2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

The Catawba Nuclear Station, Units 1 and 2 (Catawba), owned by Duke Energy Corporation (Duke), is located in York County, South Carolina. It is situated on a peninsula that protrudes into Lake Wylie, a man-made lake created by the Wylie Dam. Both units are the subject of this action. Each reactor is a pressurized light-water reactor (LWR) with four steam generators producing steam that turns turbines to generate electricity. Each unit has six mechanical draft cooling towers for heat removal. The station and its environs are described in Section 2.1, and its interaction with the environment is presented in Section 2.2.

2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term

Catawba is located on 158 ha (391 ac) of Duke-owned land in rural north-central South Carolina (Duke 2001a). Figures 2-1 and 2-2 show the site location and features within 80 and 10 km (50 and 6 mi), respectively. Duke refuels each Catawba nuclear unit on an 18- to 24-month schedule. During these refueling periods, site employment increases by as many as 500 workers for temporary duty over a 30- to 40-day period. Catawba has approximately 1218 full-time workers employed by Duke and site contractors during normal plant operations. The plant is located approximately 29 km (18 mi) southwest of Charlotte, North Carolina. Rock Hill, South Carolina, the nearest city, is about 10 km (6 mi) south of the site.

Lying within the Piedmont physiographic province, the Catawba site is characterized by rolling hills and numerous small streams and rivers. The site and surrounding area vary in elevation from 174 to 193 m (570 to 632 ft), are dominated by Iredell soils, and harbor typical Piedmont plant communities and land cover types, predominantly pine and pine-mixed hardwoods (Duke 2001a).

Four parks, three located in and owned by York County (Ebenezer Park, Pitcarin Cove Park, and Wind Jammer Beach Park) and one located in and owned by Mecklenburg County (McDowell Park), are within a 10-km (6-mi) radius of the Catawba site. Eight state parks (Andrew Jackson State Park, Chester State Park, Croft State Park, Crowders Mountain State Park, Kings Mountain State Park, Lake Norman State Park, Rosehill Plantation State Park, and South Mountains State Park), Cowpens National Battlefield, Kings Mountain National Military Park, and the Catawba Indian Reservation are located within 80 km (50 mi) of Catawba (Duke 2001a).

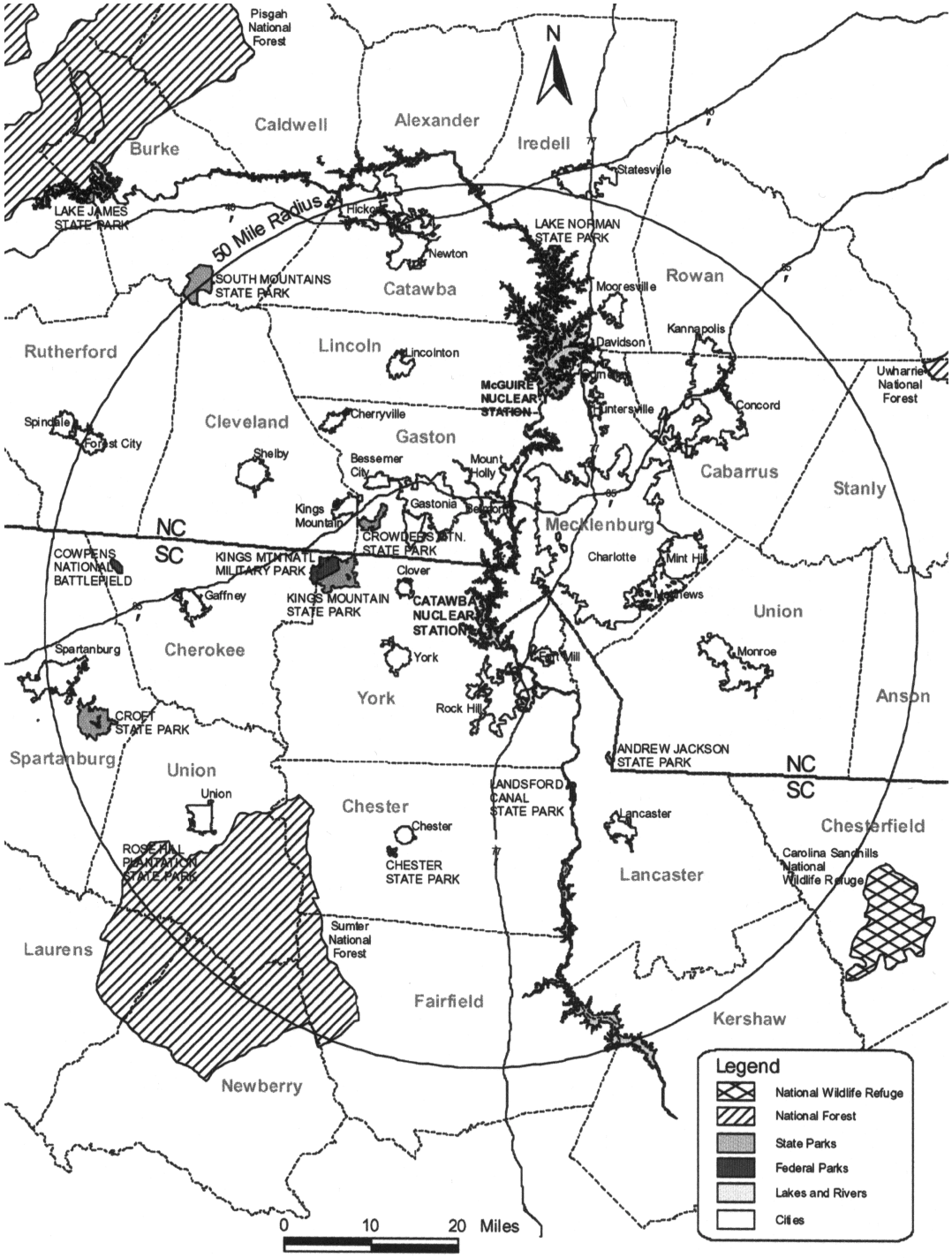
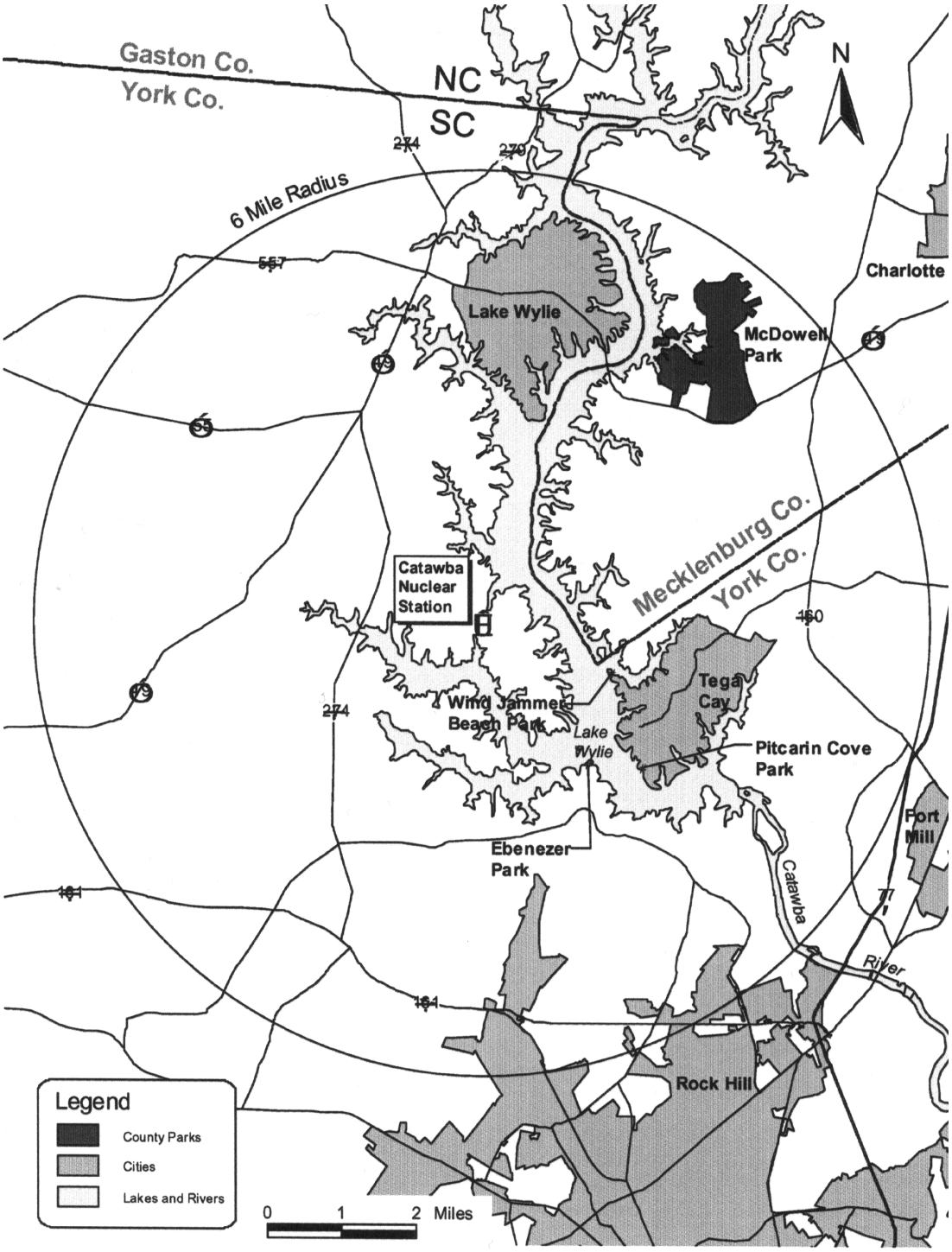


Figure 2-1. Location of Catawba 80-km (50-mi) Region (Duke 2001a)



1 **Figure 2-2**. Location of Catawba 10-km (6-mi) Region (Duke 2001a)

2.1.1 External Appearance and Setting

Catawba consists of two reactor buildings, two turbine buildings, two diesel generator buildings, six mechanical draft cooling towers, one shared service building, one auxiliary building, one water chemistry building, and one switchyard. The cooling water intake and discharge structures and standby nuclear service water pond are shared features (Duke 2001a).

The Catawba site lies within the Piedmont physiographic province, a northeast trending zone from Georgia through Virginia that varies in width from about 129 to 193 km (80 to 120 mi) (Duke 2001a). The Piedmont physiographic province is bounded on the northwest by the Blue Ridge province and on the southeast by the Atlantic Coastal Plain province (AEC 1972).

The site is underlain by a variety of low-quartz granite known as adamellite. Although there are numerous faults in the Piedmont physiographic province (AEC 1972), it is an area of infrequent earthquakes of only moderate intensity (AEC 1973). No faults or other geological structures have been identified that could be expected to localize earthquakes in the immediate vicinity of the Catawba site (AEC 1972).

2.1.2 Reactor Systems

The Catawba site is shown in Figure 2-3. Units 1 and 2 are pressurized LWRs with four reactor coolant loops, each of which contains a steam generator that produces steam and turns turbines to generate electricity. Each unit is designed to operate at core power levels up to 3411 megawatts (thermal) (MW[t]), with a corresponding net electrical output of approximately 1129 megawatts (electric) (MW[e]). The nuclear steam supply system for each unit and the Unit 2 steam generators were supplied by Westinghouse Electric Corporation. The current Unit 1 steam generators, installed in 1996, were supplied by Babcock & Wilcox International.

The reactor containment is housed in a separate free-standing steel containment structure within a reinforced concrete shield building. The containment employs the ice condenser pressure-suppression concept, and is designed to withstand environmental effects and the internal pressure and temperature accompanying a postulated loss-of-coolant accident or steam-line break. Together with its engineered safety features, the containment structure for each unit is designed to adequately retain fission products that escape from the reactor coolant system.

The Catawba reactors are licensed for fuel that is slightly enriched uranium dioxide, up to 4.73 percent by weight uranium-235. Catawba has several different fuel designs that are 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 approved fuel pin

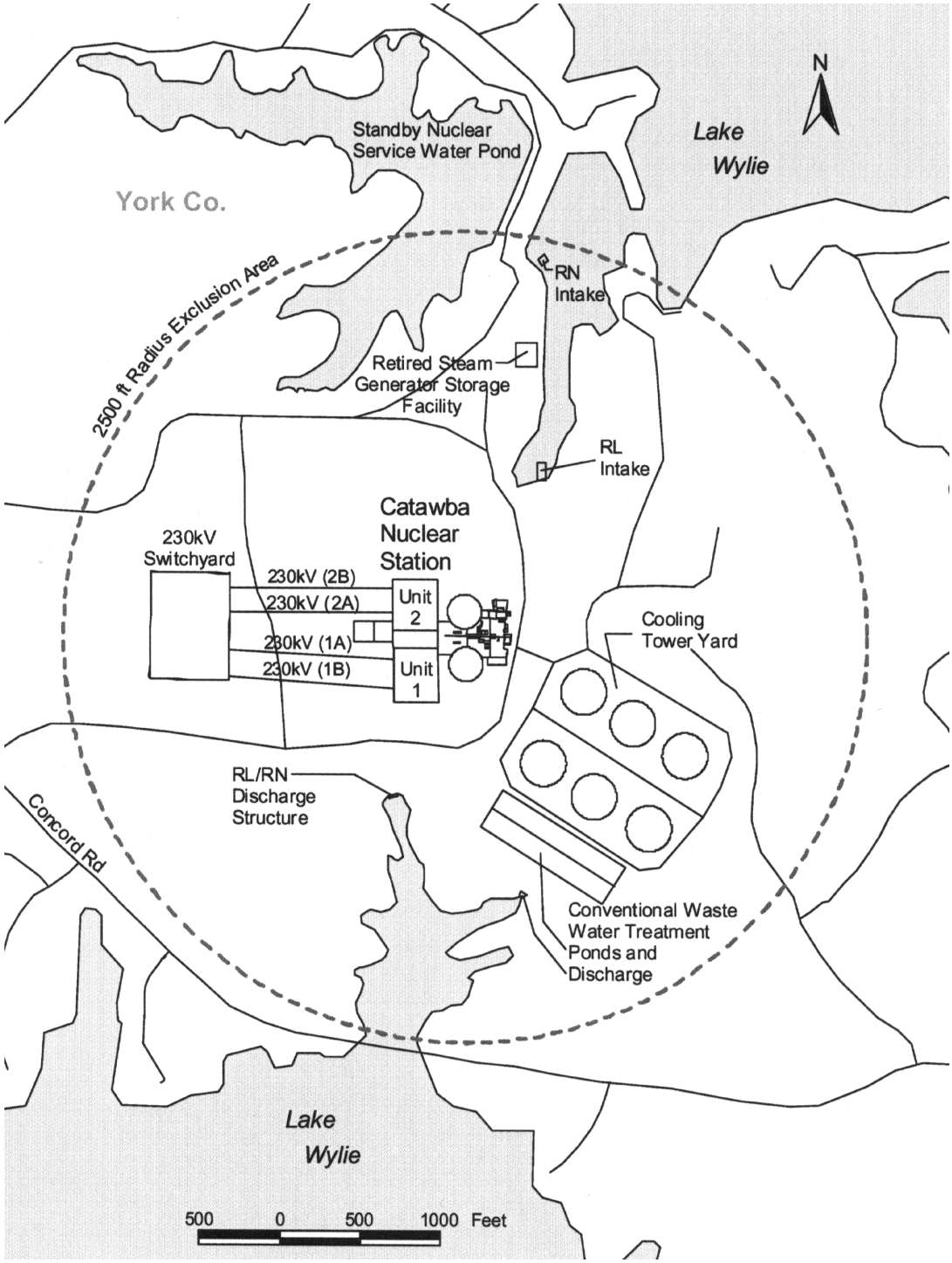


Figure 2-3. Catawba Exclusion Area (Duke 2001a)

burnup of 60,000 MWd/MTU. The Westinghouse Robust Fuel Assembly design does not have a maximum fuel assembly burnup limit; however, this burnup value would be limited by the maximum approved fuel pin burnup limit of 60,000 MWd/MTU (Duke 2001a).

2.1.3 Cooling and Auxiliary Water Systems

Catawba uses water from Lake Wylie for cooling and process water. The average daily withdrawal from Lake Wylie for the cooling water and other service water systems is 386 million liters per day (L/d) (102 million gallons per day [MGD]). The average daily discharge back into Lake Wylie from Catawba is 230 million L/d (60.7 MGD). The consumptive water losses result from evaporation and drift from the six mechanical-draft cooling towers that provide cooling for the condenser circulating water system.

Water from Lake Wylie is taken in through two intake structures. The low pressure service water intake structure is located on the Beaver Dam Creek arm of Lake Wylie (Figure 2-3; RL Intake). Trash racks and traveling screens are used to remove trash and debris from this intake water. The intake structure is designed for a maximum water velocity of 0.15 m/s (0.5 ft/s) in front of the trash racks at the maximum design drawdown of Lake Wylie. The low pressure service water system supplies water for various functions on the secondary side of the plant. The nuclear service water intake structure also is located in the Beaver Dam Creek arm (Figure 2-3; RN Intake). This intake supplies cooling water to various heat loads in the primary side of the plant and supplies water to the standby nuclear service water pond.

Catawba does not use cooling ponds for normal operations; however, it does have a standby nuclear service water pond. The purpose of this pond is to provide an ultimate heat sink in the event of a rapid decline in water level in Lake Wylie. The pond is isolated from the plant service water during normal plant operations.

The discharge structure is located on the Big Allison Creek arm of Lake Wylie (Figure 2-3; RL/RN Discharge Structure). This structure is designed to allow warm discharge water to float on the surface with a minimum amount of mixing. Approximately 1.48 million L/d (0.39 MGD) from the conventional waste water treatment system and from the sewage treatment system is discharged to Lake Wylie.

Catawba obtains potable water from the city of Rock Hill. There are a total of three groundwater supply wells at the Catawba site. These wells supply water on a periodic basis to remote locations and for seasonal irrigation. The average annual groundwater withdrawal rate from these wells is 1.89 L/s (30 gallons per minute [gpm]).

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

Catawba uses liquid, gaseous, and solid radioactive waste management systems to collect and process the liquid, gaseous, and solid wastes that are the by-products of operations. These systems process radioactive liquid, gaseous, and solid effluents before they are released to the environment. The waste disposal systems for Catawba meet the design objectives of 10 CFR Part 50, Appendix I (Numerical Guide for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents). These systems 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 LWRs. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products mostly are contained in the sealed fuel rods, but small quantities escape and contaminate the reactor coolant. Neutron activation of the primary coolant system also is responsible for coolant contamination.

Nonfuel 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 modifications and operations and routine maintenance activities. Solid wastes may be shipped to a waste processor for volume reduction before disposal at a licensed burial site (Duke 2001a). Spent resins and filters are stored or packaged for shipment to a licensed offsite processing or disposal facility.

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. Each unit is refueled approximately every 18 to 24 months, and refueling outages are staggered so both units are not in an outage at the same time. Spent fuel is stored onsite in one of the two spent fuel pools. Each unit has its own spent fuel pool and fuel storage facility. Although an independent spent fuel storage installation (ISFSI) is planned, Catawba does not currently have an ISFSI facility.

The waste gas and solid waste systems are common to both units. Portions of the liquid radioactive waste system are shared.

The *Offsite Dose Calculation Manual* (ODCM) for Catawba (Duke 2001b) describes the methods used for calculating radioactivity concentrations in the environment and the estimated

potential offsite doses associated with liquid and gaseous effluents. The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the following:

- The concentration of radioactive liquid effluents released from the site to the unrestricted area will not exceed 10 times the concentration specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained gases. For dissolved or entrained noble gases, the concentration shall not exceed 7.4 Bq/mL (0.0002 µCi/mL).

- The dose or dose commitment per reactor to a member of the public from any radioactive materials in liquid effluents released to unrestricted areas shall be limited to the design objectives of 10 CFR Part 50 Appendix I (i.e., [1] less than or equal to 0.015 mSv [1.5 mrem] to the total body and less than or equal to 0.05 mSv [5 mrem] to any organ during any calendar quarter, and [2] less than or equal to 0.03 mSv [3 mrem] to the total body and less than or equal to 0.1 mSv [10 mrem] to any organ during any calendar year).

- The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to (1) less than or equal to 5 mSv/yr (500 mrem/yr) to the total body and less than or equal to 30 mSv/yr (3000 mrem/yr) to the skin due to noble gases, and (2) less than or equal to 15 mSv/yr (1500 mrem/yr) to any organ due to iodine-131, iodine-133, tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days per NUREG-1301 (NRC 1991).

- The air dose per reactor to areas at and beyond the site boundary due to noble gases released in gaseous effluents shall be limited to the design objectives of 10 CFR Part 50, Appendix I, of less than or equal to 0.1 mGy (10 mrad) for gamma radiation and less than or equal to 0.2 mGy (20 mrad) for beta radiation during any calendar year.

- The dose to any individual member of the public from nuclear facility operations will not exceed the maximum limits of 40 CFR Part 190 (less than 0.25 mSv [25 mrem]) and 10 CFR Part 20 (i.e., less than or equal to 5 mSv [500 mrem] in a year and less than or equal to 0.02 mSv [2 mrem] in any hour).

The systems used for processing liquid waste, gaseous waste, and solid waste are described in the following sections.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

All radioactive and potentially radioactive liquids generated in the plant are collected, segregated, and processed. Most deaerated reactor- or primary-grade liquids containing fission product gases and other radioactive materials, including tritium, are collected in the reactor coolant drain tank in the reactor building or in the waste drain tank in the auxiliary building and then are recycled. The liquid radwaste system collects aqueous solutions from equipment flush and drain lines, floor drains, decontamination sink drains, ultrasonic cleaner drains, laundry drains, and ventilation equipment drains. These potentially contaminated liquid wastes are collected in storage tanks in the auxiliary building and waste monitor tank building for processing by filtration or demineralization or both. Wastes from the auxiliary building and from secondary system drains are processed in the waste monitor tank building. Waste input streams are segregated based on radioactivity content and disposed of depending on the concentration of radioactive material in the waste. Those waste streams containing little measurable activity above background levels are discharged to Lake Wylie.

Further processing by filtering, chemical treatment, or demineralization is required for other waste streams. Following treatment, effluents that meet regulated radioactivity levels for release are discharged into Lake Wylie. Wastes with higher radioactive material concentrations are packaged and shipped to an offsite vendor for further waste processing or for disposal in a licensed burial.

The ODCM (Duke 2001b) prescribes the alarm/trip setpoints for the liquid effluent radiation monitors; the setpoints are derived from 10 times the effluent concentration limits provided in 10 CFR Part 20, Appendix B, Table 2, Column 2. Liquid effluent radiation monitors are located on the waste monitor tank release line, the recycle monitor tank release line, the auxiliary monitor tank release lines, and conventional waste water treatment system release line.

During 2000, there were 192 batch releases of liquid effluents for the two units with a total volume of 5060 m^3 (1.33×10^6 gal) prior to dilution. The combined liquid waste volume prior to dilution for batch and continuous releases for 2000 was 305,000 m^3 (8.05×10^7 gal). The liquid waste holdup capacity for the plant is approximately 840 m^3 (221,500 gal) (Duke 2001a). In this liquid waste, there was a total fission and activation product activity of 0.003 TBq (0.083 Ci) and a total tritium activity of 26.6 TBq (718 Ci). These volumes and activities are typical of past years. The actual liquid waste generated is reported in the *Catawba Nuclear Station, Units 1 and 2, 2000 Annual Radioactive Effluent Release Report* (Duke 2001d). See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

Duke does not anticipate any increase in liquid waste releases during the renewal period.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The waste gas system is designed to remove fission gases from radioactive contaminated fluids and to contain these gases. Fission gases are removed from other systems to the maximum extent possible and are contained in the waste gas system. The system is designed so storage and the subsequent decay of activity of these gases reduces to a large extent the need for regularly scheduled discharge of radioactive gases into the atmosphere during normal plant operation. There are times, however, when the release of radioactive gas may be necessary. As a result, there are provisions to sample and isolate each of the decay tanks.

The waste gas decay tanks, containment building purges, auxiliary building ventilation, and flow from the condenser air ejectors exhaust into the two unit vents. These four contributors to the unit vent exhaust are discussed below. The unit vents are the primary (major) gaseous release points from the plant and contain radiation monitors and flow rate measuring instrumentation (Duke 2001b).

- The waste gas system in the auxiliary building is shared between the two reactor units and consists of two waste gas compressors, two catalytic hydrogen recombiners, six gas decay storage tanks for use during normal power generation, and two gas decay storage tanks for use during shutdown and startup operations (Duke 2000a). Gases are allowed to decay in these tanks, then are released at permissible rates and activity to the vent as prescribed by the ODCM (Duke 2001b).

- Within the containment building, nonrecyclable reactor coolant leakage gases are released through the containment air release and addition system or through the containment purge system. The containment atmosphere is discharged through charcoal absorbers before its release.

- Gases collected inside the auxiliary building are released to the environment without further decay. Ventilation exhaust from potentially contaminated areas is passed through charcoal adsorbers before release.

- Gases from the condenser air ejectors are monitored continuously and discharged into the unit vent.

A separate gaseous effluent release point is the auxiliary monitor tank building. This effluent is normally considered nonradioactive. However, because of the potential for its release of radioactive effluents, ventilation of process areas pass through particulate and charcoal filters.

Radioactive gaseous wastes from Catawba are released primarily through the Unit 1 and Unit 2 vents. The exhaust streams that flow into the unit vents (i.e., waste gas decay storage tanks, containment ventilation, auxiliary building ventilation, and condenser air ejectors) are monitored for radioactivity. The unit vents are continuously monitored for noble gases, radioiodines, and particulate activity. The ODCM prescribes alarm/trip setpoints for these effluent monitors and control instrumentation to ensure that the alarm/trip will occur prior to exceeding the limits established in 10 CFR Part 20 for gaseous effluents (Duke 2001b). See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

During 2000, there was a total fission and activation gas activity of 2.3 TBq (60.3 Ci), a total iodine activity of 7.77×10^{-7} TBq (2.1×10^{-5} Ci), a total particulate activity of 7.40×10^{-7} TBq (2.00×10^{-5} Ci), and a total tritium activity of 9.36 TBq (2.1×10^{2} Ci) released from the two units. These releases are typical of past years.

Duke does not anticipate any increase in gaseous releases during the renewal period.

2.1.4.3 Solid Waste Processing

Solid radioactive wastes from Catawba consist of spent resin and spent filters used in treating and separating radionuclides from gases and liquids; reactor components, equipment, and tools removed from service; contaminated oils and sludges; and contaminated protective clothing, paper, rags, and other trash generated from routine plant operations and from design modification and maintenance activities (Duke 2001a). The solid radwaste system is shared by the two units to contain and store radioactive waste materials and prepare them for shipment to a waste processor for volume reduction before disposal or for shipment directly to the licensed burial site.

Spent resin is flushed from plant demineralizers into spent resin storage tanks. The spent resin is processed by dewatering or solidification and packaged in a cask liner. Spent filter cartridges are removed from their housing and transferred to a shielded filter storage bunker where they are lowered into a disposal drum (Duke 2000a). Contaminated oils and sludges either are pumped to a processing area for solidification in cement or are shipped to an offsite vendor for processing prior to disposal.

Lower-activity wastes (i.e., miscellaneous solid materials) are processed at an offsite waste processing facility for volume reduction or segregation prior to disposal at a licensed facility such as those in Barnwell, South Carolina, or Envirocare in Utah. Higher-activity wastes (i.e., spent resins) are typically sent directly to a licensed disposal facility such as Barnwell, South Carolina (Duke 2001a). Onsite disposal within the owner-controlled area of slightly contami-

nated materials, of which secondary resins is an example, is approved by the NRC and the State of South Carolina in a process described in 10 CFR 20.2002 for materials confirmed to have acceptably low radionuclide concentrations.

Disposal and transportation of solid wastes 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.

Approximately 90 solid waste shipments containing contaminated parts, tools, and equipment and 10 radwaste shipments containing dry active waste, dewatered resins, and irradiated hardware are made from Catawba each year as reported in the Catawba ER (Duke 2001a). The average yearly radioactive contaminated waste generated is about 250 m^3 (8825 ft^3). The volume shipped for burial averages about 50 m^3 (1750 ft^3) per year. These quantities may vary significantly from year to year.

In 2000, Catawba made five shipments of radwaste with a volume of 26.6 m^3 (938 ft^3) to a disposal facility. This includes the volume but not the shipment numbers sent for brokered dry active waste treatment and waste reduction. The combined waste contained a total activity of 50 TBq (1343 Ci; Duke 2001d). Catawba has been aggressively reducing volume and minimizing waste for several years and intends to do so in the future.

2.1.5 Nonradioactive Waste Systems

Nonradioactive solid wastes from Catawba are disposed of in the onsite landfill or in other approved landfills. The onsite landfill typically handles the following types of wastes: asbestos, empty paint containers, and oil-contaminated materials. This landfill is permitted by the South Carolina Department of Health and Environmental Control (SCDHEC) (Duke 2001a). General office trash and cafeteria wastes are collected and transported to an offsite permitted landfill. Construction wastes are hauled to a county construction and demolition debris landfill. Items such as paper, aluminum cans, and scrap metal are sent to a recycler.

Nonradioactive liquid wastes are sampled and treated according to the Site National Pollutant Discharge Elimination System (NPDES) permits issued to Catawba by the SCDHEC. These wastes originate from system drainage/leakage, water treatment activities, housekeeping and cleaning wastes, stormwater runoff, and floor and yard drains. These wastes are treated by sedimentation, skimming, precipitation, neutralization, and mixing before being discharged to Lake Wylie (Duke 2001a). Sanitary wastes are treated in an aerated facultative lagoon followed by an effluent polishing basin. The treated sanitary wastes are discharged into Lake Wylie through the station discharge structure (NRC 1983).

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation. Maintenance activities conducted at Catawba include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating, but others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. Duke refuels each of the Catawba units every 18 to 24 months (Duke 2001a). Each outage is typically scheduled to last approximately 30 to 40 days, and the outage schedules are staggered so that both units are not shut down at the same time. One-third of the core is replaced at each refueling. Approximately 500 additional workers are onsite during a typical outage (Duke 2001a).

Duke provided an appendix in *Duke Energy Company Catawba Nuclear Station Updated Final Safety Analysis Report* (Duke 2000a) regarding the aging management review to manage the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. Chapter 3 and Appendix B of the Catawba license renewal application specify the programs and activities that will manage the effects of aging during the license renewal period (Duke 2001a). Duke expects to conduct activities related to the management of aging effects during plant operation or during normal refueling and other outages, but no outages specifically for refurbishment activities are planned. Duke has no plans to add additional full-time staff (non-outage workers) at the plant during the period of the renewed licenses.

2.1.7 Power Transmission System

Catawba has five 230-kV transmission lines leaving the site from the switch yard (NRC 1983, Duke 2001a). The five lines (Table 2-1) are contained within rights-of-way ranging from 35 to 46 m (115 to 150 ft) in width and from 1 to 40 km (0.7 to 24.4 mi) in length covering a total of approximately 295 ha (730 ac) (Duke 2001a, NRC 1983). The rights-of-way extend out from Catawba to the north, south, and west (Figure 2-4). The lines and rights-of-way were constructed or rebuilt between 1973 and 1983.

Duke owns less than 10 percent of the rights-of-way and has easements for the remaining 90 percent. Vegetation in the rights-of-way is managed through a combination of mechanical and herbicide treatments (Duke 2001a). Initial treatments include mowing and/or treatment with Arsenal (imazapyr) and Accord (glyphosate). Spot treatments then are applied once every 3 years using Arsenal, Accord, Garlon4A, and Krenite. Herbicide treatments in wetlands are limited to Arsenal and Accord, which are approved for use in wetlands. In addition, Duke cooperates with the South Carolina Department of Natural Resources (SCDNR) regarding

Table 2-1. Catawba Transmission Line Rights-of-Way

Line	Direction	kV	Length		Width		Area	
			km	(mi)	m	(ft)	ha	(ac)
Catawba-Allen	N	230	17.5	(10.9)	46	(150)	80	(198)
Catawba-Ripp	W	230	39.3	(24.4)	44	(145)	173	(426)
Catawba-Pacolet[(a)]	W	230	1.9	(1.2)	46	(150)	9	(22)
Newport (Allison Creek)	S	230	1.1	(0.7)	43	(140)	5	(12)
Newport (Newport)	S	230	8.4	(5.2)	35	(115)	29	(72)
Total			75.7	(42.4)			296	(731)

(a) An additional 64.4 km (40.1 mi) of line existing prior to construction of Catawba is shared but is not part of Catawba transmission system.

conservation easements and partners with The Wildlife Federation on vegetation management in some portions of the rights-of-way.

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts on other Federal project activities.

2.2.1 Land Use

The Catawba site is located in the north-central portion of South Carolina 1.6 km (1 mi) west of the North Carolina-South Carolina state line and is situated within the Piedmont physiographic province. The power station is in northeastern York County, adjacent to Lake Wylie, and is approximately 16 km (10 mi) northeast of York, the county seat. The site is situated in the center of a peninsula about 1.6-km (1-mi) wide and 4.8-km (3-mi) long that protrudes into Lake Wylie, a body of water extending 45 km (28 mi) in length between dams and having a surface area of 4916 ha (12,139 ac) at normal operating level. Lake Wylie was formed by impounding the water of the Catawba River. Full pond was achieved in 1904, and an increase in dam

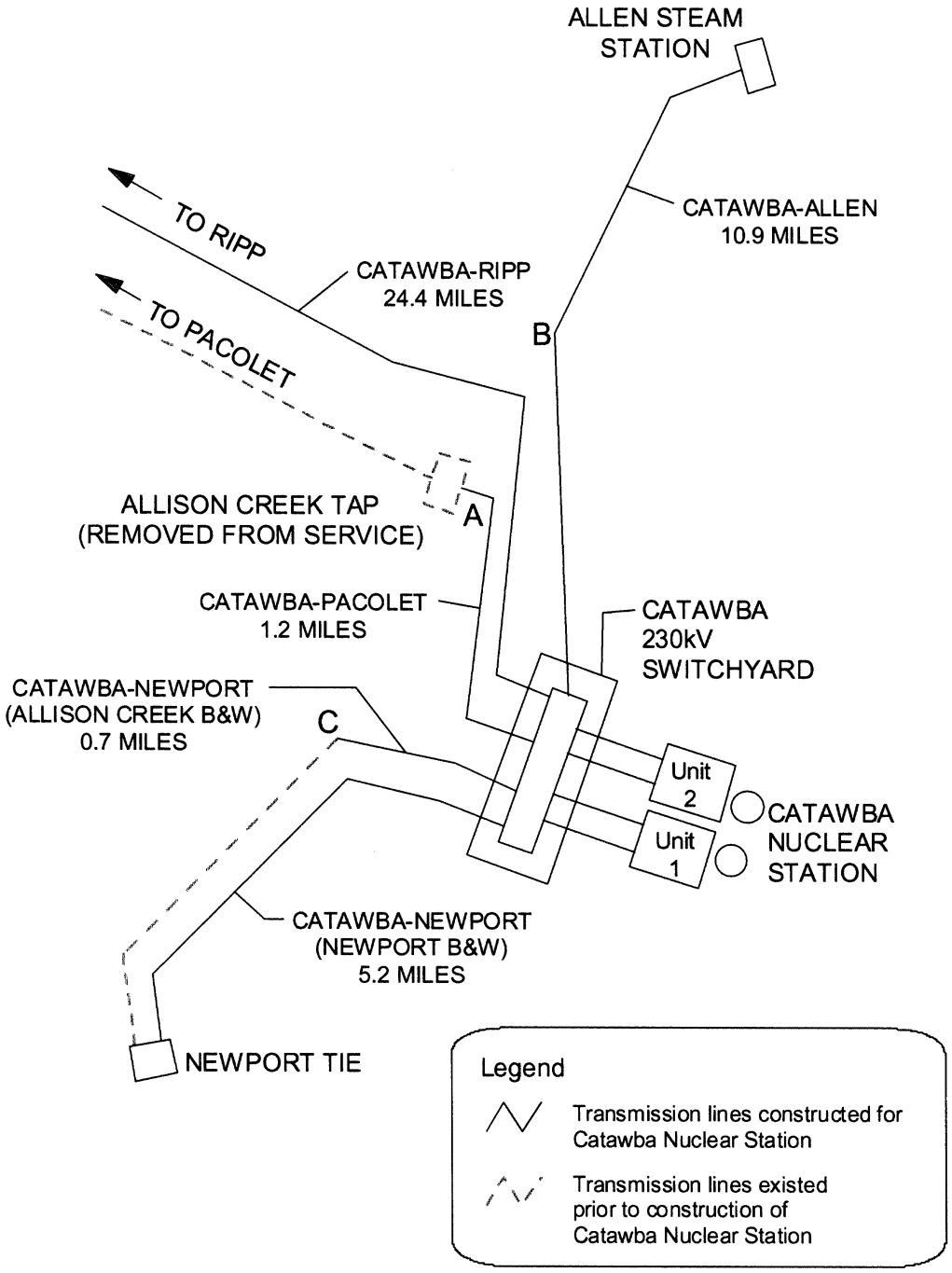


Figure 2-4. Catawba Transmission Lines and Rights-of-Way (Duke 2001a)

elevation in 1924 raised the water level and increased the size of the lake. Duke owns the land that underlays the lake up to the high-water mark. The lake level fluctuates in accordance with hydroelectric generation needs. Lake Wylie is a source of drinking water for several municipalities and supports extensive recreational use by fisherman, boaters, water skiers, and swimmers.

The total land area occupied by the site is 158 ha (391 ac) of which 106 ha (262 ac) is non-forested and contains generation, maintenance, and distribution facilities; a visitors center and lookout area; parking lots; open water; roads; a railroad line; and a fenced cemetery. A recreation park and boat launch for Duke employees is located on a small peninsula protruding into Lake Wylie. Plans for an independent spent fuel storage installation are in the early stages of development and involve use of land presently used for other station purposes. There are approximately 51 ha (125 ac) of pine and pine-mixed hardwood forests. Forests cover the majority of the land area in the region surrounding the site. Most of the land within 8 km (5 mi) of the station is level to rolling with elevations ranging from 183 to 213 m (600 to 700 ft) above mean sea level with a few hills reaching 244 m (800 ft) in elevation.

The land occupied by Catawba is in unincorporated York County. York County and its municipalities currently have land-use plans and zoning requirements that govern development activities within the county.

2.2.2 Water Use

Catawba uses water from Lake Wylie for cooling and service water. Lake Wylie is the seventh of 11 impoundments in the 410-km (255-mi) Catawba-Wateree Project managed by Duke and licensed by the Federal Energy Regulatory Commission (FERC). Lake Wylie extends 45 km (28 mi) upstream from Wylie Dam to Mountain Island Dam. Flow through the Catawba-Wateree Project is managed by Duke to optimize hydroelectric generation, provide flood control, meet FERC minimum release requirements, and maintain a constant and reliable water supply for thermoelectric generating stations, surrounding communities, and industry. Lake Wylie has a storage volume of 3.48×10^8 m^3 (281,900 ac-ft) and a mean depth of 7 m (23 ft). The minimum daily release from Wylie Dam is 11.6 m^3/s (411 cfs).

As mentioned in Section 2.1.3, during operation, the average daily withdrawal from Lake Wylie is 380 million L/d (102 MGD), and the average daily discharge back into Lake Wylie from Catawba is 230 million L/d (60.7 MGD). During full-power operation, the water loss of 156 million L/d (41.3 MGD), or equivalently 1.81 m^3/s (64 cfs), results from evaporation and drift from the cooling towers. From 1997 through 1999, the average overall annual consumptive use of water from the Catawba River by Catawba was approximately 1.47 m^3/s (52 cfs). The mean flow in the Catawba River (below Wylie Dam) is 124 m^3/s (4390 cfs); therefore, evaporation and

drift from Catawba from 1997 to 1999 represented a decrease of 1.46 percent in the long-term mean annual flow below Wylie Dam.

There are a total of three groundwater supply wells at the Catawba site. These wells supply water on a periodic basis to remote locations and for seasonal irrigation. The average annual groundwater withdrawal rate from these wells is 1.89 L/s (30 gpm). In addition to the groundwater wells, a dewatering system is used to reduce the hydrostatic pressures on the reactor and auxiliary buildings. The drainage system permanently maintains a groundwater level at or near the base of the foundation mat and basement walls, thus eliminating the hydrostatic forces. This groundwater drainage system consists of foundation underdrains and continuous exterior wall drains. The foundation underdrains and exterior wall drains discharge into three sumps. On a yearly basis, the average groundwater drainage discharge from these sumps is 2.15 L/s (34 gpm); therefore, total average annual groundwater use at Catawba is 4.04 L/s (64 gpm).

Potable water for Catawba is provided by the city of Rock Hill.

2.2.3 Water Quality

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 Wylie's water quality. Lake Wylie exhibits thermal and oxygen dynamics similar to other southeastern reservoirs of comparable size, depth, flow conditions, and trophic status. Lake Wylie supports a good warm-water fishery.

Pursuant to the Federal Water Pollution Control Act (FWPCA) of 1977, also known as the Clean Water Act, the water quality of the plant effluents is regulated through the National Pollutant Discharge Elimination System (NPDES). The South Carolina Department of Health and Environmental Control (SCDHEC) is the agency delegated to issue NPDES permits. The current permit (SC0004278) was issued April 30, 2001, and is due to expire April 30, 2006. Any new regulations promulgated by EPA or the SCHDEC would be included in future permits.

The temperature of the discharge to Lake Wylie is one aspect of the discharge regulated by the NPDES permit. For temperature, discharge limitations are specified as an allowable temperature rise (between intake and discharge) of 5.6°C (10°F) for the months of April through September and 7.8°C (14°F) from October through March.

2.2.4 Air Quality

The site is located in the north-central region of South Carolina at the very southern end of a region known as the Piedmont. In this region, the basic climatic classification is subtropical where a majority of the rainfall occurs in the summer creating some periods of unpleasantly humid conditions. The winter season is generally pleasant and attracts migratory birds. A feature unique to this climatic area is the occasional entry of very cold air masses during the winter season plunging temperatures well below freezing with resulting calamitous effects on the vegetation in the region. Temperatures in the region rarely exceed 35°C (95°F) or fall below -12°C (10°F). The best available extreme temperature data for the region (Charlotte, North Carolina) indicates the highest recorded temperature being 40°C (104°F), with the lowest reported temperature being -20.5°C (-5°F). The average precipitation in the region is 109 cm (43.1 inches) per year, which is evenly distributed throughout the year.

Normally, about 42 thunderstorms per year occur in the region (NOAA 1983). A vast majority of these storms occur during the months of May through September (34 of the 42). The most recent severe weather event was Hurricane Fran in August 1996. Based on statistics for the 30 years from 1954 through 1983, on the average, only 9 tornadoes are expected to occur in the state of South Carolina during the course of a year (Ramsdell and Andrews 1986). The probability of a tornado striking the site is calculated to be about 1×10^{-4} per year.

The wind energy resource in the vicinity of the site is limited, with the annual average wind power rated as 1 on a scale of 1 to 7 (Elliott et al. 1987). Wind turbines are economical for wind power classes 4 through 7 that have average wind speeds of 5.6 to 9.4 m/s (12.5 to 21.1 mph; DOE 2001a). Areas suitable for wind turbine application in South Carolina are limited to the ridges along the Blue Ridge Mountains in the extreme northwest corner of the state.

The Catawba site is located in Metropolitan Charlotte Interstate Air Quality Control region (40 CFR 81.75). This region is designated as in-attainment or unclassified for all criteria pollutants in 40 CFR 81.334 except for the EPA's reinstated 1-hr ozone standard. The County is at risk of being classified as non-attainment regarding ozone in the future if a new 8-hr standard is implemented. The Cape Romain Area is the only area in South Carolina designated in 40 CFR 81.426 as a mandatory Class I Federal area in which visibility is an important value. There are more Class I areas located in North Carolina (40 CFR 81.422), but a vast majority are located in the region of the North Carolina-Tennessee border in the Smoky Mountains. None of these areas are within 80 km (50 mi) of the site.

Diesel generators, boilers, and other activities and facilities associated with Catawba operations emit various pollutants. Emissions from these sources are regulated under air quality permit number 2440-0070 issued by SCDHEC (Appendix E). This permit expires on December 31, 2005.

2.2.5 Aquatic Resources

Aquatic resources in the vicinity of Catawba are associated with Lake Wylie and the Catawba River. Lake Wylie, which serves as the cooling water source for Catawba, extends 45 km (28 mi) in length between Mountain Island Dam in North Carolina and Wylie Dam in South Carolina. Mountain Island Lake and Lake Wylie, which are part of the Catawba-Wateree Project, are owned and operated by Duke and are 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 River chain (Duke 2001a). Tributaries for Lake Wylie include the Catawba River, Allison Creek, Mill Creek, Crowders Creek, and the South Fork Catawba River (NCDENR 1999; SCDHEC 1999).

Upon leaving Lake Wylie, the Catawba River flows about 40 km (25 mi) south to Landsford Canal (Figure 2-1). This reach is a substantial portion of the 67 km (42 mi) of the Catawba River's total 360 km (225 mi) upstream of Lake Wateree Dam that remains free-flowing (Duke 2000b). The Catawba River then continues to Lake Wateree, the lowermost lake of the Catawba-Wateree Project, which is about 80 km (50 mi) south of Wylie Dam. Lake Wylie and the Catawba River are part of the Santee-Cooper drainage unit (Warren et al. 2000). Counties directly adjacent to Lake Wylie, adjacent to the immediate reaches of the Catawba River upstream and downstream of Lake Wylie, or with tributaries into the immediate adjacent reaches of the Catawba River include Gaston, Mecklenburg, and Union Counties in North Carolina and York, Chester, and Lancaster Counties in South Carolina. Besides serving as the cooling water source for Catawba, Lake Wylie is the source of municipal drinking water for several cities in the region and is used extensively by fisherman, boaters, water skiers, and swimmers (Duke 2001a).

Lake Wylie was formed from the impoundment of the Catawba River by Duke's Wylie Dam and initially achieved full pond volume in 1904; however, the dam was raised 15 m (50 ft) in 1924 (NRC 1983). It is reasonably shallow (mean depth of 7 m [23 ft], maximum depth of 28.4 m [93.2 ft]) and has a full pond surface area of 4916 ha (12,139 ac), a full pond volume of 348 million m^3 (281,900 ac-ft), a shoreline length of 526 km (327 mi), and a drainage area of 7822 km^2 (3020 mi^2). The annual mean flow at Wylie Dam is 106.9 m^3/s (3774 ft^3/s) with a minimum average daily flow (as specified by FERC) of 11.6 m^3/s (411 ft^3/s). Maximum drawdown is 3 m (10 ft) (Duke 2001a).

Lake Wylie is typical of many shallow impoundments in the Piedmont physiographic province region. Since impoundment, it has gone through the typical ecological succession experienced by all man-made reservoirs in which the biotic community initially is highly productive and then decreases in production until it reaches ultimate stability (Paterson and Fernando 1970; Voschell and Simmons 1978). Lake Wylie had achieved a degree of stability by the time initial

aquatic studies were conducted (NRC 1983). More recent monitoring shows the aquatic community remains relatively stable (Duke 2001a, 2002a,b).

Duke's periodic biota monitoring program at Lake Wylie includes surveys of phytoplankton, zooplankton, and fisheries (Duke 2002a). The lake shows a pattern of aquatic organism distribution between up-lake and down-lake locations that is atypical from similar lakes. Up-lake locations are typically more diverse and productive due to the influx of nutrients from upstream, which are consumed further down-lake. However, the South Fork Catawba River, a major tributary, contributes substantial nutrient loads to lower Lake Wylie, and thus contributes to the unusual distribution of aquatic organisms (Duke 2001a).

Lake Wylie supports numerous phytoplankton, zooplankton, and macroinvertebrate communities. Ten phytoplankton classes comprising 114 genera and 293 species and varieties have been observed (Duke 1993). Cryptophyic algae, blue-green algae, green algae, and diatoms dominate, forming a generally stable community whose densities and relative importance change seasonally (Duke 1993, 2001a). The dominant zooplankton genera in Lake Wylie are primarily planktonic or limnetic species characteristic of most North American reservoirs (NRC 1983). Thirty-three taxa have been identified, with major groups including Rotifera (rotifers), Copepoda (copepods), and Cladocera (cladocerans) (Duke 1993).

A total of 88 macroinvertebrate taxa have been reported from Lake Wylie in the vicinity of Catawba (NRC 1983). Midges (Chironomidae) are the most diverse group, typically dominating macroinvertebrate assemblages (Duke 1993). The most abundant chironomid genera are *Coelotanypus*, *Chironomus*, *Tanytarsus*, *Ablesmyia*, and *Cryptochironomus* (Duke 1993). There are a few native freshwater mussels (primarily Unionids) in Lake Wylie (Duke 1988, 2001a). The only mussel of any abundance is the introduced Asiatic clam (*Corbicula sp.*). No consistent spatial trend in the Asiatic clam standing crop has been observed in Lake Wylie in previous studies (Duke 1993). Current Asiatic clam monitoring focuses on clam densities at the intake screen conducted to assess impacts to plant operations from its presence.

A total of 49 fish species from 10 families have been reported at Lake Wylie since sampling began in 1973 (Duke 1988). Dominant species include threadfin shad (*Dorosoma petenense*), gizzard shad (*D. cepedianum*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), redbreast sunfish (*L. auritus*), pumpkinseed (*L. gibbosus*), redear sunfish (*L. microlophus*), black crappie (*Pomoxis nigromaculatus*), white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*), and yellow perch (*Perca flavescens*). Data collected between 1978 and 1979 found largemouth bass accounted for the greatest biomass of all species collected at locations near the Catawba site, whereas threadfin shad were the most numerous (NRC 1983). In studies conducted through 1993, gizzard shad, threadfin shad, and bluegill were the dominant species observed in cove rotenone sampling, white catfish and gizzard shad were the species captured most frequently in gill netting, and bluegill and red-

breast sunfish most frequently captured during electro-fishing (with threadfin shad and gizzard shad occasionally common). Threadfin shad was the dominant forage fish from 1993 to 1997 and comprised from 99.8 to 100 percent of the forage fish in purse seine hauls (Duke 2002a). Forage fish densities ranged from 1692 (1997) to 115,432 fish/ha (1993) (677 to 46,173 fish/ac, respectively). Total population estimates ranged from about 15 million (1997) to 403 million (1993). Between 1993 and 1997, the Lake Wylie littoral (shoreline) fish community, measured as mean total biomass, ranged from approximately 70 to160 kg fish/1000 m (250 to 570 lbs/mi) of shoreline electro-fished with a trend of decreasing biomass progressively downstream (Duke 2002b). Sunfish, catfish, and common carp (*Cyprinus carpio*) compose the majority of the biomass at all shoreline locations (Duke 2002b). Historic differences in species composition can be attributed to differences in areas sampled, sampling frequency, and sampling technique. Current fish monitoring consists of hydroacoustic and purse sein sampling and shoreline electro-fishing at 3-year intervals at locations that allow comparison to historic data (Duke 2002a, 2002b).

Lake Wylie supports a good warm-water fishery. The resident species generally favor the relatively stable water levels that are maintained in the reservoir (Duke 2001a). Game fish of the Centrarchid (sunfish) family (redbreast sunfish, pumpkinseed, bluegill, redear sunfish, largemouth bass, and black crappie) need relatively stable water levels during their springtime spawning seasons. Duke, in cooperation with 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 (Duke 2001a). White bass (*Morone chrysops*, a member of the Percichthyidae family) is the only fish species that makes an appreciable spawning run in Lake Wylie. This spawning run, which occurs during the February through April time period, is most evident in the area of Dutchman's Creek, which enters Lake Wylie on the extreme northwestern side of the reservoir. In the past few years, both blue catfish (*Ictalurus furcatus*) and flathead catfish (*Pylodictis olivaris*) have established populations in Lake Wylie (Duke 2001a). 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.

Table 2-2 lists Federal special status aquatic species found in Gaston, Mecklenburg, and Union Counties in North Carolina and York, Cherokee, Lancaster, and Chester Counties in South Carolina (Gaddy 2001, SCDNR 2001, North Carolina Atlas of Freshwater Mussels and Endangered Fish 2001, FWS 2002). No Federally listed fish species occur in counties immediately adjacent to Lake Wylie, counties adjacent to the Catawba River immediately upstream or downstream of Lake Wylie, or tributary streams crossed by Catawba transmission lines (York and Cherokee Counties). The Carolina darter (*Etheostoma collis*), a Federally-listed species of concern, has been found in small to medium-sized streams 2-3 ft (0.6-0.9 m) deep

Table 2-2. Aquatic Species as Endangered or Threatened by the FWS and Species that are Candidates for FWS Listing as Threatened or Endangered or are Considered Species of Concern by FWS Potentially Occurring in Gaston, Mecklenburg, and Union Counties in North Carolina, and York, Cherokee, Lancaster, and Chester Counties in South Carolina

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]
Fish			
Etheostoma collis	Carolina darter	SOC	SC-SOC
Freshwater mollusks			
Lasmigona decirata	Carolina heelsplitter	E	NC-E SC-E
Alasmidonta varicosa	Brook floater	SOC	NC-E SC-SOC

(a) SC = South Carolina, NC = North Carolina, E = endangered, SOC = species of concern

from backwater pools or near stream banks in slow moving water (Collette 1962). It has not been collected from Lake Wylie in the vicinity of Catawba.

The Carolina heelsplitter (*Lasmigona decorata*), a Federally listed endangered freshwater mollusk that is also listed as endangered by both North and South Carolina, occurs downstream of Lake Wylie. All known populations of this species occur in the Pee Dee, Catawba, and Savannah River systems (FWS 1996; FWS 2001). All known populations in the Catawba River system occur in tributary streams to the Catawba River downstream of Lake Wylie. Areas containing these populations comprise two of the six units proposed as critical habitat (FWS 2001). Unit 2 consists of a 20-km (12-mi) stretch of Waxhaw Creek in Union County, North Carolina. Waxhaw Creek enters the Catawba River just above Landsford Canal (Figure 2-1), about 24 to 32 km (15 to 20 mi) downstream of Wylie Dam. Unit 3 consists of a 10-km (6-mi) stretch of Gill Creek in Lancaster County, South Carolina. Flow from Gill Creek combines with Bear Creek just outside of the town of Lancaster (Figure 2-1), then joins Crane Creek before entering the Catawba River just below Landsford Canal about 48 km (30 mi) downstream from Wylie Dam. Three locations in the Catawba River downstream of Wylie Dam were surveyed for Carolina heelsplitter on October 26, 2001, by the FWS, NCDENR, and the North Carolina Department of Transportation (Duke 2002c). The locations surveyed included the river immediately below Lake Wylie Dam and the river at the I-77 bridge. The Catawba River at Landsford Canal State Park could not be surveyed due to high turbidity. No Carolina heelsplitter were found in this survey, and none have been observed in monitoring programs or surveys of Lake Wylie.

In addition, there are several aquatic species identified by North and South Carolina as state species of concern (rare species that have no legal protection) with potential to occur in the Catawba River system in counties in the vicinity of Lake Wylie. None of the species have been reported in monitoring or survey data from Lake Wylie.

2.2.6 Terrestrial Resources

The Catawba Nuclear Station is located in the Piedmont physiographic province (Bailey 1980). Common vegetation types on the Catawba site and the transmission line rights-of-way are pine *(Pinus* sp.), pine-mixed hardwood, mixed hardwoods, and bottomland hardwoods (Duke 2001a). Currently, ornamental plantings, parking areas, and facilities make up about 67 percent of the 183-ha (450-ac) Catawba Site. Thirty-two percent is forest habitat; and less than one percent is wetland habitat (Duke 2001a). Several of the ravines have mature mixed hardwood stands that include chalk maple (*Acer leucoderme*). In addition, many of the chalk maple stands in open dry bluff areas are dominated by black oak (*Quercus velutina*) rather than the more typical chestnut oak (*Quercus prinus*). The wetlands on the site are associated with beaver ponds, seeps, creeks, artificial impoundments, and Lake Wylie (Duke 2001a). Duke's environmental policies prohibit construction work in the wetlands and limit activities in woodlands.

Disturbed pastures and old fields are the dominant vegetation types in the transmission line rights-of-way with bluestems (*Andropogon* sp.), wire-grasses (*Aristida* sp.), asters (*Aster* sp.), sunflowers (*Helianthus* sp.), and goldenrods (*Solidago* sp.). Trees such as tag alder (*Alnus serrulata*) and black willow (*Salix nigra*) are common around seeps and ponds. These herbaceous communities in the transmission line rights-of-way are maintained by mowing and spot herbicide treatments.

Wetlands are found on portions of the transmission line rights-of-way and at the power station. These wetlands are small, and at the power station, they primarily are associated with Lake Wylie. Duke avoids these areas when possible during vegetation management activities, transmission line maintenance, and site maintenance, and consults with the U.S. Army Corps of Engineers as needed to comply with Section 404 of the Clean Water Act.

Eleven Federal and 14 State-listed threatened, endangered, and candidate species occur or potentially may occur at Catawba or along the transmission line rights-of-way (Duke 2001a, North Carolina 2001a, South Carolina 2001, FWS 2002). In addition, there are many species identified as species of concern (rare species that have no legal protection) that potentially may occur at the Catawba site or along the transmission line rights-of-way. Based on field surveys (Duke 2001a), no protected species, critical habitat, or species of concern are known to occur on the Catawba site or the transmission line rights-of-way, with the exception of the bald eagle (*Haliaeetus leucocephalus*). Eagles rarely are sighted near Catawba, and there are no known

nesting sites on the site or its transmission line rights-of-way (Duke 2001a). Dwarf-flowered heartleaf (*Hexastylis naniflora*) has been identified in Cherokee County and habitat exists within the transmission line corridors. However, no plants have been observed on Catawba or the transmission line corridors. Georgia aster *(Aster georgianus)* has been found near the Allison Creek transmission line corridor, however, no plants have been found in any of the corridors or at the Catawba site. Table 2-3 lists the State- and Federal-protected species and their status.

2.2.7 Radiological Impacts

Duke has conducted a radiological environmental monitoring program (REMP) around the Catawba site since 1981 (Duke 2001c). The radiological impacts to workers, the public, and the environment have been routinely monitored, documented, and compared to the appropriate standards. The objectives of the REMP are:

- provide surveillance of detailed effluent monitoring to evaluate the significance, if any, of the contributions to the existing environmental radioactivity levels that result from station operation (Duke 2001c)

- detect and identify changes in environmental levels as a result of station operations (Duke 2001c)

- provide representative measurements of radiation and radioactive materials in the exposure pathways for the radionuclides that have the highest potential for radiation exposures of members of the public (Duke 2000a)

- implement Section IV.B.2 of Appendix I to 10 CFR Part 50, verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways (Duke 2000a).

Radiological releases are summarized in the annual reports *Catawba Nuclear Station, Units 1 and 2, Annual Radiological Environmental Operating Report* (Duke 2001c) and *Catawba Nuclear Station Annual 2000 Radioactive Effluent Release Report* (Duke 2001d). The limits for all radiological releases are specified in the Catawba ODCM (Duke 2001b), and these limits are designed to meet Federal standards and requirements. The REMP includes monitoring of the air, direct radiation, surface water, drinking water, groundwater, shoreline sediment, milk, fish, broadleaf vegetation, and food products in about a 24-km (15-mi) radius of the station.

Review of historic data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of the Catawba site were a small fraction of the

Table 2-3. Terrestrial Species Listed as Endangered, Threatened, Candidate, or Federal Species of Concern by the FWS, South Carolina, or North Carolina that Occur or Potentially Occur at Catawba or Its Associated Transmission Line Rights-of-Way

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]
Reptiles			
Clemmys muhlenbergii	bog turtle	T	NC-T
Birds			
Haliaeetus leucocephalus	bald eagle	T	SC/NC-E
Picoides borealis	red-cockaded woodpecker	E	SC/NC-E
Mammals			
Myotis austroriparius	Southeastern myotis	SOC	SC-T
Vascular Plants			
Amphianthus pusillus	pool sprite	T	SC-T
Aster georgianus	Georgia aster	C	NC-T
Delphinium exaltatum	tall larkspur	SOC	NC-E
Echinacea laevigata	Smooth coneflower	E	SC/NC-E
Helianthus schweinitzii	Schweinitiz's sunflower	E	SC/NC-E
Hexastylis naniflora	dwarf-flowered heartleaf	T	SC/NC-T
Hymenocallis coronaria	shoals spider-lily	SOC	SC/SOC
Isoetes virginica	Virginia quillwort	SOC	NC-SOC
Isoetes melanospora	black-spored quillwort	E	SC-E
Lotus helleri	Heller's trefoil	SOC	NC-T
Oxypolis canbyi	Canby's dropwort	E	SC-E
Rhus michauxii	Michaux's sumac	E	NC-E
Rudbeckia heliopsidis	sun-facing coneflower	SOC	SC-SOC

(a) SC = South Caroline, NC = North Carolina, E = endangered, T = threatened, C = candidate., SOC = species of concern

limits specified in the EPA's environmental radiation standards 40 CFR Part 190 as required by 10 CFR 20.1301(d). For 2000 (the most recent year that data were available), dose estimates were calculated based on actual liquid and gaseous effluent release data (Duke 2001c) and on measured concentrations of radionuclides from the REMP (Duke 2001c). Dose estimates based on effluent data were performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM.

A breakdown of maximum dose to an individual located at the Catawba site boundary from effluent-based releases and environmental-based releases for the year 2000 are summarized in Duke (2001c) is as follows:

- Total body dose from liquid effluent-based estimates was 4.37E-4 mSv (4.37E-2 mrem) compared to 7.31E-4 mSv (7.31E-2 mrem) from environmental-based estimates. These estimates were approximately 1 percent of the 0.06-mSv (6-mrem) dose limit[(a)]. The maximum total organ dose for the liquid effluent-based estimates was 1.21E-3 mSv (1.21E-1 mrem) to the adult gastrointestinal tract-lower large intestine (GI-LLI) compared to 3.28E-3 mSv (3.28E-1 mrem) to the adult GI-LLI from the environmental-based estimates. These estimates were between 0.6 and 1.6 percent of the 0.20-mSv (20-mrem) dose limit (Duke 2001c).

- The air dose due to noble gases in gaseous effluents was 3.38E-4 mGy (3.38E-2 mrad) gamma (0.17 percent of the 0.20-mGy [20-mrad] gamma dose limit)[(a)] and 7.37E-4 mGy (7.37E-2 mrad) beta (0.18 percent of the 0.40-mGy [40-mrad] beta dose limit; Duke 2001c). Noble gases are not collected as part of the REMP; therefore, an environmental-based estimate was not calculated (Duke 2001c).

- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days is 1.21E-2 mSv (1.21 mrem), which is 4 percent of the 0.30-mSv (30-mrem) dose limit (Duke 2001c).

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Catawba operations during the renewal period, and therefore, the impacts to the environment are not expected to change.

(a) The dose limit is twice the dose limit in 10 CFR Part 50, Appendix I, because the limit is per reactor unit and Catawba has two operating reactor units.

2.2.8 Socioeconomic Factors

The staff reviewed the Catawba ER (Duke 2001a) and information obtained from several county, city, and economic development staff during a site visit to York County from October 22 through 26, 2001. The following information describes the economy, population, and communities near the Catawba site.

2.2.8.1 Housing

The full-time work force at Catawba is approximately 1218 employees, which includes permanent and contractor staff. Approximately 55 percent of these employees live in York County, South Carolina; 15 and 14 percent live in Gaston and Mecklenburg Counties, North Carolina, respectively; and the rest live in other locations (Table 2-4; Duke 2001a). Table 2-5 presents a further breakdown of employee residency by city and county. Since over half of the Catawba employees live in York County, the focus of the socioeconomic analysis for the most part is on that county.

Table 2-4. Catawba Permanent and Contractor Employee Residency by County

County	Number of Personnel	Percent of Total Personnel
York (SC)	673	55
Gaston (NC)	188	15
Mecklenburg (NC)	166	14
Other – NC	95	8
Other – SC	96	8
Total	1218	100

Source: Duke 2001a.

Table 2-5. Catawba Permanent and Contractor Employee Residency by County and City

County and City	Duke Power
YORK COUNTY, SOUTH CAROLINA	
Clover	76
Fort Mill	52
Lake Wylie	13
Rock Hill	362
York	131
Other Cites and Towns	39
Total York County	673

Table 2-5. (contd)

County and City	Duke Power
GASTON COUNTY, NORTH CAROLINA	
Belmont	34
Dallas	11
Mount Holly	15
Stanley	8
Gastonia	104
Other Cites and Towns	16
Total Gaston County	188
MECKLENBURG COUNTY, NORTH CAROLINA	
Charlotte	141
Huntersville	6
Matthews	11
Pineville	6
Other Cites and Towns	2
Total Mecklenburg County	166
CHEROKEE COUNTY, SOUTH CAROLINA	
Gaffney	27
Other Cites and Towns	4
Total Cherokee County	31
CHESTER COUNTY, SOUTH CAROLINA	
Chester	13
Other Cites and Towns	7
Total Chester County	20
LANCASTER COUNTY, SOUTH CAROLINA	
Lancaster	16
Other Cites and Towns	3
Total	19
UNION COUNTY, NORTH CAROLINA	
Other Cites and Towns	17
CABARRUS COUNTY, NORTH CAROLINA	
Concord	6
Harrisburg	5
Kannapolis	3
Total	14
CLEVELAND COUNTY, NORTH CAROLINA	
Kings Mountain	15
Shelby	7
Other Cites and Towns	3
Total	25

Table 2-5. (contd)

County and City	Duke Power
LINCOLN COUNTY, NORTH CAROLINA	
Denver	7
Lincolnton	15
Other Cites and Towns	3
Total	25
Other Counties	
North Carolina	31
South Carolina	9
Total	1,218

Source: Duke 2001a.

Duke refuels each reactor at Catawba on an 18- to 24-month cycle. During refueling outages, an average of 1400 workers are onsite during the day shift, compared to a norm of 900 workers onsite during normal plant operations (Duke 2001a).

Table 2-6 provides the number of housing units and housing unit vacancies for York, Gaston, and Mecklenburg Counties for 1990 and 2000. York County has an urban development boundary within which development is to take place, but otherwise, it does not have growth-management controls.

Table 2-6. Total, Occupied, and Vacant (Available) Housing Units by County 1990 and 2000

	1990	2000	Approximate Percentage Change
YORK COUNTY, South Carolina			
Housing Units	50,438	66,061	31.0
Occupied Units	47,006	61,051	29.9
Vacant Units	3,432	5,010	46.0
GASTON COUNTY, North Carolina			
Housing Units	69,133	78,842	14.0
Occupied Units	65,347	73,936	13.1
Vacant Units	3,786	4,906	29.6
MECKLENBURG COUNTY, North Carolina			
Housing Units	216,416	292,780	35.3
Occupied Units	200,219	273,416	36.6
Vacant Units	16,197	19,364	19.6

Sources: USCB 2000; USCB 1990.

Table 2-7 contains data on population, estimated population, and annual growth rates for York County, South Carolina, and Mecklenburg and Gaston Counties, North Carolina.

Table 2-7. Population Growth in York County, South Carolina, and Mecklenburg and Gaston Counties, North Carolina, 1970 to 2020

	York County		Mecklenburg County		Gaston County	
	Population	Annual Growth Percent[(a)]	Population	Annual Growth Percent	Population	Annual Growth Percent
1970	85,216	--	354,656	--	148,415	--
1980	106,720	2.3	404,270	1.3	162,568	0.9
1990	131,497	4.4	511,433	2.4	175,093	0.7
2000	164,614	2.3	695,454	2.5	190,365	0.8
2010	184,800	1.2	888,137	2.5	203,623	0.7
2020	211,500	1.4	1,089,258	2.1	215,587	0.6

(a) Annual percent growth rate is calculated over the previous decade.
-- = Data not available.
Sources: USCB 2000; USCB 1990; North Carolina 2001b.

2.2.8.2 Public Services

Public services include water supply, education, and transportation.

- **Water Supply**

  Table 2-8 summarizes the daily consumption and areas served for each of the two water systems within York County, the county most impacted by the re-licensing of Catawba. The county is served by two interconnected water systems–the eastern and western systems. The western system includes the town of York water treatment plant. The municipal water reservoir, which produces malodorous water when it turns over once each year, is the only source of drinkable water for the town of York. The town will soon remedy the problem through the construction of a new water treatment plant (York County 1999).

  Water treated by the town of York is purchased by York County for the unincorporated parts of the county. From the town of York, York County mains carry water through the central part of the county. The system branches off along Mount Gallant Road to Museum Road, where it connects to the city of Rock Hill water system and becomes the eastern part of the system. The central portion of the western system also branches off to the Catawba site and serves the Lake Wylie area.

Table 2-8. Major Public Water Supply Systems in York County

Water System	Source	Maximum Daily Capacity m^3/day (MGD)	Average Daily Capacity m^3/day (MGD)	Areas Served
City of Rock Hill[(a)]	Lake Wylie	75,400 (20.0)	52,780 (14.0)	Rock Hill, Fort Mill, and unincorporated parts of York County
Town of York[(b)]	Lake Wylie	9048 (2.4)	4524 (1.2)	York, Lake Wylie, Catawba site, and unincorporated parts of York County

(a) Personal communication, Susan Featherstone, city of Rock Hill, South Carolina, November 28, 2001.
(b) Personal communication, Charles Helms, Director of Public Works, town of York, South Carolina, December 3, 2001.

The city of Rock Hill also has a water treatment plant and serves the eastern part of the county. York County purchases water from Rock Hill, and Rock Hill also sells water to the town of Fort Mill, which transports the water through its own lines to the York County water district where it is sold (York County 1999).

In addition, York County buys water from the Charlotte-Mecklenburg Utility District, North Carolina. This arrangement was initiated as a standing emergency agreement that began in the summer of 1998. Since then, water has been purchased as needed under the arrangement (York County 1999).

- **Education**

There are four school districts in York County. The Rock Hill School District is the largest with a total enrollment (elementary through high school) of 14,468 students. There are 44 elementary, 11 middle, and 7 high schools in the County. Catawba is located within the Clover School District, which receives 75 percent of the taxes paid by Catawba. The remaining 25 percent of this tax revenue is apportioned between York County and the remaining school districts. Table 2-9 presents summary information on each of the four school districts.

In addition, York County is the home of three colleges, all of which are located in Rock Hill. Winthrop University is the only comprehensive teaching university in South Carolina with 100 percent accreditation for all eligible programs. It offers programs in four broad areas: arts and sciences, business, visual and performing arts, and education. Total enrollment is approximately 6100 students (The Herald 2001).

Table 2-9. York County School District Profile

	York School District	Clover School District	Rock Hill School District	Fort Mill School District
Total enrollment	4,955	4,488	14,468	4,817
Number of schools				
Elementary	4	5	14	4
Middle	2	3[(a)]	4	2
High	2[(b)]	1	3[(c)]	1
Expenditures ($1000)	25,444	30,218	77,057	23,647

(a) Includes the Crowders Creek Elementary/Middle School complex.
(b) Includes the Floyd Johnson Vocational Center.
(c) Includes the Applied Technology Center.
Source: The Herald 2001.

York Technical College is a 2-year college with total enrollment of 3600 students. The college has 96 full-time faculty and offers 68 degree programs. It also offers certificates in business, computer, arts and sciences, health and human services, and industrial and engineering technology (The Herald 2001). Clinton Junior College is a 2-year college that offers course work in the liberal arts and business. It also offers a certificate in church ministry. Its total enrollment is less than 100 students (The Herald 2001).

- **Transportation**

There are 24 counties within the 80-km (50-mi) radius of the Catawba site: 13 in South Carolina and 10 in North Carolina. The 23-county area is served by 3 major interstate freeways. Interstate 85 (I-85) enters the region from the northeast and connects Charlotte, North Carolina, with points in Georgia to the southwest. Interstate 77 (I-77) runs in a north-south direction, passes through Charlotte into South Carolina through York County, and continues on to Columbia, South Carolina. Interstate 40 (I-40) lies in an east-to-west direction, bypassing Charlotte on the north.

York County is traversed by several highways. In addition to I-77, the county is traversed by several other Federal highways including U.S. Highways 21 and 321, which are north-south thoroughfares, and South Carolina Highway (SCH) 274. Major east-west highways are SCHs 5 and 161.

In June 1997, the citizens of York County passed a one percent sales tax for the purpose of generating funds for roadway improvements. New roadways and roadway improvements are currently on-going throughout the County. The tax was expected to raise approximately $100 million over a 7-year period. Tax revenues collected and accounted for to date have exceeded projections; therefore, the maximum amount of the tax, ($100 million) that could be collected over the 7-year period has been collected (York County 1999). Tax collection for the roadway improvements, therefore, has been terminated.

Access to the Catawba site is via Concord Road, a two-lane road leading to the plant entrance. The average annual daily traffic (AADT) count on the road numbers 3000 (Duke 2001a). Other roads lead to turnoffs for Concord Road from both North Carolina (State Route 49, the most heavily traveled route with AADT counts of 23,000 [Duke 2001a]) and South Carolina (SCHs 49, 274, 80, 55, and others). Level-of-service designations for these roads were not available (Duke 2001a).

2.2.8.3 Offsite Land Use

Land use designations have been applied in York County except for unincorporated areas. The county is divided into six major planning sectors for land use planning designations. Table 2-10 presents the major land use designations for York County.

Table 2-10. Land Use in York County

Land Use	Hectares	Acres	Percent of Total
Forest (all types)	118,570	292,990	65
Scrub/shrub[(a)]	18,600	45,970	10
Agriculture/grasslands	26,100	64,480	14
Water	4560	11,270	3
Urban/built up	10,780	26,640	6
Barren disturbed land	1910	4730	2
Total	180,520	446,080	100

(a) Scrub/Shrub class of land may include pasture or fallow farmland.
Note: Land use based on satellite imagery from 1988 to 1990.
Source: South Carolina 1998.

Each of the planning sectors, and the predominant land use characteristics in each sector, are briefly discussed below.

The Fort Mill Planning Sector encompasses the northern part of York County along the I-77 corridor. The presence of I-77, combined with the proximity of Fort Mill to the metropolitan area of Charlotte, North Carolina, and its municipal airport, which provides major airline service to other parts of the country, has resulted in substantial growth in population over the last 20 years. The last decade has seen growth in light industrial/commercial type development, including an office space buildup near I-77. Lake Wylie provides recreational and scenic amenities and a water supply, which increases the value of homes and encourages the development of high quality, residential property.[(a)]

The Rock Hill East Planning Sector encompasses the area east of Rock Hill, both south and west of the Catawba River and north to the adjoining Chester County border. Land use in this sector is impacted by I-77, the developing Catawba Indian Nation Reservation, and the Catawba River. Major employers in this planning sector include the Celanese-Acetate Corporation, AMP, Inc., State Farm Insurance, and Bowater, Inc. Major focal points of development include the intersection of SCH 161 and I-77. Land use has been historically rural but is transitioning to residential/subdivision use with building lots being 0.4 to 1.2 ha (1 to 3 ac) in size. Other communities located in the area include Leslie, Harmony, and Catawba, all of which are located along SCH 21 and the CSX railroad.[(b)]

The Rock Hill West Planning Sector is bounded on the north by Lake Wylie and on the east by the western portion of the city of Rock Hill. The more rural portion of this sector is the area along the Chester/York County boundary. The soils in this area tend to shrink/swell with wet and dry cycles, so for that reason, the county is discouraging intense residential development in the area (York County 1999a). Factors affecting land use patterns in this sector include the Rock Hill-York County Airport, which is surrounded by a mix of land uses including residential, commercial, and rural.[(a)]

The Bethel/Lake Wylie Planning Sector is bordered by Lake Wylie and Mecklenburg County, North Carolina, to the east and Gaston County, North Carolina, on the north. Given good road access, this area historically has encouraged the location of residential commuters to the sector's northern part. Parts of the area are in rapid transition from rural use to residential

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(a) York County. York County Comprehensive Plan — Land Use Element. Planning and Development Services. York, South Carolina. <http://www.yorkcountygov.com/departments/Planning Development/docs/land%20use.pdf> (Accessed November 21, 2001).

(b) York County. York County Comprehensive Plan — Land Use Element. Planning and Development Services. York, South Carolina. <http://www.yorkcountygov.com/departments/Planning Development/docs/land%20use.pdf> (Accessed November 21, 2001).

development. Relatively more dense residential development is occurring around Lake Wylie. Historically, the sector has lacked open space and recreational land, but this situation has been remedied with acquisition of the Ferguson's/Nanny's Mountain area, which has been of prime, historical significance from colonial times when it served as a source of iron products during the Revolutionary War.[(a)]

The Clover/Kings Mountain Planning Sector has an observable difference between the more established and economically developed portions of eastern York County and the more rural sectors of the western part of the county. The area encompasses land that extends from the western town limits of the town of Clover to the boundary between Cherokee and York Counties. The predominant land use is agricultural conservation. The more developed, suburban/residential parts of the county lie to the east. Growth is projected to occur more to the east of Clover than to the west. Most of the workers from this section commute to Gaston and Mecklenburg Counties in North Carolina for employment. In recent years there have been ongoing attempts to foster growth within the town of Clover in hopes of reducing the amount commuting.[(a)]

The York/McConnells/Broad River Planning Sector includes the town of York, which is the county seat. The town of York is the principal urban land use influence within the sector. It has pursued aggressively the installation of water and sewer lines to the east of town along SCHs 161 and 5. Wal-Mart has opened a 150,000 square foot facility to the east of town, which is expected to be an area of further economic development. It is anticipated that SCH 5 to the west will be widened to five lanes and, when completed, will evolve into an east-west connector between I-85 and I-77.[(a)]

The areas to the south (McConnells) and west (Smyrna) of the town of York are predominantly rural and designated for agricultural conservation, and have been characterized as York County's last frontier. However, improved roads, which enable easier and faster access to the western part of the county, may lead to economic development similar to that experienced in the eastern part of the county (Bair 2001). Much of the land around McConnells is still farmed, and tree farming is the main economic activity in the land west of McConnell's and north to Smyrna. The County, in its update to the County-wide land use plan, will be placing increased emphasis on the preservation of rural lands. The Broad River, which has designated scenic status by the state of South Carolina, forms the sector's western boundary.[(a)]

(a) York County. York County Comprehensive Plan — Land Use Element. Planning and Development Services. York, South Carolina. <http://www.yorkcountygov.com/departments/Planning Development/docs/land%20use.pdf> (Accessed November 21, 2001).

2.2.8.4 Visual Aesthetics and Noise

Catawba is located on the shores of Lake Wylie, a reservoir on the Catawba River that separates North and South Carolina and one of a series of impoundments on the Catawba River. Lake Wylie has a full-pond surface area of approximately 4912 ha (12,139 ac) and is the third largest lake in the Catawba chain of reservoirs. It serves as a recreational resource for Charlotte, North Carolina, and York County, South Carolina; a source of cooling water for Catawba; and a source of drinking water for several cities in the region (Duke 2001a).

The Catawba site covers 158 ha (391 ac). Several transmission lines cut across the landscape leading to the site. Land use around the site is rural/suburban and wooded with houses. Visibility of the site when approaching by land from access off Concord Road is limited until close to the plant boundary. Condensation from the cooling towers is visible from many miles on cooler mornings.

From onsite, a panoramic view can be seen from the visitor's center (Energy Quest), which overlooks the site.

The nuclear station and its cooling towers also can be seen from Lake Wylie. Noise from Catawba, at both the Energy Quest building and on the lake, is noticeable but not obtrusive.

2.2.8.5 Demography

Population was estimated from the Catawba site out to 80 km (50 mi) in 16-km (10-mi) rings. Population estimates for the 80-km (50-mi) area surrounding the site are based on information provided by the University of North Carolina (Duke 2002c), derived from the 2000 census data. NRC Guidance calls for the use of the most recent United States Census Bureau (USCB) decennial census data, which in the case of the Catawba, was the 2000 census (USCB 2000; Duke 2001a).

- Resident Population within 80 km (50 mi). Table 2-11 presents the population distribution within 80 km (50 mi) of the Catawba site for population estimates in 10-year increments starting with 2000 and ending with 2040.

Table 2-11. Population Distribution from 2000 to 2040 Within 80 km (50 mi) of Catawba

	0 to 16 km (0 to 10 mi)	16 to 32 km (10 to 20 mi)	32 to 48 km (20 to 30 mi)	48 to 64 km (30 to 40 mi)	64 to 80 km (40 to 50 mi)	Total
Total 2000	140,760	586,474	524,292	404,417	383,522	2,041,465
Total 2010	182,527	694,129	694,243	504,540	119,202	2,524,641
Total 2020	228,349	814,999	875,273	612,428	528,018	3,059,067
Total 2030	276,446	944,688	1,061,916	726,321	614,635	3,624,006
Total 2040	326,238	1,080,791	1,252,307	844,328	706,416	4,210,080

Source: Duke 2002c

In 2000, an estimated 2,041,465 people lived within 80 km (50 mi) of Catawba. Between 2000 and 2010, total population within the 80-km (50-mi) radius is projected to increase by 24 percent. Between 2010 and 2020, the population is expected to increase by 21 percent. The growth rate then will experience a slight downward trend through 2030 and 2040, during which time the growth is projected to be 18 and 16 percent, respectively.

All or parts of 23 counties, one major city (Charlotte, North Carolina), and many small towns are located within 80 km (50 mi) of Catawba. Lake Wylie lies within a 16-km (10-mi) radius, as do the towns of Rock Hill (population 49,800), York (population 7000), and Fort Mill (population 7600). Over the past 25 years, York County has been ranked as one of the fastest growing counties in South Carolina, and between 1990 and 2000, the county experienced a population growth of 25.2 percent (USCB 2000, 1990).

The largest population center within a portion of the 32-km (20-mi) area is Charlotte, North Carolina, which is northwest of Catawba. The population of Charlotte in 2000 was 541,000 (USCB 2000).

Table 2-12 lists the projected age distribution for York (South Carolina), Gaston (North Carolina), and Mecklenburg (North Carolina) Counties in 2000 compared to the general age distribution of South and North Carolina. The population age distribution in York County tracks fairly closely with the general distribution for the State of South Carolina. The biggest difference is in the 65-and-over age bracket where York County's percentage of population is 10.4 percent compared to 12.1 percent for the general population in South Carolina. Gaston County's population age distribution closely parallels North Carolina's general population distribution. The exception is in the 18-to-24 age bracket where Gaston County

Table 2-12. Estimated Age Distribution of Population in 2000

	York County, S.C.		South Carolina		Gaston County, N.C.		Mecklenburg, N.C.		North Carolina	
Age Group	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Under-18	43,284	26.3	1,009,641	25.2	46,874	24.6	174,249	25.1	1,964,047	24.4
18-to-24	15,557	9.5	407,851	10.2	15,700	8.2	67,336	9.7	806,821	10.0
25-to-44	51,123	31.1	1,185,955	29.6	28,853	15.2	252,803	36.4	2,500,535	31.1
45-to-64	37,578	22.8	923,232	23.0	44,710	23.5	141,342	20.3	1,808,862	22.5
65-and-Over	17,072	10.4	485,333	12.1	23,985	12.6	59,724	8.6	969,048	12.0
Total	164,614		4,012,012		190,365		695,454		8,049,313	

Source: USCB 2000.

lags North Carolina by 1.8 percent. Mecklenburg County has a higher percentage of its population in the 25-to-44 age group than North Carolina (36.4 versus 31.1 percent, respectively). Mecklenburg County slightly exceeds North Carolina in the under-18 age bracket (25.1 versus 24.4 percent, respectively) and is less than the North Carolina general population in the 65-and-over age bracket.

- Transient Population. The transient population in the vicinity of the Catawba can be characterized as daily or seasonal. Daily transients are associated with places where a large number of people gather regularly, such as local businesses, industrial facilities, and schools. Table 2-13 presents information on the major employment sectors and number of employees by sector for York County.

  Seasonal transients also result from part-time residents' pursuit of recreational activities. Lake Wylie is a major source of recreation in York (South Carolina) and Mecklenburg (North Carolina) Counties. The daily and seasonal population associated with recreation on the lake is listed in Table 2-14.

  Lake Wylie is located west to southwest of Charlotte in Gaston and Mecklenburg Counties in North Carolina and in the northeast part of York County in South Carolina. The lake has a full-pond surface area of approximately 4912 ha (12,139 ac) and 526 km (327 mi) of shoreline at full pond elevation (Duke 2001a).

  Duke owns nine developed public recreational access locations on Lake Wylie. Three of these access locations are leased. There are several county and city parks. Three undeveloped county parks are owned by Mecklenburg County. Twelve commercial

Table 2-13. Major Employment Sectors in York County, South Carolina in 1999

Employment Sector	Number of Employees
Services	22,380
Retail trade	14,641
Manufacturing	12,733
Government and government enterprises	10,393

Source: BEA 1999.

Table 2-14. Visitors to Lake Wylie: 1999 and Projected 2050

Recreational Activity	Estimated 1999	Projected 2050
Boating – all types	1,076,299	2,550,256
Bank/pier fishing	299,132	733,461
Lake swimming	252,173	678,044
Tailrace fishing	26,460	64,878
Backpacking	1967	8132
Hunting	12,783	20,136
Tent/vehicle camping	17,699	80,996
Windsurfing	1967	4506
Bicycling	9833	28,985
Picnicking	112,514	359,466
Sightseeing	90,375	310,981
Hiking	29,797	106,673
Wildlife viewing	57,032	211,249
Use of playgrounds	10,816	33,497
Total	1,998,846	5,191,260

Source: Duke 2000b.

non-residential marinas and one commercial/residential marina provide additional public access to the lake (Duke 2000b).

In 1999, Duke undertook a study to estimate recreational use on Lake Wylie (Duke 2000a). Visitation figures were derived based on estimates of the traffic entering the Duke-owned

public access areas. During the 1999 study period, the estimated number of visits was 839,531. A visit is considered a vehicle or vehicle/trailer entering the site for any part of a day. From survey data, a ratio of 1.3 to 1 occupants per vehicle was observed for those respondents claiming use of both public and private access areas. Employing the 1.3 to 1 ratio, Duke estimated that overall recreational visitation for Lake Wylie during the 1999 study period totaled 1,076,300 visits for boating (including fishing, canoeing, jet skiing, kayaking, sailing, and water skiing/tubing; see Table 2-14).

Using population projections for the counties within 80 to 96 km (50 to 60 mi) of Lake Wylie (the impact zone) from 1999 to 2050 in 10-year increments, Duke estimated future recreational use on the reservoir (Duke 2000a). Population projections to 2050 used a combination of 1970-1990 population data and 2000 and 2010 population projections from USCB data.[(a)]

The recreational use projections were estimated by computing the projected population increase for each impact zone and incorporating indexed values for future recreational use for the various activities. The index values for each recreational activity were obtained from Cordell (1999). The indices are based on models that incorporate a number of variables, including age structure of the population, income, race, sex, population density, and other explanatory variables. For the year 2050, Duke has estimated that recreational use of the lake will total 5,191,260 visitors. Of this total, boating-related activities will account for 2,550,256 visitor days, or 49 percent. Table 2-14 presents information on the estimated use of Lake Wylie by recreational activity for 1999 and projections to 2050.

- Migrant Labor. Migrant workers typically are members of minority or low-income populations. Their travels, and the fact that they can temporarily spend a significant amount of time in an area without being an actual resident, means they may be unavailable for census counts. If this occurs, these workers would be "underrepresented" in minority and low-income population counts undertaken by the USCB.

  In 1997, York County had 726 individual farms. Nursery and greenhouse crops are increasing substantially, and migrant labor is used in these farming operations. There are about 500 migrant workers who reside in the county most of the year, and they work 8 to 10 months of the year.[(b)] The workers also may work in other lower paying occupations besides agriculture. Given the fact that they are not concentrated in a single location and

(a) USCB 1990 decennial census data was used because the 2000 census was not available at the time the recreational study was undertaken.
(b) Henry Nunnery and Rusty Thompson, personal communication, Clemson University Agricultural Extension Service, York, S.C. October 24, 2001.

their numbers are small, migrant workers probably do not materially change the population characteristics of any particular census tract in York County.

2.2.8.6 Economy

The prosperity of York County is closely linked to the economy of Charlotte, North Carolina. Charlotte (population 541,000; USCB 2000) is the second fastest growing region in the Nation behind Austin, Texas.[a] It is a major financial center for the southeastern United States and is the home of corporate headquarters for Bank of America, Wachovia Bank, and Duke Energy Corporation.

In 2000, York County was the sixth fastest growing county in South Carolina (York County 2001). Population in York County is expected to grow a total of 11 percent from 2000 to 2015. This is more than twice the general growth rate predicted for South Carolina, which is expected to grow a total of approximately 5 percent during the same time period. New job creation in the county increased from a little less than 500 per year in 1990 to 1500 per year in 2000. Capital investment increased from an annual $50 million (1990 dollars) to $250 million (2000 dollars).

From an economic standpoint, York County was a county in transition during the decade of the 1990s. Like many areas of the southeastern United States, the County has lost some of its manufacturing base, primarily in textiles and mining. Table 2-15 lists the major industrial groups by SIC code, their employment levels in 1990 and 1999, and the percentage change in employment. Significant increases in employment occurred in three major categories: (1) agricultural services, forestry, fishing and other; (2) retail and wholesale trade; and (3) services. Increases in employment more than offset losses in employment during the 7-year period.[b]

Still, York County is a net exporter of workers to surrounding counties linked to the economy of Charlotte. For example in 1990, 49 percent of the workers commuted to jobs outside York County with most of the commuters traveling to jobs in Mecklenburg and Gaston Counties in North Carolina. Table 2-16 presents information on York County labor commuting patterns between 1980 and 1990, which is the latest data available.

(a) Duke site presentation to NRC during the site audit, October 22, 2001.
(b) During the 9-year period there was a net increase in employment within the county of approximately 17,370.

Table 2-15. Economic Base for York County by Standard Industrial Classification (SIC) Code

Business Sector	Employment 1990	Employment 1999	Percent Change
Agriculture, forestry, and fishing	584	951	62.8
Mining	50	66	32.0
Construction	3994	4971	24.5
Manufacturing	14,858	12,733	-14.3
Transportation and public utilities	4070	3954	-2.9
Wholesale trade	2212	4397	98.8
Retail trade	10,367	14,641	41.2
Finance, insurance, and real estate	2711	3589	32.4
Services	13,783	22,380	62.4
Government and government enterprises	8207	10,393	26.6
Farm	1045	1174	12.3
Totals	61,881	79,249	

Source: BEA 1990, 1999.

Table 2-16. Commuting Patterns of York County Workers

	1980	1990	% Change
Residents working in York County	33,425	42,675	27.7
Residents commuting to:			
Mecklenburg County, N.C.	8057	16,849	109.1
Gaston County, N.C.	1359	2745	102.0
Chester County, S.C.	559	952	70.3
Lancaster County, S.C.	292	482	65.1
Workers commuting to York County from:			
Mecklenburg County, N.C.	1047	2389	128.2
Gaston County, N.C.	864	2166	150.7
Chester County, S.C.	1334	1780	33.4
Lancaster County, S.C.	969	917	-5.4

Source: York County 1999.

Economic development in York County is concentrated along the I-77 corridor running from Rock Hill north to the North Carolina border. This corridor is the location of the greatest commercial/industrial development and is home to new office parks and product distribution centers. Also, there is a concentration of new residential development paralleling I-77 and in a band roughly encompassed by the town of York and the city of Rock Hill. Along I-77, Fort Mill is experiencing a high level of mid-scale ($150,000 average per home) residential development.

To the west and northwest, development is influenced by Lake Wylie. Clean water, recreation opportunities, and an excellent fishery have led to construction of numerous upscale ($250,000-plus per home) residential developments around the lake.

The western part of the county, generally defined as that half of the county to the west of the towns of York and McConnell, is rural with agriculture and timber production being the predominant economic factors. Large farms and tracts of undeveloped land predominate, with a few residential developments and houses with acreage.

The economic contribution of agriculture to the economy of York County is significant. The market value of agricultural products produced and sold in York County increased from about $22 million in 1992 (1992 dollars) to $41 million in 1997 (1997 dollars) (USDA 1997). The main crop grown within York County is timber ($14.981 million in value in 1997 [South Carolina 2000]) with approximately 118,560 ha (293,000 ac; South Carolina 1998) in production during the 1990s.

Production of nursery and greenhouse crops is also increasing substantially. There are 20 greenhouse operations in the county.[(a)] Crop sales in 1992 were $5 million (1992 dollars) and increased by 173 percent to approximately $14 million (1997 dollars) in 1997 (USDA 1997). The increasing residential development in the county provides major market for the nurseries. Other crops of importance in the county are soybeans, hay, oats, and wheat (South Carolina 2001).

The unemployment rate for York County was at 3.6 percent at the beginning of 1990. It rose to a high of 8.1 percent as the economic ramifications of the North American Free Trade Agreement (NFTA) began to be felt in the southeastern part of the United States. Manufacturing in York County started to decline in 1992, and textile companies left to start plants in Mexico and other places. By December 2000, the unemployment rate in York County was at 2.7 percent[(b)] as the county continued its transition to a different type of employment base and economy.

(a) Personal communication Henry Nunnery and Rusty Thompson, Clemson University Agricultural Extension Service, October 24, 2001.

(b) Personal communication and supporting data from Matt Snellgrove, York County (South Carolina) Economic Development, November 28, 2001.

In 1990, the average per capita personal income in York County was $17,480 (1990 dollars). This average compares to the South Carolina average of $16,050 and the U.S. average of $19,585. By 1999, the average per capita income in York County had increased to $24,575 (an increase of 41 percent in nominal terms), while the increases in South Carolina and the United States were to $23,540 (47 percent increase) and $28,545 (46 percent increase), respectively (BEA 1999). While the increase was significant, York County tended to lag behind both South Carolina and the rest of the United States in average per capita income.

The percent of York County's population identified in poverty status remained fairly constant at 10.3 percent of the population in 1989 (compared to 15.4 percent for South Carolina) versus an estimated 11 percent in 1997 (compared to 14.9 percent for South Carolina; South Carolina 2000).

The growth that has occurred in York County may change the significance of Catawba's influence on the County's economy. If the economy continues to grow at the past-decade rate, which seems likely given the rising importance and significant impact of Charlotte on the regional economy, it is likely that the importance of Catawba as an employer and property tax payer in York County may decline. Catawba will continue to be an important contributor to the economic stability of the County and the surrounding region, particularly the Clover School District for which Catawba will continue to be a major economic benefactor. But the relative importance of its contribution will decline as the economic base of the region and county continues to grow and diversify.

Catawba currently pays a significant amount of annual property taxes to York County. There are five owners of the Catawba facility, and Duke's ownership share is approximately 9.6 percent. Table 2-17 presents information on the total real and personal property taxes paid by Catawba to York County, the total real and personal property taxes collected by the county, and

Table 2-17. Catawba Contribution to York County Property Tax Revenues

Year	Real and Personal Taxes Paid by Catawba ($)	Percent of Total County Property Taxes	Total County Real and Personal Property Taxes Collected ($)
1996	33,322,651	27.1	123,179,094
1997	35,377,146	26.4	133,762,343
1998	35,796,436	25.5	140,404,832
1999	35,957,979	23.4	153,351,879
2000	35,861,194	21.9	163,503,134

Source: Isaiah Boyd, York County Auditor, November 6, 2001.

the proportion of the total Catawba property taxes paid as it relates to the county total. This percentage declined between 1996 and 2000.

Approximately 75 percent of the property taxes paid by Catawba are allocated to support the schools in York County School District 2 (Clover District), the school district within which Catawba is located. The remaining 25 percent of the tax revenue from Catawba supports countywide operations and the three other school districts.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known and potential historic and archaeological resources at Catawba and in the immediate surrounding area.

2.2.9.1 Cultural Background

The area around the Catawba plant is rich in prehistoric and historic Catawba Native American and historic Euro-American resources; although, in some cases the cultural periods have not been extensively documented. This is particularly true for the archaeological resources in the immediate area of the plant. General historical aspects of the Catawba Indians can be found in regional overviews (Brown 1966; Hudson 1970; Merrell 1989). More recently, the Catawba Indian Nation has initiated both archaeological (Kenion and May 1995) and historical projects through the Catawba Cultural Preservation Project to document the cultural resources both on the current reservation and the larger area of former occupation. Non-Indian history of the county, including information on historic properties, also has been documented (Shankman et al. 1983; Kissane and Kissane 1993; Thomas 1995).

- Prehistoric Period

  The prehistoric Native American occupation of the region that encompasses the Catawba site includes three periods: the Paleo-Indian period (about 10,000 to 8000 B.C.), the Archaic period (about 8000 to 1000 B.C.), and the Woodland period (about 1000 B.C. to A.D. 1600). Toward the end of the Woodland period from about A.D. 1500 to 1675, a transitional episode known as the Protohistoric period occurred during which initial contacts with Europeans and cultural changes associated with subsequent European settlement of the area took place.

  The prehistoric periods were marked by initial reliance on big game hunting subsistence, followed by increased use of smaller game animals and plant foods in the Archaic era. Major environmental changes in the Archaic period led to an increasingly more sedentary lifestyle, focused primarily in riverine settings. Late in the Archaic era, more sedentary villages and an increasing reliance on cultivated crops became the norm, and the

subsequent Woodland period was characterized by larger base camps in the river valleys with subsistence based on agriculture, hunting and gathering, and intergroup trade. The latter part of the Woodland period is primarily identified by the added presence of European trade goods.

- Native American Historic Period

  At the time of European contact and subsequent intrusion into the area surrounding Catawba, the lands on both sides of the Catawba River in what would become North and South Carolina were occupied by the Catawba Indian Nation. Initial contact between the Catawba Indians and European explorers occurred in the 1560s, although European colonization of the region did not take place until nearly a century later. Following hostilities in the French and Indians Wars, a 39 km^2 (15 mi^2) reservation was established in 1763 for the Catawba Nation in South Carolina. This reservation was located in what would eventually become York and Lancaster Counties. The northern boundary line of the reservation was located just south of the current Catawba site. As a result of an 1840 treaty between the Catawba Nation and the State of South Carolina, the state purchased all of the land within the original reservation, much of which had already been leased by the Indians to white settlers. In 1850, a tract of some 254 ha (630 ac) of land on the west side of the Catawba River was purchased for the Catawba, including the reservation that continues to be occupied today. The reservation is located about 8 km (5 mi) southeast of the plant site. In 1962, the tribe was disbanded, and lands were divided among its members. The Catawba Tribe reorganized in 1973 and was awarded renewed Federal recognition in 1993.

- Euro-American Historic Period

  In 1785, following the Revolutionary War, York County became one of the original counties in the newly created state of South Carolina. In a census taken 5 years later, the County had a population of just over 6600. Cotton was introduced to the area in the 1790s and quickly dominated the economy and land-use patterns of the County. Though interrupted by the Civil War, depletion of the County's soils as a result of intensive cultivation, and recurring ups and downs in the agricultural economy, cotton remained the primary crop into the first few decades of the 1900s when other crops, such as soybeans, became more prevalent.

  An important event in the history of York County was the beginning of construction of the Catawba Dam and Power Plant in 1900. The completion of the dam and the newly formed Lake Wylie were instrumental in subsequent development of other dams and hydropower projects on the Catawba River and in sparking industrialization of the river corridor, including the beginnings of the Duke Power Company.

2.2.9.2 Historic and Archaeological Resources at Catawba

To assess known and potential cultural resource sites at Catawba, several existing literature and database sources were consulted, along with direct contacts at several organizations (see Appendix D). In addition to the sources included in Appendix D, electronic database searches were conducted at the National Park Service's National Register of Historic Places Information System and the Historic American Buildings Survey/Historic American Engineering Record listings.

Examination of the National Register listings did not disclose any listed or potentially eligible properties in proximity to the plant site. The closest potentially eligible property is the location of the Revolutionary-War-era Hill's Ironworks. This property is located near the point where SCH 274 crosses Allison Creek, about 2 miles southwest of the Catawba site. Similarly, discussions with personnel at the Catawba Cultural Preservation Project did not reveal the presence of any known archaeological or other traditional cultural properties at the Catawba site that might be of interest to the Catawba Indian Nation.

Examination of archaeological and historic site files at the South Carolina Department of Archives and History and the South Carolina Institute of Archaeology and Anthropology (SCIAA) indicated that no prehistoric or historic properties have been recorded at the Catawba site itself. However, no formal archaeological surveys have been completed at the plant. The nearest recorded archaeological sites are located along Catawba transmission line rights-of-way, southwest of the site, which was surveyed in 1978 (Brockington 1980), and by a more recent survey along SCH 274, running north-south to the west of the plant site (Joy and Stine 2000). There are six archaeological sites within 1.6 km (1 mi) of the plant, the closest being situated in a transmission line right-of-way at a distance of about 1 km (0.6 mi). None of these sites has been evaluated as being potentially eligible for the National Register of Historic Places.

Examination of historical maps and aerial photographs that include the Catawba site reveal the past presence of several historic properties either close to or within the plant site boundaries. Copies of these maps are located at either the South Carolina Department of Archives and History or the Historical Center of York County. Documents examined, along with results, include the following:

- York District, South Carolina Map, Surveyed by Gordon Moore, 1820, Improved for Mills Atlas 1825. This map shows the location of Hill's Old Ironworks on the south side of Allison Creek, southwest of the Catawba site and the Thorn's Ferry and Road that passed in an east-west direction to the south of the site. The ferry landing was located at the south end of Long Island, southeast of the site, and now is inundated by Lake Wylie. The boundary of the 1763 Catawba Indian Nation Reservation also is indicated.

- Map of York District Post Offices, 1802 - 1861. There are no post offices indicated within the Catawba site during this period. The closest post offices were at Hill's Ironworks, Clay Hill, and McElwee's Store, all to the southwest near Allison Creek.

- Grants of Land Made by Commissioner of Locations for York District, South Carolina, During the Years 1841-42 in the Catawba Indian Boundary, prepared by Mr. and Mrs. J. Thomas Williams, 1983. This map shows lands in the vicinity of the site being owned by the Biggers, Faris, Mitchell, and Partlow families.

- Geonostic Map of York District, 1858. This map shows churches and mineralogical, geological, and agricultural features. Nothing in these categories was shown at the current Catawba site.

- York County South Carolina, Geological and Agricultural Map, 1873. This map shows the Thorn's Ferry Road south of the plant site, along with the location of Mason's Ferry just upriver from the plant. A road from Allison Creek to this ferry crossed just northwest of the present Catawba site.

- York County, South Carolina, copyright 1910 by Jones and Walker, Rock Hill, South Carolina. This map was the first to show the Concord Church and Cemetery, along with several residences that once existed on lands now included within the Catawba site. Several homes, along with family names, are shown along Concord Road and along a road that extended north from the Concord Church vicinity through the site and across Beaver Dam Creek. In addition to the church and cemetery, some 12 homes and/or structures are indicated within the plant boundary. The Concord Cemetery, still located within the Catawba site boundary, is discussed below.

- U.S. Geological Survey Clover, SC - NC, 15' Quadrangle Map, 1947. This map shows the location of the Concord Road and Church, along with 12 homes or structures that were located either within or very close to the Catawba site.

- U.S. Department of Agriculture Soil Survey Map of York County, South Carolina, 1961. This map, actually an aerial photograph, shows the location of Concord and the associated road, cleared field or pasture areas along the road, and the presence of at least six structures in the vicinity of the Catawba site.

The Concord Cemetery is the only acknowledged cultural resource property within the Catawba site today, although the historical records listed above indicate that a church was once situated adjacent to the cemetery, and there were several residences in proximity along the Old Concord Road. Presently, the cemetery is located just north of the northwest corner of the plant's cooling tower yard and is fenced and protected within the plant site boundary. Since

1974 the cemetery has been owned and managed (including access) by the Concord Cemetery Association. Two tombstone surveys (Caldwell and Hart 1997, Hill 2001) have been conducted and indicate that over 150 persons are buried in the cemetery, the earliest occurring in 1834 and the most recent in 1995. The earliest interments were members of the Faris family, owners in the 1840s of parts of Long Island and other tracts south of the Catawba site.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies (including FERC) might impact the renewal of the Catawba OLs. Any such activities could result in cumulative environmental impacts and the possible need for such a Federal agency to become a cooperating agency in the preparation of this SEIS (10 CFR 51.10[b][2]).

Duke's McGuire Nuclear Station (McGuire) is located approximately 48 km (30 mi) north of Catawba. Duke also is requesting that the NRC review the OLs for McGuire.

The Federal Power Commission, now FERC, issued a license (FERC Project No. 2232) to Duke Power Company on September 17, 1958, for the Catawba-Wateree Project. This license expires in 2008, and Duke plans to seek a renewal of the license. The Catawba-Wateree Project consists of 11 lakes on the Catawba River, which were formed by hydroelectric power plant dams. Lake Wylie, from which Catawba draws water, extends 45 km (28 mi) between Mountain Island Dam and Wylie Dam. This lake was formed by impounding the water of the Catawba River, and full pond volume was achieved in 1904. Following an increase in dam height in 1924, the lake now covers 4912 ha (12,139 ac) at a normal operating level, though fluctuations exist based on hydroelectric generation needs.

The Federal lands closest to the Catawba site are within the Kings Mountain National Military Park. The park is located near Blacksburg, South Carolina, and is operated by the U.S. National Park Service. The park is approximately 27 km (17 mi) northwest of Catawba.

The Native American land closest to the Catawba site is a section of the Catawba Indian Reservation, north of the city of Rock Hill, approximately 10 km (6 mi) southeast of Catawba.

After reviewing the Federal activities in the vicinity of Catawba, the staff determined there were no Federal project activities that could result in cumulative impacts or would make it desirable for another Federal agency to become a cooperating agency for the preparing this SEIS.

NRC is required under Section 102 of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. NRC consulted with FWS, and the consultation correspondence is included in Appendix E.

2.3 References

10 CFR 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

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

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

10 CFR 54. Code of Federal Regulation, Title 10, Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”

10 CFR 61. Code of Federal Regulations, Title 10, *Energy*, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR 71. Code of Federal Regulations, Title 10, Energy, Part 71, "Packaging and Transportation of Radioactive Material."

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

40 CFR 190. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

2000-01 South Carolina Statistical Abstract. Population Projections at Five Year Intervals for South Carolina Counties: 1990 Census and Projections. 2000-2025 Revised. Updated on 8/14/01. <http://www.ors.state.sc.us/abstract_99/chap14/pop4.htm> (Accessed April 9, 2002).

Bailey, R.G. 1980. *Descriptions of the Ecoregions of the United States.* U.S. Department of Agriculture, Miscellaneous Publication No. 1391. Washington, D.C.

Bair, Karen. October 21, 2001. “Special Report: Western York County – Vanishing Eden.” *The Herald*. Rock Hill, South Carolina.

Banks. 2001. Letter from U.S. Fish and Wildlife Service to B. Miller, Duke Power Company. Subject: Duke Power License Renewal Application for McGuire and Catawba Nuclear Stations (April 24, 2001).

Brockington, Paul E. 1980. *Test Pits in the Piedmont: An Archaeological Survey of Duke Power Company's Proposed Catawba Transmission Lines*. Institute of Archaeology and Anthropology, University of South Carolina, Columbia, South Carolina.

Brown, Douglas S. 1966. *The Catawba Indians: The People of the River*. University of South Carolina Press, Columbia, South Carolina.

Bureau of Economic Analysis (BEA). *Regional Accounts Data. 1990 and 1999*. <http://www.bea.doc.gov/bea/regional/reis/> (Accessed April 9, 2002).

Caldwell, T. J. and J. E. Hart, Jr. 1997. "Concord Cemetery." The York County Genealogical and Historical Society Quarterly, December 1997.

Collette, B. B. 1962. "The swamp darters of the subgenus Hololepis (Pisces, Percidae)." *Tulane Studies in Zoology* 9(4):115-211.

Cordell Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends 1999. As cited in Duke Power. Draft Shoreline Management Plan Update for the Catawba – Wateree Hydro Project. FERC No. 2232. Group Health and Safety Department, Lake Management. September 22, 2000.

Duke Energy Corporation (Duke). 1988. *Catawba Nuclear Station 316(a) Demonstration Two Unit Operational Report*. Duke Power Company, Charlotte, North Carolina.

Duke Energy Corporation (Duke). 1993. *Catawba Nuclear Station Supplemental 316a Demonstration Data*. Duke Power Company, York, S.C. January 1993.

Duke Energy Corporation (Duke). 2000a. *Duke Energy Company Catawba Nuclear Station Updated Final Safety Analysis Report*. Revised April 8, 2000. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2000b. *The Catawba: An Update on the Catawba River Basin and the Catawba Reservoirs*. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2001a. *Applicant's Environmental Report – Operating License Renewal Stage Catawba Nuclear Station, Units 1 and 2.* Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2001b. *Catawba Nuclear Station Units 1 and 2, Offsite Dose Calculation Manual (ODCM)*. Rev. 43, January 2001. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2001c. *Catawba Nuclear Station Units 1 and 2, Annual Radiological Environmental Operating Report 2000*. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2001d. *Catawba Nuclear Station Units 1 and 2, 2000 Annual Radioactive Effluent Release Report (January 1, 2000 Through December 31, 2000)*. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2002a. *Application to Renew the Operating Licenses of the McGuire and Catawba Nuclear Power Stations*. "Attachment 2: Catawba River Forage Fish Densities, Population Estimates and Species Composition: 1993-1997." Response to a request for additional information. Docket Nos. 50-369, 50-370, 50-413, and 50-414. February 8, 2002. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2002b. *Application to Renew the Operating Licenses of the McGuire and Catawba Nuclear Power Stations*. "Attachment 1: Number and Percent Composition of Fishes Collected in Electrofishing Samples at Locations 215 and 216 on Lake Wylie during 1991, 1993, 1994, 1995, and 1996." Response to a request for additional information. Docket Nos. 50-369, 50-370, 50-413, and 50-414. February 8, 2002. Charlotte, North Carolina.

Duke Energy Corporation (Duke). 2002c. *Application to Renew the Operating Licence of McGuire and Catawba Nuclear Stations*. "Attachment 1: Responses to NRC Request for Additional Information Concerning the Catawba Environmental Report." In response to NRC letter dated December 12, 2001. Charlotte, North Carolina.

Duke Power. 2000a. *Draft Shoreline Management Plan Update for the Catawba-Wateree Hydro Project*. FERC No. 2232. Group Health and Safety Department, Lake Management. September 22, 2000.

Elliott, D. L., C. G. Holladay, W. R. Barchet, H. P. Foote, and W. F. Sandusky. 1987. *Wind Energy Resource Atlas of the United States*. DOE/CH 10093-4, U.S. Department of Energy, Washington, D.C.

Endangered Species Act (ESA). 16 USC 1531, et seq.

Federal Water Pollution Control Act (FWPCA) of 1977, as amended, 33 USC 1251 et seg. (Also known as Clean Water Act).

Gaddy, L. L. 2001. "Biological Assessment for Endangered, Threatened, and Noteworthy Species, Wetlands, and Significant Natural Areas in Association with the Catawba Nuclear Station and Related Power Transmission Lines." *Terra Incognita*. Columbia, South Carolina.

Hill, Jim. 2001. *Old Concord Presbyterian Cemetery*. <http://ns1.rfci.net/wdfloyd/oconcord.html> (Accessed April 9, 2002).

Hudson, Charles. 1970. *The Catawba Nation*. University of Georgia Press, Athens, Georgia.

Joy, Deborah and Linda France Stine. 2000. *Archaeological Survey Report: Improvements to SC 274 between Newport and Five Points, York County, South Carolina*. Legacy Research Associates, Durham, North Carolina.

Kenion, Rita and J. Alan May. 1995. *An Archaeological Survey of the Catawba Indian Reservation: Archaeological Sites on an Ancient Landscape*. Catawba Indian Nation, Rock Hill, South Carolina.

Kissane, Amy C. and John A. Kissane. 1993. *York County Historical and Architectural Inventory – 1992*. The Jaeger Company, Gainesville, Georgia.

Merrell, James H. 1989. *Indian's New World: The Catawbas and Their Neighbors from European Contact through the Era of Removal*. University of North Carolina Press, Chapel Hill, North Carolina.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

NatureServe. 2001. *NatureServe: An On-line Encyclopedia of Life*. <http://www.natureserveeexplorer.org> (Accessed April 9, 2002).

NOAA. 1983. *Local Climatological Data, Annual Summary with Comparative Data – Charlotte, NC.* U.S. National Oceanic and Atmospheric Administration, Environmental Data Service, Asheville, North Carolina.

North Carolina Atlas of Freshwater Mussels and Endangered Fish. 2001. <http://www.ncwildlife.com/pg07_WildlifeSpeciesCon/pg7b1.htm> (Accessed April 9, 2002).

North Carolina Department of Environmental and Natural Resources (NCDENR). 1999. *Catawba River Basinwide Water Quality Plan*. Division of Water Quality, Water Quality Section.

North Carolina. 2001a. *North Carolina Rare, Threatened, and Endangered Species Inventory for Gaston and Cleveland Counties, North Carolina*. <http://www.ncsparks.net/nhp/> (Accessed April 9, 2002).

North Carolina. 2001b. *North Carolina State Demographics. Population Overview: 2000-2020*. Updated: May 16, 2001. <http://demog.state.nc.us/> (Accessed October 9, 2001).

Paterson, C. G. and C. H. Fernando. 1970. "Benthic fauna colonization of a new reservoir with particular reference to the chironomidae." *J. Fish. Res*. Bd. Canada 27:213-232.

Ramsdell, J. V. and G. L. Andrews. 1986. *Tornado Climatography of the Contiguous Unites States*. NUREG/CR-4461, U.S. Nuclear Regulatory Commission, Washington, D.C.

Shankman, Arnold, E. Thomas Crowson, C. Jack Tucker, and Joel Nichols. 1983. *York County, South Carolina: Its People and Its Heritage*. The Donning Company, Norfolk, Virginia.

South Carolina Department of Health and Environmental Control (SCDHEC). 1999. *Watershed Water Quality Management Strategy: Catawba-Santee Basin*. Technical Report No. 002-96. Watershed Strategy Coordinator. Columbia, South Carolina.

South Carolina Department of Natural Resources (SCDNR). 2001. *South Carolina Rare, Threatened and Endangered Species Inventory*. <http://www.dnr.state.sc.us/pls/heritage/county_species.select_county_map> (Accessed April 9, 2002).

South Carolina. 1998. *South Carolina Statistical Abstract*. *South Carolina Land Use/Land Cover by County: 1988-1990 - Parts A, B. South Carolina's Information Highway*. <http://www.sciway.net/statistics/scsa98/ag/ag12a.html> (Accessed April 9, 2002).

South Carolina. 2000. *South Carolina Statistical Abstract. 2001.* <http://www.ors.state.sc.us/cen_statabs.html> (Accessed April 9, 2002).

South Carolina. 2001. *South Carolina Rare, Threatened, and Endangered Species Inventory for York and Cherokee Counties, South Carolina*. Updated September 10, 2001 <http://www.dnr.state.sc.us/pls/heritage/county_species.list?pcounty=cherokee> (Accessed April 9, 2002).

The Herald. February 18, 2001. York County Magazine.

Thomas, Samuel N., Jr. 1995. *Historical Properties of York County, South Carolina*. York County Historical Commission, McConnells, South Carolina.

U.S. Atomic Energy Commission (AEC). 1972. *Final Environmental Statement Related to the Proposed Catawba Nuclear Station Units 1 & 2, Duke Power Company*. Docket Nos. 50-369 and 50-370, Washington, D.C.

U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to the Proposed Catawba Nuclear Station Units 1 & 2, Duke Power Company*. Docket Nos. 50-413 and 50-414, Washington, D.C.

U.S. Census Bureau (USCB). 1990. *American Fact Finder. 1990 Census. Housing Units. By County in South Carolina*. <http://factfinder.census.gov/servlet/BasicFactsTable?_lang=en&_vt_name=DEC_1990_STF1_GCTHA_ST2&_geo_id=04000US45> (Accessed April 9, 2002).

U.S. Census Bureau (USCB). 1991. *1990 Census-Population and Housing; Public Law 94-171 Data*. Washington D.C.

U.S. Census Bureau (USCB). 2000. *American Fact Finder. 2000 Census. Population and Housing by County in South Carolina*. 2000. <http://factfinder.census.gov/servlet/BasicFactsServlet> (Accessed April 9, 2002).

U.S. Census Bureau (USCB). 2001. Glossary - Definition and Explanations–decennial census terms. http://www.census.gov/main/www/glossary.html (Accessed April 9, 2002).

U.S. Department of Agriculture (USDA). 1997 Census of Agriculture. South Carolina and County Data. Volume 1. Geographic Area Series, Part 9, AC(&-A-9, Washington, D.C. <http://usda.mannlib.cornell.edu/> (Accessed April 9, 2002).

U.S. Department of Agriculture (USDA). 2001. 1*997 Census of Agriculture. South Carolina County-Level Data*. Volume 1: Part 40, Chapter 2. <http://www.nass.usda.gov/census/census97/volume1/sc-40/toc297.htm> (Accessed April 9, 2002).

U.S. Department of Energy, Energy Information Administration (DOE/EIA). 2000. *Annual Energy Outlook 2002 with Projections to 2020.* DOE/EIA-0383 (2002). Washington, D.C. <http://www.eia.doe.gov/oiaf/aeo/index.html> (Accessed February 19, 2002).

U.S. Department of Energy (DOE). 2001. "U.S. Wind Energy Resource Map." <http://www.eren.doe.gov/wind/we_map.html> (Accessed April 8, 2002).

U.S. Fish and Wildlife Service (FWS). 1996. *Carolina Heelsplitter Recovery Plan*. U.S. Fish and Wildlife Service, Atlanta, GA. 30 pp.

U.S. Fish and Wildlife Service (FWS). 1999. "Proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife." *Federal Register* 64(128):36453-36464.

U.S. Fish and Wildlife Service (FWS). 2001. "Endangered and Threatened Wildlife and Plants: Proposed Designation of Critical Habitat for the Carolina Heelsplitter." *Federal Register* 66(133):36229–36246. Wednesday, July 11, 2001.

U.S. Fish and Wildlife Service (FWS). 2002. Letter from R. L. Banks (FWS) to E. A. Carpenter (NRC). (Re: Request for list of species within the area under evaluation for the Catawba Nuclear Station License Renewal. February 12, 2002.)

U.S. Nuclear Regulatory Commission (NRC). 1983. *Final Environmental Statement Related to the Operation of Catawba Nuclear Station Units 1 and 2.* Docket Nos. 50413 and 50414. NUREG-0921, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1991. *Offsite Dose Calculations Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors*. NUREG-1301, Washington, D.C.

Voshell, J. R. and G. M. Simmons , Jr. 1978. "The Odonota of a new reservoir in the southeastern United States." *Odonatologia* 7(1):67-76.

Warren, Jr., M. L., B. M. Burr, S. J. Walsh, H. L. Bart, Jr., R. C. Cashner, D. A. Etnier, B. J. Freeman, B. R. Kuhajda, R. L. Mayden, H. W. Robison, S. T. Ross, and W. C. Starnes. 2000. *Diversity, Distribution, and Conservation Status of the Native Freshwater Fishes of the Southern United States*. Fisheries 25(10): 7-29. October 2000.

York County. 1999. *York County Comprehensive Planning*. Planning and Development Services. York, South Carolina.

York County. 2001. *York County Economic Development – Future Trends in Economic Development*. Fort Mill, South Carolina.