Applicant's Environmental Report
Operating License Renewal Stage

Catawba 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 Catawba Nuclear Station (Catawba). The Duke application is a combined application to renew the licenses for McGuire Nuclear Station, Units 1 and 2, and Catawba 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 Catawba licenses. A separate ER is submitted as part of the application to analyze potential environmental impacts associated with the renewal of the McGuire licenses. This ER is designed to assist the NRC Staff in preparing the Catawba-specific Supplemental Environmental Impact Statement required for license renewal.

The Catawba 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 Catawba operating licenses. No major plant refurbishment activities have been identified as being necessary to support the continued operation of Catawba 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 maintenance activities 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.

Catawba Nuclear Station
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Acronyms and Abbreviations

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
MGD	Million Gallons per Day
NAAQS	National Ambient Air Quality Standards
NCDENR	North Carolina Department of Environment and Natural Resources
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
NRHP	National Register of Historic Places
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
SCDNR	South Carolina Department of Natural Resources
SCDHEC	South Carolina Department of Health and Environmental Control
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
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
$^{\circ}C$	Degrees Celsius
$^{\circ}F$	Degrees Fahrenheit
μm	Micron (1 $x10^{-6}$ meter)

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]"

Duke Power, a division of Duke Energy Corporation, is the operator of Catawba Nuclear Station. Duke Power is also one-eighth owner of Catawba. Catawba Nuclear Station is located geographically near the center of a highly industrialized region of the Carolinas.

Catawba Nuclear Station has a generation capacity of 2258 megawatts (net) base load power. Catawba 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 and contributes to the economic growth and prosperity in the Piedmont region of North Carolina and South Carolina.

The proposed action is to extend the operating licenses for Catawba Nuclear Station, Units 1 and 2 for a period of up to twenty (20) years past the current operating license expiration dates. For Catawba Unit 1 (Facility Operating License NPF-35), the requested renewal would extend the existing license expiration date from midnight December 6, 2024, until either midnight December 6, 2044 or midnight 40 years from the date of the issuance of the renewed operating license for Unit 1, whichever is earlier. For Catawba Unit 2 (Facility Operating License NPF-52), the requested renewal would extend the existing license expiration date from midnight February 24, 2026, until either midnight February 24, 2046 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

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

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.

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 Catawba plant site is located in the north central portion of South Carolina, in northeastern York County, adjacent to Lake Wylie. The Catawba site is approximately 18 miles southwest of Charlotte, N.C. The nearest town, Rock Hill, S.C., is located approximately 6 miles south of the site. The site is located at Latitude 35 degrees-3 minutes-5 seconds North and at Longitude 81 degrees-4 minutes-10 seconds West. The location of the site is shown on Figure 2-1 and Figure 2-2.

Catawba is located approximately 30 miles south-southwest of the McGuire Nuclear Station. McGuire is located approximately 17 miles north-northwest of Charlotte, N.C., as shown on Figure 2-1.

2.2 Site Description

The Catawba site lies in the Piedmont Physiographic Province. The Piedmont is a northeast trending zone that varies in width from about 80 to 120 miles. The site is bounded on the northwest by the Blue Ridge Province and on the southeast by the Atlantic Coastal Plain Province. The plateau generally slopes southeastward with an elevation range from about 1200 feet to 400 feet. The Catawba plant has a 2500 foot radius Exclusion Zone totaling 450.5 acres. Of this 450.5 acres, plant site land area covers 391 acres. This acreage varies in elevation from 570 to 632 feet above mean sea level (msl).

The Catawba site is located on a peninsula bounded by Beaver Dam Creek to the north, Big Allison Creek to the south, the main body of Lake Wylie to the east and private property to the west. Lake Wylie is impounded by Duke Power's Wylie Dam , which is located approximately 4.5 miles southeast of the site. The plant, major buildings and other features associated with Catawba 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 Catawba is shown on Figure 2-2. The region surrounding the Catawba plant is typical of the Piedmont region. Catawba is located near the major urban center of Charlotte, near major transportation routes (I-77 and I-85), and Lake Wylie.

State parks, national battlefields and military parks, and national forests located within 50 miles of Catawba are shown on Figure 2-4. The nearest state parks are approximately 20 miles from Catawba. Four state parks, Kings Mountain, Crowders Mountain, Andrew Jackson and Landsford Canal, are located within 25 miles of Catawba. The Kings Mountain National Military Park is located approximately 20 miles northwest of Catawba.

Four county parks are located within six miles of the site. These parks are shown on Figure 2-5.

The only Native American lands within 50 miles of Catawba are the three sections of the Catawba Indian Reservation, located in York County, S.C., southeast of the Catawba site, as shown on Figure 2-6.

2.4 Population

The population in the region near Catawba consists of both small towns and communities as well as larger cities and towns. The largest nearby population centers are Charlotte, Gastonia and Rock Hill. The population of these and other civil divisions is presented in Table 2-1.

The population densities for areas with 20 miles and 50 miles (radial distance from Catawba) are presented in Table 2-2.

Table 2-1 Populations of Major Civil Divisions Near Catawba Nuclear Station

	2000 Population	
Gaston County, NC	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	
Mecklenburg County, NC	695,454	
Charlotte	540,828	
Cornelius	11,969	
Davidson	7,139	
Huntersville	24,960	
Matthews	22,127	
Mint Hill	14,922	
Pineville	3,449	
York County, SC	164,614	
Clover	4,014	
Fort Mill	7,587	
Rock Hill	49,765	
Tega Cay	4,044	
York	6,985	

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.

Source: South Carolina Budget and Control Board, Office of Research and Statistics – Health and Demographics Section Web Site: http://www.ors.state.sc.us/.

Table 2-2 2000 Population Density at 20 and 50 Miles

Radial Distance From Catawba	2000 Census Population	Population Density (Population/square mile)
20 miles	727,170	579
50 miles	2,041,355	260

These values show that the area near Catawba would be classified as a high population area, based on the criteria in Appendix C of the GEIS.

2.5 Aquatic Environment

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

2.5.1 Lake Wylie – General Description

Lake Wylie serves as the cooling water source for Catawba Nuclear Station. Lake Wylie extends 28 miles in length between Mountain Island Dam and Wylie Dam. Lake Wylie was formed from the impoundment of the Catawba River and initially achieved full pond in 1904. The lake was expanded in 1924 [Reference 2].

Duke Power's Plant Allen, a coal-fired power station, is located on the western shore of Lake Wylie, approximately 11 miles upstream from Catawba.

Mountain Island Lake and Lake Wylie 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 Wylie is the third largest lake in the Catawba chain. The major tributaries for Lake Wylie are the Catawba River, Allison Creek, Crowders Creek and the South Fork River [Reference 3].

Table 2-3 Lake Wylie Summary Data

Full Pond Elevation	569.4 feet (mean sea level)
Maximum Drawdown	10 feet
Full Pond Surface Area	12,139 acres
Full Pond Volume	281,900 acre-feet
Shoreline Length	327 miles
Mean Depth	23 feet
Maximum Depth	93.2 feet
Drainage Area	3020 square miles
Annual Mean Flow (at Wylie Dam)	3774 cubic feet/second
Minimum Average Daily Flow (FERC)	411 cubic feet/second

In addition to serving the needs of the nuclear and hydroelectric power plants, Lake Wylie is a source of municipal drinking water for several cites in the region. The South Carolina Department of Health and Environmental Control (SCDHEC) and the FERC are responsible for permitting withdrawals from Lake Wylie for drinking water.

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

2.5.2 Lake Wylie – Water Quality and Aquatic Resources

Duke conducts periodic monitoring of selected water quality parameters and biota on Lake Wylie. This monitoring, albeit not generally on a specific frequency, includes data on water chemistry, phytoplankton, zooplankton and fisheries.

As Lake Wylie is situated in both North Carolina and South Carolina, both states are involved in the protection, from a watershed perspective, of the lake's water quality. The NCDENR Division of Water Quality prepares basinwide water quality plans for each of the major river basins in the state's waters. While these plans are prepared by the Division of Water Quality, 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 the North Carolina section of Lake Wylie to be fully supportive of all uses, but as defined by the Division of Water Quality, the Catawba Creek arm is "not supporting."

The Watershed Water Quality Management Strategy- Catawba-Santee Basin is a document that describes, at the watershed level, all water quality related activities that may have a negative impact on Catawba River water quality in South Carolina [Reference 4]. Eutrophic conditions in Lake Wylie and several of its major South Carolina tributaries (e.g., South Fork Catawba River) have been evident for several years. To address euthrophication in Lake Wylie, the South Carolina Department of Water Quality and the South Carolina Department of Health and Environmental Control (SCDHEC) have developed a nutrient control program, for both point and non-point source pollution, for the South Carolina portion of the Lake Wylie watershed.

Duke has a long history of working cooperatively with a variety of partners and stakeholders. Duke fishery biologists generally meet annually with the fishery biologists from North Carolina the Wildlife Resources Commission to discuss the fishery programs on the North Carolina section of Lake Wylie, and conversely, with the South Carolina Department of Natural Resources when the issues pertain to the South Carolina sections of the lake. These periodic meetings, as well as ongoing dialogue, are extremely effective in the exchange of information and data, as well as for sharing resources for monitoring the fish populations in Lake Wylie.

2.5.3 Lake Wylie - Water Chemistry

Lake Wylie 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 Wylie's trophic status during 1994-1997, as

measured by the North Carolina Trophic State Index, showed that the uplake (North Carolina) and downlake (South Carolina) regions of Lake Wylie changed frequently, from occasionally oligotrophic to mesotrophic, and even borderline eutrophic. These changes are primarily due to high nutrients from the South Fork River and not from the operation of Catawba Nuclear Station.

2.5.4 Lake Wylie - Aquatic Resources

Phytoplankton Community

Lake Wylie continues to support a generally stable (spatial and seasonal) and diverse phytoplankton community. Differences between uplake (near Plant Allen) and downlake (Lake Wylie Hydro forebay) sampling locations are not nearly as discernable as in other Catawba River reservoirs. This is likely due to the influence of the South Fork Catawba River, a major tributary and significant source of nutrients, which affects lower Lake Wylie. In 1997, the last year data was collected, the yearly average chlorophyll concentration at the downlake sample location was approximately 5 ug/m^3, while the uplake value was ~6 mg/m^3. This 1997 value was somewhat less than the annual 1993-1996 values of 6, 11, 12 and 10 ug/l respectively. Based on 1993-1997 data, Lake Wylie has a Myxophycean Index (number of blue-green species/number of desmid species) value of approximately 3-4 and continues to be classified as meso-eutrophic.

In February and May 2000 uplake and downlake phytoplankton densities were generally comprised of Cryptophytic algae. By August 2000, blue-green algae and diatoms predominated with some green algae, followed in November by diatoms alone assuming dominance. This general trend, with some year-to-year variation, was also seen from 1993-1999.

Zooplankton Community

The downlake Lake Wylie annual zooplankton populations exhibited an unusual trend from other Catawba River reservoirs in that they were usually higher than uplake densities. From 1993-1997, downlake populations (number/m^3) averaged 153,235, 79,056, 66,158, 118,945, and 85,485, respectively, while uplake densities were 52,841, 48,723, 93,264, 50,007, and 70,580. These high downlake zooplankton values are reflective of the trophic conditions of Lake Wylie. An unusual feature of the zooplankton community was the very low percentage of cladocerans. Species of *Brachionus*, an indicator of eutrophic conditions, were found downlake, attaining large numbers in years when productivity was greatest, but were rarely found uplake.

Benthic macroinvertebrates

Benthic macroinvertebrate studies on Lake Wylie are limited to an annual ongoing *Corbicula* monitoring program, which began in 1990. Sampling for this program is conducted in front of the three low-pressure service water intake screens at Catawba Nuclear Station. In 1999, *Corbicula* densities (number/m^2) ranged from 65-297 while in

1998 the range was 245-426. The *Corbicula* densities reported above are not intended to reflect lake-wide populations, but are a measure of the clams found in front of the intake screens.

Fish Community

The 1993-1998 Lake Wylie littoral fish community, measured as mean total biomass, generally ranges from 70-140 kg/1000 m of shoreline electrofished with a historical trend of decreasing biomass from mid-lake (Highway 49 region) to down-lake (Big Allison Creek area). Sunfish (*Lepomis* spp. and *Micropterus salmoides*), catfish (*Ameiurus* spp. and *Ictalurus punctatus*), and common carp (*Cyprinus carpio*) compose the majority of the biomass at all shoreline locations.

In the past few years, both blue catfish (*Ictalurus furcatus*) and flathead catfish (*Pylodictis olivaris*) have established populations in Lake Wylie. These fish are apparently migrants from upstream reservoirs and are presently represented by sparse populations. However, both populations are expanding and their predatory nature may eventually impact other species of fish (primarily other ictalurids) in Lake Wylie.

Threadfin shad (*Dorosoma petenense*) was the dominant forage fish from 1993 to 1997 on Lake Wylie and comprised from 99.8% to 100.00% of the forage fish in purse seine hauls. Threadfin shad densities (number/ hectare) in the four zones of Lake Wylie were variable and ranged from 1,692 to 156,657 during 1993 to 1997. Lake Wylie threadfin shad populations did not exhibit the general trend found in most reservoirs of a greater density uplake compared to downlake. With the exception of 1993, threadfin shad densities were greater downlake than uplake. Lake Wylie threadfin shad population estimates ranged from approximately 15 million to 403 million fish from 1993 to 1997.

2.6 Terrestrial Environment

The Catawba Nuclear Station site and its transmission lines and associated rights-of-way are located in the Piedmont physiographic province of South Carolina. The terrestrial environment of the plant and transmission system is typical of the region. The Catawba site harbors typical Piedmont plant communities such as pine, pine-mixed hardwoods, mixed hardwoods, bottomland mixed and wetlands. The soils of the site and those in associated power line rights-of-way are quite diverse. In eastern York County, there are belts of poorly drained, basic to circumneutral Iredell soils; in central York County, typical Piedmont sandy and loam soils such as Cecil and Lloyd are predominant, and in western York County and eastern Cherokee County, the sandy, rocky soils of the Kings Mountain belt prevail [Reference 5].

Catawba Site Exclusion Zone

The 2500 foot radius Exclusion Zone covers approximately 450.5 acres, 301.1 acres of which is non-forested and consists largely of generation and maintenance facilities, parking lots, open waters and roads. Pines (103.6 acres) and pine-mixed hardwood (36 acres) communities comprise the majority of the Exclusion Zone not occupied by plant structures, waters or facilities [Reference 5]. See Figure 2-7.

The approximately 149 forested acres of the Exclusion Zone, as well as the sections of the transmission rights-of-way inside the Exclusion Zone, do not provide significant terrestrial habitat because of the operational activity involved with Catawba, as well as the small acreage involved. However, a wildlife enhancement area adjacent to the switchyard has wildlife food plots managed to attract quail (*Colinus virginianus*), morning dove (*Zenaida macroura*), white-tailed deer (*Odocoileus virginianus*), songbirds, a variety of voles and mice, raptors, raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana*), etc. Wildlife food plots include plum, sumac, small grain and barberry. A selective mowing program is also practiced to further provide increased cover for wildlife.

The wetland cover type at Catawba includes eleven small wetland communities scattered around the site. Among the wetland areas mapped are small bottomlands, beaver ponds, disturbed seepages, creekbanks, lake margins and artificial impoundments. Wildlife in these areas include various species of turtles, snakes, wading birds, salamanders, beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*).

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

1. Although not presently using the Catawba site to nest, bald eagles (*Haliaeetus leucocephalus*) frequent the Lake Wylie area.

2. Ospreys (*Pandion haliaetus*) are quite common and routinely nest on Catawba facilities and structures.
3. White-tail deer frequent the site and their numbers have increased significantly since Catawba has been operating. There are many reasons for this increase in population size, not only near Catawba, but across the Carolinas. Fragmentation of large tracts of forest and more desirable grazing lands and associated crops are certainly contributors.
4. Canada geese (*Branta canadensis*) numbers around Catawba as well as North and South Carolina 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.

As mentioned previously, bald eagles, state and federally classified as 'threatened', are often observed along Lake Wylie. In 1999, several eagles (presumed to be immature birds) began constructing a small nest in a pine tree adjacent to the cooling towers. The nest was later abandoned. With the exception of the bald eagle, there are no federally or state-listed species known within the Catawba site exclusion area. Additionally, no areas designated by the U.S. Fish and Wildlife Service as "critical habitat" for threatened/endangered species exists at Catawba or in adjacent site properties.

Duke has an effective working relationship with the SCDNR Heritage Trust staff and with personnel of the U.S. Fish and Wildlife Service. Duke and these agencies are in communication about pertinent heritage data, including state and federally listed species, new findings and special habitats.

Transmission System

The Catawba site also includes approximately 42.4 miles of transmission rights-of-way radiating northward, southward and westward from the station. With the exception of the bald eagle, there are no federally or state-listed species known along the transmission lines. Additionally, no areas designated by the U.S. Fish and Wildlife Service as "critical habitat" for threatened/endangered species exists along Catawba's transmission lines.

The data base of the SCDNR Heritage Trust is used in the Duke Electric Transmission Department process of establishing and reviewing rights-of-way vegetation management programs.

2.7 Historic and Archaeological Resources

2.7.1 Cultural Background

The area around Catawba has been inhabited since prehistoric times. Aboriginal groups including the Catawba Indians were in the area when European settlers arrived and displaced the groups. The Catawba Indian reservation is currently located approximately 14 miles (23 km) from Catawba near Rock Hill, S.C. See Figure 2-6.

Settlement of York County by Scots-Irish and other Europeans began in the 1750's when the county was still considered part of North Carolina. York County was established in 1785 after a boundary dispute between North and South Carolina was settled. The county and its county seat, the Town of York, were named for York County, Pennsylvania.

York County's economy was heavily dependent upon cotton production and other agricultural activities until the late 1800s. The development of textile mills and other industrial facilities near Rock Hill altered the economy of the region. Today, western York County remains more rural than eastern York County. Eastern York County is experiencing increased residential development due to its proximity to Charlotte.

2.7.2 Historic and Archaeological Resources at the Catawba Site

No known historic or archaeological sites are located at Catawba. Duke consulted with the South Carolina Department of Archives & History and the University of South Carolina's Institute of Archaeology and Anthropology (SCIAA) in 1973 during the development of Catawba Nuclear Station. Mr. John Combes of the SCIAA stated in a letter dated July 25, 1973 [Reference 6] that his investigations of the site indicated that it was free of significant archaeological and historical sites. The only area of known historic interest is the Concord Cemetery located adjacent to Catawba. See Figure 2-8. The cemetery has been owned and managed by the Concord Cemetery Association since 1974. The Association manages access to the cemetery. No additional archaeological investigations have been conducted on the site since the early 1970s.

2.7.3 Historic and Archaeological Resources Near the Catawba Site

While there are no National Register of Historic Places (NRHP) eligible sites located at Catawba, there is one site listed on the NRHP within a 3.1-mi. radius of the facility. This site, Nanny's Mountain Iron Mines (38YK0216), was nominated to the NRHP in 1996. The site is located approximately 2.4 miles from the facility. In addition to Nanny's Mountain Iron Mines, there are numerous archaeological and historic sites located within a 3-mile radius of Catawba.

Duke conducted additional archaeological investigations in 1978 in conjunction with the development of the Catawba – Ripp and Catawba – Newport transmission lines. Twenty-seven sites were discovered during the survey. None of these sites was located at the facility nor were any of these sites recommended as eligible for the National Register of Historic Places.

Figure 2-1 Location of Catawba Nuclear Station

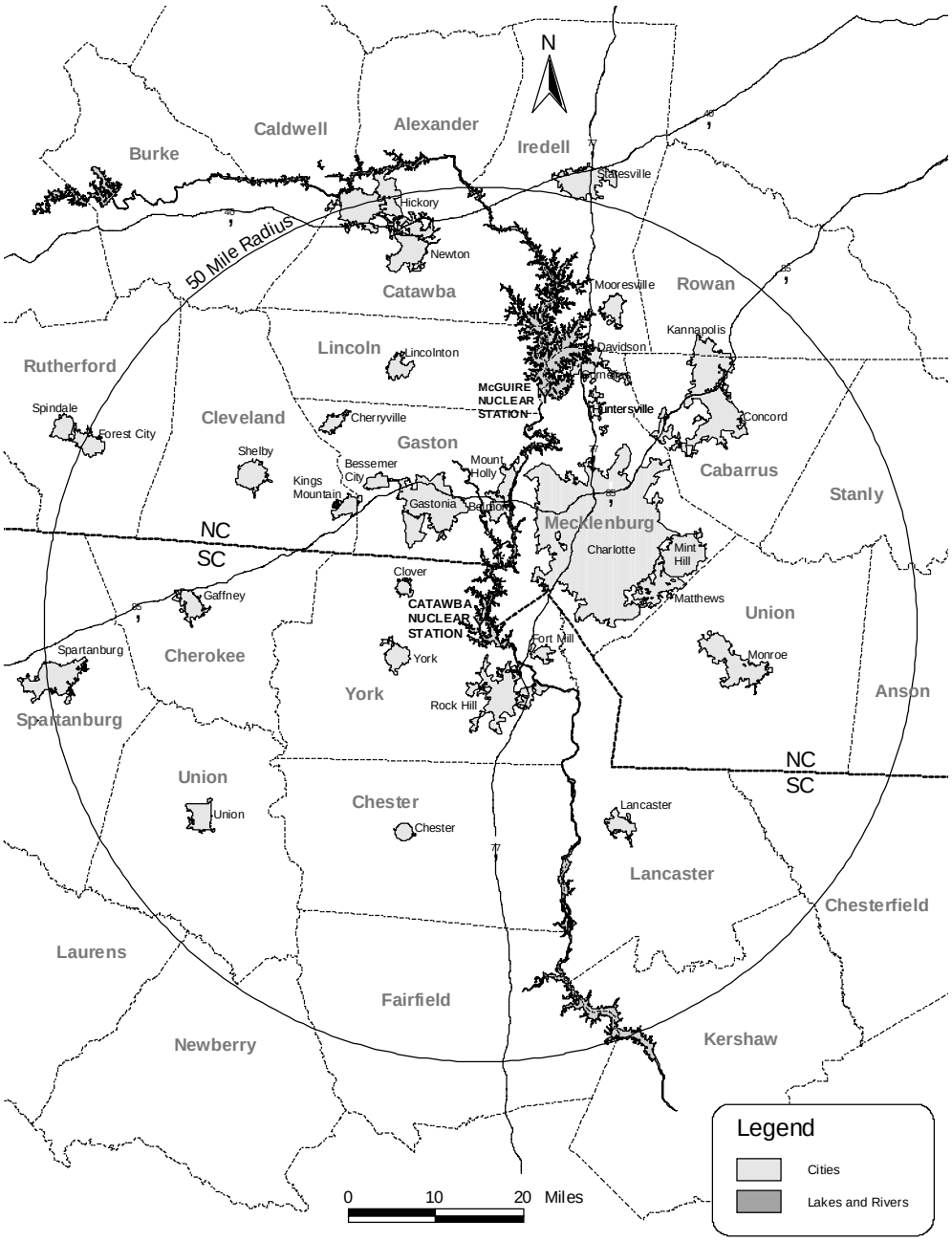


Figure 2-2 General Area Near Catawba Nuclear Station

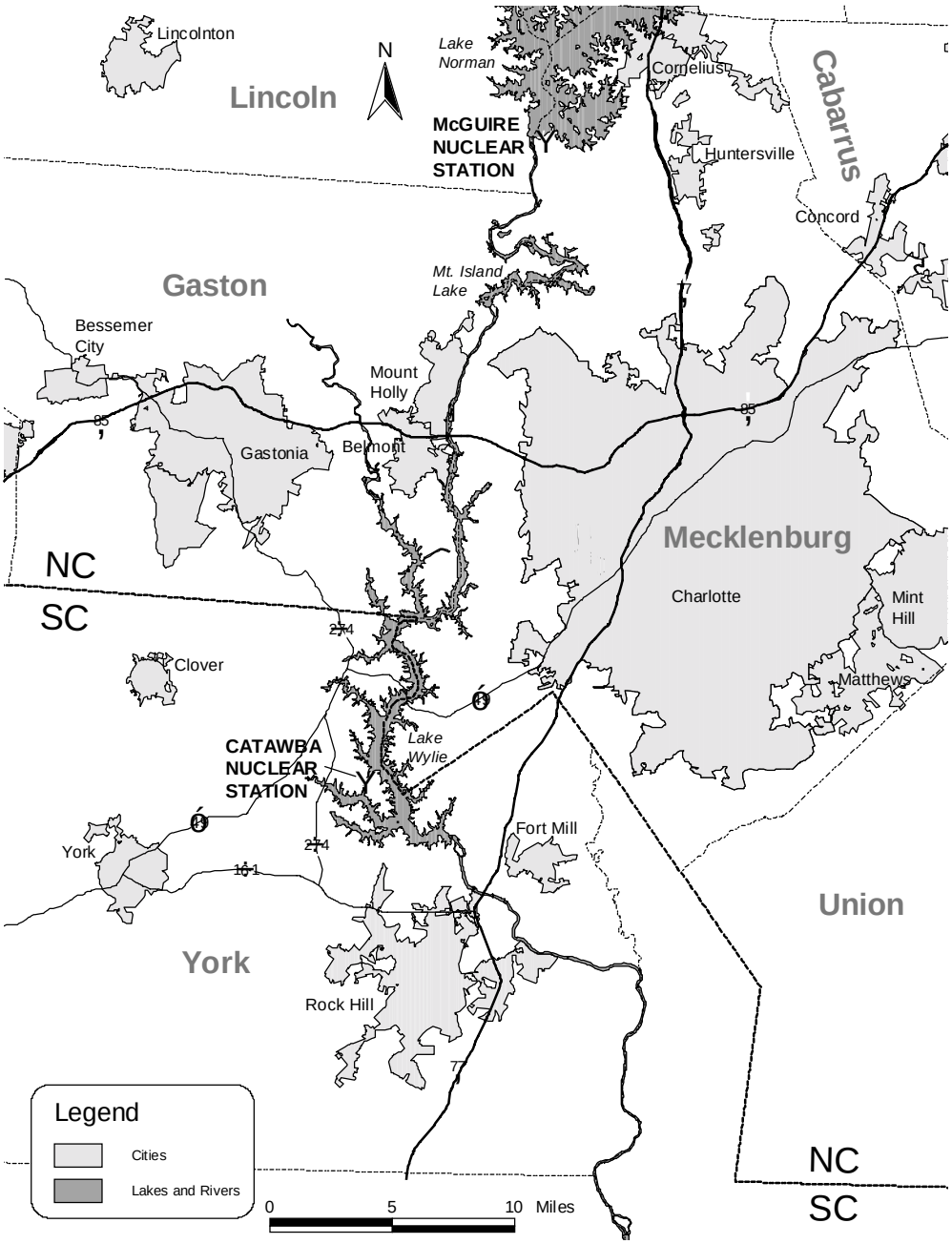


Figure 2-3 Catawba Exclusion Zone and Features

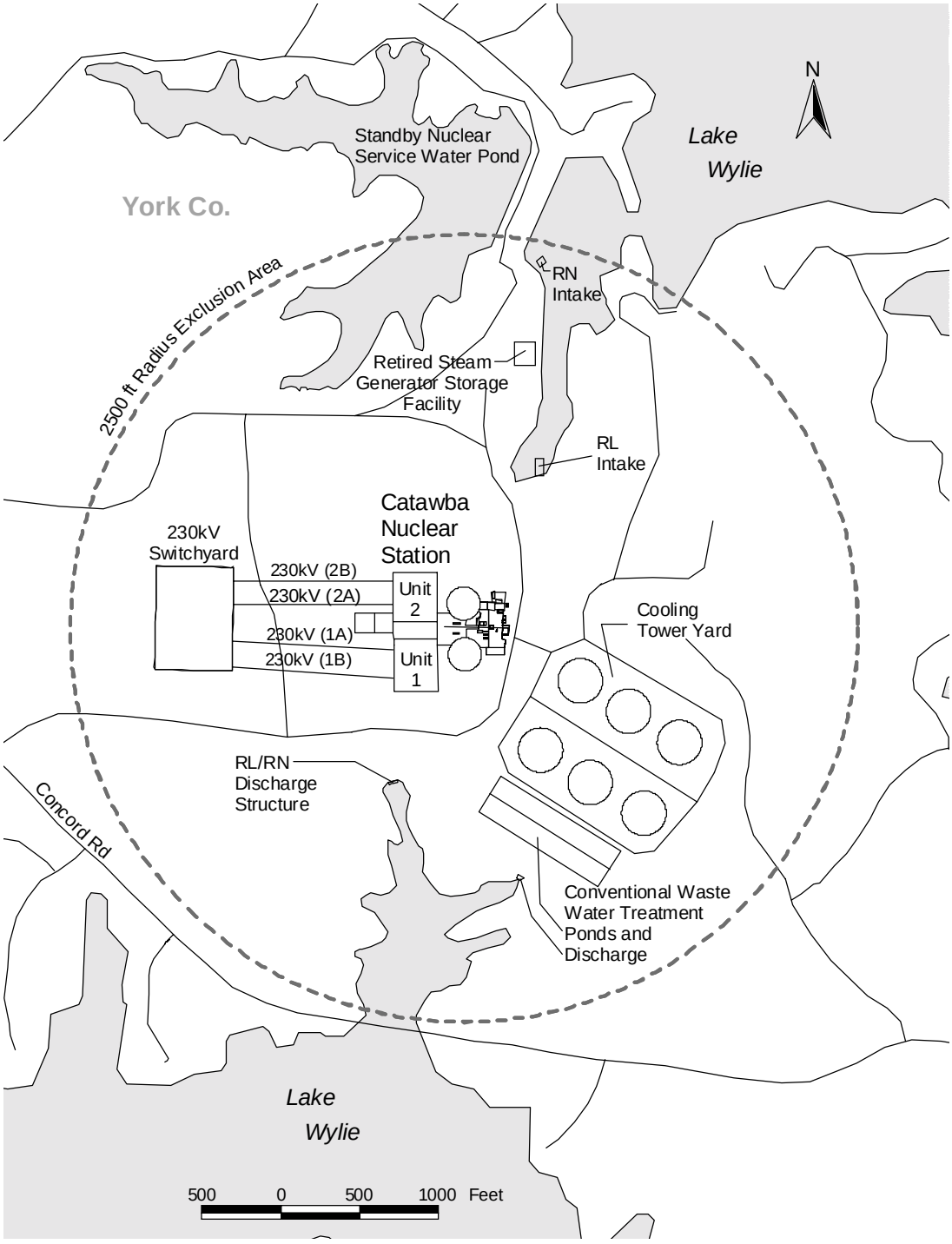


Figure 2-4 50 Mile Radius – State and Federal Lands

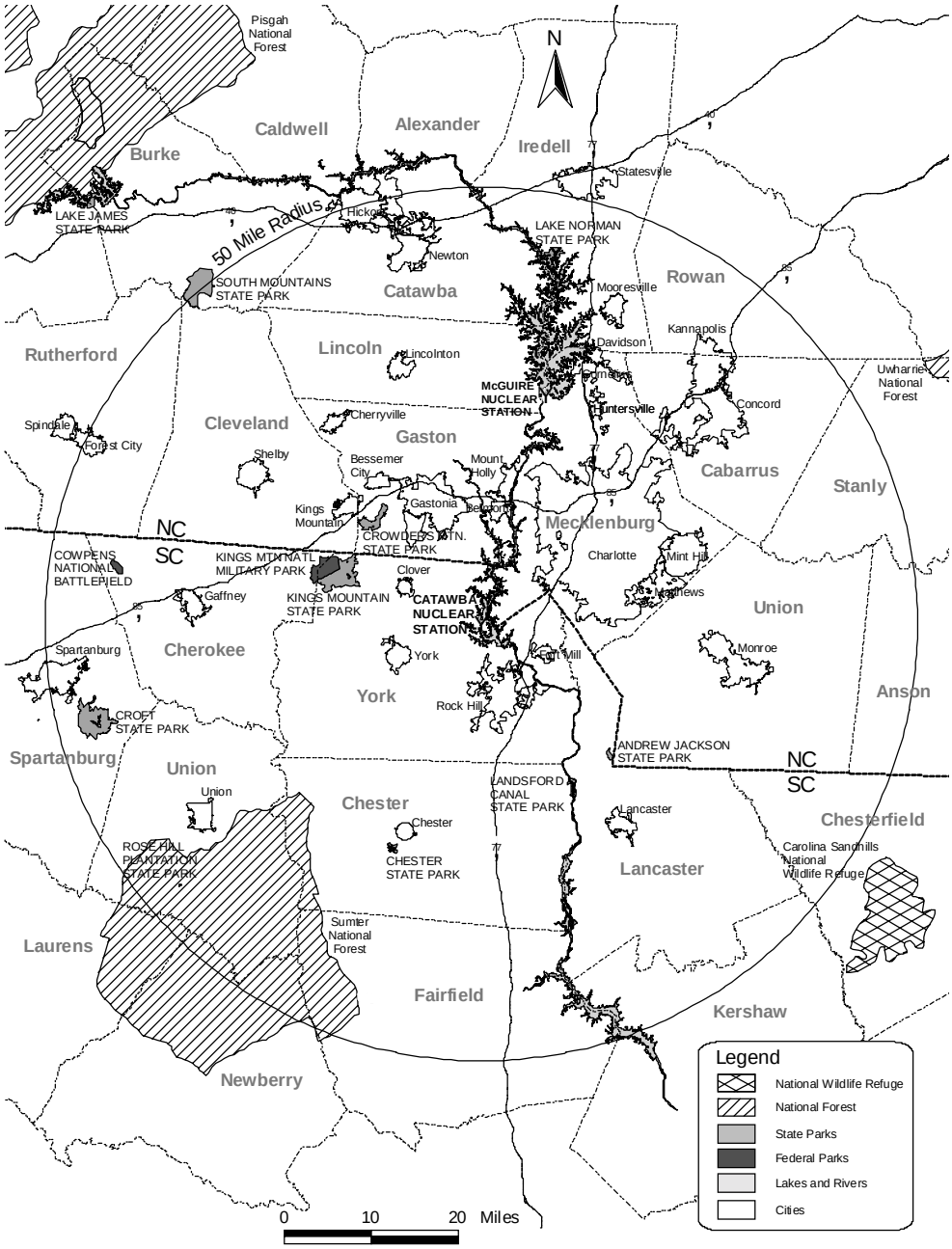


Figure 2-5 6 Mile Radius – Parks and Wildlife Refuges

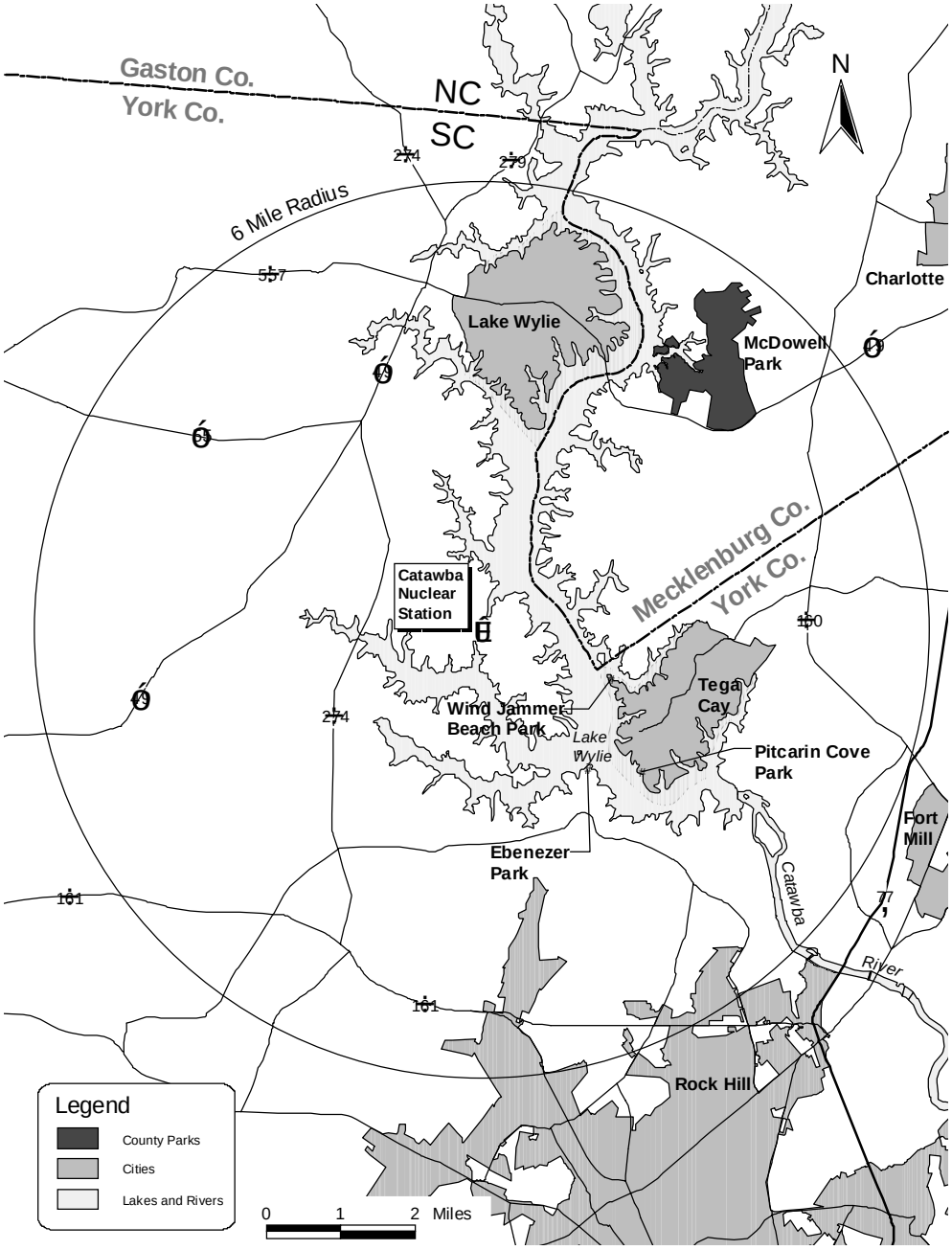
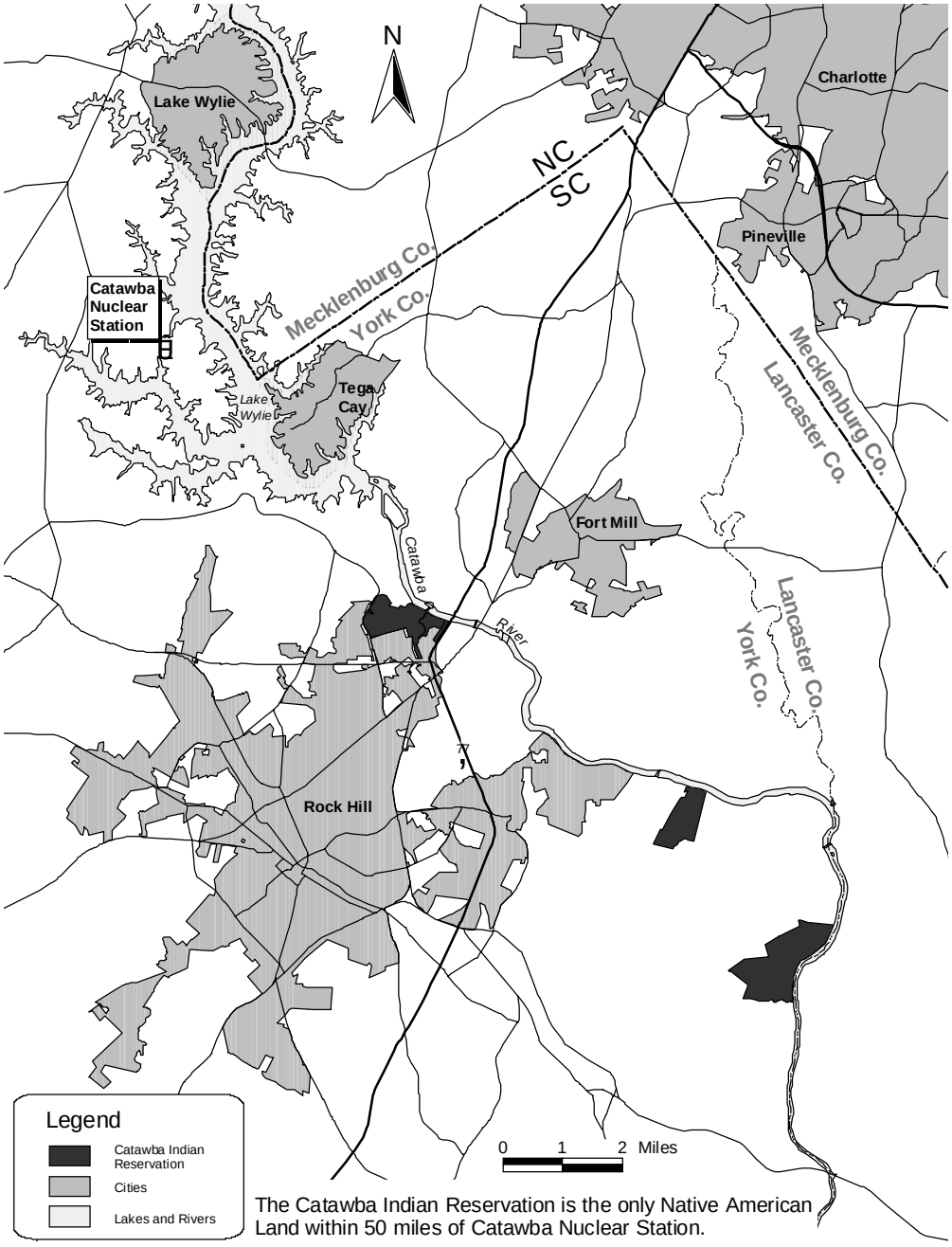


Figure 2-6 Native American Lands



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

Figure 2-7 Catawba Site Land Cover

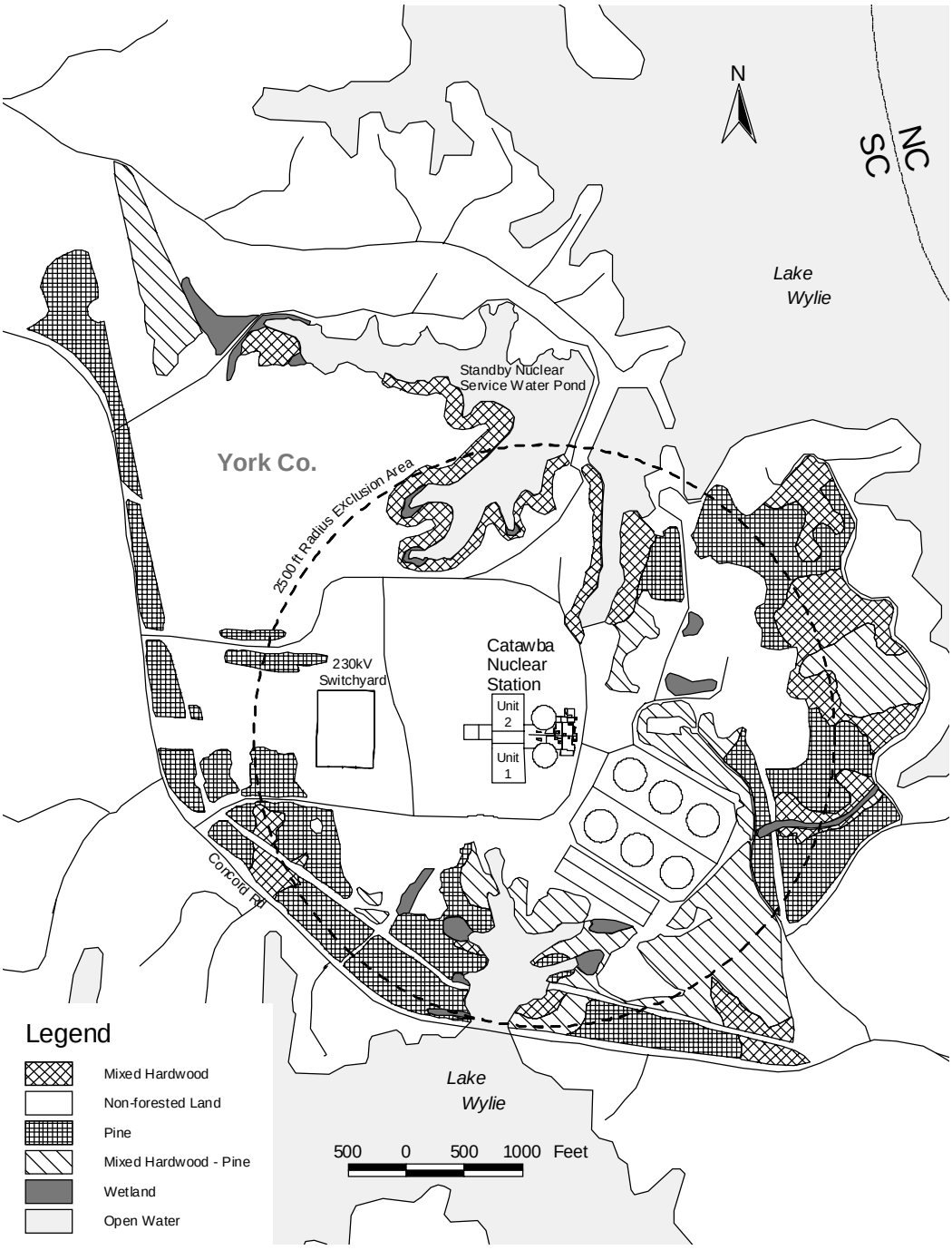
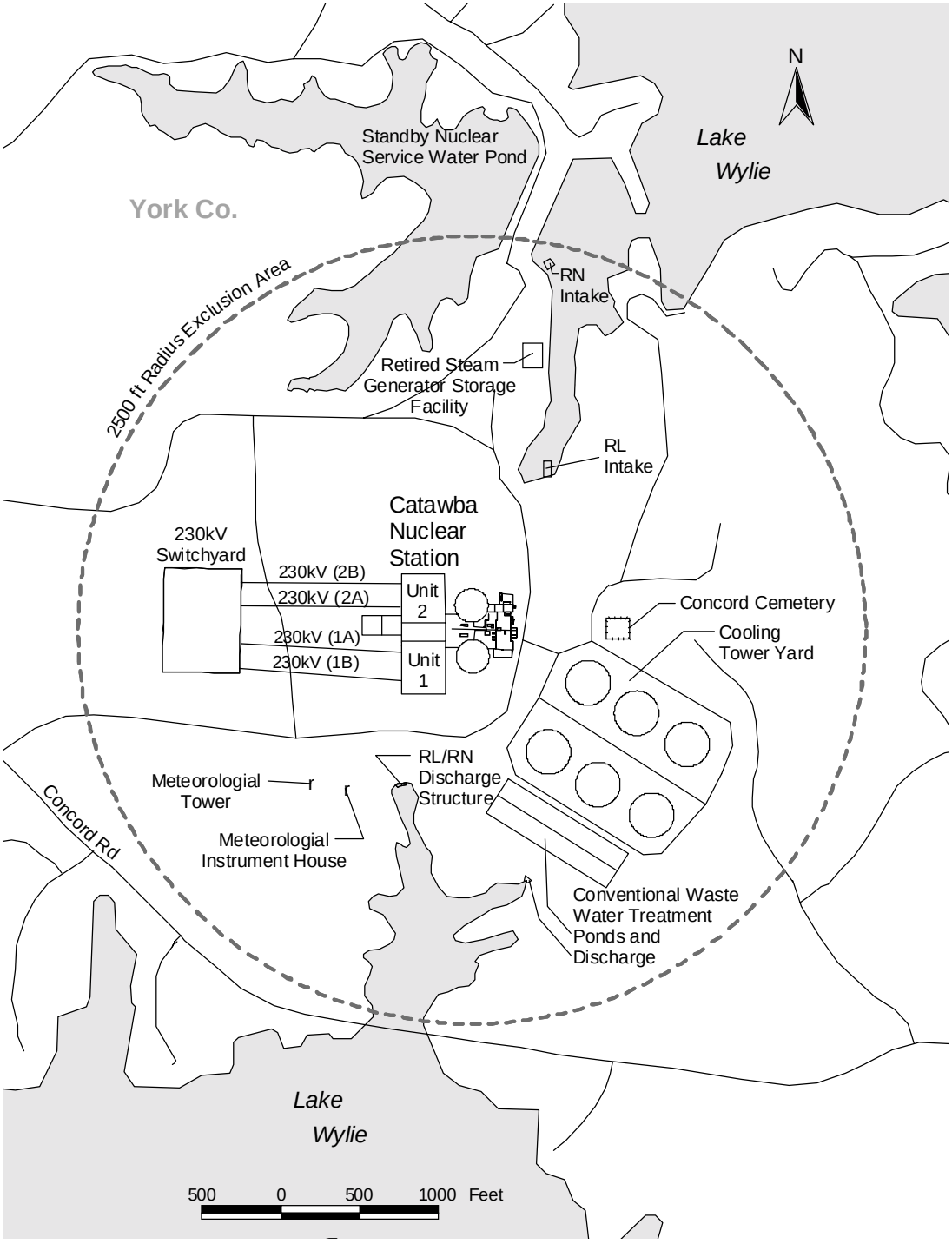


Figure 2-8 Location of Concord Cemetery



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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 Catawba Nuclear Station for an additional twenty (20) years beyond the expiration of the current operating licenses.

For Catawba Unit 1 (Facility Operating License NPF-35), the requested renewal would extend the existing license expiration date from midnight December 6, 2024, until either midnight December 6, 2044, or midnight 40 years from the date of the issuance of the renewed operating license for Unit 1, whichever is earlier. For Catawba Unit 2 (Facility Operating License NPF-52), the requested renewal would extend the existing license expiration date from midnight February 24, 2026, until either midnight February 24, 2046, 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 Catawba units that would significantly affect the environment, including station effluents, during the period of license extension. 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 Catawba plant consists of two Reactor Buildings, one Auxiliary Building, two Turbine Buildings, two Diesel Generator Buildings, one shared Service Building, one Water Chemistry Building and six Mechanical Draft Cooling Towers. The Intake Structure, Discharge Structure and Standby Nuclear Service Water Pond are shared features. In addition to these buildings and features, there are additional office buildings and other facilities at the site used for support staff at Catawba. 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 June 1985. Unit 2 began commercial operation in August 1986.

3.1.1 Reactor and Containment Systems

Each of the two essentially identical units employs a pressurized water reactor Nuclear Steam Supply System (NSSS) with four coolant loops which is furnished by Westinghouse Electric Corporation. These units are similar to those of the McGuire Nuclear Station. 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. Westinghouse Electric Corporation supplied the Nuclear Steam Supply System for each unit. Catawba Unit 1 steam generators were replaced in 1996. Babcock & Wilcox International provided the replacement steam generators.

3.1.2 Fuel and Fuel Handling Systems

The fuel used at Catawba is low-enriched (up to 4.73 percent by weight) uranium dioxide in the form of ceramic pellets contained in zirconium alloy fuel rods (tubes fitted with welded end caps).

Catawba 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 RFA (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 [Reference 7].

The enrichment and burnup conditions for fuel used at Catawba are less than those evaluated in 10 CFR §51.52, Table S-4.

Each unit has a separate fuel handling facility, including the spent fuel pool and a new fuel storage facility. New fuel assemblies are removed from the rail car or truck and stored dry in the new fuel storage racks located in the New Fuel Storage Building or are stored in the Fuel Pool. Spent fuel is removed from the reactor core and placed in the fuel transfer mechanism by the Reactor Building manipulator crane. This transfer mechanism passes the fuel assembly through the transfer tube into the Fuel Pool Transfer Canal. Spent fuel is handled and stored under water. The current status of the fuel storage facilities at Catawba is briefly described below:

Spent Fuel Pool Status

There are two spent fuel pools at Catawba, one each for Unit One and Unit Two. The Unit 1 Spent Fuel Pool has a capacity to store 1,419 assemblies and currently has an inventory of 861 assemblies. The Unit 2 Spent Fuel Pool has a total capacity of 1419 assemblies, with a current inventory of 758 assemblies.

Dry Storage

Duke plans to add an independent spent fuel storage installation (ISFSI) at Catawba in order to expand the storage capacity. Plans for implementation of ISFSI are presently in the early stages of development.

3.1.3 Cooling and Service Water Systems

The Catawba station uses water from Lake Wylie for cooling and process water. The city of Rock Hill supplies potable water used at Catawba. The average daily withdrawal from Lake Wylie for the cooling water and other service water systems is 102 mgd. The average daily discharge to Lake Wylie from Catawba is 60.7 mgd. Water losses are from cooling tower evaporation and drift. Approximately 0.39 mgd from the Conventional Waste Water Treatment system and from the Sewage Treatment System is discharged to Lake Wylie.

The Nuclear Service Water (RN) System and the Low Pressure Service Water (RL) System are the systems that withdraw water from Lake Wylie. These systems in turn supply water to other plant systems as described below.

Intake Structures

The Low Pressure Service Water System (RL) Intake Structure is located on the Beaver Dam Creek arm of Lake Wylie, as shown Figure 3-1. Trash racks and traveling screens are used to remove trash and debris from the intake water. Water from the backwash system is returned to Lake Wylie. The RL Intake Structure is designed to withdraw water from the lake to a pool elevation of 559.4 feet msl, or ten feet below the maximum pool elevation of 569.4 feet msl. The structure is designed for a maximum water velocity of 0.5 feet/second in front of the trashracks/screens at maximum drawdown.

The Nuclear Service Water Intake Structure is located in the same cove, further north, near the Standby Nuclear Service Water Pond Dam. This intake withdraws water through a single 48" diameter pipe at Elevation 540 feet msl.

Discharge Structure

The discharge structure is located on the Big Allison Creek arm of Lake Wylie, as shown on Figure 3-1. This structure is designed to allow warm discharge water to float on the surface with a minimum amount of mixing. The RN, RL, cooling tower blowdown, and liquid radwaste systems discharge through this structure.

Nuclear Service Water System (RN) System

The RN system is used to supply cooling water to various heat loads in the primary portions of each unit. In addition to supplying cooling water to the plant, the system supplies water to the Standby Nuclear Service Water Pond (SNSWP).

Low Pressure Service Water (RL) System
The RL system supplies cooling water for various functions on the secondary side of the plant. These functions include the following systems: Filtered Water Systems, Demineralized Water, and other systems. The RL system also supplies water to the Condenser Circulating Water System. It can also be used to dilute low level liquid radioactive waste to levels acceptable for discharge to the environment. The system also receives discharges from the Nuclear Service Water System (RN) and Condenser Circulating Water System (RC) cooling tower blowdown for discharge to the environment.

Standby Nuclear Service Water Pond
Catawba does not use cooling ponds for normal operation. However, Catawba 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 access to Lake Wylie. 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 shutdown condition. The SNSWP has a volume of approximately 570 ac-ft. at a full pond surface area of approximately 44 acres. The pond is isolated from the plant service water during normal plant operations. The SNSWP has a net inflow from runoff and subsurface interflow.

Condenser Circulating Water (RC) System
The Condenser Circulating Water System supplies water to the main condenser and the cooling towers. The water for the RC system is supplied by the RL system. The heated condenser cooling water is cooled by a closed cycle system using three round, mechanical draft, cross-flow Marley cooling towers per unit.

Cooling tower makeup to replace evaporation, drift and blowdown losses from the system is provided from the Conventional Low Pressure Service Water System to the cooling tower basins. Cooling tower blowdown is extracted from the cooling tower outlet header and is normally returned to the Conventional Low Pressure Service Water System discharge piping, which returns the blowdown to the lake.

An Amertap System on the main and feedwater pump turbine condensers is used to clean the condenser tubes while the plant is in operation. Elastic sponge rubber balls slightly larger in diameter than the condenser tubes, are injected into the condenser circulating water flow upstream of the condenser inlet waterboxes. The sponge rubber balls are forced through the tubes by the pressure differential across the condenser and scrub the tubes clean as they go through. After passing through the condenser, the balls are caught by collectors mounted on the discharge pipes, and pumped back to the waterbox inlet.

The normal chemical additives for the Cooling Towers are A) Sulfuric Acid for pH Control, B) an Algaecide (e.g., Sodium Hypochlorite/Bromine) for biological control and

C) a silt dispersant for silt control. If required, a dechlorination agent may be added to the Cooling Towers prior to blowing down to Lake Wylie. Provisions are made to comply with applicable environmental guidelines concerning NPDES discharge limits.

3.1.4 Radioactive Waste Treatment Processes (Gaseous, Liquid and Solid)

Catawba uses liquid, gaseous and solid radioactive waste management systems to collect and process the radioactive liquid, gaseous and solid wastes that are the by-products of the Catawba operation. These systems reduce radioactive liquid, gaseous and solid effluents before they are released to the environment. The Catawba waste processing systems meet the design objectives of 10 CFR Part 50, Appendix I, and control the processing, disposal and release of radioactive liquid, gaseous and solid wastes. Radioactive material in the reactor coolant is the source of gaseous, liquid and solid radioactive wastes in Liquid Waste Releases (LWRs). Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system also is responsible for coolant contamination.

The systems used for processing--liquid waste processing, gaseous waste processing, solid waste processing, and non-radioactive waste systems--are discussed in the subsequent sections.

The Offsite Dose Calculation Manual (ODCM) specifies the following methodology and parameters used to calculate potential offsite doses due to radioactive liquid and gaseous effluents and to ensure compliance with the dose limitations of the Selected Licensee Commitments (Section 16.11, "Radiological Effluents Control," of the Updated Final Safety Analysis Report [UFSAR, Reference 9]):

- The concentration of radioactive liquid effluents released from the site to the unrestricted area will be limited to ten times the effluent concentration (EC) levels of 10 CFR Part 20, Appendix B, Table 2.
- The exposures to any individual member of the public from radioactive liquid effluents will not result in doses greater than the design objectives of 10 CFR Part 50, Appendix I.
- The dose rate at any time at the site boundary from radioactive gaseous effluents will be limited to (a) less than or equal to 5 mSv/yr (500 mrem/yr) to the whole body and less than or equal to 30 mSv/yr (3000 mrem/yr) to the skin for noble gases and (b) less than or equal to 15 mSv/yr (1500 mrem/yr) to any organ for iodine-131 and 133, tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days.
- The exposure to any individual member of the public from radioactive gaseous effluents will not result in doses greater than the design objectives of 10 CFR Part 50, Appendix I.

- The dose to any individual member of the public from the nuclear fuel cycle will not exceed the limits of 40 CFR Part 190 and 10 CFR Part 20.

Liquid Waste Processing Systems and Effluent Controls

Based on the water source and process train, radioactive liquid wastes from the operation of Catawba are accumulated in storage tanks. These wastes are collected in the Auxiliary Building and the Waste Monitor Tank Building for processing by filtration or demineralization or both. The Waste Monitor Tank Building processes wastes from the Auxiliary Building and, following primary to secondary leaks, secondary system drains. Catawba liquid wastes are disposed of by one of the following three methods based on the concentration of radioactive material in the waste:

- Wastes are collected, sampled, analyzed and then discharged to Lake Wylie.
- Wastes are processed by filtration or demineralization or both, collected, sampled, and analyzed with the filters and/or resins. These wastes are then packaged and shipped to an approved licensed burial ground.
- Wastes are processed by filtration or demineralization or both, collected, sampled, and analyzed with the filters and/or resins. These wastes are then packaged and shipped to an offsite vendor waste processor.

The potential liquid waste generation rate for the two units is 32,880 m^3 (1,161,082 ft^3) per year. The liquid waste holdup capacity is approximately 838,559 liters (221,500 gal). The quantities of radioactive liquid effluents are reported in the Catawba Annual Effluent Report.

The Offsite Dose Calculation Manual (ODCM) prescribes the effluent release rate that will ensure that the concentration of radioactive liquid effluents released from the site to the unrestricted area is less than ten times the effluent concentrations of 10 CFR Part 20, Appendix B, Table 2. In addition, the ODCM provides calculationsfor 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 Selected Licensee Commitments are met.

Gaseous Waste Processing Systems and Effluent Controls

Radioactive gaseous wastes at Catawba are created by the evolution of gases in liquid contained in tanks and piping. The wastes are monitored and released at a permissible rate prescribed by the ODCM. Units 1 and 2 share a Gaseous Waste Disposal System. The purposes of the Gaseous Waste Disposal Systems are to (1) maintain a non-oxidizing cover gas of nitrogen in tanks and equipment that may contain radioactive gas, (2) holdup gas for decay, and (3) release the gases under controlled conditions.

The gaseous wastes are to be released in the following ways depending on the source, quantities, and concentration of radioactive material:

1. Release of Auxiliary Building ventilation air, Containment Air and Addition system, and Reactor Building purges into the unit vents;
2. Release of, Containment Air and Addition system and Reactor Building purges through high-efficiency particulate and charcoal iodine filters to the unit vents;
3. Release of waste gas directly or through high efficiency particulate and charcoal iodine filters to the unit vents;
4. Diversion of gaseous radioactive waste to waste gas tanks followed by a controlled release to the unit vents via high-efficiency particulate and charcoal iodine filters after sampling and analysis; and
5. Release of Waste Monitor Tank Building heating, ventilation and air conditioning (HVAC) and process exhaust.

The quantities of radioactive gaseous effluents are reported in the Catawba Annual Effluent Report.

The ODCM prescribes the effluent release rate to ensure that releases are less than the Selected Licensee Commitments. In addition, the ODCM provides the calculational methodology for the radiation monitor alarm/trip set points, which defines 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 limit is not exceeded and thereby that the Selected Licensee Commitments are met.

Solid Waste Processing and Handling

Non-fuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment and tools removed from service as well as contaminated protective clothing, paper, rags and other trash generated from plant design, operations, modifications, and routine maintenance activities. Solid wastes may be shipped to a waste processor for volume reduction before disposal or may be sent directly to the licensed burial site. Spent resins and filters are de-watered and stored or packaged for shipment to an offsite processing or disposal facility.

Catawba also temporarily stores mixed waste onsite (mixed wastes are composed of radioactive material and hazardous waste). This storage is governed by the Atomic Energy Act (AEA) for radioactive material and the Resource Conservation and Recovery Act (RCRA) for hazardous waste, consistent with NRC and EPA requirements (42 USC 2011-2259 [AEA]; 42 USC 6901 [RCRA]).

3.1.5 Transportation of Radioactive Materials

Solid waste is packaged in containers to meet the applicable requirements of 49 CFR Parts 171 through 177. Disposal and transportation are performed in accordance with the applicable requirements of 10 CFR Part 61 and Part 71, respectively. There are no releases to the environment from radioactive solid wastes created at Catawba. NRC and the state of South Carolina have approved the disposal of slightly contaminated materials within the Owner Controlled Area. For each onsite disposal, the waste is analyzed and confirmed to have acceptably low radionuclide concentrations, following the approval process described in 10 CFR 20.2002.

Approximately 100 solid waste shipments are made from Catawba each year. About 90 are radioactive material shipments (contaminated parts, tools, equipment, sources, etc.) and 10 radwaste shipments (dry active waste, de-watered resins, irradiated hardware, etc.). The radwaste shipments may be shipped to a waste processor to reduce the volume before disposal, or may be sent directly to a licensed burial site.

From year to year, the volume of radioactive contaminated waste generated will vary, but averages are about 250 m^3 (8,825 ft^3) per year. The volume of radioactive contaminated waste shipped for burial averages about 50 m^3 (1,750 ft^3) per year. Catawba has been aggressively reducing volume and minimizing waste for several years and plans to continue to do so in the future.

Low Level Waste Disposal

The typical low level wastes presently and routinely generated by Catawba Nuclear Station consist of primary and secondary resins, filter media, dry active wastes (DAW) and noncompactible trash (contaminated hardware). The waste classification system in 10 CFR Part 61 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, 2 of §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 concentrations and must meet specified waste form and stability requirements. In addition to the stability requirement, Class C waste also requires additional measures at the disposal facility to protect against inadvertent intrusion.

There are different options to dispose of the low level wastes generated from Catawba. Class A wastes, such as secondary resin, DAW trash, 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 the facility at Barnwell, S.C. or the Envirocare facility, located in Utah. Class B or C wastes are usually sent directly to Barnwell, S.C. for disposal.

South Carolina is the hosting member of the Atlantic Compact which includes the states of New Jersey and Connecticut. The Barnwell site is the hosting site for the compact.

3.1.6 Non-radioactive Waste Systems

Solid Waste

Non-radioactive solid wastes generated at Catawba are disposed of either in the on-site landfill or in other approved landfills. Wastes such as asbestos, empty paint containers and oil-contaminated materials are disposed of in the on-site landfill, which is permitted by the South Carolina Department of Health and Environmental Control (SCDHEC). General trash such as cafeteria wastes and office waste are collected and transported off-site to a permitted landfill. Construction waste such as wood and concrete is transported off-site 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.

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 SCDHEC. Liquid sanitary wastes are treated on site in a wastewater treatment system. The Conventional Wastewater (WC) System receives wastewater from various plant sumps. Before discharge to Lake Wylie, these wastes are treated by sedimentation, skimming, precipitation, neutralization and mixing.

Gaseous Waste

Non-radioactive gaseous releases come from operation of emergency diesel generators and site painting activities. These releases are regulated and permitted by South Carolina Department of Health and Environmental Control.

3.1.7 Maintenance, Inspection and Refueling Activities

Various programs and activities currently exist at Catawba to maintain, inspect, test and monitor the performance of plant equipment. These programs and activities include 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, In-service 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.

3.1.8 Power Transmission Systems

Two separate and physically independent overhead transmission line circuits are provided to connect each Catawba unit to the 230kV transmission network via the 230 kV switchyard as shown in Figure 3-2. Four lines connect the plant to the switchyard. Each line is 230kV, three phase with an average length from the transformer yard to the 230kV switchyard of approximately 1,000 feet. Due to the short length of these lines, supporting towers are not required between the station and the switchyard. These 230kV transmission lines are designed to withstand the heavy loading conditions defined in the 1973 edition of the National Electric Safety Code

The Catawba switchyard is connected to the primary transmission system by six 230kV double-circuit overhead transmission lines as shown on Figure 3-1. As described in Section 4.2.7 Power Transmission System [Reference 8] (FES- Operating), the lines constructed:

> *"for connecting Catawba with Duke's existing transmission system consist of constructing two new 230 kV lines and connecting three existing 230 kV lines to the Catawba Switching Station."*

These lines are shown on Figure 4.5 of Reference 8 and described in Table 4.6 of Reference 8.

Figure 3-2 shows these lines and the lengths are presented in Table 3-1.

3.1.9 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 Catawba 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.

Table 3-1 Power Transmission Lines Related to the License Renewal for Catawba Nuclear Station

Name of Line	Total Right-of-Way Length	Comments
Catawba-Allen	10.9 miles (17.5 km)	9.6 miles (15.5 km) rebuilt; 1.3 miles (2.1 km) new
Catawba-Ripp	24.4 miles (39.3 km)	24.4 miles(39.3 km) all new
Catawba-Pacolet	1.2 miles (2.1 km)	Extended line 1.2 miles (2.1 km) from former Allison Creek tie; no work performed on remainder of line
Catawba-Newport (Allison Creek B&W (Black &White))	0.7 miles (8.4 km)	0.7 miles (1.1 km) new line; total length 5.2 miles (8.4 km) from Catawba to Newport tie
Catawba-Newport (Newport B&W)	5.2 miles (8.4 km)	5.2 miles (8.4 km) all new
Total Length	**42.4 miles (75.7 km)**	

3.1.10 Groundwater

The Catawba site lies within a groundwater region that is part of the Piedmont Groundwater Province. Groundwater recharge in this area is derived entirely from infiltration of local precipitation. The surface materials in many locations are relatively impermeable, with the result that only 10 in. (25 cm) to 15 in. (38 cm) of the average 45 in. (114 cm) of annual precipitation percolate to the water table [Reference 9]. Groundwater is contained in the pores that occur in the weathered material (residual soil-saprolite) above the relatively unweathered rock, and in the fractures in the igneous and metamorphic rock. The depth to the water table depends on climate, topography, rock type and rock weathering. The water table varies from ground surface elevation in valleys to more than 100 ft (30 m) below the surface on sharply rising hills.

As noted in Section 3.1.3, the city of Rock Hill supplies potable water used at Catawba. The only groundwater withdrawals at Catawba are from three water supply wells, that supply periodic water demands, and from the Reactor Building and Auxiliary Building Dewatering System. The following sections describe these withdrawals.

Water Supply Wells

There are three (3) groundwater supply wells at the Catawba site. As shown in Table 3-2 below, these wells are used for periodic water supply to remote facilities and for seasonal irrigation use.

Table 3-2 Groundwater Supply Wells

Well Location and Number of Wells	Pumping Capacity	Description of Use	Average Annual Groundwater Withdrawal Rate
Catawba Park Employee Recreational Area on Lake Wylie	11 gpm	Supplies water to restrooms, boat docks, and picnic shelter. (8 hr/day usage)	4 gpm
Security Training Facility	27 gpm	Non-potable supply used as flush water for restrooms. (8 hr/day usage)	9 gpm
Catawba Training Center	264 gpm	Supplies water to irrigation system only. Usage is approx 2 hrs/day during growing season. (9 months/year)	17 gpm
			Total Rate 30 gpm

Reactor Building and Auxiliary Building Dewatering System

In addition to the groundwater wells described above, a dewatering system is used to reduce the hydrostatic pressures on the Reactor and Auxiliary Buildings. In the site area, groundwater is generally encountered under water table conditions in weathered rocks and residual soils that overlie less weathered rocks. Pre-construction groundwater elevations indicate the level varies from about 10 ft. (3m) to 40 ft. (12 m) below natural ground surface near the location of the Reactors, and that it approaches the surface elevation of Lake Wylie near the lake shore. Thus, groundwater movement is from the plant area toward the lake coves that cut into the peninsula to the north and to the south of the site.

A permanent groundwater drainage system is installed as shown on the Catawba UFSAR Figure 2-60 and Figure 2-61 [Reference 9]. The drainage system creates and permanently maintains a normal groundwater level at or near the base of the foundation mat and basement walls, thus eliminating the uplift and hydrostatic forces. This groundwater drainage system consists of foundation underdrains and continuous exterior wall drains. The foundation underdrains and the exterior wall drains discharge into three sumps located adjacent to the Auxiliary Building (Sumps A and B are 10 feet by 10 feet by 15 feet deep. Sump C is 17 feet by 17 feet by 12 feet deep). A design flow rate of 68 gallons per minute (gpm) into the Reactor and Auxiliary Building area was determined from subsurface investigation and testing. On a yearly basis, the average groundwater drainage discharge from these sumps is 34 gpm (average annual discharge).

3.1.11 Operational Data

Catawba Units 1 and 2 had a combined annual capacity factor of 90% in 2000. The monthly average discharge temperature ranged from 59.6° F in February to 92.2° F in July. The operation of Catawba during the period of the extended license is expected to be similar to recent performance.

The low pressure service water (RL) and nuclear service water systems (RN) combine into a common header and discharge into Lake Wylie. The thermal discharge is regulated by NPDES permit # SC0004278. The monthly average NPDES thermal discharge limitations are a temperature rise (from intake to discharge) of 10.0 degrees F for the months of April through September and 14.0 degrees F for the months of October through March. These limits were based on the successful completion of a 316 (a) demonstration, which shows that the operation of Catawba Nuclear Station had no adverse impact to the balanced indigenous aquatic community of Lake Wylie.

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 10]. 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. These activities will not affect the environment outside the bounds of the plant operations evaluated by the FES [Reference 8] nor applicable portions of NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants [Reference 13].

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. These are identified through review of the "Technical Issues Checklist." 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 10] 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 any significant environmental impacts.

3.4 Employment

The full time work force at Catawba consists of approximately 1200 persons. Duke has no plans to add significant numbers of 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. There is an average of 1400 workers on site during the dayshift of plant outage periods. This compares to a norm of 900 during weekdays of normal plant operation. 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 Catawba.

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

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

Cherokee County, S.C.	**31**
Gaffney	27
Other Cites and Towns	4
Chester County, S.C.	**20**
Chester	13
Other Cites and Towns	7
Lancaster County, S.C.	**19**
Lancaster	16
Other Cites and Towns	3
York County, S.C.	**673**
Clover	76
Fort Mill	52
Lake Wylie	13
Rock Hill	362
York	131
Other Cites and Towns	39
Cabarrus County, N.C.	**14**
Concord	6
Harrisburg	5
Kannapolis	3
Cleveland County, N.C.	**25**
Kings Mountain	15
Shelby	7
Other Cites and Towns	3
Gaston County, N.C.	**188**
Belmont	34
Dallas	11
Gastonia	104
Mount Holly	15
Stanley	8
Other Cites and Towns	16
Lincoln County	**25**
Denver	7
Lincolnton	15
Other Cites and Towns	3
Mecklenburg County	**166**
Charlotte	141
Huntersville	6
Matthews	11
Pineville	6
Other Cites and Towns	2
Union County	**17**
Other Cites and Towns	17
Other North Carolina Counties	**31**
Other South Carolina Counties	**9**
Total	**1218**

Figure 3-1 Catawba Plant Features

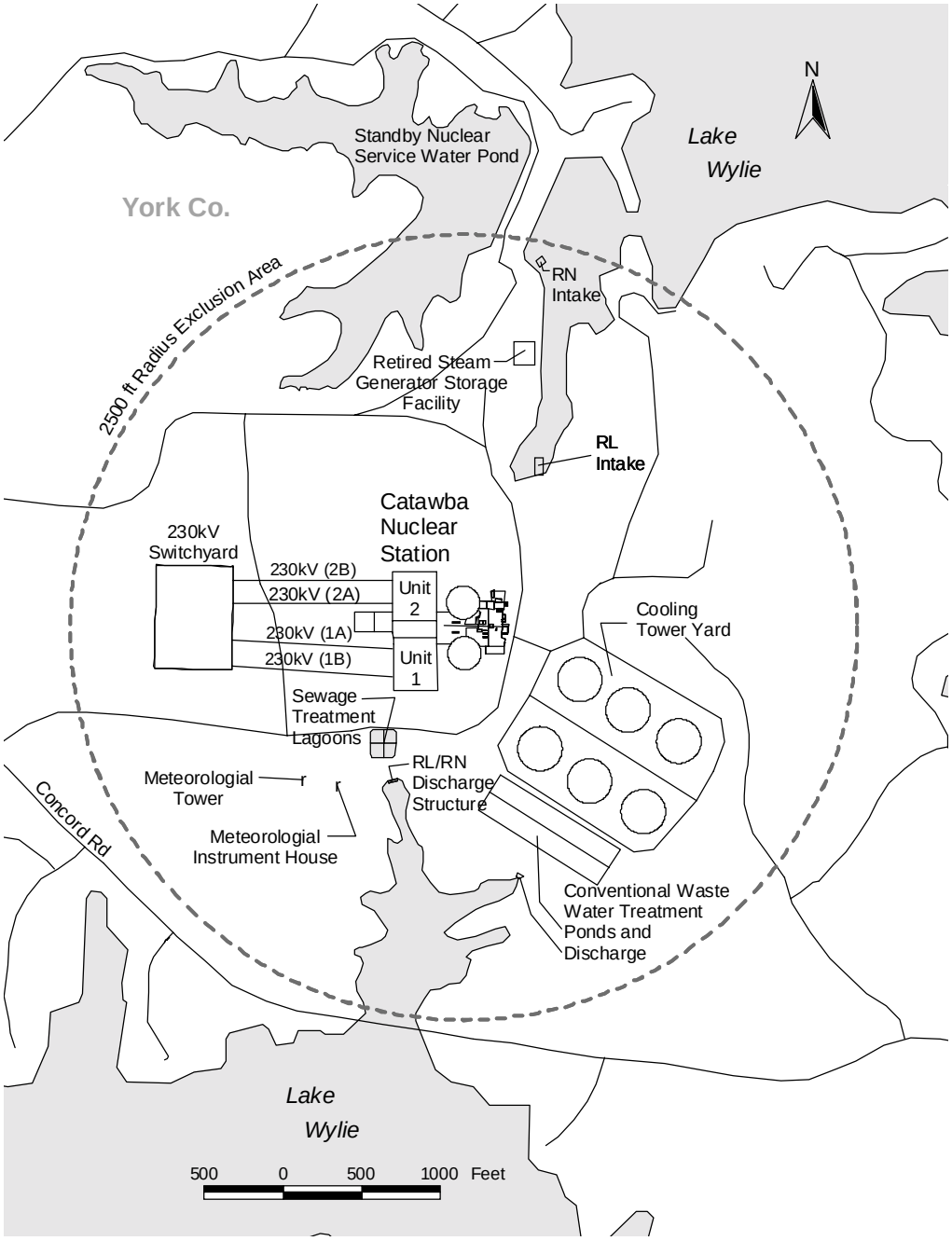
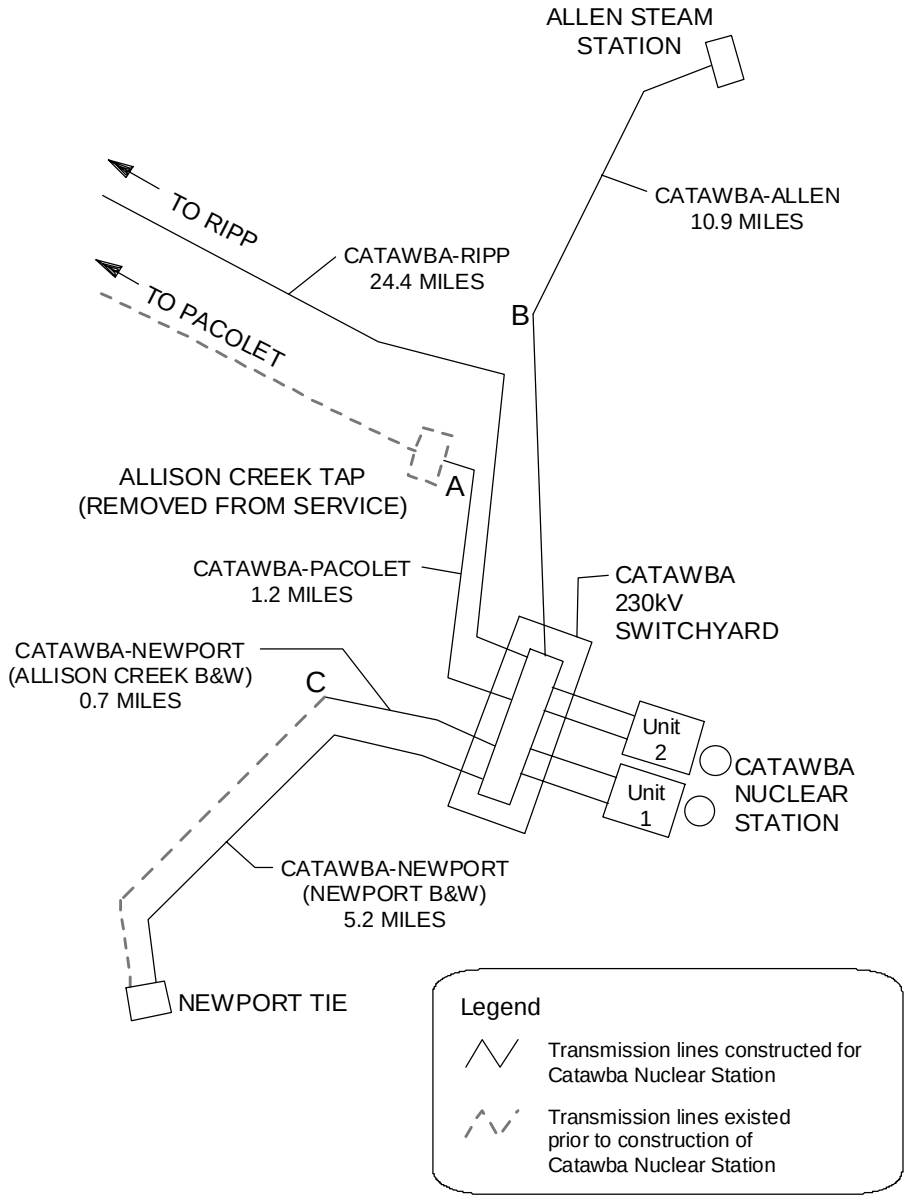


Figure 3-2 Catawba Transmission Lines



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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. 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 Catawba because no refurbishment activities have been identified. These issues are listed in Table 4-1.

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

The remaining Category 1 issues listed in Table B-1 were reviewed to determine if the conclusions found in the GEIS for these issues are valid for Catawba. The review found that the conclusions in the GEIS are valid for Catawba and that no new information exists 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 Activities

The following Category 1 issues are related to refurbishment. These issues are not applicable to Catawba because no refurbishment activities have been identified.

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

The following 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 Catawba, based on the location or the design of Catawba.

Surface Water Quality, Hydrology, and Use (for all plants)	
Altered salinity gradients	Not applicable due to plant location.
Scouring caused by discharged cooling water	Not applicable. Catawba uses cooling towers rather than once-through cooling.
Water use conflicts (plants with once-through cooling systems)	Not applicable. Catawba uses cooling towers rather than once-through cooling.
Ground-water Use and Quality	
Ground-water quality degradation (Ranney wells)	Not applicable. Catawba 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 pond impacts on terrestrial resources	Not applicable. Catawba does not use cooling ponds.

Table 4-3 Category 1 Issues Applicable to Catawba

The remaining Category 1 issues listed in Table B-1 were reviewed to determine if the conclusions found in the GEIS for these issues are valid for Catawba. The review found that the conclusions in the GEIS are valid for Catawba and that no new or significant information exists 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 below.

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
Eutrophication
Discharge of chlorine or other biocides
Discharge of sanitary wastes and minor chemical spills
Discharge of other metals in waste water
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)
Entrainment of fish and shellfish in early life stages (for plants with cooling-tower-based heat dissipation systems)
Impingement of fish and shellfish (for plants with cooling-tower-based heat dissipation systems)
Heat shock (for plants with cooling-tower-based heat dissipation systems)

Table 4-3 Category 1 Issues Applicable to Catawba

(Continued)

Ground-water Use and Quality
Ground-water use conflicts (potable and service water; plants that use <100 gpm)
Terrestrial Resources
Cooling tower impacts on crops and ornamental vegetation
Cooling tower impacts on native plants
Bird collisions with cooling towers
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 Catawba

(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 §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) 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 Catawba and McGuire 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. 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 Catawba

No analysis was performed for issues that are not applicable to Catawba due to plant design. The basis for Duke's determination that a certain issue is not applicable is set forth in the specific sections that follow.

Issues Applicable to Catawba 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 Catawba 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 4.1 through 4.21. Information concerning Environmental Justice is found in Section 4.22. 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 Catawba, 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. Background information is not provided for issues that are not applicable to Catawba.
- **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 Catawba-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 3.15×10^{12} ft^3/ year (9×10^{10} m^3/ year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided.

4.1.4 Background

Two factors may cause water-use and water-availability issues to become important for some nuclear power plants that use cooling towers. First, the relatively small rates of cooling water withdrawal and discharge allowed some power plants with cooling towers to be located on small bodies of water that are susceptible to droughts or competing water uses. Second, closed-cycle cooling systems evaporate cooling water, and consumptive water losses may represent a substantial proportion of the flows in small rivers. Loss of a substantial portion of flow from a small stream as a result of evaporative losses from a cooling tower will reduce the amount of habitat for fish and aquatic invertebrates. Off-stream water uses, such as power plant consumption, must be regulated to ensure that important in-stream uses, such as habitat for aquatic organisms, boating, angling, and waste assimilation, are not compromised.

Consumptive water use can adversely impact riparian vegetation and associated animal communities by reducing the amount of water in the stream that is available for plant growth, maintenance, and reproduction. Riparian vegetation is defined as streamside vegetation that is structurally and floristically distinct from adjacent upland plant communities (Taylor 1982). Riparian vegetation has important ecological functions; and its importance as a resource has been widely recognized and reviewed (e.g., Brinson et al. 1981; Johnson et al. 1985). Briefly, riparian vegetation stabilizes stream channels and floodplains. It influences biogeochemical cycles, water temperature and quality, and the duration and magnitude of flooding. Riparian vegetation also provides diverse cover, food, water, reproductive habitat, and migration corridors for many aquatic and terrestrial animals. As a result, riparian zones often support a wide variety and high density of

wildlife (deer, small mammals, songbirds, raptors, reptiles, and amphibians), especially in arid or urbanized areas. Riparian vegetation may be adversely affected by dewatering in a number of ways (Taylor 1982), including decreases in the width of the riparian corridor, changes in species and community diversity, increased susceptibility to flooding, changes in tree canopy cover, lower tree basal area, and lower seedling densities. Impacts to wildlife occur as a direct or indirect result of degradation of riparian habitats. Such dewatering effects are most apparent in the arid and semi-arid West; in the eastern United States, dewatering effects generally involve more subtle changes in community composition because of the higher precipitation, humidity, and soil moisture and the lower water stress conditions that prevail.

Because water use conflicts may be small or moderate during the license renewal period, this is a Category 2 issue for nuclear plants with closed-cycle cooling systems. Related to this, the effects of consumptive water use on in-stream and riparian communities could also be small or moderate, depending on the plant, and is also a Category 2 issue.

4.1.5 Analysis of Environmental Impact

The Catawba Nuclear Station is located on Lake Wylie. Average annual flow through Lake Wylie is 4,390 cfs ($1.38 \times 10^{11} ft^3/yr$), see Table 4-4, from USGS Water Resources Data, South Carolina – Water Year 1999 [Reference 11], which is less than the 3.15×10^{12} ft^3/year minimum flow rate specified by requirement §51.53(c)(3) (ii)(A). Therefore, Duke must provide an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities. The assessment of the impact of license renewal on flow through Lake Wylie is provided in Section 4.1.5.1. Effects on riparian and aquatic communities are discussed in Section 4.1.5.2.

4.1.5.1 HYDROLOGIC AND HYDRAULIC INFORMATION

Lake Wylie is the seventh of eleven impoundments in the 225-mile Catawba-Wateree project managed by Duke. Lake Wylie extends 28 miles upstream from Wylie Dam to Mountain Island Dam. There are no free-flowing sections of the Catawba River between the two dams. Flow through the Catawba-Wateree Project is managed by Duke to optimize hydroelectric generation, provide flood control, meet FERC minimum release requirements and to maintain a constant and reliable water supply for their thermoelectric stations, surrounding communities, and industry.

At the full pond level of 569.4 feet, Lake Wylie has a storage volume of 281,900 acre-feet and a mean depth of 23 feet. The lake level is usually maintained at an elevation below full pond to allow for flood storage. The optimal elevation to provide adequate flood protection and optimize hydroelectric generation is called the rule curve elevation. For Lake Wylie, the rule curve elevation is three feet below full pond, and the associated

storage volume is 246,750 acre feet. The maximum drawdown level for the lake is 10 feet below full pond. Catawba would not operate if the lake level fell below the maximum drawdown level. At maximum drawdown, the lake would have 174,700 acre-feet of storage volume. Statistics for Lake Wylie are summarized in Table 4-4.

Table 4-4 Lake Wylie Summary Data

Full Pond Elevation	569.4 feet (msl)
Rule Curve Elevation	566.4 feet (msl)
Maximum Drawdown	10 feet
Full Pond Surface Area	12,139 acres
Full Pond Volume	281,900 acre-feet
Shoreline Length	327 miles
Mean Depth	23 feet
Maximum Depth	93.2 feet
Drainage Area	3020 square miles
Annual Outflow (1991-2000)	3524 cubic feet/second
Minimum Average Daily Release (FERC)	411 cubic feet/second

Lake Levels

Lake Wylie is managed to maintain a stable stage level. The rule curve elevation for Lake Wylie is three feet below full pond level, and actual conditions closely approximate this goal. The daily average lake level from 1991 to 2000 was 2.8 feet below full pond. The minimum daily stage in that time period was approximately 4.8 feet below full pond. Thus, lake levels have been consistent, even during the recent drought years, and lake levels have remained well above the maximum drawdown level.

Flow Through Lake Wylie

The USGS stream flow gage 02146000 is located 3.5 miles downstream from Lake Wylie Dam. Flow at this gage is directly influenced by releases from Wylie Hydro Station. The average flow for this gage is 4,390 cfs for the time periods of October 1895 to September 1902 and April 1942 through 1999. Flow statistics for the gage are shown in Table 4-5 [Reference 11].

Table 4-5 Stream Flow Statistics, USGS Gage 02146000 Catawba River near Rock Hill

Min Annual	Annual	Max Annual	90 percent	50 percent	10 percent

Mean Flow (cfs)	Mean Flow (cfs)	Mean Flow (cfs)	Exceedence (cfs)	Exceedence (cfs)	Exceedence (cfs)
1,923	4,390	9,635	919	3,590	8,650

Note: Percent exceedence means that 90, 50, or 10 percent of the time, the flows have been greater than the values shown over the period of record.

Average flow at the USGS gage in the Catawba River downstream of Lake Wylie was $1.38 \times 10^{11} ft^3$/year for a 65 year period of record. This is less than the 3.15×10^{12} ft^3/year minimum flow rate requirement set forth by requirement §51.53(c)(3) (ii)(A). For the 65 year period of record, the minimum annual mean flow at this gage was 1,923 cfs. This flow rate occurred in water year 1999.

Flow in the Catawba River downstream of Wylie Hydro Station fluctuates hourly depending upon hydro station operations. When the station is not operating, flow consists of leakage from the dam and groundwater inflow, usually less than 500 cfs. When the Wylie Hydro Station begins generating, flow spikes rapidly. Flow through each of the four units is usually about 3,500 to 4,000 cfs or up to a total flow of 16,000 cfs. When generation ceases, flow rapidly falls.

Minimum Inflow and Outflow

All of the reservoirs in the Catawba-Wateree Project have minimum daily outflow requirements. The minimum outflow requirements were established by the FERC to ensure adequate flow downstream of the dams. Low flow inflow to Lake Wylie is calculated to be 516 cfs based on a 314 cfs minimum release from Mountain Island Lake and the 7Q10 flow of 202 cfs from tributaries that flow into Lake Wylie [Reference 9]. The minimum daily release from Wylie Dam is 411 cfs.

Catawba Consumptive Use

Total evaporative losses for Lake Wylie are estimated to be 130 cfs. Consumptive use by Catawba represents 52 cfs (1997 through 1999 average) [Reference 30] of that total. Since Lake Wylie is managed to maintain a stable stage level, consumptive uses by Catawba do not affect lake levels as long as there is adequate inflow to maintain the rule curve elevation. Under average conditions, the effect of Catawba consumptive use is a decrease of about 1.2% in outflow from Lake Wylie. Using the USGS rating table for the gage 02146000, the reduction in outflow attributable to Catawba results in a stage decrease of 0.02 feet for the Catawba River downstream of Lake Wylie under average conditions.

Under 7Q10 conditions, total outflow from Lake Wylie would be 25 cfs greater than inflow. The 7Q10 inflow into Lake Wylie is 516 cfs. Total outflow from Lake Wylie would be 541 cfs, including the 411 cfs minimum release from Lake Wylie Hydro Station and 130 cfs for natural and forced evaporative losses. If Lake Wylie lost 25 cfs for seven

days, the lake level would decline 0.03 feet from the rule curve elevation. Under low flow conditions, Catawba consumptive use does not affect downstream conditions because of the minimum release requirement.

Future Water Use and Planning

Withdrawals from Lake Wylie are regulated by federal and state agencies. Proposed new or expanded withdrawals greater than 1 mgd must be approved by the FERC. The applicant must submit a detailed environmental assessment and consult with all applicable local, state and federal agencies to gain FERC approval.

Pursuant to state legislation, the SCDNR has developed a water resources plan. The plan seeks to "establish considerations, guidelines, and procedures for the effective management of the State's water resources in order to sustain the availability of water for the present and future uses. The South Carolina State Drought Response Committee may impose water withdrawal restrictions, if necessary.

Catawba consumptive use will not change during the period of the proposed license renewal. It is impossible to predict the quantity of future withdrawals. However, there are state and federal procedures in place to ensure future withdrawals do not adversely impact the aquatic and riparian communities in Lake Wylie. The following discussion of the effects of consumptive use of water from Lake Wylie on riparian communities is limited to the effects caused by Catawba operations.

4.1.5.2 Effects on Aquatic and Riparian Communities

A description of the effects of Catawba consumptive use on riparian and aquatic communities is provided for Lake Wylie. The Lake Wylie aquatic community is described in Chapter 2.

The water levels in the Catawba River downstream of Lake Wylie Dam fluctuate on a daily basis, as a result of releases from the Lake Wylie Hydro Station. The Catawba consumptive use of Catawba represents about 1.2% of the mean flow measured below Wylie Hydro. During periods of low flow, downstream areas are ensured an adequate flow because of the minimum daily outflow requirement established by the FERC. This requirement is independent of Catawba operations.

Riparian Communities at Lake Wylie

Lake Wylie does not have the typical riparian areas found alongside a river. Most of the lake's shoreline adjoins upland settings. However, there are some extensive areas of riparian vegetation adjacent to the headwaters of the reservoir in the area of Interstate 85 and at confluences with major tributaries such as the South Fork River, Catawba Creek,

Crowder's Creek, Big Allison Creek and Little Allison Creek. There are smaller areas of riparian vegetation in the heads of some shallow coves. These riparian zones are dominated by species typical of piedmont bottomlands and shallow water areas and include: river birch (*Betula nigra*), buttonbush (*Cephalanthus occidentalis*), black willow (*Salix nigra*), red maple (*Acer rubrum*), cat-tail (*Typha latifolia*), Joe Pye weed (*Eupatorium* sp.), cardinal flower (*Lobelia cardinalis*), pickerel weed (*Pontederia cordata*), and numerous sedges (*Carex* sp) and rushes (*Juncus* sp).

Low water levels in Lake Wylie could be a factor for these riparian areas if prolonged drawdowns occurred. However, as indicated above, such drawdowns do not occur. Rather, water levels are quite stable on a year-round basis. Under average conditions, Catawba operations do not affect lake levels. The effect of Catawba operations on Lake Wylie water levels during 7Q10 conditions is small.

Aquatic Communities in Lake Wylie

Lake Wylie supports a good warm-water fishery. The relatively stable water levels maintained in this reservoir throughout the year are generally considered as a positive factor for the resident species that inhabit the reservoir. Members of the centrarchid gamefishes need relatively stable water levels during their springtime spawning seasons. Duke, in cooperation with the SCDNR, implements a reservoir water level stabilization program each spring to ensure stable water levels during the spawning season for largemouth bass and other members of the centrarchid family.

White bass (*Morone chrysops*) is the only fish species that makes an appreciable spawning run in Lake Wylie. This spawning run is most evident in the Dutchman's Creek area, which enters Lake Wylie on the extreme northwestern side of the reservoir. Because of the relatively stable lake levels, coupled with the fact that white bass make their spawning migration in the February-April time period, the time of the highest rainfall in the area, the impact of any consumptive loss from Catawba plant operations is considered negligible.

There are a few native freshwater mussels (primarily Unionids) in Lake Wylie, but because water levels do not fluctuate, mussel strandings are not an issue. The only mussel of any abundance in Lake Wylie is the non-indigenous Asiatic Clam (Corbicula *fluminea*), and this organism is considered a noxious pest.

The impact of the consumptive use of water by Catawba on these and other aquatic communities in Lake Wylie is small.

4.1.6 Conclusion

Consumptive use by Catawba does not appreciably affect stage in Lake Wylie or outflow from Lake Wylie. Thus, Catawba consumptive use does not adversely affect riparian or

aquatic communities in Lake Wylie or downstream of Lake Wylie. The impact of Catawba consumptive use on instream and riparian communities in Lake Wylie and the Catawba River is small.

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 cannot 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 Analysis of Environmental Impact

Catawba utilizes closed-loop cooling towers, not a once through or cooling pond heat dissipation system. Therefore, this issue is not applicable to Catawba. Additionally, in accordance with Section 316(b) of the Clean Water Act, the NPDES permit re-issued by the SCDHEC on April 30, 2001 [Reference 12], accepted the no impact assessment submitted by Duke on March 17, 1987. That study concluded that the location, design, construction and capacity of Catawba Nuclear Station condenser cooling water system minimizes adverse environmental impact to the Lake Wylie aquatic ecosystem. Therefore, further analysis is not required.

4.2.5 Conclusion

Catawba utilizes cooling towers, not a once through or cooling pond heat dissipation system.

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 13]

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 cannot 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 Analysis of Environmental Impact

Catawba utilizes closed-loop cooling towers, not a once through or cooling pond heat dissipation system. Therefore, this issue is not applicable to Catawba. Additionally, in accordance with Section 316(b) of the Clean Water Act, the NPDES permit re-issued by the SCDHEC on April 30, 2001 [Reference 12], accepted the no impact assessment submitted by Duke on March 17, 1987. That study concluded that the location, design, construction, and capacity of Catawba Nuclear Station condenser cooling water system minimizes adverse environmental impact to the Lake Wylie aquatic ecosystem. Therefore, further analysis is not required.

4.3.5 Conclusion

Catawba utilizes cooling towers, not a once through or cooling pond heat dissipation system.

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 cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock.

4.4.4 Analysis of Environmental Impact

Catawba utilizes closed-loop cooling towers, not a once through or cooling pond heat dissipation system. Therefore, this issue is not applicable to Catawba. Additionally, in accordance with Section 316(a) of the Clean Water Act, the NPDES permit re-issued by the SCDHEC on April 30, 2001 [Reference 12], accepted the no impact assessment submitted by Duke on March 17, 1987. That study concluded that the location, design, construction, and capacity of Catawba Nuclear Station condenser cooling water system minimizes adverse environmental impact to the Lake Wylie aquatic ecosystem. Therefore, further analysis is not required.

4.4.5 Conclusion

Heat shock of fish and shellfish is not an issue at Catawba as the station utilizes closed-loop cooling towers, not a once through or cooling pond heat dissipation system.

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 13, GEIS Section 4.8.1].

4.5.5 Analysis of Environmental Impact

The Catawba plant does not use Ranney wells. The station uses water from Lake Wylie for cooling and service water. Potable water for the plant and support buildings is supplied by the city of Rock Hill, South Carolina. The following sections describe the groundwater uses at Catawba.

Groundwater Supply Wells

There are a total of three (3) groundwater supply wells at the Catawba site. A brief description of these wells and their usage is presented in Table 4-6. These wells supply water on a periodic basis to remote locations and for seasonal irrigation. As shown in Table 4-6, the average annual groundwater withdrawal rate from these wells is 30 gpm.

Reactor Building and Auxiliary Building Dewatering System

In addition to the groundwater wells described above, a dewatering system is used to reduce the hydrostatic pressures on the Reactor and Auxiliary Buildings. In the site area, groundwater is generally encountered under water table conditions in weathered rocks and residual soils that overlie less weathered rocks. Pre-construction groundwater elevations indicate the level varies from about 10 ft to 40 ft below natural ground surface near the location of the Reactors and that it approaches the surface elevation of Lake Wylie near the lake shore. Thus, groundwater movement is from the plant area toward the lake coves that cut into the peninsula to the north and to the south of the site.

A permanent groundwater drainage system is installed as shown on the Catawba UFSAR [Reference 9], Figure 2-60 and Figure 2-61. The drainage system creates and permanently maintains a normal groundwater level at or near the base of the foundation mat and basement walls, thus eliminating the uplift and hydrostatic forces. This groundwater drainage system consists of foundation underdrains and continuous exterior wall drains. The foundation underdrains and the exterior wall drains discharge into three sumps located adjacent to the Auxiliary Building (Sumps A and B are 10 feet by 10 feet by 15 feet deep. Sump C is 17 feet by 17 feet by 12 feet deep). A design flow rate of 68 gallons per minute (GPM) into the Reactor and Auxiliary Building area was determined from subsurface investigation and testing. On a yearly basis, the average groundwater drainage discharge from these sumps is 34 GPM.

Total Groundwater Use at Catawba

As shown in Table 4-6, the total average annual groundwater use at Catawba is 64 GPM. The total average annual groundwater withdrawal is below 100 gallons per minute.

Table 4-6 Average Annual Groundwater Withdrawal

Well Location and Number of Wells	Pumping Capacity	Description of Use	Average Annual Groundwater Withdrawl Rate
Catawba Park Employee Recreational Area on Lake Wylie	11 gpm	Supplies water to restrooms, boat docks, and picnic shelter. (8 hr/day usage)	4 gpm
Security Training Facility	27 gpm	Non-potable supply used as flush water for restrooms. (8 hr/day usage)	9 gpm
Catawba Training Center	264 gpm	Supplies water to irrigation system only. Usage is approx 2 hrs/day during growing season. (9 months/year)	17 gpm
Total Withdrawal Rate for Groundwater Supply Wells			**30 gpm**
Total Groundwater Flow for Reactor Building and Auxiliary Building Dewatering System			**34 gpm**
Total			**64 gpm**

4.5.6 Conclusion

The average annual groundwater withdrawal rate at Catawba is less than 100 gallons per minute. Therefore, this issue is not applicable to Catawba 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 3.15×10^{12} ft^3/ year (9×10^{10} m^3/ year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.6.4 Background

Many plants located on small rivers have cooling towers. Rivers often supply alluvial aquifers, and large-scale withdrawals of makeup water for evaporative loss could impact an alluvial aquifer during periods of low flow. However, withdrawal from the river is regulated by local or state agencies.

For example, the withdrawal of water at Duane Arnold is restricted at low flow (Water Use Permit). Under normal flow conditions, Duane Arnold withdraws 1.6 m^3/s (27,000 gal/min) from the Cedar River as cooling tower makeup water. This plant continues to operate, at least temporarily, during low flow by withdrawing water from a standby reservoir on a tributary to Cedar River. This reservoir is used only during emergencies when low-flow conditions exist on the Cedar River.

Indirect groundwater-use conflict resulting from surface water withdrawal from a small river for use in cooling towers is a potentially important concern. Because the significance of these conflicts cannot be determined at this time, this is a Category 2 issue.

4.6.5 Analysis of Environmental Impact

Catawba Nuclear Station is located in the Piedmont Physiographic Province of the southeastern United States, see Figure 4-1. For years 1997 through 1999, the average annual consumptive uses of water from the Catawba River by Catawba Nuclear Station are approximately 52 cfs. As noted in Table 4-5, the mean flow in the Catawba River (below Wylie Dam) is 4,390 cfs or is $1.38 \times 10^{11} ft^3$/year, which is less than 3.15×10^{12} ft^3/year. The following sections describe the groundwater system in the Piedmont region and present information on the flow in the Catawba River relative to consumptive use by Catawba Nuclear Station.

The Catawba River flows southeastward through the Piedmont region (Physiographic Province) towards the Coastal Plain, as shown on Figure 4-1. The hydrogeology of the Piedmont region is different from and is considered in a different way from conventional sedimentary aquifer systems. Groundwater recharge in this area is derived entirely from infiltration of local precipitation. In the Piedmont region, there is typically a net inflow of groundwater into the stream and river systems.

In the Piedmont region, a thoroughly weathered and structureless material termed residuum occurs near the ground surface, with the degree of weathering decreasing with depth. The residuum grades into a coarser-grained material that retains the structure of the parent bedrock and is termed saprolite. Beneath the saprolite, partially weathered bedrock occurs with depth until sound bedrock is encountered. This mantle of residual soil, saprolite and weathered rock (regolith) is a special hydrogeologic unit that covers and crosses various types of rock. It provides an intergranular medium through which the recharge and discharge of water from fractured rock commonly occurs. A transition zone at the base of the regolith is present in many areas of the Piedmont. In this zone the unconsolidated material grades into the bedrock and consists of partially weathered bedrock and lesser amounts of saprolite. The fractured nonporous bedrock is the most abundant lithologic unit underlying the Piedmont region. It includes many different types of igneous and metamorphic rocks. The fractures in the bedrock control both the hydraulic conductivity and the storage capacity of the rock mass.

Where alluvial aquifers exist in the Piedmont region, they are generally confined to the major streams and are narrow and thin. When looking at groundwater resources within the Piedmont, the alluvial aquifers are generally considered as part of the overburden (regolith) on top of the fractured bedrock.

A thin, narrow alluvial layer is associated with the Catawba River below Wylie Dam. These alluvial deposits are about 2000 ft wide for about 4000 ft downstream to where they are about 500 ft wide. The estimated thickness of these deposits is approximately 20 feet. Recharge to the alluvium is through rainfall and the discharge of groundwater from the fractured bedrock layer into overlying residuum and alluvium along the river. The

alluvium below Wylie Dam is not a large potential source of water. Discontinuous alluvial deposits are located on the Catawba-Wateree River and major tributaries all the way (90km) to the Coastal Plain.

The USGS stream flow gage 02146000 Catawba River near Rock Hill, is located downstream of the US Highway 21 bridge, 3.5 miles south of the Lake Wylie dam. The gage has a period of record of 65 years. The period of record is 1896 through 1999, however data was not available from 1902 through 1942. The flow statistics for this gage are shown in Table 4-7 and is taken from USGS Water Resources Data, South Carolina – Water Year 1999 [Reference 11]:

Table 4-7 USGS Gaging Station Data – Catawba River near Rock Hill

Annual 7-Day Minimum Flow (cfs)	Annual Mean Flow (cfs)	90 percent Exceedence (cfs)	50 percent Exceedence (cfs)	10 percent Exceedence (cfs)
541	4,390	919	3,590	8,650

Note:
Percent exceedence means that 90, 50, or 10 percent of the time, the flows have been greater than the values shown for the period of record.

As this gage information shows the mean flow in the Catawba River is 1.38 x 10^{11}ft^3/year, which is less than 3.15 x 10^{12} ft^3/year. However, the average annual use of 52 cfs by Catawba is approximately 1.2% of the mean annual flow rate of the river at this location.

The nearest alluvial aquifer along the Catawba River, outside of the Piedmont Region is located approximately 140 miles (90 km) downstream of the Catawba Nuclear Station in the Coastal Plain Physiographic Province. These alluvial deposits are associated with the Middendorf Aquifer of the Upper Coastal Plain.

The USGS gage # 02148000 on the Wateree River, near Camden S.C., is located near the nearest alluvial aquifer. This gage is located 7.4 mi downstream from Wateree Dam. The period of record is from 1930 through 1999. Table 4-8 provides flow information for this gage [Reference 11].

Table 4-8 USGS Gaging Station Data – Wateree River near Camden, S.C.

Annual 7-Day Minimum Flow (cfs)	Annual Mean Flow (cfs)	90 percent Exceedence (cfs)	50 percent Exceedence (cfs)	10 percent Exceedence (cfs)
279	6,219	1,100	4,960	13,000

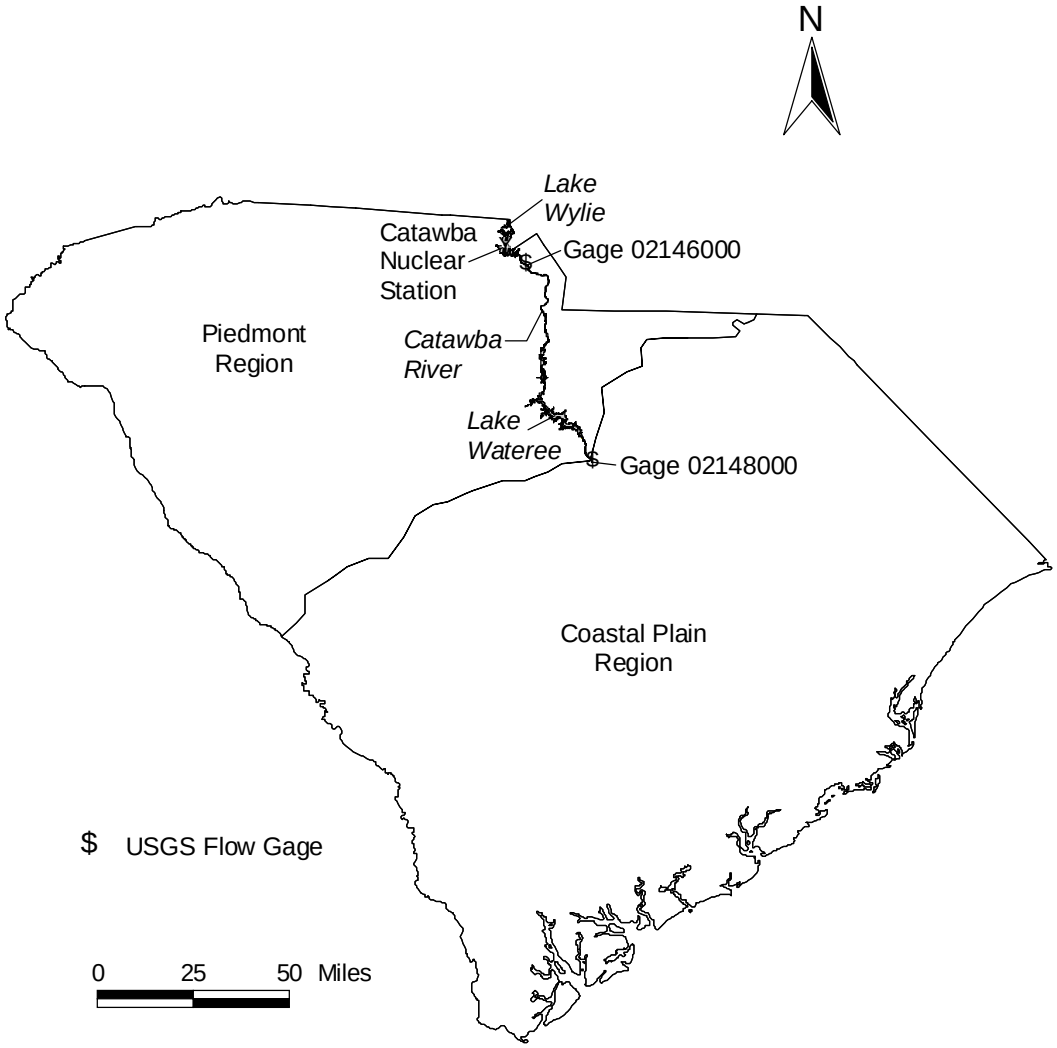
The average annual use of 52 cfs by Catawba is approximately 0.8% of the mean annual flow of the river at this location.

Withdrawal of water at Catawba will have no or minimal effect on the recharge of downstream alluvial aquifers.

4.6.6 Conclusion

Duke concludes that the impacts of cooling tower make-up water withdrawal by Catawba on river flow and alluvial aquifers will be small.

Figure 4-1 Location of Catawba Relative to Coastal Plain Aquifers



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

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

4.7.5 Conclusion

This issue is not applicable to Catawba 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

Catawba does not use cooling ponds for normal operation. However, Catawba 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 Wylie. 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 shutdown condition. The SNSWP has a volume of approximately 570 ac-ft. at a full pond surface area of approximately 44 acres. The pond is isolated from the plant service water during normal plant operations.

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

4.8.5 Conclusion

This issue is not applicable to Catawba 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 3.2.1, no refurbishment activities have been identified for Catawba. Therefore this issue is not applicable to Catawba and no analysis is required.

4.9.5 Conclusion

This issue is not applicable to Catawba 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 impacted. 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 13, GEIS Section 3.9].

4.10.5 Analysis of Impacts from Refurbishment Activities On Important Plant and Animal Habitats

There are no major refurbishment activities required for license renewal at Catawba. Therefore, no analysis of the impact of this issue is required.

4.10.6 Analysis of Impacts of the Proposed Action on Threatened or Endangered Species

Duke has discussed the impact of the continued operations of Catawba to threatened or endangered species with the South Carolina Department of Natural Resources (SCDNR) and the United States Fish and Wildlife Service (USFWS).

A survey was performed on the area within the 450.5-acre (182.4 ha) Exclusion Zone at Catawba and in the approximately 42.4 miles (68.3 km) of transmission line corridors.

The results of this survey is contained in the report, *Bioligical Assesment for Endangered, Threatened, and Noteworthy Species, Wetlands, and Significant Natural Areas in Association with the Catawba Nuclear Station and Related Power Transmission Lines* [Reference 5]. The purpose of this survey was to investigate the presence of threatened or endangered species in these areas. Fieldwork for this project began in June 2000 and continued into the autumn of 2000. The Exclusion Zone is shown on Figure 2-3. The transmission lines associated with Catawba are shown on Figure 3-2 and described in Table 3-1.

The findings of the inventory for endangered species, wetlands, and natural areas conducted in the summer and fall of 2000 for the Catawba Exclusion Zone and the associated transmission line corridors are summarized below:

1. Five major plant community/habitat types were found within the Exclusion Area. Most of the Exclusion Area is non-forested, open land and open water; currently, approximately 36% of the Exclusion Area is forested.

2. Eleven small wetlands totaling approximately 34 acres (14 ha) occur within the Exclusion Area. Several significant natural areas, including mixed hardwood ravines and one small mature stand of a dry slope oak-chalk maple forest, were found during the course of the biological inventory of the Exclusion Area.

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

4.10.7 Conclusion

There are no major refurbishment activities required for license renewal at Catawba. 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 Catawba 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

Catawba is located in York County, South Carolina. York County is south of the urban area of Charlotte, N.C. The county is located within the Charlotte ozone maintenance area as identified in EPA's reinstated one-hour ozone standard. Based on recent monitoring data, York County will be an ozone nonattainment area if the EPA's 8-hour standard is finalized.

Because of these ozone declarations, any new major generation source within the county must meet New Source Review (NSR) standards with regard to nitrogen oxide (NOx) and volatile organic compound (VOC) pollutant emissions. No ozone causing pollutants are directly associated with the operation of the Catawba 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 identified major refurbishment activities required for license renewal at Catawba. Therefore, this issue is not applicable to Catawba and no analysis of the impact of this issue is required.

4.11.5 Conclusion

There are no identified major refurbishment activities required for license renewal at Catawba. Therefore, this issue is not applicable to Catawba 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

Thermophilic organisms may or may not be influenced by operation of nuclear power plants discharging into cooling ponds, lakes, canals, or small rivers. Although it is nearly impossible to predict the level of thermophilic organism enhancement at any given site because the issue is largely unstudied, the NRC does recognize a potential health problem.

4.12.5 Analysis of Environmental Impact

The Catawba River, which was impounded to form Lake Wylie, has an annual average flow rate of 4,390 cubic feet per second (cfs) (1.38×10^{11} ft^3/yr) [Reference 11], which is less than the $3.15x10^{12}$ ft^3/ yr flow rate. Catawba Nuclear Station uses Lake Wylie as a source for condenser cooling water. The station utilizes closed-loop cooling towers. Operational data on Catawba's discharge temperatures is found in Section 3.1.11. The distance from the discharge canal to the nearest dock is approximately 1360 feet, as shown in Figure 4-2.

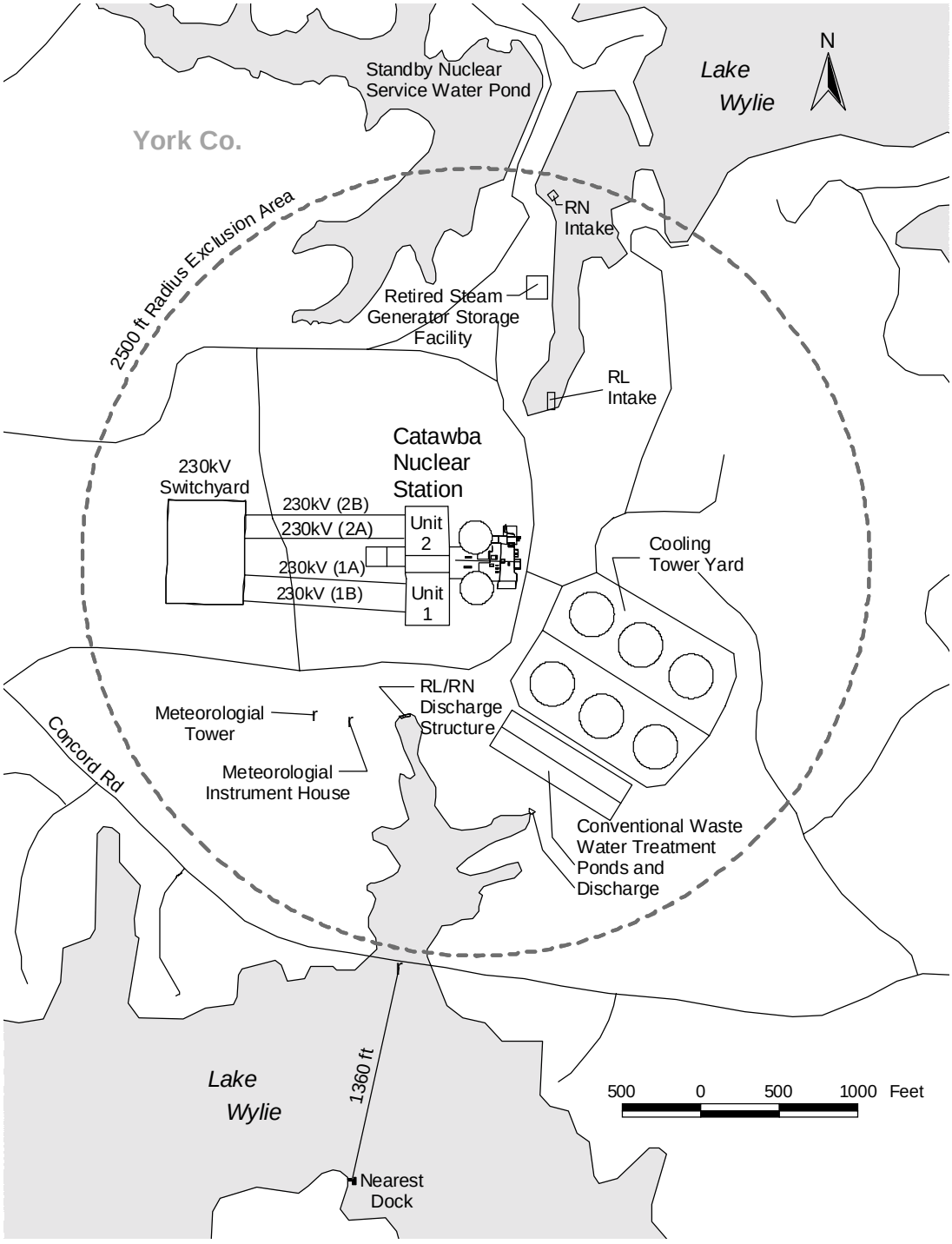
Duke, in consultation with South Carolina Department of Health and Environmental Control (SCDHEC) public health authorities, has done an assessment of whether continued operation of Catawba would induce public health impacts due to the enhancement of thermophilic organisms [Reference 14]. Based on Catawba-specific experience, the review of available technical literature on thermophilic organisms, and the fact that there is little heated discharge from Catawba as it utilizes cooling towers, such impacts seem unlikely. SCDHEC's letter states, [Reference 15]:

"The potential public health hazard from pathogenic microorganisms whose abundance might be promoted by artificial warming of recreational waters is largely theoretical and not substantiated by available data. There is some justification for providing appropriate respiratory and dermal protection for workers regularly exposed to known contaminated water, but there seems no significant health threat to off-site persons near such heated recreational waters."

4.12.6 Conclusion

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

Figure 4-2 Catawba 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 Requirement [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 lines of concern are those 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 13, Sections 4.5.4 and 4.5.4.1]

4.13.5 Analysis of Environmental Impact

The Catawba 230 kV switchyard is located approximately 800 feet west of the Catawba powerhouse as shown on Figure 3-1. The switchyard is connected to the primary transmission system by five 230kV double-circuit overhead transmission lines. As described in Section 4.2.7 Power Transmission System [Reference 8] (FES- Operating), the lines constructed:

> *"for connecting Catawba with Duke's existing transmission system consist of constructing two new 230 kV lines and connecting three existing 230 kV lines to the Catawba Switching Station."*

These lines and the switchyard are shown on Figure 3-2.

An evaluation was performed to determine if the transmission lines meet the requirements of the 1997 NESC. The results of the evaluation found that the measured clearances from the sagged plan and profile of each of the five 230 kV transmission lines in the majority of spans exceed the original design vertical clearance requirement. For those lines where the vertical clearances are less than the original requirement, the lines are designed to exceed the 1997 NESC vertical clearance requirements.

Duke has an ongoing program that ensures maintenance and inspections are critical items that are performed at regular intervals. Aerial inspections of the Catawba 230kV 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. Inspect steel structures for excessive rust, loose bolts, bent or missing parts.

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

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

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

4.13.6 Conclusion

The transmission lines that connect Catawba 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 13, GEIS Section 3.7.2].

4.14.5 Analysis of Environmental Impact

Catawba is located in northeastern York County, approximately 18 miles southwest of Charlotte, N.C. As described in Section 2.3, Catawba is located in a high population area, the rapidly developing Charlotte metropolitan area. There are no prohibitions on the development of residential housing within York County. However, York County does have zoning requirements that govern development activities within the county.

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 Catawba site has 1218 full time workers employed by Duke or site contractors during normal plant operations. As noted in Section 3.2, Refurbishment Activities, no refurbishment activities have been identified. 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 Catawba 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. No refurbishment activities outside the bounds of normal plant replacement and inspection activities have been identified. 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 Catawba 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 13, GEIS Section 3.7.4.5].

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

Catawba's drinking water is currently provided through the York County West System. During 2000, Catawba's water was supplied through the York County West System by the City of York from January through August 2000, and by the city of Rock Hill for the

remainder of 2000 through the present. Sales to Catawba by the York County West System in 2000 represented approximately 8% of the West System's water sales.

The city of Rock Hill's water source is Lake Wylie. The total water usage at Catawba for year 2000 was 12.78 million gallons. Based on this figure, Catawba's average daily use of municipally supplied water was 0.035 million gallons per day (MGD) for Year 2000. For the final four months of 2000, Catawba's municipal water consumption was 3.96 million gallons or 0.0325 MGD. The city of Rock Hill supplies water to the York County West System as well as other customers. For the final four months of 2000, the city of Rock Hill supplied York County West over 46.7 million gallons of water or 0.38 MGD.

No refurbishment activities outside the scope of normal plant maintenance activities have been identified. Therefore, there will be no impact to public utilities from refurbishment activities.

There are no identified increases in demand of the water supplied by the city of Rock Hill during the period of extended operation at Catawba.

Duke does not anticipate that additional workers will be employed during the period of extended operations. Therefore, water demands are not projected to significantly increase. Based upon Catawba's limited demand for water and its current and projected impact on the overall water supply even during peak periods, the continued operation of Catawba is of little impact to public utilities and the impact will be small.

4.15.6 Conclusion

No refurbishment activities outside the scope of normal plant maintenance activities have been identified. Duke does not anticipate that a significant number of additional workers will be employed during the period of extended operations. There are no identified increases in demands on water supplied to Catawba by the city of Rock Hill during the period of extended operation. 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, no refurbishment activities have been identified for Catawba. Therefore this issue is not applicable to Catawba and no analysis is required.

4.16.5 Conclusion

This issue is not applicable to Catawba 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, no refurbishment activities have been identified for Catawba. Therefore, there will be no impacts from refurbishment activities and no analysis is required.

4.17.5 Conclusion

This issue is not applicable to Catawba 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 land-use 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 renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development. If the plant's tax payments are projected to be medium to large relative to

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."

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 preestablished 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 [Reference 13, 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 Catawba during the license renewal term will be small. Duke does not anticipate that additional workers will be employed at Catawba 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 1999, property taxes assessed to Duke for its ownership of Catawba Nuclear Station totaled $3,489,522. Duke owns approximately one-eighth of Catawba, therefore the total tax paid to York County for Catawba totaled approximately $27,916,000. Seventy-five (75) % of property taxes paid by Catawba are allocated to support York County's District 2 schools; the remaining 25% supports countywide operation of public services. For tax year 1999 (Year ending June 30, 2000), the total tax dollars levied on assessed real and personal property in York County were $128,817,246. The total tax revenue for York County for this same period was $153,351,879. The property taxes paid for Catawba

represent approximately 18.2% of the total tax revenues collected by York County for the period.

[Reference 13, 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. The GEIS states that the significance level is considered moderate if new tax payments are between 10 and 20 percent of the taxing jurisdiction's revenue. Therefore, Catawba's tax payment impact on York County falls in the moderate range.

No refurbishments outside the bounds of normal plant maintenance are anticipated during the license renewal period. Therefore, it is reasonable to assume that there will be no significant change in assessed value of Catawba during the period of license renewal. The relative importance of tax payments to York County would, therefore, be unchanged during the period of license renewal. There are no indications that the county intends to modify how it currently allocates the property taxes generated by Catawba. Duke is unaware of any plans by the county to utilize property taxes generated by Catawba to provide increased services to the plant that would drive land use changes.

York County and its municipalities currently have zoning requirements that govern development activities within the county.

The impacts from tax-driven off-site land use changes will be moderate; however, this impact is lessened for the following reasons:

- Only 25% of the tax payments for Catawba are used for non-public school purposes.
- The area around Catawba has pre-established land patterns of development, such as land use plans and controls.
- The area around Catawba has public services in place to support and guide development.

The impact on tax-driven land use changes from the continued payment of property taxes at Catawba is moderate; however, no mitigation is warranted due to the positive impact the taxes have on the public school system and the small impact on non-public school uses.

4.18.6 Conclusion

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

Catawba's continued property tax contributions are anticipated to continue being allocated primarily to support of York County's District 2 schools and countywide activities. Based upon total tax payments coming from the operation of Catawba, the impact to tax-driven land use changes is moderate. Duke does not believe that consideration of mitigation is warranted.

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 13, 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 13, GEIS Section 4.7.3.2].

4.19.5 Analysis of Environmental Impact

There are presently 1218 workers employed at the Catawba site for normal plant operations (non-outage periods). The workers employed at Catawba primarily reside in York County and in adjoining counties.

There is an average of 1400 workers on site during the dayshift of plant outage periods. This compares to a norm of 900 during weekdays of normal plant operation. The plant outages last from 30 to 40 days and occur about every 18 to 24 months.

There are no identified major refurbishment activities required for license renewal at Catawba. 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 3-3, the workers employed at Catawba reside in locations that are well distributed geographically. Therefore, with the exception of travel along Highway 274 and Secondary State Route (SSR) 1132, the workers would travel to the plant from different routes.

The South Carolina Department of Transportation's Traffic Engineering for York County was contacted on this issue and asked to supply information on traffic counts in the vicinity of Catawba. The SCDOT provided Average Annual Daily Traffic (AADT) count data for the requested locations [Reference 16]. Level of service (LOS) designations are not available from SCDOT. The AADTs for roads in the vicinity of Catawba is shown on Figure 4-3.

As shown on Figure 4-3, the largest AADT is on Highway 49. Highway 49 is a major corridor from the Charlotte area toward York County and the Catawba site.

Continued growth in population will occur in the areas adjacent to Catawba through the period of the extended license. This growth will necessitate increases in traffic capacity to accommodate the growth.

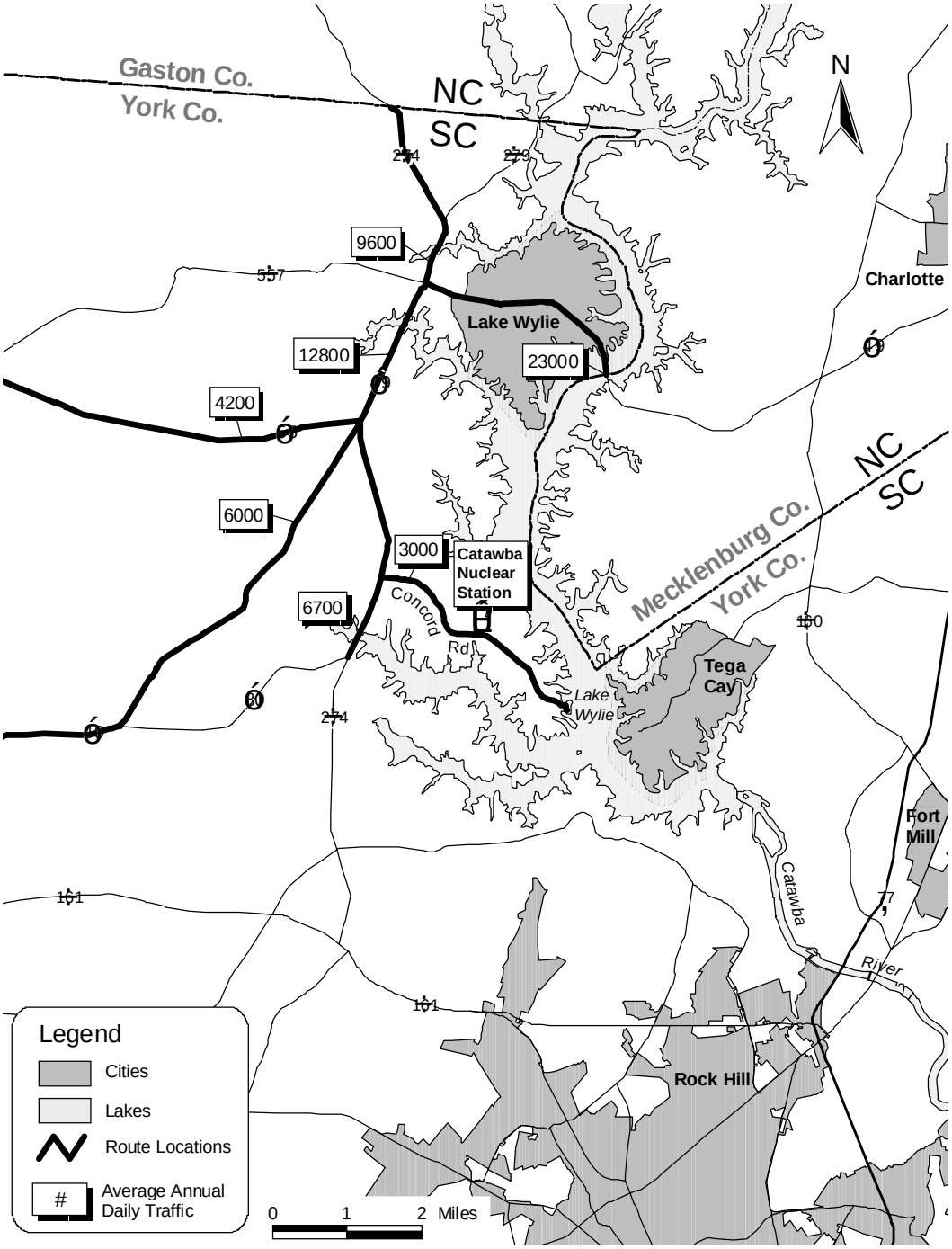
The Catawba site has taken the following steps to minimize the impacts to local traffic:

- The starting times for workers at the station have been staggered in order to minimize the impact of plant workers entering and leaving the site.
- Work schedules of 10 and 12 hours are also used, which eliminates the number of travel days to/from the work site.

4.19.6 Conclusion

There are no identified major refurbishment activities required for license renewal at Catawba. 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 Catawba. The growth in population in the area near Catawba will not be attributed to increases in employment at Catawba; therefore, the impact of continued operation of Catawba on any future degradation in traffic service will be small and no mitigation measures are warranted.

Figure 4-3 AADT's and LOS on Roads in Vicinity of Catawba



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 13, GEIS Section 3.7.7].

4.20.5 Analysis of Environmental Impact

Duke consulted with the South Carolina State Historic Preservation Office (SHPO) on this issue [Reference 17]. 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 18].

No refurbishment activities have been identified as being necessary to support continued operation of Catawba 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 Catawba 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

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

The impact of continued operation of Catawba during the period of the renewed license on historic or archaeological properties will be small and consideration of additional 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 [Reference 13, GEIS Section 5.5.2.5].

4.21.5 Analysis of Environmental Impact

Duke has performed a number of severe accident studies on Catawba and has implemented several plant enhancements to reduce the risk of severe accidents [Reference 19]. Attachment H provides a report that summarizes the evaluation of severe accident mitigation alternatives for Catawba.

The results of the Catawba-specific analyses for severe accidents show that the total core damage frequency is estimated at 5.8E-05 per year (internal and external events) and the risk is estimated at 31.4 person-rem per year. This analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvements) in excess of $2,200 to $570,000 are not cost justified based on 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 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.

Measures exist to mitigate the environmental impacts of potential severe accidents and additional measures to reduce such impacts would not be justified from a public risk perspective. Duke concludes that no additional severe accident mitigation alternative measures beyond those already implemented during the current term license are warranted for Catawba.

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 the review in its SEIS. The staff's review will be based on information*

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.

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 20] 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 Catawba 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 Catawba 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 Catawba 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 (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 Catawba's operating licenses.

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

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 Catawba. This area was selected to be consistent with the NRR Procedure. There are 1461 block groups either partially or completely within the 50 mile radius (80 km) of Catawba.

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 Catawba were obtained from the US Census Bureau. There were 1,407 block groups within a 50-mile radius of Catawba in the 2000 census; there were 1,461 block groups within a 50-mile radius of Catawba 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 Catawba, 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 is 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. 27.4% of the population within a 50-mile radius (80 km) of Catawba 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 286 block groups with minority populations that meet the definition outlined in the NRR Procedure. This represents 19.0% 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 urban areas associated with Gastonia and Charlotte, N.C. and Rock Hill, S.C. along with rural Fairfield and Lancaster counties, South Carolina.

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

4.22.5.6 LOW INCOME POPULATION REVIEW

Low income households comprise 11.5% of all households located within a 50-mile radius (80 km) of Catawba. 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 97 low income block groups. This represents 6.6% of the total number of block groups within the 50-mile radius. These populations are depicted in Figure 4-5. The majority of these block groups are located in Charlotte, N.C.

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

Figure 4-4 Block Groups-Minority Population Review -50-Mile Radius

★ Catawba Nuclear Station

Block groups meeting NRR criteria for Minority population

Figure 4-5 Low Income Population Review-50-Mile Radius

★ Catawba 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 Catawba, 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 Catawba and McGuire 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 Wylie 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 Catawba were properly reviewed prior to submittal of the Environmental Report and to ensure that new and significant information related to renewal of the Catawba 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 Catawba and to determine if further review of these issues was needed. Further review would be required if the GEIS conclusion were

9 Cumulative impacts are discussed further in Section 6.1.

found not to be valid for Catawba or if new and significant information were determined to exist for the issue.

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

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

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

  - *Catawba Nuclear Station Units 1 and 2 Annual Radiological Environmental Operating Report 1999* [Reference 21].
  - *Watershed Water Quality Assessment: Catawba Basin, February 2000,* South Carolina Department of Health and Environmental Control, Bureau of Water [Reference 22].
  - *Catawba River Basinwide Water Quality Plan, NCDENR, Division of Water Quality, Water Quality Section, December 1999* [Reference 3].

- **Consultations with Federal, State and local environmental natural resource agencies** - Meetings and discussions with the federal and state agencies listed below were conducted to determine if there are new and significant issues or information related to license renewal at Catawba. 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:
  - South Carolina Department of Health and Environmental Control
  - South Carolina Department of Natural Resources
  - 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 South Carolina Department of Health and Environmental Control notified Duke that they have not identified any "new or significant issues" [Reference 23]. A second agency, the U.S. Fish and Wildlife Service responded that "the Service believes that all issues concerning fish and wildlife resources have been adequately identified" [Reference 24].

- **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 Catawba. 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 25]

- *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 2 Regarding the Oconee Nuclear Station, Final Report, December 1999* [Reference 26].

- *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 3 Regarding Arkansas Nuclear One, Unit 1,Draft Report, April 2001* [Reference 27].

- *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*. [Reference 28]

- **Review of Environmental Issues Associated with Continued Operation of Both Catawba and McGuire -** A review of environmental issues associated with continued operation of both the Catawba and McGuire 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 McGuire [Reference 29], when considering the continued operation of Catawba and McGuire.

Refer to Section 6.1 for further discussion regarding cumulative impacts associated with 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 Catawba. 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 Catawba.

The review found that the continued operation of both Catawba and McGuire 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 McGuire ER are valid considering the continued operation of Catawba and McGuire.

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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 Catawba 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 Catawba. 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 Catawba or the impacts associated with continued operations of Catawba during the period of the extended license were not adverse. One issue, applicable to Catawba during the period of the extended license, was concluded as having a moderate impact. All other issues were found to be of small impact. 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 Catawba 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 state and federal agencies. No new issues relevant to license renewal at Catawba were identified as a result of this review.

Cumulative Impacts from Operation of Catawba and McGuire

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 Catawba Nuclear Station, Units 1 and 2 and at McGuire Nuclear Station, Units 1 and 2 were reviewed, taking into consideration cumulative impacts, given the location of the stations relative to each other. In both this ER and in the McGuire 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 Catawba and McGuire. 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 cumulative environmental impacts due to the continued operation of Catawba and McGuire 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 Catawba and McGuire.

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 Summary of Mitigation Commitments

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 presented in Table 6-1, the analysis of the Category 2 issues found the impacts to be small[10] for all but one of the applicable issues. One issue was identified as having a potentially moderate impact.[11] 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.

11 40 CFR §1508.27 defines ***Moderate:*** For the issue, environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

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)	Consumptive use by Catawba does not appreciably affect stage or outflow from Lake Wylie and thus does not affect riparian or aquatic communities in or downstream of Lake Wylie.	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 in Early Life Stages §51.53(c)(3)(ii)(B)	Catawba does not use once-through or cooling pond heat dissipation systems. Issue is not applicable to Catawba.	None.
Impingement of fish and shellfish §51.53(c)(3)(ii)(B)	Catawba does not use once-through or cooling pond heat dissipation systems. Issue is not applicable to Catawba.	None.
Heat shock §51.53(c)(3)(ii)(B)	Catawba does not use once-through or cooling pond heat dissipation systems. Issue is not applicable to Catawba.	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)	Average Ground-water withdrawal rate is 64 gallons per minutes. Small impacts from continued operation with no impact to off site ground-water users. 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)	Make-up water use represents only about 1% of the river flow. Withdrawal of water at Catawba will have no or minimal effect on the recharge of downstream alluvial aquifers.	None.
Ground-water use conflicts (Ranney Wells) §51.53(c)(3)(ii)(C)	Catawba does not use Ranney wells. Issue is not applicable to Catawba. Consideration of mitigation is not required.	None.
Degredation of Ground-Water Quality §51.53(c)(3)(ii)(D)	Catawba does not use cooling ponds. Issue is not applicable to Catawba. 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 Catawba. 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 Catawba. 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 Catawba. 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 South Carolina Department of Health and Environment Control found no significant health risk. Impacts from continued operation will be small. No mitigation measures are considered warranted.	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 §51.53(c)(3)(ii)(I)	• No major refurbishment activities identified. • Duke does not anticipate an increase in employment during period of extended license. Therefore, there will be no additional impacts to housing due to continued operations of Catawba.	None.
Public Utilities: Public Water Supply Availability §51.53(c)(3)(ii)(I)	• No major refurbishment activities identified. • Small impact from continued operation.	None.
Education Impacts from Refurbishment §51.53(c)(3)(ii)(I)	No major refurbishment activities identified. Issue is not applicable to Catawba. Consideration of mitigation is not required.	None.
Offsite land Use (effects of refurbishment activities) §51.53(c)(3)(ii)(I)	No major refurbishment activities identified. Issue is not applicable to Catawba. Consideration of mitigation is not required.	None.
Offsite land Use (effects of license renewal) §51.53(c)(3)(ii)(I)	• The significance of tax payments made by Catawba to local governments will continue to be moderate. Only 25% of Catawba's tax payments are used for non-public school purposes. • The area around Catawba has pre-established land patterns of development. • The area around Catawba has public services in place to support and guide development. • New population driven land use changes at Catawba during the license renewal term will be small	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. • Continued Small impacts from operation.	None.
Historic and archaeological properties §51.53(c)(3)(ii)(K)	• No major refurbishment activities identified. • Small impacts from continued operation. Site environmental work practices ensure protection for archaeological 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 (SAMAs) §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 Catawba Nuclear Station Units 1 and 2 [Reference 6] (FES-CP), the adverse environmental effects of plant construction and operation were evaluated. The FES-CP found that the principal adverse impacts are associated with the following:

- impacts from land clearing for the station and transmission lines.
- impacts to aquatic biota in Lake Wylie from operation of the station intake and discharge

The GEIS evaluated the environmental impacts associated with onsite land use and land use in transmission line rights-of way and found these impacts to be small. The GEIS evaluated the environmental impacts associated with entrainment and impingement of aquatic organisms and heat shock to aquatic organisms and found the impacts to be small.

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 Catawba Nuclear Station during the period of the extended license. The analyses of the Category 2 issues, presented in Chapter 4, found that the environmental impacts from continued operation of Catawba, where they existed, 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 Catawba.

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 Catawba Nuclear Station Units 1 and 2 [Reference 6] (FES-CP), prepared in connection with the issuance of the original operating licenses for Catawba, evaluated the irreversible and irretrievable commitment of resources associated with the construction and operation of Catawba.

The FES-CP evaluation found that the operation of Catawba 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 FES-CP specifically mentions the land used for certain plant buildings and the uranium consumed by the reactor.

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. The Catawba units use 74 to 84 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 Catawba 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 Catawba 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 9roposed Catawba Nuclear Station Units 1 and 2 [Reference 6], prepared in connection with the issuance of the original operating licenses for Catawba, 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 Catawba. 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 Catawba 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 13]. 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 Catawba units generate 2258 MW(e) of electricity and operated at a capacity factor of 90% in 2000. The proposed action is the renewal of the operating licenses of each of the two Catawba units. This action would provide the opportunity for Duke to continue to operate Catawba 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 Catawba 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 Catawba Nuclear Station. In the event that the operating licenses of Catawba are not renewed, it is expected that Catawba 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 license renewal 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 Catawba 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 Catawba 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 13]. 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 Catawba. 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 Catawba units.

Aquatic Ecological Resources

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

- elimination of impingement and entrainment. However, as noted in GEIS Section 4.3.3, for plants with cooling-tower based heat dissipation systems, the impacts of impingement and entrainment are small.
- elimination of thermal discharges. However, as noted in GEIS Section 4.3.3, for plants with cooling-tower based heat dissipation systems, the impacts of heat shock are small.

Socioeconomics

When Catawba ceases operation, there will be a decrease in the employment in the area. As noted in Section 3.4, the workforce employed at Catawba resides primarily in the adjacent counties. The impacts associated with the loss of these jobs would be concentrated in the counties of York, Gaston and Mecklenburg. The loss of these jobs would be an adverse impact to the economies of these counties.

Catawba 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 Section 4.18, the property taxes paid for Catawba represented 18.2% of the total tax revenues collected by York County for tax year 1999 (Year ending June 30, 2000). Of this amount, 75% is allocated for support of York County's District 2 schools. The loss of the tax revenues would be an adverse impact to the economy of York County.

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 13]. Accordingly, for the purposes of the review of alternative energy sources for Catawba, 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 Catawba.
- 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 that would be considered to replace Catawba's generation upon the termination of operation. The light water reactor option is addressed only as a green field option. The comparison of the environmental impacts of these technologies is discussed in detail in Chapter 8.0.

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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 2025 through 2046.
- 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 Catawba Nuclear Station in 2000 was 90%. 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 13]. 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 Catawba. 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 Catawba).

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 Catawba generation upon its termination of operation.

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 Catawba 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 Catawba 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 Catawba's generating capacity. The total generation from this electricity source is 2400 MW(e) and would only slightly overestimate the impacts from an exact replacement of Catawba's 2258 MW(e).

Water Use and Quality

Water quality impacts would be associated with 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, which would have a similar impact to the Catawba cooling system. Evaporation from the cooling towers would be similar to the 1997 – 1999 annual average of 23,400 gpm of forced evaporation associated with Catawba's cooling tower system [Reference 30]. 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, depending 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. SCR operation could also require use of large quantities of anhydrous ammonia, which poses additional public health risks. 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. Catawba Nuclear Station is located in York County, which is at 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 Catawba. 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 [Reference 27] estimates approximately 1700 acres would be needed for a 100MW(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 and 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 the Catawba 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 Catawba 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 950 jobs (Catawba employs 1200 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 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 16 km (10 mi). Visual impacts of stack emissions will be an additional factor not present with Catawba 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 Catawba'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. 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 Catawba.

8.1.1.2 Oil and Natural Gas (Combined Cycle)

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

A trade-off of water quality impacts would be associated with a large base load oil and gas combined cycle plant. Though water requirements are less for combined cycle plants than with conventional steam electric, a green field site would likely require the construction of a new intake structure to provide water needs for the facility. New base load oil and gas combined cycle units would likely utilize closed loop cooling towers. 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 23,400 gpm of forced evaporation associated with Catawba's cooling tower system [Reference 30]. 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, however, 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 be very infrequent and because of this 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 a 90% 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 likely not be as significant as those for 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. 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 of Catawba license renewal. The overall impacts are characterized as small to moderate.

Human Health

A new 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 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 Catawba 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 Catawba.

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 1050 jobs to the regional economy (Catawba employs 1200 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 approximate 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 Catawba. 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 Catawba's base load generation. However, the air quality impacts would be far greater than the impacts from the continued operation of Catawba. 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)

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

A trade-off of water quality impacts would be associated with a large base load natural gas combined cycle plant. Though water requirements are less for combined cycle plants than with conventional steam electric, a green field site would likely require the construction of a new intake structure to provide water needs for the facility. New base gas combined cycle units would likely utilize closed loop cooling towers. 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 23,400 gpm of forced evaporation associated with Catawba's cooling tower system [Reference 30]. 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. 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 upon the location of the green field site, the 8-hour ozone standard could require offsets of NOx emissions from the 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 90% 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 at a green field site would alter the ecology. On-site impacts would likely not 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 for the Catawba license renewal. The overall impacts are characterized as small to moderate.

Human Health

A new 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 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 Catawba 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 Catawba.

Operational impacts could result in moderate socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, by comparison, 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 1050 jobs to the regional economy (Catawba employs 1200 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 approximate 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 Catawba license renewal. 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 resources maintained. The overall impacts are characterized as small.

Summary
A natural gas-fired combined cycle facility would be a viable replacement for Catawba's base load generation. However, the air quality impacts would be far greater than the impacts from the continued operation of Catawba. 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 Catawba's generating output. This total generation would closely approximate the impacts from an exact replacement of Catawba'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 the Catawba license renewal.

Water Quality
Water quality impacts associated with a new base load nuclear plant of this size would be similar to those for the continued operation of Catawba. 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, creating similar thermal impacts. Water requirements for new nuclear generation due to evaporative cooling tower losses would be comparable to those at Catawba. 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 wastes are similar to that with continued operation of Catawba. Low level radwaste impacts from this technology would be slightly greater but similar to continued operation of Catawba. 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 comparable to that of Catawba. 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 similar acreage as Catawba 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 Catawba 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 Catawba 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 Catawba 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 Catawba.

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.

Once a new nuclear plant is constructed and Catawba is decommissioned, operational impacts 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 Catawba's generating capacity. Construction of a new coal-fired facility on the Catawba site would have many of the same impacts as were discussed under the green field evaluation for coal-fired units.

The environmental impacts from the construction and operation of a conventional coal-fired plant at the Catawba site are summarized in Table 8-6.

Water Use and Quality
Water quality impacts associated with a base load coal unit to replace Catawba would be very similar to those of the existing nuclear units. 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 Catawba site would likely utilize closed loop cooling towers, which would create a similar impact on Lake Wylie as the existing nuclear units. Evaporation from coal-fired unit cooling towers would be comparable to the 1997 – 1999 annual average of 23,400 gpm of forced evaporation associated with Catawba's existing cooling system [Reference 30]. 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 those described at the green field site for a coal-fired unit. Waste storage ponds for ash and scrubber wastes would likely have to be located on 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 Catawba site is the air quality non-attainment issue. Catawba Nuclear Station is located in York County, which is at risk of being an ozone non-attainment county. Obtaining air permits for construction of a coal-fired plant on the existing Catawba site would likely create emissions offsets from other Duke generating facilities. These offsets equate to a reduction in generation or capital investment at other sites in order to reduce emissions.

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

Land Use
The Catawba site covers an area of approximately 391 acres. Existing transmission substations and lines could be re-used with negligible new environmental impact. The Cope site uses substantially more acreage for a much smaller generating station. A coal-fired station of more than 2200 MW(e) would require more than the available 391 acres. The NRC's GEIS for Arkansas Nuclear One, Unit 1, dated September 2000 estimates approximately 1700 acres would be needed for a 1000 MW(e) facility. Based on this estimate, the Catawba site would have to be expanded by several times to attain this acreage. This expansion, if possible, would obviously 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 Catawba 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 and a closed-cycle cooling tower system, to which the area aquatic communities have become acclimated, would limit operational impacts. Siting at the existing Catawba site would have a small to moderate ecological impact that would be greater than that for Catawba 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 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 York County community would be impacted by a loss of jobs. Construction workers would leave, the nuclear plant workforce (1200) 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, by comparison, these benefits will be much less than those achieved through license renewal of Catawba.

The size of the construction workforce for a coal-fired plant and plant-related spending during construction would be very noticeable. Once the coal-fired replacement plant is constructed and the nuclear plant decommissioned, operational impacts would result in an eventual loss of approximately 950 jobs (Catawba employs 1200 workers compared to a projected 250 for the coal-fired plant). There would also be 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 Catawba license renewal. New stacks and accompanying emissions at the Catawba site would be a significant new visual impact for the Lake Wylie community.

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 come from mechanical equipment, such as induced-draft fans, during 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 Catawba 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 Catawba site is not a likely scenario for replacement of Catawba Nuclear Station's generation. Siting a new coal-fired station in York County would be an air permit challenge due to its proximity to a major urban area, Charlotte, N.C. In addition, significant new land would be needed in order to site a large coal plant at the Catawba site.

8.1.2.2 OIL AND NATURAL GAS (COMBINED CYCLE)

This alternative would require five 482 MW(e) combined cycle units to replace Catawba's generating output. Construction of a new oil and natural gas combined cycle facility on the Catawba site would have many of the same environmental impacts as discussed under the green field evaluation for this combined cycle option 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. 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 re-utilize some portion of the closed loop cooling towers. 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 23,400 gpm of forced evaporation associated with Catawba's cooling water system [Reference 30]. 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

A major impact of a fossil fuel plant at the Catawba site is air quality. Catawba Nuclear Station is located in York County, which is at 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 potentially require emissions offsets from other Duke generating facilities. These offsets equate to a reduction in generation or capital investment at other sites in order to reduce emissions.

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

Land Use

The Catawba site is adequate in size to support a combined cycle facility. Transmission substations and lines are in existence and could be re-used with negligible new environmental impact. The TRANSCo interstate pipeline is located a significant distance (approximately 16 miles) from the site. However, a new pipeline would be required in

order to supply the gas capacities required for significant new base load generation. A new oil pipeline would also likely be required to connect to existing oil pipelines northwest of the site. A new oil pipeline from the existing trunk line to the Catawba site would create new 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 Catawba would alter the ecology. On-site impacts would not likely be as significant as with coal-fired units, 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. These ecological impacts would be primarily off-site due to new gas and oil transmission requirements, and would exceed impacts of the Catawba license renewal. The overall impacts are characterized as small to moderate.

Human Health

A new 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 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 Catawba 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 substantially less than with continued operation of Catawba.

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 1050 jobs to the local economy (Catawba employs 1200 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 approximate 200-ft stacks and large fuel oil storage tanks could be visible at a distance of several miles in the Lake Wylie area. Visual impacts of stack emissions will be an additional factor not present with Catawba license renewal. 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. The combustion turbine units would be continuous sources during normal plant operations for a base load plant. 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 Catawba 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 Catawba site is a possible alternative for replacing Catawba Nuclear Station's generation. However, siting a new combined cycle station in a suburban area such as York County would be a challenge, due to air emission impacts. Existing lands are available at the Catawba 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 Catawba's generating output. Construction of a new gas-fired combined cycle facility on the Catawba site would have many of the same issues and impacts as were discussed under the green field evaluation section of this option in Section 8.1.1.

Water Use and Quality
Water quality impacts associated with new base load natural gas combined cycle generation at the Catawba 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 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

Again, the main impact with a fossil fuel plant on the Catawba site is the air quality. Catawba Nuclear Station is located in York County, which is at 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 Catawba site would be as described in the green field evaluation. The overall impacts are characterized as small to moderate.

Land Use

The Catawba site is adequate in size to support a combined cycle facility. Existing transmission substations could be re-used with negligible new environmental impact. The TRANSCO interstate pipeline is approximately sixteen miles from the site; however, as previously stated, a new pipeline would be required to supply the gas capacities required for new base load generation. The overall impacts are characterized as small to moderate.

Ecology

Locating new combined cycle generation at Catawba 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. These ecological impacts would be mostly off-site due to new gas transmission requirements, and would exceed the impacts of the Catawba license renewal. The overall impacts are characterized as small to moderate.

Human Health

A new 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 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 Catawba 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 substantially less than with continued operation of Catawba.

Operational impacts could result in small socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, by comparison, 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. Once the combined cycle replacement plant is constructed and the nuclear plants decommissioned, operational impacts would result in an eventual net loss of approximately 1050 jobs to the local economy (Catawba employs 1200 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 approximate 200-ft stacks could be visible at a distance of several miles in the Lake Wylie area. Visual impacts of stack emissions will be an additional factor not present with Catawba license renewal. 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. The combustion turbine units would be continuous sources during normal plant operations for a base load plant. 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 Catawba 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 Catawba site is a possible alternative for replacing Catawba Nuclear Station's generation. However, siting a new combined cycle station in a suburban area such as York County would be a challenge, due to air emission impacts. Existing lands are available at the Catawba site with minimal land/water impacts expected. Major land use impacts would be associated with providing natural gas at the necessary quantities 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 13]. 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 13].

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 (Catawba's capacity factor in 2000 was 90%), 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 31] 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 32].

Environmental impacts associated with wind farms 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 13].

Photovoltaic Cells

The average annual capacity factor for Photovoltaic (PV) Cells is estimated at 25% (Catawba's 2000 capacity factor was 90%). 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 31]. 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 32].

Solar Thermal Power

The average capacity factor for this technology is low, estimated to be between 25% and 50% annually (Catawba's 2000 capacity factor was 90%). 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 Catawba 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 32]. 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 them from being viable alternatives. Each technology affords only minimal capacity factors when compared to Catawba's base load capability, and requires large land-use needs – ranging from 1750 ha (4,000 acres) for dish/engine systems to approximately 3,500 ha (8,000 acres) using parabolic trough technology for 1000 MW(e) of electricity. Land use needs are more substantial for power towers. Land use needs are projected at approximately 1.2×10^{-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 32]. 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% (Catawba's 2000 capacity factor was 90%). 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 thus sites with high generating potential have already

been tapped. Thus, there is no feasible location in the Duke service area for new hydroelectric generation [GEIS, Section 8, Reference 13].

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 13].

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 Catawba 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 13].

Municipal Solid Waste (MSW)

The initial capital costs for this technology are much greater than for the 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 Catawba license renewal [GEIS, Section 8, Reference 13].

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, are not economically practicable, and are not a reasonable alternative to the license renewal of Catawba [GEIS, Section 8, Reference 13].

Delayed Retirement of Non-Nuclear Units

The Duke Power Annual Plan, dated September 1, 2000 [Reference 33], 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 Catawba (2025 and 2026).

The delayed retirement of the above generation sources could not be used to replace the 2258 MW(e) generated at Catawba. 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 Catawba.

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 2025 through 2046 time frame to replace the 2258 MW(e) base load generation from Catawba.

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 Catawba'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 provides a more likely combination scenario for replacing Catawba's 's generation. A combination of purchase power agreements, along with 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 at either Catawba or at a green field site would have similar types of 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, of which there is

no certainty of its availability. 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 the license renewal of Catawba.

8.3 Proposed Action vs No-Action

The proposed action is the renewal of the operating licenses for Catawba Unit 1 and Unit 2. The Catawba-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 Catawba 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 Catawba 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 Catawba, to the environmental impacts associated with the construction and operation of a new generation facility. This new generation 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 Catawba site. Therefore, the no-action alternative would have no net environmental benefits.

The environmental impacts associated with the proposed action (the continued operation of Catawba) 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 Catawba 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 to the area around Catawba from the decision not to pursue license renewal, including local unemployment, loss of local property tax revenue, and higher energy costs.

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 34]. The renewal of the Catawba operating licenses is consistent with these goals.

8.4 Summary

The proposed action is the renewal of the Catawba operating licenses. The proposed action would provide the continued availability of 2258 megawatts of base load power generation through 2045. The results of the review of alternatives to the proposed action are summarized in Table 8-5 and Table 8-6.

The environmental impacts of the continued operation of Catawba, providing 2258 megawatts of base load power generation through 2045, 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 Catawba operation. As discussed in this chapter and as shown in Table 8-5 and Table 8-6, the continued operation of Catawba would create significantly less environmental impact than the construction and operation of new base load generation capacity.

Finally, the continued operation of Catawba 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 for DPC
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 Low NOx Burner NOx emission 7.44 #/ton (.3 #/MMBTUs) SCR NOx emission 2.5 #/ton (.1 #/MMBTUs) 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	HR estimated w/SCR & FGD
Capacity factor = .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

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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
e. 67% of TSP PM_{10} Reference AP-42, Table 1.1-5 [Reference 35]

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] Two 172 MW-combustion turbines 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

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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
SO_2 = sulfur dioxide
PM_{10} = particulates having diameter less than 10 microns
TSP = total suspended particulates

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Table 8-5 Comparison of Environmental Impacts – Green field Site

Expected Environmental Impact[c]	Renewal of Catawba 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**-23,400 gpm[b] (1997 – 1999 avg.)	**Small**-~ 23,400 gpm[b]	**Small**-< 23,400 gpm[b] (includes demin water injection)	**Small**-< 23,400 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 ermits	**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**-Approx. 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
Socioeconomic	**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**-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	**Small –** New visual/noise impacts from plant structures
Historic and Archaeological	**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 Catawba 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**-23,400 gpm[b] (1997 – 1999 avg.)	**Small**-~ 23,400 gpm[b]	**Small**-< 23,400 gpm[b] (includes demin water injection)	**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
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 950 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 Archaeological	**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 Catawba 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 Catawba operating licenses. None of the state and local permits listed in Table 9-1 is required to be renewed to support the renewal of the Catawba operating licenses.

The Catawba plant site is subject to York County's zoning requirements. The area is currently zoned ID (Industrial Development). The site meets the current zoning requirements.

9.3 Environmental Permits - Discussion of Compliance

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

9.4 Other Permits and Licenses

The following additional permits and licenses are listed:

Facility Operating License No. NPF-35 for Unit 1, Docket #50-413, 100 % power license was granted by Amendment 2 to NPF-35 on January 17, 1985.

Facility Operating License No. NPF-52 for Unit 2, Docket #50-414, 100% power license was granted by Amendment 2 to NPF-52 on May 15, 1986.

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

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

9.5 Discussion of Compliance

Table 9-1 lists the environmental permits held by Catawba 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 Catawba operating licenses. None of the state and local permits listed in Table 9-1 requires renewal to support the renewal of the Catawba operating licenses.

On July 8, 1996, the NRC issued Amendment No. 149 to Facility Operating License NPF-35 and Amendment No. 143 to Facility Operating License NPF-52 for Catawba Units 1 and 2. These amendments deleted the Environmental Protection Plans (EPP) from both operating licenses [Reference 36]. The EPP was originally issued with the Catawba 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.

Table 9-1 Catawba Environmental Permits and Compliance Status

Catawba Environmental Permits	Federal Act	Federal, State or Local Permitting Agency	Date Permit Issued or Expired Compliance Status
NPDES Wastewater Permit # SC0004278	Federal Water Pollution Control Act Section 402	South Carolina Department of Health and Environmental Control	Issued 4/30/2001. Expires on 6/30/2005. In compliance.
NPDES General Stormwater Permit #SCR000000; Permit Cert. No: SCR003773	Federal Water Pollution Control Act Section 402	South Carolina Department of Health and Environmental Control	Effective 6/01/2001. Expires on 1/31/2003. In compliance.
EPA Identification # for Generation and Storage of Hazardous Waste SCD070619796	Resource Conservation and Recovery Act Section 3010	South Carolina Department of Health and Environmental Control	EPA ID issued at the opening of the facility and remains with site for life of station. Annual operating fee submitted to SCDHEC. In compliance
Operating Permit – Air Quality #2440-0070	Clean Air Act Section 112	South Carolina Department of Health and Environmental Control	Issued 1/3/2001. Expires on 12/31/2005. In compliance.

Table 9-1 Catawba Environmental Permits and Compliance Status

(Continued)

Catawba Environmental Permits	Federal Act	Federal, State or Local Permitting Agency	Date Permit Issued or Expired Compliance Status
Landfill Permit # 463303-1601	Resource Conservation and Recovery Act Subtitle D	South Carolina Department of Health and Environmental Control	Issued prior to 1989. The permit is currently under revision with SCDHEC. In compliance.
Underground Storage Tank Permit Station # R-46-NN-09244	Resource Conservation and Recovery Act Subtitle I	South Carolina Department of Health and Environmental Control	Renewed annually. Exp. Date – 7/31/2001 In compliance.
Underground Storage Tank Permit Catawba Garage # P-46-NN-09242	Resource Conservation and Recovery Act Subtitle I	South Carolina Department of Health and Environmental Control	Renewed annually. Exp. Date – 7/31/2001 In compliance.
Asbestos Nonscheduled Removal Permit # 8044	National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart M	South Carolina Department of Health and Environmental Control	The non-scheduled asbestos permits are annual permits – 1/1 thru 12/31. In compliance.
Depredation Permit DPRD – 757484	Migratory Bird Treaty Act	US Dept. of the Interior Federal Fish and Wildlife	Renewed annually. In compliance.

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 Catawba 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 *Watershed Water Quality Management Strategy; Catawba-Santee Basin. Technical Report No. 002-96,* South Carolina Department of Health and Environmental Control, 1996.

5 Biological Assessment For Endangered, Threatened, and Noteworthy Species, Wetlands and Significant Natural Areas in Association with Catawba Nuclear Station and Related Power Transmission Lines, York County, South Carolina, prepared by L.L. Gaddy, Ph.D., March 2001. [A copy of this report is included as Attachment A].

6 *Final Environmental Statement Related to the proposed Catawba Nuclear Station Units 1 and 2, U.S. Atomic Energy Commission, December 1973.*

7 Catawba 1 Cycle 13 Final Reload Change Document, Revision 3, July 24, 2000.

8 *Final Environmental Statement related to the operation of Catawba Nuclear Station, Units 1 and 2, U.S. Nuclear Regulatory Commission, January 1983.*

9 Catawba Nuclear Station, Updated Final Safety Analysis Report, As Revised.

10 *Application to Renew the Operating Licenses of McGuire Nuclear Station, Units 1 & 2 and Catawba Nuclear Station, Units 1 & 2,* June 2001.

11 U.S. Geological Survey, Water Resources Data, South Carolina – Water Year 1999. [A copy of this report is included as Attachment B].

12 Duke Power Company. Catawba Nuclear Station, Units 1 and 2. NPDES Permit submittal from SCDHEC, April 30, 2001. [A copy of this report is included as Attachment C].

13 *NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants*, Final Report, May 1996.

14 Letter from Mary Santini, Duke Power to Dr. John F. Brown, SC Dept. of Health and Environmental Control, requesting information on assessment of public health impacts from thermophilic organisms from Catawba operation, dated June 7, 2000. [A copy of this report is included as Attachment D].

15 Letter from Dr. John F. Brown, SCDHEC, to Mary Santini dated July 27, 2000. [A copy of this report is included as Attachment E].

16 Personal Communication from Danny W. Carns from Traffic Engineering of South Carolina Department of Transportation, dated March 2, 2001.

17 Letter from Jennifer R. Huff to Nancy Brock, South Carolina State Historic Preservation Office, dated March 17, 2000. [A copy of this report is included as Attachment F].

18 Letter from Nancy Brock, South Carolina State Historic Preservation Office, to Jennifer R. Huff dated May 30, 2000. [A copy of this report is included as Attachment G].

19 Catawba Nuclear Station – Severe Accident Mitigation Alternatives (SAMAs) Analysis, May 2001 Final Report. [A copy of this report is included as Attachment H].

20 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.

21 *Catawba Nuclear Station Units 1 and 2 Annual Radiological Environmental Operating Report 1999.*

22 *Watershed Water Quality Assessment: Catawba Basin, February 2000,* South Carolina Department of Health and Environmental Control, Bureau of Water.

23 Letter from R. Michael Gandy, SCDHEC Radioactive Waste Management Section to William M. Miller dated March 7, 2001 concerning review of the Catawba license renewal. [A copy of this report is included as Attachment I].

24 Letter from Roger L. Banks of the US Department of the Interior Fish and Wildlife Service to William M. Miller dated April 24, 2001 concerning review of the license renewal. [A copy of this report is included as Attachment J].

25 *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.*

26 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 2 Regarding the Oconee Nuclear Station, Final Report, December 1999.*

27 *NUREG-1437 Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 3 Regarding Arkansas Nuclear One, Unit 1,Final Report, April 2001.*

28 *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.*

29 *Applicants' Environmental Report Operating License Renewal Stage, McGuire Nuclear Station,* included as Appendix E of the Application.

30 U.S. Dept. of Energy – Form EIA-764, Steam-Electric Plant Operation and Design Report – 1997, 1998 and 1999 for Catawba.

31 United States Department of Commerce; "1998 Local Climatological Data for Charlotte, N.C."

32 "Renewable Energy Technology Characterizations": EPRI, Palo Alto, CA: 1997 Report TR-109496.

33 The Duke Power Annual Plan, September 1, 2000. [A copy of this report is included as Attachment K].

34 "Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants", Volume 1, March 20, 1998.

35 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.

36 Letter from Peter S. Tam, USNRC to William M. McCollum, Duke Power, dated July 8, 1996.