than those for conventional steam electric generation, evaporation from combined cycle cooling towers would be less than the 1997 – 1999 annual average of 16,600 gpm of forced evaporation associated with McGuire's surface discharge [Reference 36]. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. There are no low-level radioactive waste discharges to surface water associated with a combined cycle unit. The overall impacts are characterized as small to moderate.

**Waste**

The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for $NO_x$ control. The SCR process would generate approximately 1500 $ft^3$ of spent catalyst material per year. The overall impacts are characterized as small.

**Air Quality**

The largest environmental impact from this type of facility would result from the air emissions. These emissions are based on burning natural gas throughout the year. The emissions resulting from burning natural gas only would be 34.4 tons per year of $SO_2$, 517 tons per year of $NO_x$, 287 tons per year of particulate matter (PM) and 482 tons per year of carbon monoxide (CO). Assumptions and calculations for these emissions are provided in Table 8-3 and Table 8-4, respectively. The $PM_{2.5}$ and Regional Haze rules will not be of concern with natural gas combined cycle because these units have minimal $SO_2$ emissions. Depending on the location of the green field site, the 8-hour ozone standard could require offsets of $NO_x$ emissions from this facility. The overall impacts are characterized as small to moderate.

**Land Use**
Use of a green field site for a natural gas-fired combined cycle plant would require fairly minimal new lands. A new site for a major combined cycle generation station can be located on less than 200 acres. However, land-disturbing activities for new roads and rail, additional transmission right-of-way needs for electric transmission connections, natural gas pipelines, etc. would be required.

One obstacle to the consideration of combined cycle generation using only natural gas is the availability of the gas. Based on current technology, a facility of this size would require in excess of 100 billion cubic feet per year of natural gas. If legislation is passed, requiring the reduction of $CO_2$ levels, widespread conversion to natural gas will be required in order to meet these standards. Natural gas may not be available in the quantities that would be required to offset the $CO_2$ emissions from coal-fired generation. Present interstate natural gas pipeline systems in the Duke service area are not capable of supplying the quantities of gas required by this size station operating at a 95.5% capacity factor. A large, new base load combined cycle facility would require the addition of a new gas pipeline to this region, which would disturb significant acreage. The overall impacts are characterized as moderate.

**Ecology**
Locating new combined cycle generation at a green field site would alter the ecology. On-site impacts would not likely be as significant as with coal-fired generation due to the smaller footprint requirement. However, ecological impacts created by new gas transmission needs could create significant off-site issues. Impacts would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. Impacts of a new intake (impingement and entrainment) and discharge (waste heat to a receiving water body) would be created. These ecological impacts would vary depending upon the site selected; however, impacts would exceed those associated with McGuire license renewal. The overall impacts are characterized as small to moderate.

**Human Health**
A new natural gas fired combined cycle power plant introduces small risks to workers and the public. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new natural gas fired combined cycle plant would comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**
Construction of a green field combined cycle plant would take approximately two to three years. Construction would likely take place while the existing nuclear units continue operation and would be completed at the time McGuire would cease operations. Construction of a new combined cycle station of this size would employ a construction

workforce of approximately 800, which would stimulate the local economy of the selected green field site. The surrounding communities would experience demands on housing and public services. After construction, the communities would be impacted by the loss of jobs; construction workers would leave and the plant would provide new jobs. However, long term job opportunities are much less than for a coal-fired station and substantially less than with continued operation of McGuire.

Operational impacts could result in moderate socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits will be less than those achieved through license renewal.

The size of the construction workforce for a combined cycle plant and plant-related spending during construction could be substantial, particularly for a green field site in a rural location. Operational impacts, once the combined cycle replacement plant is constructed and the nuclear plants decommissioned, would result in an eventual net loss of approximately 1200 jobs to the regional economy (McGuire employs 1345 workers compared to a projected 150 for the combined cycle plant). The overall impacts are characterized as moderate.

**Aesthetics**

The five power plant units with their 200-ft stacks could be visible at a distance of several miles. Visual impacts of stack emissions will be an additional factor not present with the continued operation of McGuire. Combined cycle generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., combustion turbine units and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to ammonia handling and solid waste disposal. The overall impacts are characterized as small to moderate.

**Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at a green field site would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. This would be required for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, and natural gas right-of-ways). These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**

A natural gas-fired combined cycle facility would be a viable replacement for McGuire's base load generation. However, the air quality impacts would be far greater than the impacts from the continued operation of McGuire. The environmental impacts resulting from the construction and operation of a natural gas combined cycle facility are summarized in Table 8-5. As shown in Table 8-5, the construction and operation of a new green field facility would result in greater environmental impacts than the impacts associated with the proposed action.

#### 8.1.1.4 ADVANCED LIGHT WATER REACTOR

This alternative is evaluated at 2300 MW(e) to replace McGuire's generating output. This total generation would closely approximate the impacts from an exact replacement of McGuire's 2258 MW(e).

Capital costs to construct a new nuclear plant and the political uncertainties surrounding nuclear plant construction projects are primary reasons that new nuclear construction has not occurred in the U.S. in recent times. These issues remain a major concern. However the environmental impacts of this technology are evaluated as a possible alternative to McGuire license renewal.

**Water Quality**
Water quality impacts associated with a new base load nuclear plant of this size would be similar to the impacts of continued operation of McGuire. A green field site would require the construction of a new intake structure to provide water needs for the facility. A new base load plant would likely utilize closed loop cooling towers. Water requirements for new nuclear generation due to evaporative cooling tower losses would be greater than the evaporative losses at McGuire. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. Low-level radioactive waste discharge impacts to surface water would be approximately the same. The overall impacts are characterized as small to moderate.

**Waste**
High level radioactive wastes would be similar to those associated with the continued operation of McGuire. Low level radwaste impacts from this technology would be slightly greater but similar to the continued operation of McGuire. The overall impacts are characterized as small.

**Air Quality**
Air quality impacts are minimal. Air emissions are primarily from non-facility equipment and diesel generators and are thus very comparable to those associated with the continued operation of McGuire. Air emission impacts are of negligible concern. The overall impacts are characterized as small.

**Land Use**
Use of a green field site for a new nuclear plant would require acreage similar to that needed for continued operation of McGuire but on previously undisturbed land. Land-disturbing activities for the new plant, new roads and rail, additional electric transmission right-of-way needs, etc. would be required. Land use impacts for a new nuclear plant exceed similar impacts from McGuire license renewal. The overall impacts are characterized as small to moderate.

**Ecology**
Locating a new nuclear plant at a green field site would alter the ecology. Ecological impacts created by new electric transmission needs could create significant off-site issues. Impacts on-site would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. Impacts of a new intake (impingement and entrainment) and discharge (waste heat to a receiving water body) would be created. These ecological impacts would vary depending upon the site selected; however, impacts would exceed those for McGuire license renewal. The overall impacts are characterized as moderate.

**Human Health**
Human health risk to the public and plant personnel is comparable to the license renewal option. The overall impacts are characterized as small.

**Socioeconomics**
Construction of a green field nuclear plant would take a minimum of five years. Construction would likely take place while the existing nuclear units continue operation and would be completed at the time McGuire would cease operations. Construction of a new nuclear station of this size would employ a very large construction workforce, which would stimulate the local economy of the selected green field site. The surrounding communities would experience moderate demands on housing and public services. After construction, the communities would be impacted by the loss of jobs; construction workers would leave and the plant would provide new jobs. Long-term job opportunities would be comparable to continued operation of McGuire.

Operational impacts would result in moderate to large socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. Primarily due to the capital investment, these benefits would exceed the license renewal option.

Operational impacts, once a new nuclear plant is constructed and McGuire is decommissioned, would result in little if any net change in jobs to the regional economy. The overall impacts are characterized as moderate.

**Aesthetics**
Visual impacts would be new at the green field site location due to the presence of plant structures and equipment. New nuclear generation would introduce additional mechanical sources of noise that would be audible offsite. The overall impacts are characterized as small.

**Historic and Archaeological Resources**
The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at a green field site would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. This would be required for all areas of potential

disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, rail and transmission corridors). These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**

A new nuclear plant would have many similar impacts as the license renewal option. Overall, as shown in Table 8-5, the construction of a new green field nuclear facility would result in greater environmental impacts than the impacts associated with the proposed action.

### 8.1.2 Brown Field Evaluation

#### 8.1.2.1 Conventional Coal-Fired Units

This alternative would require four 600 MW(e) coal units to adequately replace McGuire's generating capacity. Construction of a new coal-fired facility on the McGuire site would have many of the same impacts as were discussed under the green field evaluation for coal fired units.

**Water Use and Quality**
A trade-off of water quality impacts would be associated with a large base load coal-fired plant. In contrast to the situation for a green field site, the existing intake structure would be adequate for the coal-fired generation and would likely be utilized and modified as required to meet EPA requirements for altered cooling systems. New base load coal units on the McGuire site would likely utilize closed loop cooling towers, which would lessen the thermal impact on Lake Norman. However, evaporation from the cooling towers would be greater than the 1997 – 1999 annual average of 16,600 gpm of forced evaporation associated with McGuire's surface discharge [Reference 36]. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. There are no low-level radioactive waste discharges to surface water associated with a coal unit. The overall impacts are characterized as small.

**Waste**
Solid waste impacts would be the same as described in the analysis of the coal fired units at the green field site. Waste storage ponds for ash and scrubber wastes would likely have to be located opposite highway NC 73 from the nuclear station and would require use of previously undisturbed lands. Scrubber waste disposal, as described in the green field evaluation, is projected to require 70 acres of landfill per 5 years of operation for a station of this size. The overall impacts are characterized as moderate.

**Air Quality**
The main impact associated with an operating coal-fired plant on the McGuire site is the air quality non-attainment issue. McGuire Nuclear Station is located in Mecklenburg County, which is at high risk of being an ozone non-attainment county. Obtaining air permits for construction of a coal-fired plant on the existing McGuire site would not be likely without significant emissions offsets from other Duke generating facilities. These offsets equate to a reduction in generation or significant capital investment at other sites in order to reduce emissions.

"Global Warming" and emissions impacts from a new coal-fired plant at the McGuire site would be as described in the green field evaluation. The overall impacts are characterized as moderate.

**Land Use**
The McGuire site covers an area of approximately 577 acres. Highway NC 73 separates the overall tract on which McGuire is sited. Existing transmission substations and lines could be re-used with negligible new environmental impact. A coal-fired station for generation to replace McGuire would require more than the available 577 acres. The NRC's License Renewal SEIS for Arkansas Nuclear One, Unit 1 [Reference32] estimates approximately 1700 acres would be needed for a 1000 MW(e) coal fired facility. Based on this estimate, the McGuire site would have to be expanded by several times to attain this acreage. This expansion would impact previously undisturbed lands, primarily for use as coal piles, ash basins and waste landfills. The overall impacts are characterized as moderate.

**Ecology**
Locating a coal-fired plant at the existing McGuire site would noticeably alter ecological resources because of the need to convert approximately 1000 acres of previously undisturbed land to industrial use (plant, coal storage, ash and scrubber sludge disposal). The use of an existing intake and discharge system, to which the area aquatic communities have become acclimated, would limit operational impacts. Use of a closed-cycle cooling system alternative would introduce risk to vegetation from salt drift and alter current cooling patterns. Siting at the existing McGuire site would have a moderate ecological impact that would be greater than license renewal. The overall impacts are characterized as small to moderate.

**Human Health**
A new conventional coal-fired power plant introduces small risks to workers and the public from activities such as mining and transportation of fuel and lime/limestone, handling and storage of chemicals, and from stack-emissions. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new conventional coal-fired plant would comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**
Construction of a coal-fired plant would take approximately 4 to 5 years. Construction of a new coal-fired station of this size would employ a significant construction workforce, which would provide jobs for the local economy. The surrounding communities would experience demands on housing and public services. After construction, the Mecklenburg community would be impacted by a loss of jobs. Construction workers would leave, the nuclear plant workforce (1345) would decline through a decommissioning period to a minimal maintenance size, and the coal-fired plant would introduce only 250 new jobs.

Operational impacts could result in moderate socioeconomic benefits in the form of several hundred jobs, tax revenue, and plant expenditures. However, on a comparison

basis, these benefits will be much less than those achieved through license renewal of McGuire.

The size of the construction workforce for a coal-fired plant and plant-related spending during construction would be very noticeable. Operational impacts, once the coal-fired replacement plant is constructed and the nuclear plant decommissioned, would result in an eventual loss of approximately 1100 jobs. McGuire employs 1345 workers compared to a projected 250 for the coal-fired plant, with a commensurate reduction in demand on socioeconomic resources and contribution to the regional economy. The partial replacement of industrial tax base with that from the coal-fired power plant would help stabilize some of the loss of tax base associated with the nuclear units. The overall impacts are characterized as moderate.

**Aesthetics**

The four power plant units, which could be as tall as 60 m (200 ft), would be visible over intervening trees for miles around. The four 180-m (600-ft) stacks could be visible at a distance of up to approximately 16 km (10 mi). Visual impacts of stack emissions will be an additional factor not present with the continued operation of McGuire. New stacks and accompanying emissions at the McGuire site would be a significant new visual impact for the Lake Norman area.

Coal-fired generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., induced-draft fans and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid waste disposal, and transportation related to coal and lime delivery. The overall impacts are characterized as moderate.

**Historic and Archaeological Resources**

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

**Summary**

Construction of new coal-fired generation at the McGuire site is not a likely scenario for replacement of McGuire Nuclear Station's generation. Siting a new coal-fired station in an urban area such as Mecklenburg County would be improbable, primarily due to air emission impacts. In addition, significant new land would be needed in order to site a large coal plant at the McGuire site.

#### 8.1.2.2 OIL AND NATURAL GAS (COMBINED CYCLE)

This alternative would require five 482 MW(e) combined cycle units to replace McGuire's generating output. Construction of a new oil and natural gas combined cycle facility on the McGuire site would have many of the same environmental impacts as discussed under the green field evaluation of this alternative in Section 8.1.1.

**Water Use and Quality**

Water quality impacts associated with new base load oil and gas combined cycle units would be less than those for base load nuclear. In contrast to the situation for a green field site, the existing intake structure would be adequate for the combined cycle generation and would likely be utilized and modified as required to meet EPA requirements for altered cooling systems. New base load combined cycle units would likely utilize closed loop cooling towers, which would lessen the thermal impact. Also, because water requirements for combined cycle generation are much less than for conventional steam electric generation, evaporation from combined cycle cooling towers would be less than the 1997 – 1999 annual average of 16,600 gpm of forced evaporation associated with McGuire's surface discharge [Reference 36]. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. There are no low-level radioactive waste discharges to surface water associated with a combined cycle unit. The overall impacts are characterized as small.

**Waste**

The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for $NO_x$ control. The SCR would generate approximately 1500 $ft^3$ of spent catalyst material per year. The overall impacts are characterized as small.

**Air Quality**

The main impact associated with a fossil fuel plant on the McGuire site is air quality. McGuire Nuclear Station is located in Mecklenburg County, which is at high risk of being an ozone non-attainment county. While not as difficult as permitting a coal-fired plant at the site, obtaining air permits for construction of a combined cycle plant would again require significant emissions offsets from other Duke generating facilities. These offsets equate to a reduction in generation or significant capital investment at other sites in order to reduce emissions.

"Global Warming" and emissions impacts from a new combined cycle plant at the McGuire site would be as described in the green field evaluation. The overall impacts are characterized as small to moderate.

**Land Use**
The McGuire site is adequate in size to support a combined cycle facility. Existing transmission substations and lines could be re-used with negligible new environmental impact. The TRANSCo interstate natural gas pipeline is located within two miles of the site; however, a new pipeline would be required to supply the gas capacities required for large, new base load generation. A new oil pipeline would also likely be required from the Paw Creek oil terminal in Charlotte, N.C. A new pipeline from the terminal to the McGuire site would create new/expanded right-of-way along an approximate 15 mile route. The overall impacts are characterized as small to moderate.

**Ecology**
Locating new combined cycle generation at McGuire would alter the ecology. On-site impacts would not likely be as significant as with coal-fired generation due to the smaller footprint requirement. However, ecological impacts created by new gas transmission needs could create significant off-site issues. Impacts would include wildlife habitat loss, reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. These ecological impacts would be largely off-site and would be related to gas transmission requirements. These impacts would exceed those of the McGuire license renewal. The overall impacts are characterized as small to moderate.

**Human Health**
A new oil and natural gas fired combined cycle power plant introduces small risks to workers and the public. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new oil and natural gas fired combined cycle plant would comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**
Construction of a combined cycle plant on the McGuire site would take approximately two to three years. Construction of a new combined cycle station of this size would employ a construction workforce of approximately 800, which would assist the local economy during construction. The surrounding community would experience small demands on housing and public services. After construction, the community would be impacted by the loss of jobs; construction workers would leave and the plant would provide new jobs. However, long term job opportunities are less than for a coal-fired station and less than with continued operation of McGuire.

Operational impacts could result in small socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits will be less than those achieved through license renewal.
The size of the construction workforce for a combined cycle plant and plant-related spending during construction could be substantial. Operational impacts, once the

combined cycle replacement plant is constructed and the nuclear plants decommissioned, would result in an eventual net loss of approximately 1200 jobs to the local economy. McGuire employs 1345 workers compared to a projected 150 for the combined plant. The overall impacts are characterized as small to moderate.

**Aesthetics**

The five power plant units with their 200-ft stacks and large fuel oil storage tanks could be visible at a distance of several miles in the Lake Norman area. Visual impacts of stack emissions will be an additional factor not present with the continued operation of McGuire. Combined cycle generation would introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., combustion turbine units and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to ammonia handling, solid waste disposal, and transportation related to fuel oil delivery. The overall impacts are characterized as small to moderate.

**Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at McGuire would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. These impacts would be most significant from new gas transmission right-of-way needs. These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**

Construction of new combined cycle generation at the McGuire site is a feasible alternative for replacing McGuire Nuclear Station's generation. However, siting a new combined cycle station in an urban area such as Mecklenburg County would be a challenge, due to air emission impacts. Existing lands are available at the McGuire site with minimal land/water impacts expected. Major land use impacts would be associated with providing oil and natural gas in the necessary quantities to the site.

#### 8.1.2.3 NATURAL GAS (COMBINED CYCLE)

This alternative would require five 482 MW(e) combined cycle units to replace McGuire's generating output. Construction of a new gas-fired combined cycle facility on the McGuire site would have many of the same issues and impacts as were discussed under the green field evaluation for this alternative in ER Section 8.1.1.

**Water Use and Quality**
Water quality impacts associated with 2410 MW(e) of base load gas combined cycle generation at the McGuire site would be less than for base load nuclear. Water use impacts are virtually the same as that described for oil and gas combined cycle generation in the brown field evaluation. The overall impacts are characterized as small.

**Waste**
The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for $NO_x$ control. The SCR would generate approximately 1500 $ft^3$ of spent catalyst material per year. The overall impacts are characterized as small.

**Air Quality**
The main impact with a fossil fuel plant on the McGuire site is the air quality. McGuire Nuclear Station is located in Mecklenburg County, which is at high risk of being an ozone non-attainment county. While not as difficult as permitting a coal-fired plant at the site, obtaining air permits for construction of a combined cycle plant would likely come with significant emissions offsets from other Duke generating facilities. These offsets equate to a reduction in generation or significant capital investment at other sites in order to reduce emissions.

"Global Warming" and emissions impacts from a new combined cycle plant at the McGuire site would be as described in the green field evaluation. The overall impacts are characterized as small to moderate.

**Land Use**
The McGuire site is adequate in size to support a combined cycle facility. Existing transmission substations and lines could be re-used with negligible new environmental impact. The TRANSCO interstate natural gas pipeline is located within two miles of the site; however, as previously stated, a new pipeline would be required to supply the gas capacities required of 2410 MW of base load generation. The overall impacts are characterized as small to moderate.

**Ecology**
Locating new combined cycle generation at McGuire would alter the ecology. On-site impacts would not likely be as significant as with coal-fired generation due to the smaller footprint requirement. However, ecological impacts created by new gas transmission needs could create significant off-site issues. Impacts would include wildlife habitat loss, reduced productivity, and could include habitat fragmentation and a local reduction in

biological diversity. These ecological impacts would be largely off-site, due to gas transmission requirements, and would exceed the corresponding impacts for McGuire license renewal. The overall impacts are characterized as small to moderate.

**Human Health**

A new conventional coal-fired power plant introduces small risks to workers and the public from activities such as mining and transportation of fuel and lime/limestone, handling and storage of chemicals, and from stack-emissions. The GEIS analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new conventional coal-fired plant would comply with these regulatory requirements. The overall impacts are characterized as small.

**Socioeconomics**

Construction of a combined cycle plant on the McGuire site would take approximately two to three years. Construction of a new combined cycle station of this size would employ a construction workforce of approximately 800, which would assist the local economy during construction. The surrounding community would experience small demands on housing and public services. After construction, the community would be impacted by the loss of jobs; construction workers would leave and the plant would provide new jobs. However, long term job opportunities are much less than for a coal-fired station and much more substantially less than with continued operation of McGuire.

Operational impacts could result in small socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, on a comparison basis, these benefits will be less than those achieved through license renewal.

The size of the construction workforce for a combined cycle plant and plant-related spending during construction could be substantial. Operational impacts, once the combined cycle replacement plant is constructed and the nuclear plants decommissioned, would result in an eventual net loss of approximately 1200 jobs to the local economy. McGuire employs 1345 workers compared to a projected 150 for the combined cycle plant. The overall impacts are characterized as small to moderate.

**Aesthetics**

The five power plant units with their 200-ft stacks could be visible at a distance of several miles in the Lake Norman area. Visual impacts of stack emissions will be an additional factor not present with the continued operation of McGuire. Combined cycle generation would also introduce additional mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., combustion turbine units and mechanical-draft cooling towers) associated with normal

plant operations. Intermittent sources include the equipment related to ammonia handling and solid waste disposal. The overall impacts are characterized as small to moderate.

**Historic and Archaeological Resources**

The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction at McGuire would necessitate studies to identify, evaluate, and mitigate potential impacts of new plant construction on cultural resources. These impacts would be most significant from new gas transmission right-of-way needs. These impacts can generally be managed and the associated resources maintained. The overall impacts are characterized as small.

**Summary**

Construction of new combined cycle generation at the McGuire site is a feasible alternative for replacing McGuire Nuclear Station's generation. However, siting a new combined cycle station in an urban area such as Mecklenburg County would be a challenge, due to air emissions impacts. Existing lands are available at the McGuire site with minimal land/water impacts expected. Major land use impacts would be associated with providing the necessary quantities of natural gas to the site.

## 8.2 Alternatives Not Within the Range of Reasonable Alternatives

As stated in GEIS, Section 8, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable" [Reference 8]. The commonly known generation technologies considered reasonable by NRC are listed in the following paragraphs. However, these sources have been eliminated as "reasonable alternatives" to the proposed action because the generation of 2258 MW(e) of electricity as a base load supply utilizing these technologies is not technologically feasible [Reference 8].

**Wind**

Once installed, wind energy maintains many environmental advantages over other energy technologies, primarily zero air, water and waste emissions. However, the average annual capacity factor for this technology was estimated at 21 % in 1995 and is projected to be 29% in 2010. This low capacity factor, compared with current base load technologies (McGuire's capacity factor in 2000 was 95.5%), results from the high degree of intermittence of wind energy in many locations (DOE/EIA-0561). Wind speeds in the Piedmont Region averaged 7.4 miles per hour in 1998, [Reference 37] whereas average wind speeds of more than 13 miles per hour are needed for wind turbines to generate electricity. Good wind resources are available in many regions of the country; however, the Southeast and East Central Regions of the U.S. are without significant wind resources [Reference 38].

Environmental impacts associated with windfarms exist in several forms. Aesthetically, there are operational noise and visual effects caused by the size of the structures. Also, current energy storage technologies are too expensive to permit wind power plants to serve as large base load plants. Wind energy has a large land requirement, approximately 150,000 acres (61,000 ha) of land to generate 1000 MW(e) of electricity. This eliminates the possibility of co-locating a wind energy facility with a retired nuclear plant (brown field scenario). A green field siting plan would be required. This would have a large impact upon much of the natural environment in the affected areas [GEIS, Section 8, Reference 8].

**Photovoltaic Cells**

The average annual capacity factor for Photovoltaic (PV) Cells is estimated at 25% (McGuire's 2000 capacity factor was 95.5%). PV is solar dependent. The annual possible sunlight percentage for Charlotte, N.C. is 62%. In 1998, a total of 212 non-cloudy days were recorded [Reference 37]. PV is well suited for meeting summer daytime peaking needs, but has reduced benefits for base load generation.

Additionally, residential photovoltaic systems are not presently cost competitive with grid-connected electricity. The use of PV cells for base load capacity requires very large

energy storage devices that are not feasible to use to store sufficient electricity to meet the base load generating requirements. This is very high cost generation, which prevents it from being competitive.

This technology also has a high land-use impact which, like the wind technology, results in a large impact to the natural environment. For the period around the year 2020, it is estimated that 2.4 ha of land are needed per MW of electricity produced. Thus, 2400 ha (6,000 acres) of land would be required to generate 1000 MW(e) [Reference 38].

**Solar Thermal Power**

The average capacity factor for this technology is low, estimated to be between 25% and 50% annually (McGuire's 2000 capacity factor was 95.5%). This technology, like PV cells, has high capital costs and lacks base load capability unless combined with fossil fuel backup. Based upon solar energy resources, the most promising region of the country for this technology is in the Southwestern U.S., not in the Southeast U.S. where McGuire is located.

Three solar thermal power technologies are being developed in the U.S. These are 1) parabolic troughs, 2) power towers, and 3) dish/engine systems [Reference 38]. These technologies allow hybridization with fossil fuels and/or thermal storage to provide dispatchable power and operation during periods when solar energy is not available. Despite enhancements projected for these technologies by the 2020 timeframe, limitations and risks associated with each prevent their being viable alternatives. Each technology affords only minimal capacity factors when compared to McGuire's base load capability, and requires large land-use needs – ranging from 1750 ha (4,000 acres) for dish/engine systems to approximately two times or 3,500 ha (8,000 acres) using parabolic trough technology for 1000 MW(e). Land use needs are more substantial for power towers. Land use needs are projected at approximately $1.2 \times 10^{-3}$ ha/MWh/yr to account for the technology's ability to store energy. This equates to a land need of over 17,000 acres for a 1000 MW(e) operating at a high capacity factor of 70% for this technology [Reference 38]. Thus, large land needs and the need for a green field location would result in significant environmental impacts to the affected area.

**Hydroelectric Generation**

Hydroelectric generated power has an average annual capacity factor of 46% (McGuire's 2000 capacity factor was 95.5%). The capacity factor depends, to a large degree, on a combination of head and available water flow. A large scale hydroelectric plant of 1000 MW(e) would require approximately 1,000,000 acres (400,000 ha) of land, resulting in large environmental impacts. This option is not practical due to the large loss of environmental habitat. Duke currently operates numerous hydroelectric generating facilities in the service area and sites with a high generating potential have already been

utilized. There are no feasible location in the Duke service area for new hydroelectric generation sources [GEIS, Section 8, Reference 8].

**Geothermal**

A geothermal electricity generating facility has an average annual capacity factor of approximately 90% and can be used to provide reliable base load power. Geothermal plants may be located only in certain areas, such as the western United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. This technology is not widely used as base load generation due to the limited geographic availability of the resource and the immature status of the technology. This technology is not applicable to the Carolinas region of the U.S. where the replacement of 2258 MW(e) would be needed. There is no feasible location for geothermal generation within the Duke service area.
[GEIS, Section 8, Reference 8]

**Wood Waste (Biomass)**

A wood burning facility can provide base load power and operate with an average annual capacity factor of around 70 – 80% and with 20 – 25% efficiency. The cost of the fuels required for this type of facility is highly variable and very site specific. Among the factors influencing costs are the environmental considerations and restrictions which are influenced by public perception, easy access to fuel sources, and environmental factors. The rough cost for construction of this type of facility in the McGuire area, where 2258 MW(e) is needed, is approximately $2400/kW. Economics alone eliminate biomass technology as a reasonable alternative to license renewal.
[GEIS, Section 8, Reference 8]

**Municipal Solid Waste (MSW)**

The initial capital costs for this technology are much greater than the cost of comparable steam-turbine technology found at wood waste facilities. This is due to the need for specialized MSW handling and waste separation equipment and stricter environmental emissions controls. These facilities are typically used when landfill space is not available for handling the waste disposal needs of a community. High costs prevent this technology from being economically competitive. Thus, municipal solid waste generation is not a reasonable alternative to license renewal.
[GEIS, Section 8, Reference 8]

**Energy Crops**
This technology is comparable to the wood waste facilities. This technology is not currently cost competitive with fossil-fired alternatives. Energy crops are considered an emerging technology, not economically practicable, and are not a reasonable alternative to the license renewal [GEIS, Section 8, Reference 8].

**Delayed Retirement of Non-Nuclear Units**
The Duke Power Annual Plan, dated September 1, 2000 [Reference 39], discusses the strategy for meeting the overall future energy needs for the next 15 years. The Annual Plan discusses decision dates (as opposed to retirement dates) for the following proposed additional peaking/intermediate generation requirements: 600 MW(e) in 2002; 470 MW(e) in 2003; 1175 MW(e) in 2004; 490 MW(e) in 2005. Comparable increases in peaking power are projected through 2015 for a total 8,223 MW(e) projected. The Annual Plan also discusses the retirement of a total of 584 MW(e) of combustion turbine capacity by the end of 2014. The period of time evaluated by the Annual Plan does not extend to the retirement dates for McGuire (2021 and 2023).

The delayed retirement of the above generation sources could not be used to replace the 2258 MW(e) generated at McGuire. Combustion turbines (CTs) are used for peaking generation. Therefore, it would not be feasible for the combustion turbines to replace base load generation. Additionally, it is unlikely that these CT units could economically operate for nearly an additional 30 years beyond the current decision dates.

Duke does not have plans to retire any of its base load fossil plants. Therefore, delayed retirement of base load fossil generation could not be used as an alternative to the license renewal for McGuire.

For these reasons, the delayed retirement of non-nuclear generating units is not considered as a reasonable alternative to license renewal.

**Purchased Power**
Duke currently uses purchased power contracts and/or options as part of the Annual Plan. For the purposes of this evaluation, the power purchase option is not considered a reasonable replacement for the license renewal alternative. There is no assurance that sufficient capacity or energy would be available in the 2021 through 2043 time frame to replace McGuire's 2258 MW(e) of base load generation.

**Conservation**
Demand-side measures have been included in past integrated resource plans. Duke currently has several general demand side options planned. These measures are discussed below:
Energy Efficiency Demand-side options:

- Residential service water heating- controlled/submetered
- Existing residential housing program to encourage energy efficiency

Interruptible Demand-side options:

- Residential load control – A/C and water heating
- Standby generator control
- Interruptible power service

Currently, the demand side measures are expected to account for 566 MW(e) (winter) to slightly over 1000 MW(e) (summer) in year 2001. By 2005, this number is projected to decrease to 559 MW(e) and 920 MW(e) in winter and summer. The demand side measures are included in the growth projections. For the purposes of this evaluation, the conservation option is not considered a reasonable replacement for the license renewal alternative.

**Combination of Alternatives**

A large number of potential combinations of alternatives may exist for replacing McGuire's 2258 MW(e) of generation. These combinations would be comprised of the alternatives previously discussed. The same factors that eliminated these alternatives as stand-alone sources of power would make them impractical or unlikely in a combined scenario. Low capacity factors, even in a combined scenario, would still eliminate many alternatives such as wind, PV, simple cycle combustion turbines, solar and hydroelectric. Many others would remain impractical for the southeastern U.S. or are simply not cost competitive when compared with other alternatives.

One alternative will be addressed that is a more probable combination scenario for replacing McGuire's generation. A combination of purchase power agreements and construction of new generation is a potential alternative for replacing 2258 MW(e). Construction of new combined cycle (3 units at 482 MW(e) each) would provide 1446 MW(e). This would leave in excess of 800 MW(e) to be purchased in the open market. Construction of 1446 MW(e) of combined cycle generation at either McGuire or at a green field site would have similar environmental impacts as the 2410 MW(e) scenario, but to a lesser degree. Air emissions impacts would be less for the lower generation level but would still require offsets from other generating sources and would create much greater impact on air quality than license renewal.

This combination also still requires the purchase of significant generation in the 2025 through 2046 time frame and there is no guarantee that this amount of capacity will be available for purchase during this period. If available, this purchased power would only exist as new generation from an alternate supplier and would create its own environmental impacts. Therefore, it is unlikely that the environmental impact of a hypothetical combination could be reduced to having less than a small impact. For these

reasons, the combination of alternatives is not considered as a reasonable alternative to McGuire license renewal.

## 8.3 Proposed Action vs. No-Action

The proposed action is the renewal of the operating licenses for McGuire Unit 1 and Unit 2. The McGuire-specific review of the twelve environmental impacts, as required by §51.53(c)(3)(ii), concluded that there would be no adverse impact to the environment from the continued operation of McGuire through the license renewal period.

The no-action alternative to the proposed action is the decision not to pursue renewal of the operating license for the two units of the McGuire Nuclear Station. The environmental impacts of the no-action alternative would be the impacts associated with the construction and operation of the type of replacement power utilized. In effect, the net environmental impacts would be transferred from the continued operation of McGuire to the environmental impacts associated with the construction and operation of a new generating facility. This new generating facility would almost certainly be constructed at a green field location due to the air impacts associated with constructing one of the viable technologies on the McGuire site. Therefore, the no-action alternative would have no net environmental benefits.

The environmental impacts associated with the proposed action (the continued operation of McGuire) were compared to the environmental impacts from the no-action alternative (the construction and operation of other reasonable sources of electric generation). Duke believes this comparison shows that the continued operation of McGuire would produce fewer significant environmental impacts than the no-action alternative. There are significant differences in the impacts to air quality and land-use between the proposed action and the reasonable alternative generation sources.

In addition, there would likely be adverse socioeconomic impacts (including local unemployment, loss of local property tax revenue, and higher energy costs) to the area around McGuire from the decision not to pursue license renewal.

The *Joint DOE-Electric Power Research Institute Strategic Research and Development Plan to Optimize US Nuclear Power Plants* stated "… nuclear energy was one of the prominent energy technologies that could contribute to alleviate global climate change and also help in other energy challenges including reducing dependence on imported oil, diversifying the US domestic electricity supply system, expanding US exports of energy technologies, and reducing air and water pollution." The Department of Energy agreed with this perspective and stated "…it is important to maintain the operation of the current fleet of nuclear power plants throughout their safe and economic lifetimes" [Reference 40 ]. The renewal of the McGuire operating licenses is consistent with these goals.

## 8.4 Summary

The proposed action is the renewal of the McGuire operating licenses. The proposed action would provide the continued availability of 2258 megawatts of base load power generation through 2043. The results of the review of alternatives to the proposed action are summarized in Table 8-5and 8-6.

The environmental impacts of the continued operation of McGuire, providing 2258 megawatts of base load power generation through 2043, are superior to impacts associated with the best case assessed among reasonable alternatives. This is primarily due to the air emissions associated with the alternatives that do not exist with the continued operation of McGuire. As discussed in this chapter and as shown in Table 8-5 and Table 8-6, the continued operation of McGuire would create significantly less environmental impact than the construction and operation of new base load generation capacity.

Finally, the continued operation of McGuire will have a significant positive economic impact on the communities surrounding the station.

## Table 8-1 Coal Fired Alternative

| Characteristic | Basis |
|---|---|
| Unit size = 600 MW ISO rating net[a] | Standard size (Duke Power experience) |
| Number of units = 4 | Approximate capacity to replace 2258 MW net |
| Boiler type – tangentially fired, dry-bottom | Minimizes nitrogen oxides emissions |
| Fuel type – bituminous, pulverized coal | Typical for coal used in NC (Duke Power experience) |
| Fuel heating value = 12,409 BTU/lb | 2000 value for coal used in NC by Duke |
| Fuel ash content by weight = 10 percent | Avg value for coal used in NC |
| Fuel sulfur content by weight = 1.00 percent | Historical value for coal in NC |
| Uncontrolled NOx emission = 14.9 lb/ton<br>Low Nox Burner NOx emission 7.44 #/ton (0.3 #/MMBTUs)<br>SCR Nox emission 2.5 #/ton (0.1 #/MMBTUs)<br>Uncontrolled CO emission = 0.5 lb/ton | Typical for pulverized coal, tangentially-fired, dry-bottom Ref. EPA AP-42 (uncontrolled) |
| Heat rate = 9,364 BTU/kWh | Heat Rate estimated w/SCR & FGD |
| Capacity factor = 0.8 | Typical for large coal-fired units |
| NOx control = low NOx burners, overfire air w/SCR 83% reduction | Best available and widely demonstrated for minimizing NOx emissions (EPA BACT clearinghouse) |
| Particulate control = fabric filters or electrostatic precipitators (99.9 percent removal efficiency) | Best available for minimizing particulate emissions (EPA BACT clearinghouse) |
| $SO_2$ control = Wet scrubber-lime/limestone (95 percent removal efficiency) | Best available for minimizing $SO_2$ emissions |

Notes

| | |
|---|---|
| a. | The difference between "net" and "gross" is electricity consumed onsite. |
| BTU = | British thermal unit |
| CO = | carbon monoxide |
| ISO rating = | International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch |
| KWh = | kilowatt hour |
| NSPS = | New Source Performance Standard |
| lb, # = | pounds |
| MW = | megawatt |
| NOx = | nitrogen oxide |
| $SO_2$ = | sulfur dioxide |

## Table 8-2 Air Emissions from Coal Fired Alternative

| Parameter [Notes] | Calculation | Result |
|---|---|---|
| Annual coal consumption | $4\ units\ x\ \frac{600MW}{unit}\ x\ \frac{9{,}364BTU}{kWxhr}\ x\ \frac{1{,}000kW}{MW}\ x\ \frac{lb}{12{,}409BTU}\ x\ \frac{ton}{2000lb}\ x\ 0.8\ x\ \frac{24hr}{day}\ x\ \frac{365day}{yr}$ | 6,345,998 tons per year |
| $SO_2$ [a,b] | $\frac{40\ lb\ SO_2}{ton}\ x\ \frac{ton}{2000\ lb}\ x(1-95/100)\ x\ \frac{6{,}345{,}998\ tons}{yr}$ | 6,346 tons $SO_2$ per year |
| NOx [b,c] | $\frac{2.5\ lb\ NOx}{ton}\ x\ \frac{ton}{2000\ lb}\ x\ \frac{6{,}345{,}998\ tons}{yr}$ | 7,932 tons NOx per year |
| CO [b] | $\frac{0.5\ lb\ CO}{ton}\ x\ \frac{ton}{2000\ lb}\ x\ \frac{6{,}345{,}998\ tons}{yr}$ | 1,586 tons CO per year |
| TSP [d] | $\frac{10\%\ ash\ x10\ lb}{ton}\ x\ \frac{ton}{2000\ lb}\ x(1-99.9/100)\ x\ \frac{6{,}345{,}998\ tons}{yr}$ | 317 tons TSP per year |
| $PM_{10}$ [e] | $317\ tons\ TSP\ /\ yr\ x\ (0.67)$ | 212 tons $PM_{10}$ per year |

Notes: (tons are tons of coal burned)

a. (1#s/100# coal) x (2# SO2/#s) x (2000#/ton) = 40 lb $SO_2$/ton
b. FGD 95% $SO_2$ control
c. Based on SCR w/Low $NO_x$ Burners
d. Reference AP-42, Table 1.1-3 [Reference 41]
e. 67% of TSP $PM_{10}$ Reference AP-42, Table 1.1-5 [Reference 41]

CO = carbon monoxide
NOx = oxides of nitrogen
$PM_{10}$ = particulates having diameter less than 10 microns
$SO_2$ = sulfur dioxide
TSP = total suspended particulates

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**Table 8-3 Gas Fired Alternative**

| Characteristic | Basis |
|---|---|
| Unit size = 482 MW ISO rating net:[a]<br>Two 172 MW-combustion turbines<br>138 MW-heat recovery boiler | Standard size (Duke Power experience) |
| Number of units = 5 | Approximate capacity to replace 2258 MW net |
| Fuel type = natural gas | Assumed |
| Fuel heating value = 23,882 BTUs/# (HHV) | Typical for natural gas used in NC (Duke Power experience) |
| Fuel sulfur content = 0.0006 lb/MMBTU | Used when sulfur content is not available |
| NOx control = selective catalytic reduction (SCR) with water injection | Best available for minimizing NOx emissions |
| Fuel NOx content = 0.009 lb/MMBTU (2.5 ppm) | Typical for large SCR-controlled Combined Cycle gas fired units (EPA BACT Clearinghouse) |
| Fuel CO content = 0.0084 lb/MMBTU (9 ppm) | Typical for large SCR-controlled gas fired units |
| Heat rate = 6,800 BTU/kWh | Typical for combined cycle gas-fired turbines (@ ISO) |
| Capacity factor = 0.8 | Typical for base load units |

Notes

| | |
|---|---|
| a. | The difference between "net" and "gross" is electricity consumed onsite. |
| BTU = | British thermal unit |
| ISO rating = | International Standards Organization rating at standard atmospheric conditions of 59° F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch |
| kWh = | kilowatt hour |
| MM = | million |
| MW = | megawatt |
| NOx = | nitrogen oxide |
| HHV = | High Heating Value |

## Table 8-4 Air Emissions from Gas-Fired Alternative

| Parameter [Notes] | Calculation | Result |
|---|---|---|
| Annual gas consumption | $5\ units\ x \frac{482\ MW}{unit} x \frac{6{,}800\ BTU}{kWxhr} x \frac{1{,}000\ kW}{MW} x 0.8 x \frac{\#}{23{,}882\ BTU} x \frac{24\ hr}{day} x \frac{365\ day}{yr}$ | 4,808,939,955 # per year |
| Annual BTU input | $5\ units\ x \frac{482\ MW}{unit} x \frac{6{,}800\ BTU}{kWxhr} x \frac{1{,}000\ kW}{MW} x 0.8 x \frac{24\ hr}{day} x \frac{365\ day}{yr} x \frac{MMBTU}{10^6\ BTU}$ | 114,847,104 MMBTU per year |
| $SO_2$[a] | $\frac{0.0006\ lb\ SO_2}{MMBTU} x \frac{ton}{2000\ lb} x \frac{114{,}847{,}104\ MMBTU}{yr}$ | 34.4 tons $SO_2$ per year |
| NOx[b] | $\frac{0.0088\ lb\ NOx}{MMBTU} x \frac{ton}{2000\ lb} x \frac{114{,}847{,}104 MMBTU}{yr}$ | 517 tons NOx per year |
| CO[b] | $\frac{0.0084\ lb\ CO}{MMBTU} x \frac{ton}{2000\ lb} x \frac{114{,}847{,}104 MMBTU}{yr}$ | 482 tons CO per year |
| TSP[a] | $\frac{0.005\ lb}{MMBTU} x \frac{ton}{2000\ lb} x \frac{114{,}847{,}104\ MMBTU}{yr}$ | 287 tons filterable TSP per year |
| $PM_{10}$[a] | $\frac{287\ tons\ TSP}{yr}$ | 287 tons filterable $PM_{10}$ per year |

Notes: (tons are tons of coal burned)
a. Recent CT Application
b. 2.5 ppm recent NC Combined Cycle air permit
CO = carbon monoxide
NOx = oxides of nitrogen
$PM_{10}$ = particulates having diameter less than 10 microns
$SO_2$ = sulfur dioxide
TSP = total suspended particulates

## Table 8-5 Comparison of Environmental Impacts – Greenfield Site

| Expected Environmental Impact[c] | Renewal of McGuire Operating License 2258 MW(e) | Conventional Coal-fired 2400 MW(e) | Combined Cycle Fuel Oil /Natural Gas[d] 2410 MW(e) | Combined Cycle Natural Gas 2410 MW(e) | Advanced Light Water Reactor 2300 MW(e) |
|---|---|---|---|---|---|
| **Water Quality** | | | | | |
| **Impacts from site construction** | **Small**-None | **Moderate**-New intake structure; Sediment from land clearing | **Moderate**-New intake structure; Sediment from land clearing | **Moderate**-New intake structure; Sediment from land clearing | **Moderate**-New intake structure; Sediment from land clearing |
| **Consumption** | **Small**-16,600 gpm (1997 – 1999 avg.) | **Small**-~ 23,400 gpm[b] | **Small**-< 16,600 gpm[b] (includes demin water injection) | **Small**-<16,600 gpm[b] | **Small**-~ 23,400 gpm[b] |
| **Pollutants** | **Small**-- Per applicable discharge permits + low-level radwaste discharge | **Small**- Per applicable discharge permits | **Small**- Per applicable discharge permits | **Small**- Per applicable discharge permits | **Small**- Per applicable discharge permits + low-level radwaste discharge |
| **Waste** | **Small**-spent fuel, low level waste, mixed waste | **Moderate**-Large amounts of flyash and scrubber sludge, 8500 cubic feet/year of spent catalyst material | **Small**-1500 cubic feet/year of spent catalyst material, other wastes are minimal | **Small**-1500 cubic feet/year of spent catalyst material, other wastes are minimal | **Small**-spent fuel, slightly more mixed waste and low level waste than license renewal |
| **Air Quality** | | | | | |
| **$NO_x$** | **Small**-Very small emissions | **Moderate**-7,932 tons/year | **Small**-517 tons/year | **Small**-517 tons/year | **Small**-Very small emissions - |
| **$SO_2$** | from facility equipment (diesel generators) | **Moderate**-6,345 tons/year | **Small**-34.4 tons/year | **Small**-34.4 tons/year | from facility equipment (diesel generators |
| **Particulate Matter** | | **Moderate**-212 tons/year | **Moderate**-287 tons/year | **Moderate**-287 tons/year | |
| **CO** | | **Moderate.**-1,586 tons/year | **Small to Moderate**-482 tons/year | **Small to Moderate**-482 tons/year | |
| **Land-use** | **Small**-No additional impacts | **Moderate**-1700 acres[a] needed | **Moderate**-<200 acres needed; gas pipeline ROW | **Moderate**-<200 acres needed; gas pipeline ROW | **Small to Moderate**-Approx. 400 acres needed |
| **Ecology** | **Small**-No additional impact; (impingement, entrainment, waste heat to receiving water body have been evaluated and are minimal) | **Moderate**-New habitat loss; impingement, entrainment, waste heat to receiving water body | **Small to Moderate**-New habitat loss; impingement, entrainment, waste heat to receiving water body | **Small to Moderate**-New habitat loss; impingement, entrainment, waste heat to receiving water body | **Moderate**-New habitat loss; impingement, entrainment, waste heat to receiving water body |
| **Human Health** | **Small**-Substantial public health improvement compared with conventional fossil plant; safety risks to workers | **Small**-Risks to workers and public addressed by regulatory limits established to protect human health. | **Small**- Risks to workers and public addressed by regulatory limits established to protect human health. | **Small**- Risks to workers and public addressed by regulatory limits established to protect human health. | **Small**-< 1% natural radiation source; safety risks to workers |
| **Socioeconomics** | **Small**-Substantial employment and tax revenue benefits | **Moderate**-250 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 950 jobs. | **Moderate**-150 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 1050 jobs. | **Moderate**-150 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 1050 jobs. | **Moderate** -1300 workers – substantial long term economic community benefits. Impacts from construction workforce. |
| **Aesthetics** | **Small**-No Change | **Moderate**-New visual/noise impacts from plant structures and emissions | **Small to Moderate**-New visual/noise impacts from plant structures and emissions | **Small to Moderate**-New visual/noise impacts from plant structures and emissions | **Small**-New visual/noise impacts from plant structures |
| **Historic and Archeological** | **Small**-No Change | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines |

## Table 8-5 (Continued)

**Notes:**
a = varies based on possible site developments. Major area involved in coal handling, waste disposal and ash landfill.
b = based on evaporation rates at Catawba Nuclear Station's once through cooling tower system.
c = based in part on NUREG 1437, Vol. 1, Table 8.2
d = emissions based on natural gas operation only, (conservative)

The GEIS defines significance levels as follows: These definitions are also given in Section 4.0.

**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.

## Table 8-6 Comparison of Environmental Impacts – Brown field Site

| Expected Environmental Impact[c] | Renewal of McGuire Operating License 2258 MW(e) | Conventional Coal-fired 2400 MW(e) | Combined Cycle Fuel Oil /Natural Gas[d] 2410 MW(e) | Combined Cycle Natural Gas 2410 MW(e) |
|---|---|---|---|---|
| **Water Quality** | | | | |
| **Impacts from site construction** | **Small**-None | **Small**-Sediment from land clearing | **Small**-Sediment from land clearing | **Small**-Sediment from land clearing |
| **Consumption** | **Small**-16,600 gpm (1997 – 1999 avg.) | **Small**-~ 23,400 gpm[b] | **Small**-< 16,600 gpm[b] (includes demin water injection) | **Small**-< 16,600 gpm[b] |
| **Pollutants** | **Small**-- Per applicable discharge permits + low-level radwaste discharge | **Small**- Per applicable discharge permits | **Small**- Per applicable discharge permits | **Small**- Per applicable discharge permits |
| **Waste** | **Small**-spent fuel, low level waste, mixed waste | **Moderate**-Large amounts of flyash and scrubber sludge, 8500 cubic feet/year of spent catalyst material | **Small**-1500 cubic feet/year of spent catalyst material, other wastes are minimal | **Small**-1500 cubic feet/year of spent catalyst material, other wastes are minimal |
| **Air Quality** | | | | |
| **$NO_x$** | **Small**-Very small emissions from - facility equipment (diesel generators) | **Moderate**-7,932 tons/year | **Small**-517 tons/year | **Small**-517 tons/year |
| **$SO_2$** | | **Moderate**-6,345 tons/year | **Small**-34.4 tons/year | **Small**-34.4 tons/year |
| **Particulate Matter** | | **Moderate**-212 tons/year | **Moderate**-287 tons/year | **Moderate**-287 tons/year |
| **CO** | | **Moderate**-1,586 tons/year | **Small to Moderate**-482 tons/year | **Small to Moderate**-482 tons/year |
| **Land-use** | **Small**-No additional impacts | **Moderate**-Additional acreage needed[a] | **Small to Moderate**-No additional on-site impacts; gas pipeline ROW | **Small to Moderate**-No additional on-site impacts; gas pipeline ROW |
| **Ecology** | **Small**-No additional impact (impingement entrainment; waste heat to receiving water body have been evaluated and are minimal) | **Small to Moderate**-Habitat loss due to site expansion, primarily for waste handling | **Small to Moderate**-Habitat loss from gas pipeline addition | **Small to Moderate**-Habitat loss from gas pipeline addition |
| **Human Health** | **Small**-Substantial public health improvement compared with conventional fossil plant; safety risks to workers | **Small**- Risks to workers and public addressed by regulatory limits established to protect human health. | **Small**- Risks to workers and public addressed by regulatory limits established to protect human health. | **Small**- Risks to workers and public addressed by regulatory limits established to protect human health. |
| **Socioeconomic** | **Small**-Substantial employment and tax revenue benefits | **Moderate**-250 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 905 jobs. | **Small to Moderate**-150 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 1050 jobs. | **Small to Moderate**-150 workers – moderate long term economic community benefits. Impacts from construction workforce; Loss of 1050 jobs. |
| **Aesthetics** | **Small**-No Change | **Moderate**-Visual/noise impacts from plant structures and emissions | **Small to Moderate**-Visual/noise impacts from plant structures and emissions | **Small to Moderate**-Visual/noise impacts from plant structures and emissions |
| **Historic and Archeological** | **Small**-No Change | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines | **Small**-relatively small unless important site-specific resources affected by plant or transmission lines |

## Table 8-6 (Continued)

**Notes:**
a = varies based on possible site redevelopment. Major area involved for coal handling, waste disposal and ash landfill.
b = based on evaporation rates at Catawba Nuclear Station's once through cooling tower system.
c = based in part on NUREG 1437, Vol. 1, Table 8.2
d = emissions based on natural gas operation only, (conservative)

The GEIS defines significance levels as follows: These definitions are also given in Section 4.0.

**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.

# 9.0 STATUS OF COMPLIANCE

## 9.1 Requirement [§51.45(d)]

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

## 9.2 Environmental Permits

Table 9-1 provides a list of the environmental permits held by McGuire and the compliance status of these permits. No Federal environmental permits have been identified as being required for re-issuance to support the renewal of the McGuire operating licenses. None of the state and local permits listed in Table 9-1 are required to be renewed to support the renewal of the McGuire operating licenses.

The McGuire plant site is located within the planning zone of the Town of Huntersville. The area is currently zoned Special Purpose District. The Special Purpose District allows for industrial uses like McGuire. In addition to zoning classifications, the site is subject to North Carolina's Water Supply Watershed Protection Rules. These rules were implemented in 1992 and regulate the types of development that are allowed within a water supply watershed. McGuire is classified as existing development under these regulations and meets the land management requirements for existing development.

## 9.3 Environmental Permits - Discussion of Compliance

Station personnel are primarily responsible for monitoring and ensuring that McGuire Nuclear Station complies with all of its environmental permits and applicable regulations. Sampling results are submitted to the appropriate agency. McGuire has an excellent record of compliance with its environmental permits, including monitoring, reporting and operating within specified limits.

On February 5, 1996, the NRC issued Amendment No. 164 to Facility Operating License NPF-9 and Amendment No. 146 to Facility Operating License NPF-17 for McGuire Units 1 and 2. These amendments deleted the Environmental Protection Plans (EPP) from both operating licenses [Reference 42]. The EPP was originally issued with the McGuire Operating Licenses and contained requirements to conduct, for a limited time period,

certain aquatic and terrestrial studies. When the required studies were completed, Duke requested that the EPP requirements be deleted from the license.

## 9.4 Other Permits and Licenses

The following additional permits and licenses are listed:

Facility Operating License No. NPF-9 for Unit 1, Docket #50-369, 100 % power license was granted by Amendment 2 to NPF-9 on July 8, 1981.

Facility Operating License No. NPF-17 for Unit 2, Docket #50-370, 100% power license was granted by Amendment 2 to NPF-17 on May 27, 1983.

Storage of spent fuel in an Independent Spent Fuel Storage Installation (ISFSI) is conducted under a general permit issued in accordance with 10 CFR §72.210.

Federal Energy Regulatory Commission, Project 2232, Catawba-Wateree Project, license issued September 17, 1958.

Duke Energy is in compliance with the terms of these permits and licenses.

**Table 9-1 McGuire Environmental Permits and Compliance Status**

| McGuire Environmental Permits | Federal Act | Federal, State or Local Permitting Agency | Date Permit Issued or Expired Compliance Status |
|---|---|---|---|
| NPDES Wastewater Permit # NC0024392 | Federal Water Pollution Control Act Section 402 | North Carolina Department of Environment and Natural Resources | Current permit expires February 28, 2005.<br><br>In compliance. |
| NDPES Stormwater Permit #NCS000020 | Federal Water Pollution Control Act Section 402 | North Carolina Department of Environment and Natural Resources | Current permit expired November 30,1999. Application for permit renewal has been received by NCDENR.<br><br>In compliance. |
| EPA Identification # for Generation and Storage of Hazardous Waste NCD 108 706 029 | Resource Conservation and Recovery Act Section 3010 | North Carolina Department of Environment and Natural Resources | Permit Renewed 8/31/99.<br><br>In compliance. |

**Table 9-1 McGuire Environmental Permits and Compliance Status**

**(Continued)**

| McGuire Environmental Permits | Federal Act | Federal, State or Local Permitting Agency | Date Permit Issued or Expired Compliance Status |
|---|---|---|---|
| Operating Permit – Air Quality #98-110-269 | Clean Air Act Section 112 | Mecklenburg County | Renewed annually.<br><br>In compliance. |
| Landfill Permit # 60-04 | RCRA Subtitle D | North Carolina Department of Environment and Natural Resources | Issued 7/30/92 Beginning in 2000 will be renewed every 5 years.<br><br>In compliance. |
| Underground Storage Tank Permit McGuire # 0-013530 | RCRA Subtitle I | North Carolina Department of Environment and Natural Resources | Renewed annually.<br><br>In compliance. |
| Underground Storage Tank Permit McGuire Garage #0-031536 | RCRA Subtitle I | North Carolina Department of Environment and Natural Resources | Renewed annually.<br><br>In compliance. |
| Asbestos Nonscheduled Removal Permit #NC11014 | National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart M | North Carolina Department of Health and Human Services | Renewed annually, quarterly reporting required.<br><br>In compliance. |
| Depredation Permit DPRD – 757484 | Migratory Bird Treaty Act | US Dept. of the Interior Federal Fish and Wildlife | Renewed annually.<br><br>In compliance. |
| Petroleum Contaminated Soil Remediation Site Erosion and Sedimentation Control Permit | Sedimentation Pollution Control Act | North Carolina Department of Environment and Natural Resources | Issued 6/4/99.<br><br>In compliance. |

**Table 9-1 McGuire Environmental Permits and Compliance Status**

**(Continued)**

| McGuire Environmental Permits | Federal Act | Federal, State or Local Permitting Agency | Date Permit Issued or Expired Compliance Status |
|---|---|---|---|
| Charlotte-Mecklenburg Building Standards Hazardous Materials Permits # FO834994, FO834996, FO835036, FO835017, FO835012, FO835030, FO684265, FO835032, | No applicable Federal Act. | Mecklenburg County Fire Marshall | Renewed annually.<br><br>In compliance. |
| Certificate of Registration of Oil Terminal Facility #604020082 | Oil Pollution and Hazardous Substances Control Act of 1978 | North Carolina Department of Environment and Natural Resources | One time registration issued 11/24/1999.<br><br>In compliance. |

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# 10.0 REFERENCES

1 *Supplement 1 to Regulatory Guide 4.2 Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*, U.S. Nuclear Regulatory Commission, September 2000.

2 *Duke Power Company McGuire Nuclear Station Units 1 and 2 Environmental Report Operating License Stage.*

3 *Catawba River Basinwide Water Quality Plan*, North Carolina Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section, December 1999.

4 *Lake Norman: 1999 Summary Maintenance Monitoring Program, McGuire Nuclear Station: NPDES No. NC0024392*, Duke Power, December 1999 [A copy of the Executive Summary of this report is included as Attachment A].

5 *McGuire Nuclear Station 316(a) Demonstration*, Duke Power Company, June 1985.

6 *NUREG 0422 Safety Evaluation Report related to the operation of McGuire Nuclear Station, Units 1 and 2, Duke Power Company*, U.S. Nuclear Regulatory Commission, March 1978.

7 *Application to Renew the Operating Licenses of McGuire Nuclear Station, Units 1 & 2 and Catawba Nuclear Station, Units 1 & 2*, June 2001.

8 *NUREG-1437, Generic Environmental Statement for License Renewal of Nuclear Power Plants*, Final Report, May 1996.

9 *McGuire Nuclear Station 316(b) Predictive Study of Impingement and Entrainment*, Duke Power Company, October 1978.

10 Letter from W. Lee Fleming, Jr., North Carolina Department of Natural Resources and Community Development, Water Quality Section, to W. A. Haller, Manager, Nuclear Technical Services, Duke Power, dated February 1, 1984. [A copy of this letter is included as Attachment B].

11 Lake Norman: 1998 Summary Maintenance Monitoring Program, McGuire Nuclear Station:NPDES No. NC0024392, Duke Power, December 1999.

12 Letter from R. Paul Wilms, North Carolina Department of Natural Resources and Community Development (NCDNRCD), DEM, to H. B. Tucker, Duke Power, dated October 18, 1985. [A copy of this letter is included as Attachment C].

13 *Safety Evaluation Report related to the Operation of McGuire Nuclear Station Units 1 and 2 Duke Power Company*, March 1978, U.S. Nuclear Regulatory Commission, Section 2.4.5.

14 *Biological Assessment for Endangered, Threatened, and Noteworthy Species, Wetlands, and Significant Natural Area in Association With McGuire Nuclear Station and Related Power Transmission Lines,* L.L. Gaddy. March 2001. [A copy of this report is included as Attachment D].

15 Letter from Mary Santini,Duke Energy to Dr. Steven Cline, NC Dept. of Health and Human Services, requesting information on assessment of public health impacts from thermophillic organisms from McGuire operation, dated February 10, 2000. [A copy of this letter is included as Attachment E].

16 Letter from Dr. Ricky Langley, NC Dept. of Health and Human Services, providing response to request for evaluation of risk from thermophilic organisms, dated June 12, 2000. [A copy of this letter is included as Attachment F].

17 Final Environmental Statement Related to the Proposed William B. McGuire Nuclear Station Units 1&2 Duke Power Company Dockets 50-369 and 50-370 October 1972, United States Atomic Energy Commission.

18 County Manager's Executive Summary Fiscal Year 00-2001. The internet address for this information is:
*http://www.co.mecklenburg.nc.us/cobudget/pdf/Budget_Summaries/revfd2001app.pdf*

19 Town of Huntersville, Patricia Schimel. Tax Information for Town of Huntersville. Personal communication with W.M. Miller, Duke Power.

20 Letter from William M. Miller to Jamal Alavai, North Carolina Department of Transportation, Statewide Planning Branch, dated April 26, 2000. [A copy of this letter is included as Attachment G].

21 Letter from Terry C. Arellano, North Carolina Department of Transportation, to William M. Miller, Duke Energy, providing traffic data in the vicinity of

McGuire, dated, December 27, 2000. [A copy of this letter is included as Attachment H].

22 *2020 Transportation Plan*, Mecklenburg-Union Metropolitan Planning Organization, Adopted April 7, 1999.

23 Letter from Jennifer R. Huff to Renee Gledhill-Early, North Carolina State Historic Preservation Office, dated January 26, 2000. [A copy of this letter is included as Attachment I].

24 Letter from David Brook, North Carolina State Historic Preservation Office, (signed by Renee Gledhill-Early) to Jennifer R. Huff dated January 31, 2000. [A copy of this letter is included as Attachment J].

25 McGuire Nuclear Station Severe Accident Mitigation Alternatives (SAMAs) Analysis, May 2001, Final Report. [A copy of this report is included as Attachment K].

26 Office of Nuclear Reactor Regulation, NRR Office Letter No. 906, Revision 2, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues," dated September 21, 1999.

27 *McGuire Nuclear Station Units 1 and 2 Annual Radiological Environmental Operating Report 1999.*

28 *Catawba River Basinwide Water Quality Plan, NCDENR, Division of Water Quality, Water Quality Section, December 1999.*

29 Letter from Christopher Goudreau, North Carolina Wildlife Resources Commission, to William Miller, Duke Power, dated May 4, 2001. [A copy of this letter is included as Attachment L].

30 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 1 Regarding the Calvert Cliffs Nuclear Power Plant, Final Report October 1999.*

31 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 2 Regarding the Oconee Nuclear Station, Final Report, December 1999.*

32 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 3 Regarding Arkansas Nuclear One, Unit 1, Final Report, April 2001.*

33 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement4 Regarding Edwin I. Hatch Plant, Units 1 and 2 Nuclear One, Unit 1, Draft Report for Comment, September 2000.*

34 *Applicants' Environmental Report Operating License Renewal Stage, Catawba Nuclear Station,* included as Appendix E of the Application.

35 Final Environmental Statement Related to the Proposed William B. McGuire Nuclear Station Units 1 & 2, Duke Power Company, United States Atomic Energy Commission, October 1972.

36 U.S. Dept. of Energy – Form EIA-764, Steam-Electric Plant Operation and Design Report – 1997, 1998 and 1999 for McGuire.

37 *"1998 Local Climatological Data for Charlotte, N.C.,"* United States Department of Commerce.

38 *"Renewable Energy Technology Characterizations"* Electric Power Research Institute, Palo Alto, California, 1997, Report TR-109496.

39 *The Duke Power Annual Plan,* September 1, 2000. [A copy of this is included as Attachment M].

40 "*Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants*", Volume 1, March 20, 1998.

41 COMPLIATION OF AIR POLLUTION FACTORS VOLUME I: STATIONARY POINT AND AREA SOURCES, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, AP-42, Fifth Edition, January 1995.

42 Letter from Victor Nerses, USNRC, to M. S. Tuckman, Duke Power, dated February 5, 1996.