APPLICATION FOR RENEWED OPERATING LICENSES

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

Volume IV

Contents

Exhibit D:
Applicant's Environmental Report
Operating License Renewal Stage

Introduction

Set forth below is Duke Energy Corporation's Environmental Report ("ER"). This report was prepared in connection with Duke's application to the U.S. Nuclear Regulatory Commission (NRC) to renew the 1973 and 1974 operating licenses for Units 1, 2, and 3 of the Oconee Nuclear Station (Oconee or ONS). In compliance with applicable NRC requirements, this ER analyzes potential environmental impacts associated with renewal of the Oconee licenses. It is designed to assist the NRC Staff in preparing the Oconee-specific Supplemental Environmental Impact Statement required for license renewal.

The ER was prepared and submitted to the NRC prior to publication of the NRC's Regulatory Guide for license renewal, and therefore may not conform specifically to the format subsequently suggested in the Regulatory Guide at the time of its publication. However, Duke submits that the substantive content of the ER complies with the requirements of 10 CFR Part 51, as augmented by the NRC's "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (NUREG-1437).

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

Chapter 1: Purpose and Need for the Proposed Action
Chapter 2: Site and Environmental Interfaces
Chapter 3: Description of the Proposed Action
Chapter 4: Environmental Consequences of the Proposed Action
Chapter 5: Alternatives Considered
Chapter 6: Comparison of Impacts
Chapter 7: Status of Compliance

Based upon the evaluations discussed in the ER, Duke has concluded that there are no significant environmental impacts associated with the renewal of the Oconee operating licenses. The environmental impacts from the continued operation of Oconee Nuclear

Station would continue at the levels and to the same extent as experienced during the original operating term and as evaluated in the Final Environmental Statement [Reference 1] issued in March 1972. No major plant refurbishment activities have been identified as necessary to support the continued operation of Oconee beyond the end of the existing operating licenses. Although normal plant maintenance activities may later be performed for economic and operational reasons, no significant environmental impacts associated with such refurbishments are expected.

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Acronyms and Abbreviations

B&W	Babcock and Wilcox
CEM	Duke Power Environmental Manual
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CTP	Chemical Treatment Pond
ELQST	Environmental Leadership Quality Steering Team
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FR	Federal Regulation
GEHS	Group Environment, Health and Safety, Duke Power
GEIS	Generic Environmental Impact Statement
GL	Generic Letter
HLW	High Level (Radioactive) Waste
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination of External Events
IRP	Integrated Resource Plan
ISFSI	Independent Spent Fuel Storage Installation
LOCA	Loss of Cooling Accident
LPSW	Low Pressure Service Water
LWR	Light Water Reactor
MSA	Metropolitan Statistical Area
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRR	(Office Of) Nuclear Reactor Regulation
NSAC	Nuclear Safety Analysis Center
NSD	Nuclear Station Directive
NUREG	Nuclear Report Category
O&M	Operation and Maintenance

Acronyms and Abbreviations (continued)

ONS	Oconee Nuclear Station
$PM_{2.5}$	Particulate Matter (particulate matter with a nominal size of less than 2.5 microns)
PIP	Problem Investigation Process
PRA	Probabilistic Risk Assessment
SAMA	Severe Accident Mitigation Alternative
SAMG	Severe Accident Management Guidelines
SCR	Selective Catalytic Reduction
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SHPO	State Historic Preservation Office
SNF	Spent Nuclear Fuel
SRP	(NRC) Standard Review Plan
USEPA	United States Environmental Protection Agency
UFSAR	Updated Final Safety Analysis Report
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compounds

UNITS

ft	Feet
gpm	gallons per minute
gal/min	gallons per minute
ha	Hectares
kg	Kilograms
km	Kilometers
kV	Kilovolts
MW	Megawatts
MW(e)	Megawatts, electric
MW(t)	Megawatts, thermal
m	Meters
m^3	Cubic meters
mg/l	Milligrams/liter
m/s	meters/second
ry	Reactor year
°C	Degrees Celsius
°F	Degrees Fahrenheit
μm	micron (1 x10^{-6} meter)

1. PURPOSE AND NEED FOR THE PROPOSED ACTION

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

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

Section 1.3 of the NRC Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants, NUREG-1437. [Reference 2]

Nuclear power plants are licensed by the NRC to operate for up to forty (40) years and the licenses may be renewed. [10 CFR §50.51] 10 CFR §54.17(c) states that "[a]n application for a renewed license may not be submitted to the Commission earlier than 20 years before the expiration of the operating license currently in effect."

The proposed action is to extend the operating licenses for Oconee Nuclear Station, Units 1, 2, 3 for a period of twenty (20) years past the current operating license expiration date. The current operating license for Oconee Unit 1 expires at midnight February 6, 2013, and would be renewed to expire at midnight February 6, 2033. The current Oconee Unit 2 operating license currently expires at midnight October 6, 2013, and would be renewed to expire at midnight October 6, 2033. The current Oconee Unit 3 operating license expires at midnight July 19, 2014, and would be renewed to expire at midnight July 19, 2034.

Oconee Nuclear Station has a generation capacity of 2538 megawatts (net) base load power, producing electricity to supply the needs of more than 730,000 homes. Operating at full capacity, Oconee saves the equivalent of 7.1 million tons (6.5 trillion kg) of coal per year. Oconee supplies a large portion of the power generated on the Duke system. The low cost generation of electricity is a valuable service to the industrial, commercial, wholesale, and residential customers of Duke Energy and has contributed to the economic growth and prosperity in the Piedmont region of North and South Carolina.

2. SITE AND ENVIRONMENTAL INTERFACES

Duke Power, a division of Duke Energy Corporation, owns and operates Oconee Nuclear Station, which is part of Duke's integrated energy-producing area called the Keowee-Toxaway Complex. The Keowee-Toxaway Complex is located in the upper Savannah River drainage basin, at the foot of the Blue Ridge Mountains in northwestern South Carolina.

The Keowee-Toxaway Complex consists of the following electric power producing projects:

- Oconee Nuclear Station - three pressurized water reactors;
- Keowee-Toxaway Project (FERC Project # 2503) - consists of Keowee Hydroelectric Station, a two unit conventional hydroelectric facility, and Jocassee Hydroelectric Station, a four unit pumped storage hydroelectric facility; and
- Bad Creek Pumped Storage Project (FERC Project #2740) - a four unit pumped storage hydroelectric facility.

Oconee Nuclear Station is located in eastern Oconee County, South Carolina, approximately 8 miles northeast of Seneca, South Carolina. Lake Keowee occupies the area immediately north and west of the site. The Corps of Engineer's Hartwell Reservoir is located south, and downstream from the site. Lake Jocassee lies approximately 11 miles to the north. [See Figure 2.5-1 and 2.5-2]

The construction of Oconee Nuclear Station and the Keowee-Toxaway Project (Lake Keowee, Lake Jocassee, and the associated hydroelectric stations) occurred between 1968 and 1974. The impacts to the environment from the construction and operation of Oconee Nuclear Station were evaluated in the Final Environmental Statement for Oconee Nuclear Station [Reference 1] issued in March 1972.

2.1 General Site Environment

The Oconee site is located within the Inner Piedmont Belt, at this locality the westernmost component of the Piedmont Physiographic Province. The topography of the area is undulating to rolling; the surface elevations range from about 700 feet to 900 feet. The region is moderately well dissected with rounded hilltops, representing a mature regional development. The area is well drained by several intermittent streams flowing away from the center of the site in a radial pattern. The general station area is shown on Figure 2.5-3. The Oconee site lies within the drainage area of the Little and Keowee Rivers, which flow southerly into the Seneca River, and subsequently discharge into the main drainage course of the Savannah River. The average annual rainfall at the site area is approximately 53 inches.

The region surrounding Oconee was classified by the GEIS as having a medium population classification, based on the population near the site, and the proximity and size of nearby cities. [GEIS Appendix C, C.1.4] Nearby towns include the cities of Seneca, Walhalla, Clemson, and Central, SC. [Figure 2.5-1] Forests cover the majority of the land area, with pasture, cropland, and residential development each contributing significant proportions of total land-use. The shoreline of Lake Keowee is developed with both vacation and permanent residences, along with campgrounds, boat launch areas, marinas, golf courses, and small retail establishments. There are no permanent residences within the 1-mile (1.6 km) radius (exclusion zone) of Oconee.

2.2 Lake Keowee

Lake Keowee serves as the cooling water source for Oconee Nuclear Station. Lake Keowee was formed from the Keowee and Little Rivers. [Figure 2.5-2] The full pond elevation of Lake Keowee is 800 feet (244 m) mean sea level, providing a surface area of 18,500 acres (7486 ha) and a shoreline of 300 miles (482.7 km). Lake Keowee has a volume of 952,300 acre-feet ($1.175x10^9$ m^3), a mean depth of 52 feet (16 m), and a maximum depth of 141 feet (43 m). The main sources of inflow into Lake Keowee are the Little River and Lake Jocassee. The Keowee River and the Little River basins are connected by a canal, approximately 100 feet (31 m) wide and 40 feet (12 m) deep. [Figure 2.5-2] The Oconee Nuclear Station intake system withdraws once-through cooling water from the Little River arm of Lake Keowee, from underneath a skimmer wall. The discharge for this cooling water is located on the Keowee arm of the lake.

Besides serving the needs of the nuclear and hydroelectric power plants, Lake Keowee is used as a source of municipal drinking water by the cities of Greenville and Seneca. Lake Keowee experiences extensive recreational use by fishermen, boaters, skiers and swimmers. Concentrations of all minerals and nutrients are very low, with total dissolved solids of less than of 25 mg/l. Water clarity is generally very high. Dissolved oxygen concentrations in surface waters are adequate, and algae are never present in nuisance concentrations. Due to the low nutrient content of its waters, Lake Keowee has a relatively low standing crop (pounds per acre) of fish. The species composition and general health of the fish are normal for the region.

The South Carolina Department of Health and Environmental Control (SCDHEC), as part of the Clean Lakes program, monitors the water quality and uses of lakes in the state. The results of the monitoring program are published in <u>Watershed Water Quality Assessment, Savannah and Salkehatchie Basins, Technical Report No. 003-97</u>.

In this document, SCDHEC reported that:

- Eutrophication assessments indicate that Lake Keowee is the least eutropic large lake in South Carolina.
- Recreational uses are fully supported.
- Aquatic life uses are not supported at certain sampling locations due to excess copper and increasing trend in pH. A significant increasing trend in dissolved oxygen concentrations and a decreasing five-day biochemical oxygen demand suggest improving conditions for these parameters.

A copy of portions of the Watershed Water Quality Assessment, Savannah and Salkehatchie Basins, Technical Report No. 003-97, SCDHEC, 1997 [Reference 3] is included as Attachment A.

2.3 Lake Jocassee and Bad Creek Reservoir

Lake Jocassee has a full pond elevation of 1110 feet (338 m) mean sea level, a surface area of 7,500 acres (3035 ha), and a shoreline of 75 miles (120.7 km). [Figure 2.5-2] The main tributaries are the Whitewater, Thompson, Horsepasture and Toxaway Rivers. Jocassee Hydroelectric Station began operation in 1974, with four pump/turbines that have a total generating capacity of 610 MW(e). Jocassee Hydroelectric Station can operate in a generating mode or in a pumping mode to store water for later generation of electric power. In the generating mode, electricity is generated by allowing water to flow from Lake Jocassee (upper pond) into Lake Keowee (lower pond). In the pumping mode, water is pumped into Lake Jocassee from Lake Keowee for generation of electricity at a later time.

Bad Creek Reservoir, located to the west of Lake Jocassee, has a full pond elevation of 2310 feet (704 m) mean sea level, a surface area of 370 acres (150 ha), and a shoreline length of 6 miles (9.7 km). Bad Creek Pumped Storage facility began operation in 1991, with four pump/turbine units that have a total generating capacity of 1065 MW(e). Bad Creek Reservoir serves as the upper pond, and Lake Jocassee as the lower pond for the Bad Creek Pumped Storage plant.

2.4 Oconee Plant Description

Oconee Units 1 and 2 were licensed by the NRC and began operation in 1973. Oconee Unit 3 began operation in 1974. The three Oconee units are pressurized water reactors, with nuclear steam supply systems manufactured by Babcock & Wilcox. Each Oconee unit has a thermal rating of 2568 MW(t) and a nuclear design electrical rating of 887 MW(e). Each unit is rated at 846 MW(e) net power. This provides a combined station total of 2538 MW(e) net power. [See Table 2.5-1]

Oconee Nuclear Station consists of three individual reactor buildings, a common turbine building, and an auxiliary building that serves all three units. The reactor and nuclear steam supply system for each unit are contained within its respective reactor building. Mechanical and electrical systems required for the safe operation of each Oconee unit are located in the turbine and auxiliary buildings. Figure 2.5-3 shows the general features of the Oconee site. Figure 2.5-4 shows the Owner Controlled Area and the 1 Mile (1.6 km) radius Exclusion Zone. No residences are permitted within this exclusion zone. In addition to these facilities, there are various other office buildings and facilities at the Oconee site for personnel supporting the station.

In 1990, Duke received a Part 72 license from the NRC that permitted the construction and operation of an independent spent fuel storage installation (ISFSI) at Oconee. Materials License No. SNM-2503 was issued to Duke on January 29, 1990, with an expiration date of January 31, 2010. Because Oconee’s ISFSI is a separately licensed facility, it is not within the scope of review as defined by 10 CFR Part 54.

2.5 Keowee Hydroelectric Station

The Keowee Hydroelectric Station is a two unit, 140 MW(e) conventional hydroelectric plant, located on the Keowee River arm of the lake. The facility began operation in 1971. In addition to producing electric power for the Duke Energy transmission system, the Keowee Hydroelectric Station serves as the onsite emergency power source for Oconee. Keowee was licensed by the Federal Energy Regulatory Commission on September 26, 1966 (Project No. 2503) with a license term of fifty years.

Table 2.5-1 Oconee Nuclear Station Site Information

Location: Oconee County, South Carolina
42 km (26 miles) W of Greenville
latitude 34.7917°N; longitude 82.8986°W

Licensee: Duke Power Company

Unit Information	**Unit 1**	**Unit 2**	**Unit 3**
Docket Number	50-269	50-270	50-287
Construction Permit	1967	1967	1967
Operating License	1973	1973	1974
Commercial Operation	1973	1974	1974
License Expiration	2013	2013	2014
Licensed Thermal Power [MW(t)]	2568	2568	2568
Design Electrical Rating [net MW(e)]	887	887	887
Capability [MW(e)]	846	846	846
Type of Reactor	PWR	PWR	PWR
Nuclear Steam Supply System Vendor	B&W	B&W	B&W

Cooling Water System

Type: once through
Source: Lake Keowee
Source Temperature Range: 7-25°C (44-77°F)
Design Condenser Temperature Rise: 9.6°C (17.2°F)
Intake Structure: A skimmer wall draws water from elevations of 216-223 m (710-733 ft) at a velocity of 0.2 m/s (0.6 ft/s). [Full pond elevation of Lake Keowee is 244 m (800 ft) msl]
Discharge Structure: All three units discharge through one structure near Keowee dam. Discharge is underwater at an elevation of 233 m (765 ft) msl.

Site Information

Total Area: 210 ha (510 acres)
Exclusion Distance: 1.61-km (1.00-mile) radius
Low Population Zone: 9.66 km (6.00 miles)
Nearest City: Greenville; 1990 population: 58,256 (City of Greenville)
Site Topography: flat to rolling
Land Use within 8 km (5 miles): wooded
Nearby Features: The nearest town is Six Mile 6 km (4 miles) ENE. Keowee Dam is close to the plant. Chattahoochee National Forest is about 24 km (15 miles) W.
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
990,000	1,080,000	1,170,000	1,310,000	1,470,000

Sources are:
Reference 2, GEIS
Duke Power Data Manual
US Census Bureau 1990

Figure 2.5-1 General Area for Oconee Nuclear Station

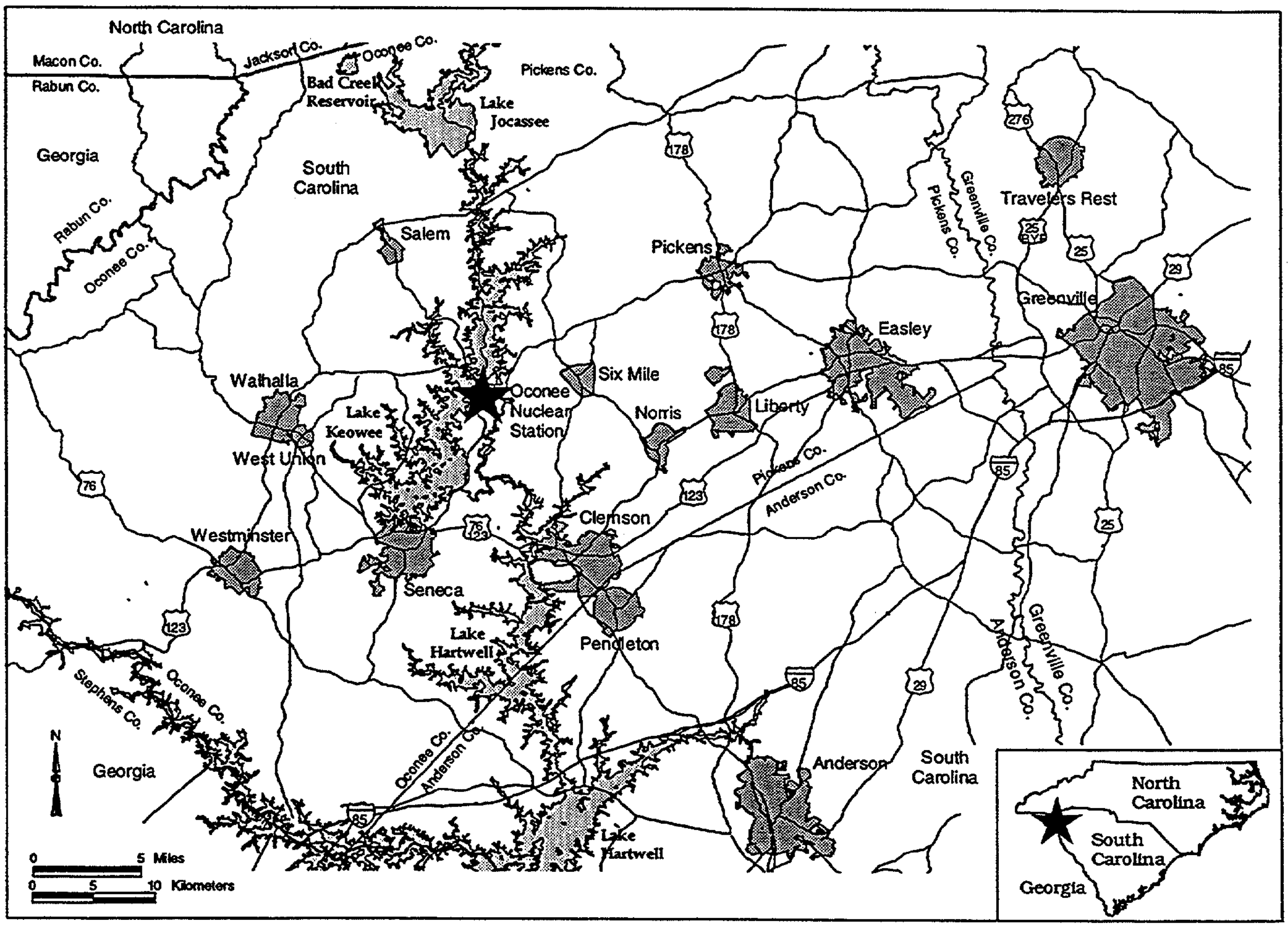


Figure 2.5-2 Keowee Toxaway & Bad Creek Projects

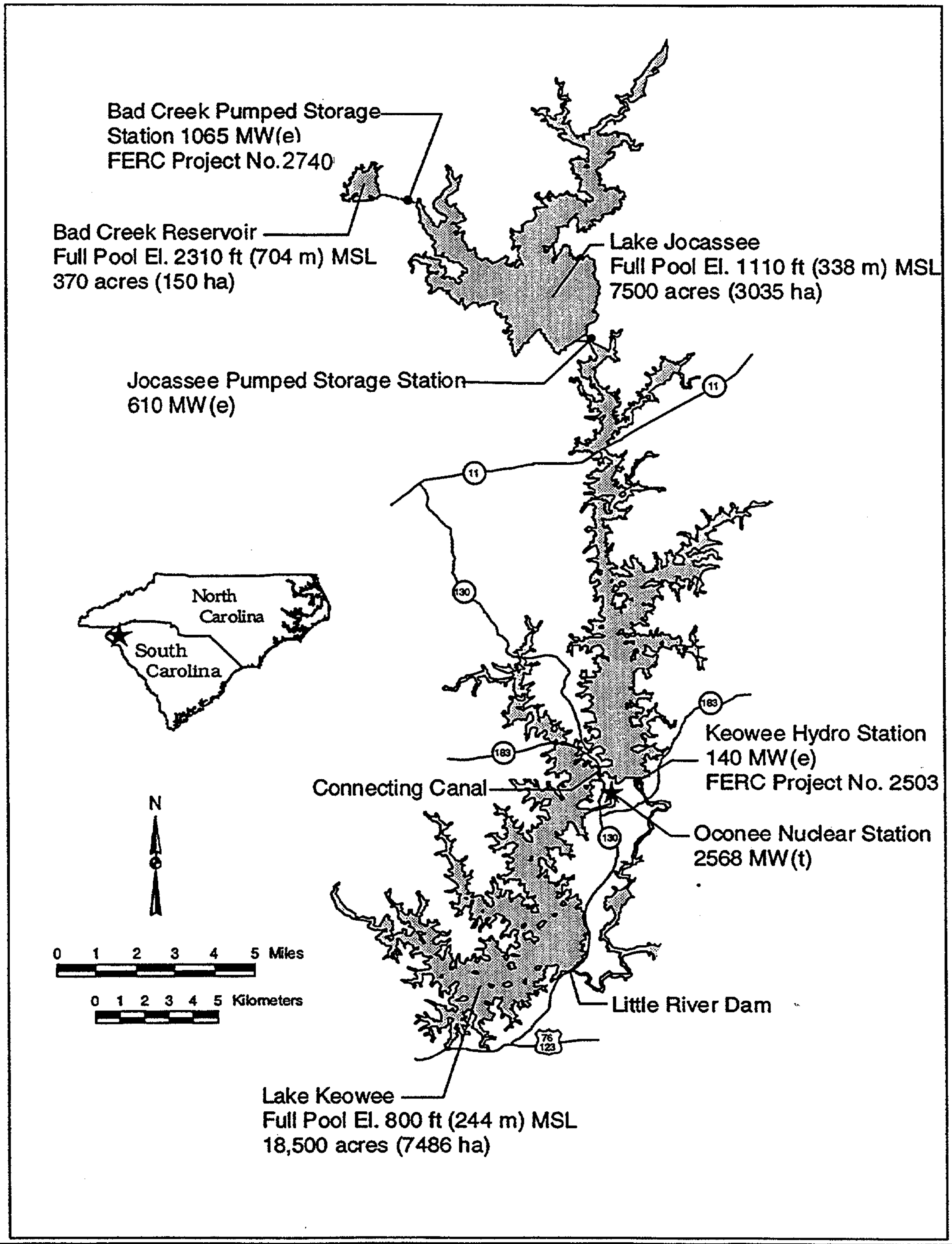


Figure 2.5-3 Oconee Nuclear Station Site - General Features

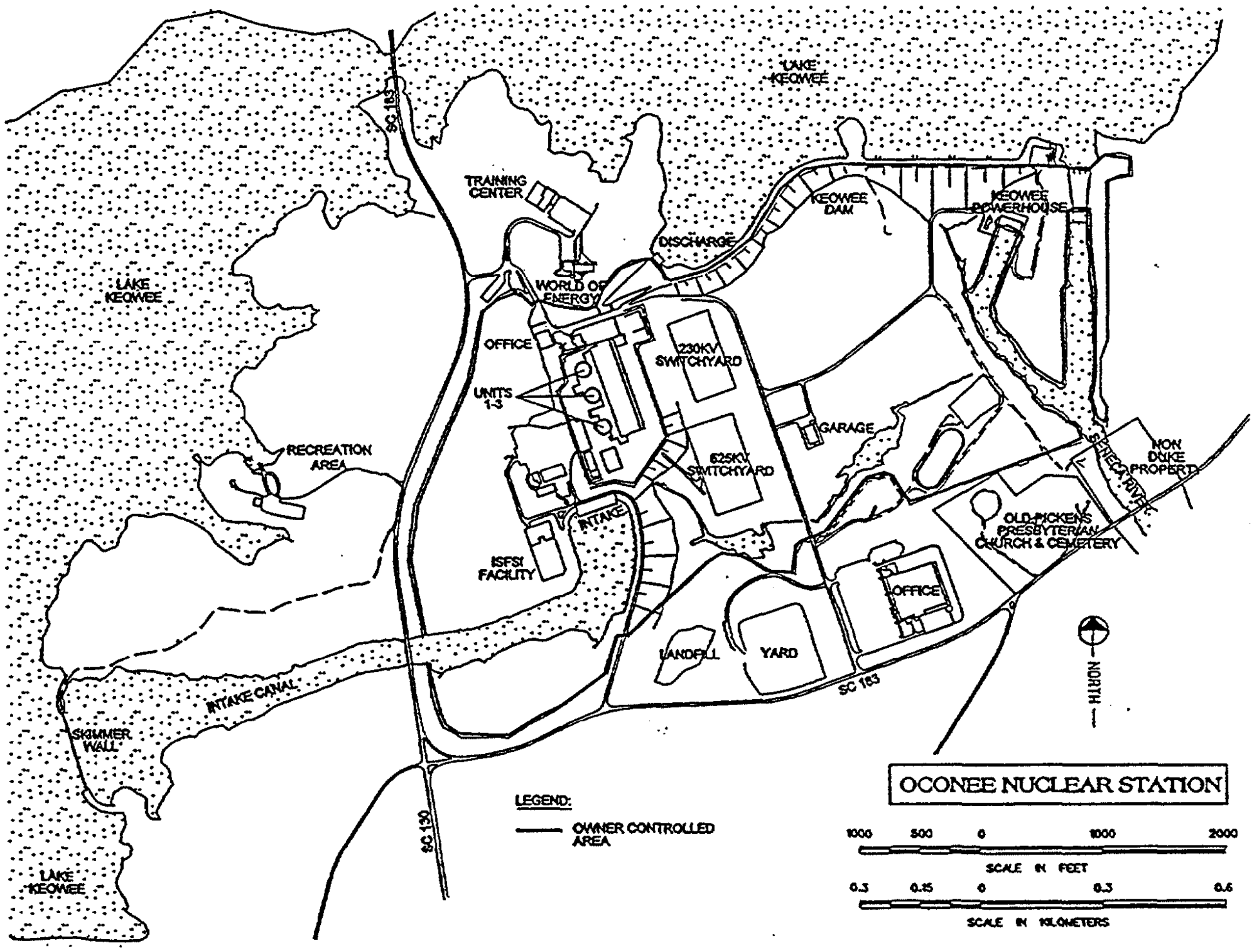
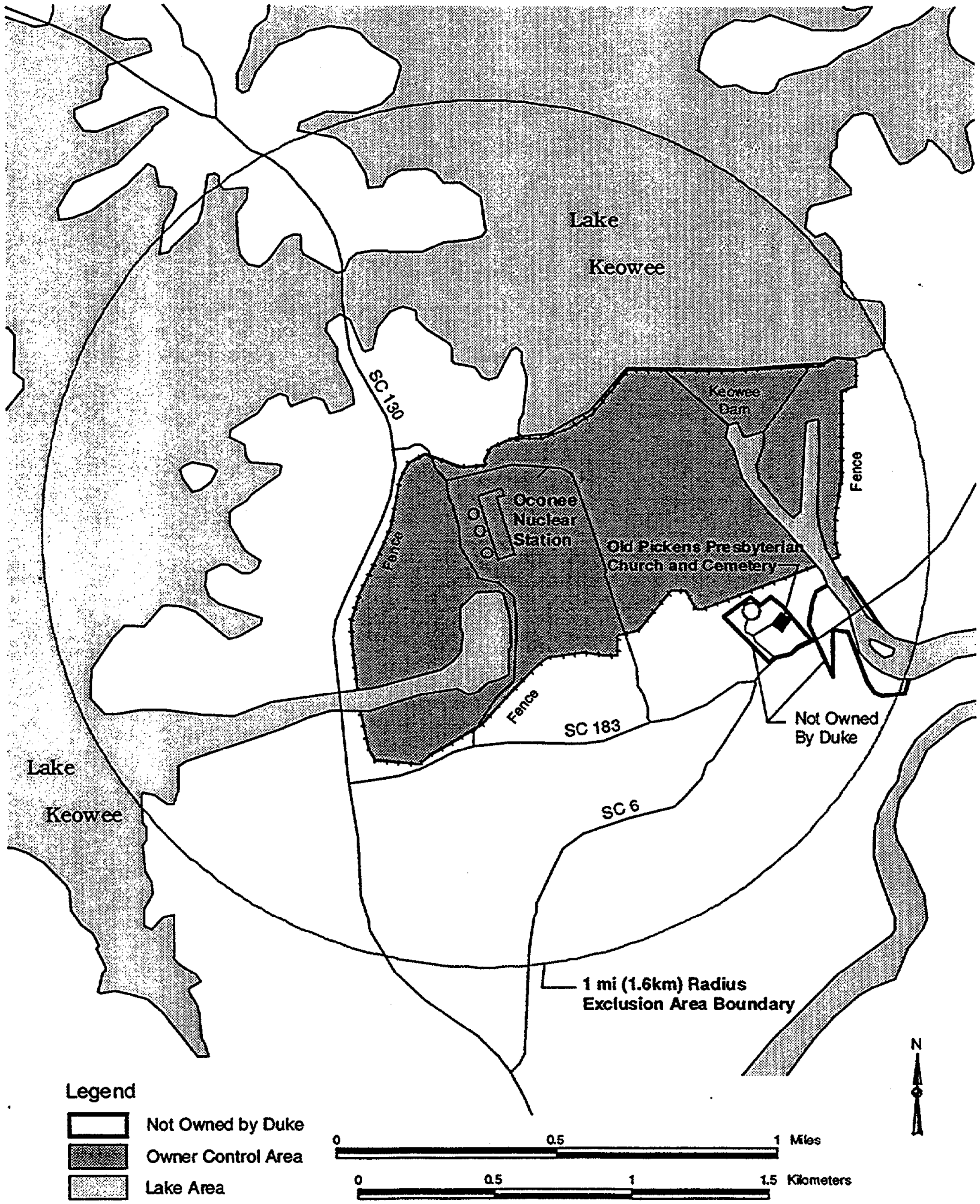


Figure 2.5-4 Oconee Nuclear Station - Owner Controlled Area and 1 Mile Exclusion Zone



3. THE PROPOSED ACTION

3.1 Description of the Proposed Action

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

The facility operating license for Oconee Unit 1 currently expires at midnight February 6, 2013, and would be renewed to expire at midnight February 6, 2033; the Oconee Unit 2 operating license currently expires at midnight October 6, 2013, and would be renewed to expire at midnight October 6, 2033; and the Oconee Unit 3 operating license currently expires at midnight July 19, 2014, and would be renewed to expire at midnight July 19, 2034.

There are no changes related to license renewal with respect to the operations of the Oconee units that would directly affect the environment or plant effluents that affect the environment during the period of license extension. The impacts to the environment during the period of license extension would be the same as the impacts that were evaluated in Final Environmental Statement (FES) [Reference 1] issued in March 1972.

3.2 Plant Modifications or Refurbishments Required for License Renewal

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

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

The objective of the review required by §54.21 is to determine whether the detrimental effects of plant aging could preclude certain Oconee systems, structures, and components from performing in accordance with the manner in which they were initially designed, during the additional 20 years of operation requested in the renewal license application.

The evaluation of structures and components as required by 10 CFR §54.21 has been completed.[1] This evaluation identified several activities necessary to continue operation of Oconee during the additional 20-years beyond the initial license term. These activities include replacement of certain components as well as new inspection activities. These activities are described in Exhibit A of the Oconee Application for Renewed Operating Licenses. [Reference 4] The replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections, and therefore, are not expected to affect the environment outside the bounds of the plant operations evaluated in the FES.

3.3 Plant Modifications or Refurbishments Not Required for License Renewal

Existing programs for testing, surveillance, inspections, and modifications to plant systems, structures, and components as normal maintenance activities will continue through the license extension period. Continuation of these programs will result in modifications to plant systems, structures, and components that are required by changes in regulations or to achieve performance improvements in the operation of the plant systems.

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

3.4 Programs for Managing Aging

The programs for managing aging of systems and equipment at Oconee are described in Application for Renewed Operating Licenses, Oconee Nuclear Station, Units 1, 2, and 3 Exhibit A License Renewal - Technical Information, OLRP-1001, Chapter 4. [Reference 4]

3.5 Employment

The non-outage work force at Oconee consists of approximately 1700 persons. There are 1350 Duke Power employees normally on site. The remainder of the 1700 persons are contract or vendor workers. Duke has no plans to add non-outage workers at the plant during the period of the extended license.

1 A full description of this review is contained in "Application for Renewed Operating Licenses Oconee Nuclear Station, Units 1, 2, and 3 Exhibit A License Renewal - Technical Information, OLRP-1001" [Reference 4]

A typical single unit refueling outage has a duration of 45 to 55 days. An additional 800 to 900 workers are typically on site during a typical outage. The number of workers required on-site for normal plant outages during the period of the renewed license is expected to be in line with the numbers of additional workers used for past outages at Oconee.

4. ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

4.1 Discussion of GEIS Categories for Environmental Issues

The Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS), NUREG-1437, summarizes the approach and findings of a systematic inquiry into the potential environmental consequences of renewing the licenses and operating individual nuclear power plants for an additional twenty years. The GEIS assesses 92 environmental issues relevant to license renewal. The GEIS assessment of these issues was used to assign the Categories to the 92 environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. In turn, Table B-1 was used to develop the requirements for the environmental issues listed in §51.53(c)(3)(ii).

The GEIS assigned most[2] environmental issues one of the three following significance levels:

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

4.1.1 Category 1 Issues

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

(1) the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics;

2 Of the 92 environmental issues evaluated in the GEIS, 68 were designated as Category 1 and 22 were designated as Category 2. Two environmental issues were assigned as Category NA (not applicable). These issues are Electromagnetic fields (chronic effects) and Environmental Justice. Footnotes to Table 9.1, in the GEIS provide details on the category definition for these issues.

(2) a single significance level (i.e., small, moderate, or large) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel); and

(3) mitigation of adverse impacts associated with the issue has been considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

Sixty-eight of the issues evaluated in the GEIS were found to be Category 1. These issues are identified in Appendix B to Subpart A of Part 51 as not requiring additional plant-specific analysis. 10 CFR Part 51.53(c)(3)(i) provides that the environmental report for the operating license renewal stage need not contain analyses of the environmental impacts of the license renewal issues identified as Category 1.

4.1.2 Category 2 Issues

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

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

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

4.1.3 Table B-1, Appendix B to Subpart A and §51.53(c)(3)(ii) Issues

Table 4.1-1, of the ER, was developed to show the relationship of the Table B-1 Category 2 issues to the §51.53(c)(3)(ii) requirements. Table B-1, Subpart A, Appendix B lists twenty-two (22) Category 2 issues. The Category 2 issues listed in Table B-1 can be referenced to the thirteen (13) Category 2 issues defined in §51.53(c)(3)(ii).

For example, §51.53(c)(3)(ii)(I) requires that an assessment of the impact of the proposed action on housing availability, land-use, public schools, and public water supplies be performed. Table B-1 lists five socioeconomic Category 2 issues that can be addressed in the same analysis required by §51.53(c)(3)(ii)(I).

Table 4.1-1 lists the issue and the findings from Table B-1, and the applicable §51.53(c)(3)(ii) requirements. The issues were grouped by broader topics, such as Surface Water Quality, Aquatic Ecology, etc.

Table 4.1-1 Comparison of Appendix B to Subpart A, Table B-1 Issues to §51.53(c)(3)(ii) Issues

SURFACE WATER QUALITY, HYDROLOGY, AND USE (for all plants)

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See §51.53(c)(3)(ii)(A).	[§51.53(c)(3)(ii)(A)] If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than $3.15x10^{12}$ ft^3/ year ($9x10^{10} m^3$/ year), an assessment of the impact of proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

AQUATIC ECOLOGY (for plants with once-through and cooling pond heat dissipation systems)

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Entrainment of fish and shellfish in early life stages	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See §51.53(c)(3)(ii)(B).	[§51.53(c)(3)(ii)(B)] If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

AQUATIC ECOLOGY (for plants with once-through and cooling pond heat dissipation systems)

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Impingement of fish and shellfish	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See §51.53(c)(3)(ii)(B).	[§51.53(c)(3)(ii)(B)] If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

AQUATIC ECOLOGY (for plants with once-through and cooling pond heat dissipation systems) (continued)

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Heat shock	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See §51.53(c)(3)(ii)(B).	[§51.53(c)(3)(ii)(B)] If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

GROUNDWATER USE AND QUALITY

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Ground-water use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users. See §51.53(c)(3)(ii)(C).	[§51.53(c)(3)(ii)(C)] If the applicant's plant uses Ranney wells or pumps more than 100 gallons of ground water per minute (total onsite), an assessment of the impact of the proposed action on ground-water use must be provided.
Ground-water use conflicts (plants using cooling towers withdrawing make-up water from a small river)	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other ground-water or upstream surface water users come on line before the time of license renewal. See §51.53(c)(3)(ii)(A).	[§51.53(c)(3)(ii)(A)] If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than $3.15x10^{12}$ ft^3/ year ($9x10^{10} m^3$/ year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

GROUNDWATER USE AND QUALITY

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Ground-water use conflicts (Ranney wells)	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See §51.53(c)(3)(ii)(C).	[§51.53(c)(3)(ii)(C)] If the applicant's plant uses Ranney wells or pumps more than 100 gallons of ground water per minute (total onsite), an assessment of the impact of the proposed action on ground-water use must be provided.
Ground-water quality degradation (cooling ponds at inland sites)	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See §51.53(c)(3)(ii)(D).	[§51.53(c)(3)(ii)(D)] If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on ground-water quality must be provided.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

TERRESTRIAL RESOURCES

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Refurbishment impacts	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See §51.53(c)(3)(ii)(E).	[§51.53(c)(3)(ii)(E)] All license renewal applicants shall assess the impact of refurbishment and other license-renewal related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

THREATENED OR ENDANGERED SPECIES (for all plants)

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Threatened or endangered species	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See §51.53(c)(3)(ii)(E).	[§51.53(c)(3)(ii)(E)] All license renewal applicants shall assess the impact of refurbishment and other license-renewal related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

AIR QUALITY

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Air quality during refurbishment (nonattainment and maintenance areas)	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage. See §51.53(c)(3)(ii)(F).	[§51.53(c)(3)(ii)(F)] If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues
HUMAN HEALTH

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See §51.53(c)(3)(ii)(G).	[§51.53(c)(3)(ii)(G)] If the applicant’s plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than $3.15x10^{12}$ ft^3/ year ($9x10^{10}m^3$/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.
Electromagnetic fields, acute effects (electric shock)	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See §51.53(c)(3)(ii)(H).	[§51.53(c)(3)(ii)(H)] If the applicant’s transmission lines that were constructed for the specific purpose of connecting the plant [3] to the transmission system do not meet the recommendations of the National Electric Safety Code (NESC) for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

3 The plant is defined as the nuclear reactors, steam-electric systems, intakes, discharges, and all other on-station facilities involved in the production of electricity. Transmission lines and other off-

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

SOCIOECONOMICS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Housing impacts	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See §51.53(c)(3)(ii)(I).	[§51.53(c)(3)(ii)(I)] An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

station facilities are not part of the plant. (NUREG-1555, Draft SRP-ER, Introduction Chapter, Definitions, August 1997)

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

SOCIOECONOMICS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Public services: public utilities	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See §51.53(c)(3)(ii)(I).	[§51.53(c)(3)(ii)(I)] An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

SOCIOECONOMICS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Public services, education (refurbishment)	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See §51.53(c)(3)(ii)(I).	[§51.53(c)(3)(ii)(I)] An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.
Offsite land use (refurbishment)	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See §51.53(c)(3)(ii)(I).	[§51.53(c)(3)(ii)(I)] An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

SOCIOECONOMICS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Offsite land-use (license renewal term)	SMALL, MODERATE, OR LARGE. Significant changes in land-use may be associated with population and tax revenue changes resulting from license renewal. See §51.53(c)(3)(ii)(I).	[§51.53(c)(3)(ii)(I)] An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.
Public services, Transportation	SMALL, MODERATE, OR LARGE. Transportation impacts are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See §51.53(c)(3)(ii)(J).	[§51.53(c)(3)(ii)(J)] All applicants shall assess the impact of the proposed project on local transportation during periods of license renewal refurbishment activities

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

SOCIOECONOMICS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Historic and archaeological resources	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See §51.53(c)(3)(ii)(K).	[§51.53(c)(3)(ii)(K)] All applicants shall assess whether any historic or archaeological properties will be affected by the proposed project.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

POSTULATED ACCIDENTS

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Severe accidents	SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See §51.53(c)(3)(ii)(L).	[§51.53(c)(3)(ii)(L)] If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.

Table 4.1-1 (Continued)

Comparison of Appendix B to Subpart A Table B-1 Issues to §51.53(c)(3)(ii) Issues

URANIUM FUEL CYCLE AND WASTE MANAGEMENT

Issue	Findings from Table B-1	§51.53(c)(3)(ii)Reference
Transportation	Table S-4 of this part contains an assessment of impact parameters to be used in evaluating transportation effects in each case. See §51.53(c)(3)(ii)(M).	[§51.53(c)(3)(ii)(M)] The environmental effects of transportation of fuel and waste shall be reviewed in accordance with §51.52. The review of impacts shall also discuss the generic and cumulative impacts associated with transportation operation in the vicinity of a high-level waste repository site. The candidate site at Yucca Mountain should be used for the purpose of impact analysis as long as that site is under consideration for licensing.

4.1.4 Review of §51.53(c)(3)(ii) Issues

The review and analysis for the §51.53(c)(3)(ii) issues are found in Sections 4.2 through 4.14. The issues can be placed into one of three categories, which are discussed below. Table 4.1.2-1 provides a summary of the results for the issues listed in §51.53(c)(3)(ii).

4.1.4.1 §51.53(C)(3)(ii) ISSUES NOT APPLICABLE TO OCONEE

No analysis was performed for issues that are not applicable to Oconee. The basis for Duke's determination that a certain issue is not applicable is set forth in the specific section. Two of the issues listed in §51.53(c)(3)(ii) are not applicable to Oconee.

4.1.4.2 §51.53(C)(3)(ii) ISSUES APPLICABLE TO OCONEE

The format for the sections of Chapter 4 reviewing the §51.53(c)(3)(ii) issues applicable to Oconee is described below:

- **Requirement** - The requirement from §51.53(c)(3)(ii) is restated.
- **Findings from Table B-1, Appendix B to Subpart A** - The Finding(s) for the issue from Table B-1 - Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Subpart A, is presented. Several of the issues in §51.53(c)(3)(ii) have more than one issue from Table B-1 associated with that issue.
- **Background** - An excerpt from the applicable section of the GEIS is provided as background. The specific section of the GEIS is referenced for the convenience of the reader.
- **Analysis of Environmental Impact** - An analysis of the environmental impact as required by §51.53(c)(3)(ii) is provided, taking into account information provided in the GEIS, Appendix B to Subpart A of Part 51, as well as Oconee-specific information.
- **Consideration of Alternatives For Reducing Adverse Impacts** - The alternatives to reduce or avoid adverse environmental effects are assessed as required by §51.45(c) and §51.53(c)(3)(iii).

4.1.4.3 §51.53(C)(3)(ii) ISSUES APPLICABLE TO OCONEE RELATED TO REFURBISHMENT

As discussed in Section 3.2 Plant Modifications or Refurbishments Required for License Renewal, the evaluation of structures and components as required by 10 CFR §54.21 did not identify any major plant refurbishment activities[4] or modifications necessary to support the continued operation of Oconee beyond the end of the existing operating licenses. Therefore, analysis of these issues is not required.[5]

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

5 Refer to ER Section 3.3 for discussion of Plant Modifications or Refurbishments Not Required for License Renewal.

Table 4.1.4-1 Summary of Results for Analyses of Category 2 Issues

Category 2 Issue §51.53(c)(3)(ii)Requirement	Summary of Analysis Results
Water use conflicts (Plants with cooling towers and cooling ponds) §51.53(c)(3)(ii)(A)	Not applicable to Oconee.
Entrainment, impingement, and heat shock of fish and shellfish §51.53(c)(3)(ii)(B)	No significant adverse impact from continued operation. Section 316(a) demonstration approved by SCDHEC. Section 316(b) demonstration submitted to EPA in 1976.
Ground-water use conflicts (Ranney Wells or pumps more than 100 gallons per minute of groundwater) §51.53(c)(3)(ii)(C)	No Ranney wells. Groundwater use is less than 100 gallons per minute.
Ground-water quality (Plants with cooling ponds) §51.53(c)(3)(ii)(D)	Not applicable to Oconee.
Refurbishment impacts on important plant and animal habitats, and threatened or endangered species §51.53(c)(3)(ii)(E)	No major refurbishment activities identified. No impact from continued operations. No federal listed species present. Four state listed species present.
Vehicle Exhaust Emissions §51.53(c)(3)(ii)(F)	Oconee is not located in or near non attainment or maintenance area. No major refurbishment activities identified
Microbiological (thermophilic) organisms §51.53(c)(3)(ii)(G)	No impact from continued operation.
Electrical shock from induced currents §51.53(c)(3)(ii)(H)	Lines meet NESC requirements.
Housing, land-use, public schools and public water supply impacts §51.53(c)(3)(ii)(I)	No impacts from continued operation. No major refurbishment activities identified.
Local transportation impacts §51.53(c)(3)(ii)(J)	No major refurbishment activities identified
Historic and archaeological properties §51.53(c)(3)(ii)(K)	No major refurbishment activities identified. No impacts from continued operation.
Severe accident mitigation alternatives §51.53(c)(3)(ii)(L)	No impact from continued operation.
Transportation of High Level Waste §51.53(c)(3)(ii)(M)	NRC rulemaking pending to categorize as Category 1 issue.

4.2 Water use conflicts (Plants with cooling towers and cooling ponds)

4.2.1 Requirement [§51.53(c)(3) (ii)(A)]

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

4.2.2 Analysis of Environmental Impact

Oconee uses a once-through cooling system.[6] Therefore, this issue is not applicable to Oconee and analysis is not required.

6 In a once-through cooling system, circulating water for condenser cooling is drawn from an adjacent body of water, such as a lake or river, passed through the condenser tubes, and returned at a higher temperature to the adjacent body of water. The waste heat is dissipated to the atmosphere, mainly by evaporation from the water body and, to a much smaller extent, by conduction, convection, and thermal radiation loss. [Reference 2]

4.3 Entrainment, impingement, and heat shock of fish and shellfish

4.3.1 Requirement [§51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling[7] or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR part 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

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

> "The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See §51.53(c)(3)(ii)(B)."
>
> "The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See §51.53(c)(3)(ii)(B)."
>
> "Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See §51.53(c)(3)(ii)(B)."

4.3.3 Background

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

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7 In a once-through cooling system, circulating water for condenser cooling is drawn from an adjacent body of water, such as a lake or river, passed through the condenser tubes, and returned at a higher temperature to the adjacent body of water. The waste heat is dissipated to the atmosphere mainly, by evaporation from the water body and, to a much smaller extent, by conduction, convection, and thermal radiation loss. [Reference 2]

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

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

4.3.4 Analysis of Environmental Impact

4.3.4.1 EFFECTS OF COOLING WATER INTAKE--IMPINGEMENT AND ENTRAINMENT

The Appendix B Environmental Technical Specifications for the Facility Operating License for Oconee Units 1, 2, and 3, initially required that:

1. "The licensee shall accumulate information required to establish baselines for the evaluation of thermal, chemical and radiological effects of station operation on terrestrial biota and aquatic biota in Lakes Keowee and Hartwell.
2. The licensee shall develop and implement a comprehensive monitoring program that will permit surveillance during plant operation of thermal,

> chemical, and radiological effects on terrestrial biota and on aquatic biota in Lake Keowee and Hartwell."

Studies of water temperature, chemistry, and fisheries were initiated before Lake Keowee reached full pond in 1971. Phytoplankton, periphyton, zooplankton, and benthos studies were begun either shortly before or after mid-1973, when Oconee Unit 1 was licensed to operate. The purpose of these studies was to detect and quantify the effects of the operation of Oconee and to verify the findings of the FES. The results of these studies were submitted to the NRC in Semi-Annual and Annual Reports. [Reference 5] None of the effects observed were judged to constitute a significant impact to the aquatic community of Lake Keowee.

In accordance with Section 316(b) of the Clean Water Act, the NPDES permit issued by the EPA, effective February 18, 1975, required Oconee to implement a program to monitor entrainment and impingement on plant intake structures. In response to this requirement, rates of fish impingement on the intake screens at Oconee, along with the rates of entrainment and entrainment mortality of plankton, were studied and the results were reported to the EPA in March 24, 1976. [Reference 6] The study results reported to EPA were taken from the studies submitted for the Appendix B Environmental Technical Specifications requirements.

The EPA issued a modified NPDES permit on August 30, 1976, that deleted the requirements to monitor impingement and entrainment on plant intake structures. No further studies or analyses were required in subsequent NPDES permits.

On March 2, 1979, the NRC issued Amendments to the Licenses for Oconee Units 1, 2, and 3. [Reference 7] These amendments revised the Environmental Technical Specifications by deleting the aquatic surveillance program and the special studies program. The Environmental Impact Appraisal performed for this amendment concluded the impact of Oconee on the aquatic environment was within the bounds of the FES and that these special study programs were no longer needed.

Duke does not believe that any further studies or investigations regarding Section 316(b) of the Clean Water Act are warranted at Oconee. EPA is in the process of reformulating the existing regulation and collecting and analyzing data applicable to each utility. EPA has not identified, as of this date, a planned strategy for rewriting the Section 316(b) regulation. Accordingly, it would not be appropriate for Duke to undertake any further studies or analyses at this time, since the EPA may ultimately determine that such studies are incongruent with its needs and policy.

A brief overview of EPA's ongoing actions and anticipated deadlines is provided below.

- EPA is currently reviewing the statutory and regulatory requirements set forth at 42 U.S.C. § 1326 and 40 CFR § 316(b) pertaining to the impingement and entrainment of organisms. Section 316(b) of the Clean Water Act requires that the location, design, construction and capacity of any cooling water intake structure reflect the best technology available ("BTA") minimizing adverse environmental impact. Although EPA attempted in 1976 to establish rules implementing Section 316(b), those rules were invalidated on procedural grounds and suspended.

- At present, there are no specific regulatory requirements set forth which establish the specific steps that must be implemented by a utility to ensure compliance with Section 316(b). There is, however, a substantial amount of guidance, administrative precedent and case law that has shaped the implementation of Section 316(b) on a case-by-case basis during the past 20 years.

- The terms of a 1995 settlement agreement required EPA to develop and to propose regulations implementing Section 316(b) by July 2, 1999, and to take final action on the regulation by August 13, 2001. EPA has now initiated a process to collect information from which to develop a proposed Section 316(b) rule, and is currently identifying and assessing the issues that the rules must address.

- EPA plans to begin administering an information collection questionnaire to utilities in Fall 1998 and will give recipients 90 days to respond. The EPA will begin receiving responsive data by the end of 1998 and must analyze the information to prepare a proposed rulemaking. EPA also plans to hold several public meetings beginning in Summer 1998 in which all stakeholders will be invited to share their views on various Section 316(b) related issues. Meetings will address specific issues including the role of mitigation and adverse impact.

In sum, EPA has many actions that it plans to undertake and implement in regard to Section 316(b). Thus, Duke believes that it is inappropriate for any further Section 316(b) studies to be undertaken for the plant at this time. Most importantly, the existing information related to impingement and entrainment issues at the plant demonstrate that there has been no adverse environmental impact from the operation of Oconee.

4.3.4.2 EFFECTS OF HEATED DISCHARGE

Oconee has a once-through condenser cooling system that uses Lake Keowee as the cooling lake. Condenser cooling water is withdrawn from the deep layers of Lake Keowee by the use of a skimmer wall. Oconee's skimmer wall is a concrete "curtain" extending from just above the full pond surface elevation of 800 feet (244 m) to a depth of 67 feet (20.4 m) below the surface. The skimmer wall extends the across canal, as shown on Figure 2.5-3. Water enters the intake canal for Oconee by passing through an opening underneath the skimmer wall at depths of 67 feet (20.4 m) to 90 feet (27.4 m) below full pond. This deep withdrawal provides intake and discharge temperatures that are considerably lower than would be obtained using a conventional surface water intake. This arrangement allows Oconee to access the cooler waters of the lake, improving its generating efficiency, minimizing discharge water temperatures, and substantially reducing the risk of impingement and entrainment of aquatic biota.

Keowee Hydro withdraws its water from the upper 35 feet (10.7 m) of the lake to conserve cooler water for Oconee's use. This arrangement also insures a well-aerated tailrace area, with minimal problems with iron, manganese, and sulfides that often occur in tailraces drawing water from a lake bottom.

At 100% capacity, Oconee withdraws water for its once-through condenser cooling system at a summer maximum rate of 4700 cubic feet per second (132 m^3/s). This water is heated by about 16 °F (8.9°C). In winter, the lowest flow rate of 3100 cubic feet per second (88 m^3/s) would result in a 24 °F (13.3°C) temperature rise. These values are the extreme range for 100% operation of all three units. Actual flows and discharge temperatures vary, often on a daily basis, depending on station output, the number of condenser cooling water pumps operating, and the intake water temperature. From 1973 through 1993, the maximum daily average temperature of the Oconee discharge water, prior to any mixing with Lake Keowee, was 98.4 °F (36.9°C). Water discharged to Lake Hartwell through Keowee Hydro has never exceeded the 90 °F (32.2°C) NPDES limit (Station continuous recorder data).

Oconee has had no violations of its NPDES thermal limits from initial operation in 1973 through the present. Those thermal limits are as follows:

> Discharge temperature cannot exceed 100°F (37.8°) for a time period in excess of two hours, unless critical hydrological and meteorological conditions are combined with high customer demand that cannot be met from other sources. Under these latter conditions, the discharge temperature shall not be allowed to exceed 103.0 ºF (39.4 ºC). Maximum temperature rise above intake temperature shall be limited to 22º F (12.2º C) when intake temperature is greater than 68 ºF (20 ºC). [Reference NPDES Permit #SC0000515]

Average daily discharge temperature from Keowee Hydro to Lake Hartwell cannot exceed 90 °F (32.2°C).

In January 1995, Duke Power Company submitted a 316(a) Demonstration Report to the SCDHEC. The 316 (a) Demonstration was necessary in order to obtain a variance for the condenser cooling water system's discharge from the temperature limits as defined in South Carolina Regulation 61-68, Water Classifications and Standards.[8] The 316(a) Demonstration presented data to support Duke's position that Oconee operation, under its alternative thermal limits, is compatible with the aquatic life of Lake Keowee. On March 28, 1995, SCDHEC issued a modified NPDES permit, which granted the thermal variance request by incorporating the alternative limits.

On May 21, 1998 SCDHEC issued a proposed draft NPDES permit which reiterated SCDHEC's position of granting a thermal variance based on the January 1995 316(a) Demonstration. [See References 8 and 9.] A copy of the "Temperature" portion of the permit is included as Attachment E.

4.3.5 Consideration of Alternatives For Reducing Adverse Impacts

Sections 316(a) and 316(b) of the Clean Water Act allow the operator of a thermal power plant to perform studies that evaluate the impact of heated discharges and intake structures on the aquatic biota. These demonstrations, if determined to be successful by the EPA or its state designee (SCDHEC), allow the operator of the power plant to continue operations with the cooling system and intake structure already in place.

Oconee has operated both the cooling system and the water intakes in a manner that has resulted in no significant adverse impacts on the aquatic communities of Lake Keowee. This result is evidenced by the approved Section 316(a) demonstration and the fact that no additional Section 316(b) studies were required. Therefore, modifications to these systems were not considered.

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8 The requirement for a 316 (a) Demonstration is defined in 40 CFR 125.73 and the South Carolina Regulation is R 61-9.125.73.

4.4 Ground-water use conflicts

4.4.1 Requirement [§51.53(c)(3)(ii)(C)]

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

4.4.2 Analysis of Environmental Impact

Oconee does not use Ranney wells and there are no plans to use them. However, Oconee does have four wells permitted as drinking water wells. One of these wells is used to supply drinking water and a rest room facility located at the station baseball field. The pumping capacity of this well is 30 gallons per minute ($0.0019 m^3/sec$).

The other three groundwater wells are used to supply irrigation water for site landscaping during the summer months (June though September). These wells were permitted as drinking water wells, but have not been used for that purpose.

The estimated combined pumping rate for the four groundwater wells at Oconee is less than 100 gal/min ($0.0068\ m^3/s$). Therefore, it is not necessary to assess the impact of license renewal on groundwater use conflicts at Oconee.

4.4.3 Consideration of Alternatives For Reducing Adverse Impacts

Oconee does not use Ranney wells. Groundwater use is less than 100 gallons per minute. Therefore, mitigation measures for reducing or avoiding this type of adverse environmental effect need not be considered.

4.5 Ground-water quality

4.5.1 Requirement [§51.53(c)(3)(ii)(D)]

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

4.5.2 Analysis of Environmental Impact

Oconee is located at an inland site. However, Oconee does not use cooling ponds. Therefore, this issue is not applicable to Oconee and analysis is not required.

4.6 Refurbishment impacts on important plant and animal habitats, and threatened or endangered species

4.6.1 Requirement [§51.53(c)(3)(ii)(E)]

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

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

> "Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See §51.53(c)(3)(ii)(E)."
>
> "Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See §51.53(c)(3)(ii)(E)."

4.6.3 Background

The issue of impacts to threatened or endangered species is potentially relevant to all cooling system types and to transmission lines. Review of power plant operations has shown that neither current cooling system operations nor electric power transmission lines associated with nuclear power plants are having significant adverse impacts on any threatened or endangered species. However, widespread conversion of natural habitats and other human activities continues to cause the decline of native plants and animals. As biologists review the status of species, additional species threatened with extinction are being identified; consequently, it is not possible to ensure that future power plant operations will not be found to adversely affect some currently unrecognized threatened or endangered species. In addition, future endangered species recovery efforts may require modifications of power plant operations. Similarly, operations-related land-disturbing activities (e.g., spent fuel and low-level waste storage facilities) could affect endangered species. As noted in GEIS Section 3.2, without site-specific and project-specific information, the magnitude or significance of impacts on threatened and endangered species cannot be assessed. For these reasons, the nature and significance of nuclear power plant operations on as yet unrecognized endangered species cannot be predicted; and no generic conclusion on the significance of potential impacts on endangered species can be reached. The impact on threatened and endangered species, therefore, is a Category 2 issue. [Reference 2, GEIS Section 4.1]

4.6.3.1 THREATENED AND ENDANGERED SPECIES

Potential impacts of refurbishment on federal- or state-listed threatened and endangered species, and species proposed to be listed as threatened or endangered, cannot be assessed generically because the status of many species is being reviewed and it is impossible to know what species that are threatened with extinction may be identified that could be affected by refurbishment activities. In accordance with the Endangered Species Act of 1973 (Pub. L. 93-205), the appropriate federal agency (either the U.S. Fish and Wildlife service or the National Marine Fisheries Service) must be consulted about the presence of threatened or endangered species. At that time, it will be determined whether such species could be affected by refurbishment activities and whether formal consultation will be required to address the impacts. Each state should be consulted about its own procedures for considering impacts to state-listed species. Because compliance with the Endangered Species Act cannot be assessed without site-specific consideration of potential effects on threatened and endangered species, it is not possible to determine generically the significance of potential impacts to threatened and endangered species. This is a Category 2 issue. [Reference 2, GEIS Section 3.9]

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

There are no major refurbishment activities required for license renewal at Oconee. [See Section 3.2 Plant Modifications or Refurbishments Required for License Renewal.] Therefore, no analysis of the impact of this issue is required.

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

Duke has discussed this issue with the South Carolina Department of Natural Resources (SCDNR) and the United States Fish and Wildlife Service (USFWS) concerning the impact of the proposed action on threatened or endangered species.

In June 1998, a survey was conducted to determine if there were threatened or endangered species at the site. This survey was performed on the area within a 1 mile (1.6 km) radius of Oconee.

The results of this survey were:

1) No federal listed rare and endangered species of plants or animals were found to be present.
2) Four state listed[9] species of plants were found to be present. These species were *Carex laxiflora*[10] (loose-flowered sedge), *Carex prasina* (drooping sedge), *Nestronia umbellula* (Indian olive), and *Viola tripartita* (three-parted violet).

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9 Listed by the SCDNR as state rare, threatened, or endangered species.

A copy of this results of this survey is included as Attachment F.[11] [Reference 10]

Duke has submitted the results of this survey to the USFWS and to the SCDNR. Duke also requested comments from the USFWS and the SCDNR on the survey results and on the Duke determination that there will be no adverse impact to these species from the continued operation of Oconee. [References 11 and 12]

The location of these species is shown on Figure 4.6-1. The location of these species is remote from plant operations areas. The continued operations of Oconee will not impact these species.

4.6.6 Consideration of Alternatives For Reducing Adverse Impacts

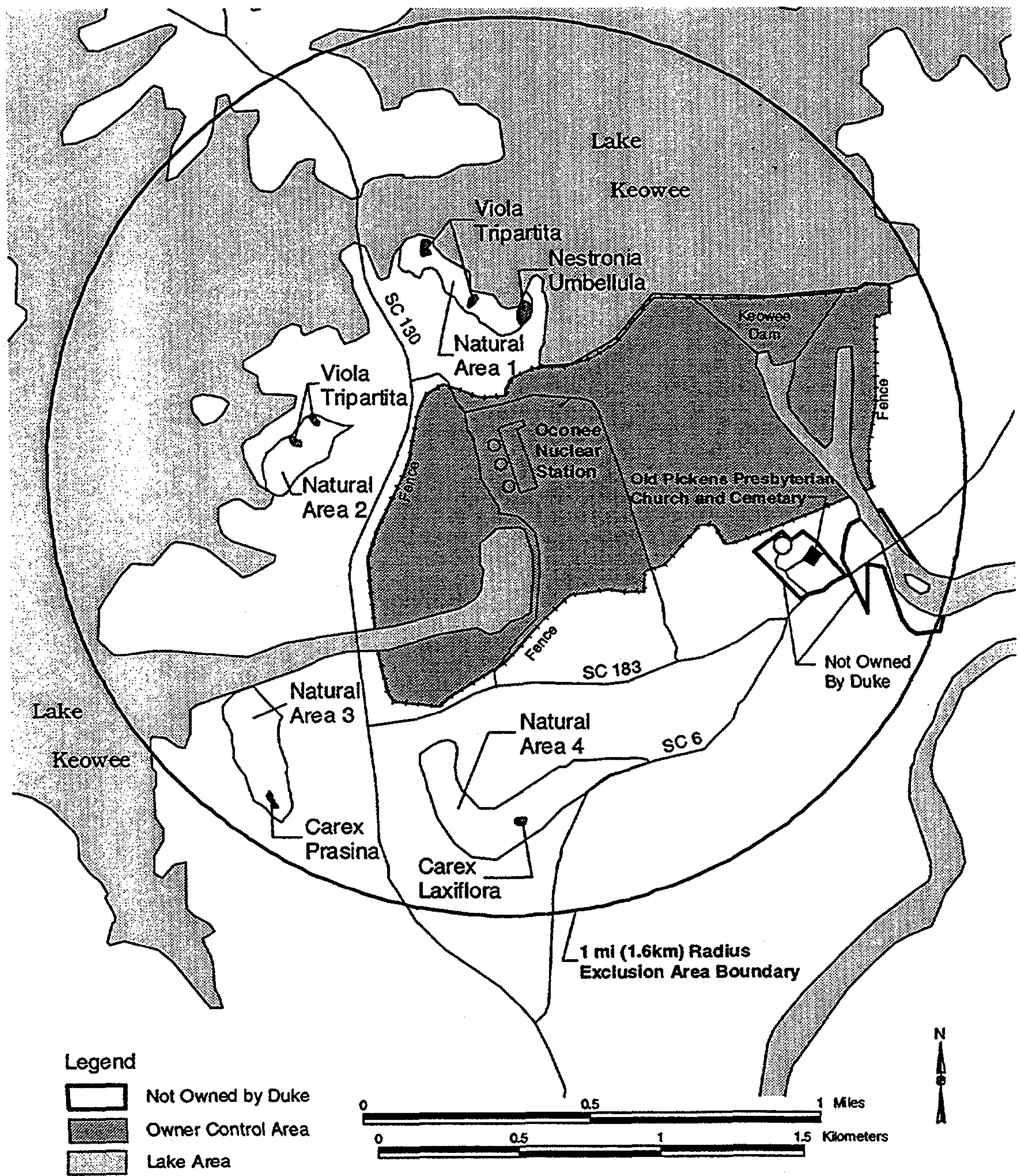
There are no major refurbishment activities required for license renewal at Oconee. [See ER Section 3.2]. Therefore, no analysis of the impact of this issue is required.

No federal listed rare and endangered species of plants or animals were found on the site. Four state listed rare, threatened, or endangered plant species were found to be present in a 1 mile radius area of Oconee. The location of these species is remote from plant operations areas. The continued operations of Oconee will not impact these species. Therefore, consideration of alternatives to reduce impact to these species is not necessary.

10 New state record for species found during this survey.

11 Due to the size of the original map, a copy of this map is not included in Attachment F. The locations of the species found is shown on Figure 4.6-1.

Figure 4.6-1 Location of State Listed Rare, Threatened or Endangered Species at Oconee Nuclear Station



Scientific Name	Common Name	Status
Viola Tripartita	Three-Parted Violet	State Listed
Carex Prasina	Drooping Sedge	State Listed
Carex Laxiflora	Loose-Flowered Sedge	State Listed
Nestronia Umbellula	Indian Olive	State Listed

4.7 Vehicle Exhaust Emissions

4.7.1 Requirement [§51.53(c)(3)(ii)(F)]

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

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

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

4.7.3 Analysis of Environmental Impact

Oconee is not located in, or near, a nonattainment or maintenance area for air pollutants, from either the federal or state regulatory standpoint. Additionally, there are no major refurbishment activities required for license renewal at Oconee. [See Section 3.2 Plant Modifications or Refurbishments Required for License Renewal.] Therefore, no analysis of the impact of this issue is required.

4.8 Microbiological (thermophilic) organisms

4.8.1 Requirement [§51.53(c)(3)(ii)(G)]

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

4.8.2 Finding from Table B-1, Appendix B to Subpart A

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

4.8.3 Background

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

4.8.4 Analysis of Environmental Impact

Oconee has a once-through cooling system, using Lake Keowee as the cooling lake. The Keowee and Little Rivers, which were impounded to form Lake Keowee, have a combined flow rate which is lower than the 3.15×10^{12} ft^3 /year ($9 \times 10^{10} m^3$/year) specified in §51.53(c)(3)(ii)(G).[12]

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

12 The combined flow rate of the Keowee and Little Rivers, measured one mile below their confluence, in what is now the upper part of the Hartwell Reservoir, was 3.60×10^{10} ft^3/yr (1.02×10^9 m^3/yr). [Reference 1]

The private piers nearest to the Oconee discharge would be located on the Keowee River arm of the lake. The approximate distance to the nearest private pier location, outside the 1 mile exclusion zone[13], would be 4200 feet (1300 meters), measured from the discharge structure. The ER Section 4.3.4.2 Effects of Heated Discharge, provides information on the discharge temperatures at Oconee.

The South Carolina Department of Health and Environmental Control (SCDHEC) is the state agency responsible for public health. Duke consulted with SCDHEC to determine if the continued operation of Oconee will have public health impacts due to the enhancement of thermophilic organisms. By letter dated October 25, 1996, Dr. John F. Brown, State Toxicologist at SCDHEC, summarized the agency's position and opinion regarding the public health implications of continued operation of Oconee. [Reference 13] Dr. Brown concluded:

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

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

4.8.5 Consideration of Alternatives For Reducing Adverse Impacts

Duke will comply with any directives issued by SCDHEC regarding public health, thermophilic organisms, and their relationship to Oconee operation. No additional mitigation measures beyond those required by SCDHEC during the current term of Oconee operation would be expected as a result of license renewal.

13 The 1 mile radius exclusion zone is measured from the center of the Unit 2 Reactor Building.

4.9 Electrical shock from induced currents

4.9.1 Requirement [§51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant[14] to the transmission system do not meet the recommendations of the National Electric Safety Code (NESC) for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.
[10 CFR §51.53(c)(3)(ii)(H)]

4.9.2 Finding from Table B-1, Appendix B to Subpart A

> "Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electrical shock potential at the site[15]. See §51.53(c)(3)(ii)(H)."

4.9.3 Background

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

The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear power plants, is of small significance for transmission lines that are operated in adherence with NESC. Without review of each nuclear plant's transmission

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14 The plant is defined as the nuclear reactors, steam-electric systems, intakes, discharges, and all other on-station facilities involved in the production of electricity. Transmission lines and other off-station facilities are not part of the plant. (NUREG-1555, Draft Standard Review Plan for Environmental Reviews for Nuclear Power Plants, Introduction Chapter, Definitions, August 1997.)

15 The site is considered to be synonymous with 'Station', which is defined as all facilities (reactors, control buildings, intakes, discharges, etc.) that are located on the applicant's site. Transmission lines and their associated facilities are not considered part of the station. (NUREG-1555, Draft, Draft Standard Review Plan for Environmental Reviews for Nuclear Power Plants, Introduction Chapter, Definitions, August 1997.)

line conformance with NESC criteria, it is not possible to determine the significance of the electrical shock potential. This is a Category 2 issue. [Reference GEIS Sections 4.5.4 and 4.5.4.1]

4.9.4 Analysis of Environmental Impact

The transmission lines that connect the plant to the transmission system are the lines from the Oconee Turbine Building to the 230 kV and the 525 kV switchyards. These lines are shown on Figure 4.9-1.

The transmission lines which connect Units 1 and 2 to the 230 kV Switching Station meet the vertical clearance requirements of the most recent (1997) Edition of the National Electric Safety Code, and the transmission lines which connect Unit 3 to the 525 kV Switching Station meet the vertical clearance requirements of the most recent (1997) Edition of the National Electric Safety Code.

The clearances for these lines were determined by first measuring the conductor ruling span length. At the same time, a survey profile of the area beneath the line was performed. This information, along with the specifications for the conductor (transmission line), and an appropriate sag template, was used to determine the minimum vertical clearance between the conductor and the ground. This minimum vertical clearance was then compared to a drawing, developed by Duke Energy's Electric Transmission Department, that provides the NESC required clearances for various line voltages. Figure 4.9-1 shows a typical view of the measurement of these clearances.

The transmission lines attributable to Oconee as listed in the Oconee Final Environmental Statement [Reference 1, pages 32 and 35] at the time of original licensing are part of the Duke Energy Transmission System. The Duke Energy Transmission System consists of a highly integrated 525 kV and 230 kV loop network. Underlying the 525 kV and 230 kV transmission system is an extensive 100 kV sub-transmission network integrated into the primary system by means of 230/100 kV tie stations. [See the Oconee UFSAR, Chapter 8 Electric Power, Reference 14.]

The transmission lines listed in the Oconee Final Environmental Statement were constructed concurrently with the construction of Oconee and the Keowee-Toxaway Project (FERC Project #2503).[16] These lines connect both Oconee and the Keowee-Toxaway Project plants to the Duke Energy Transmission System. The 230 kV and the

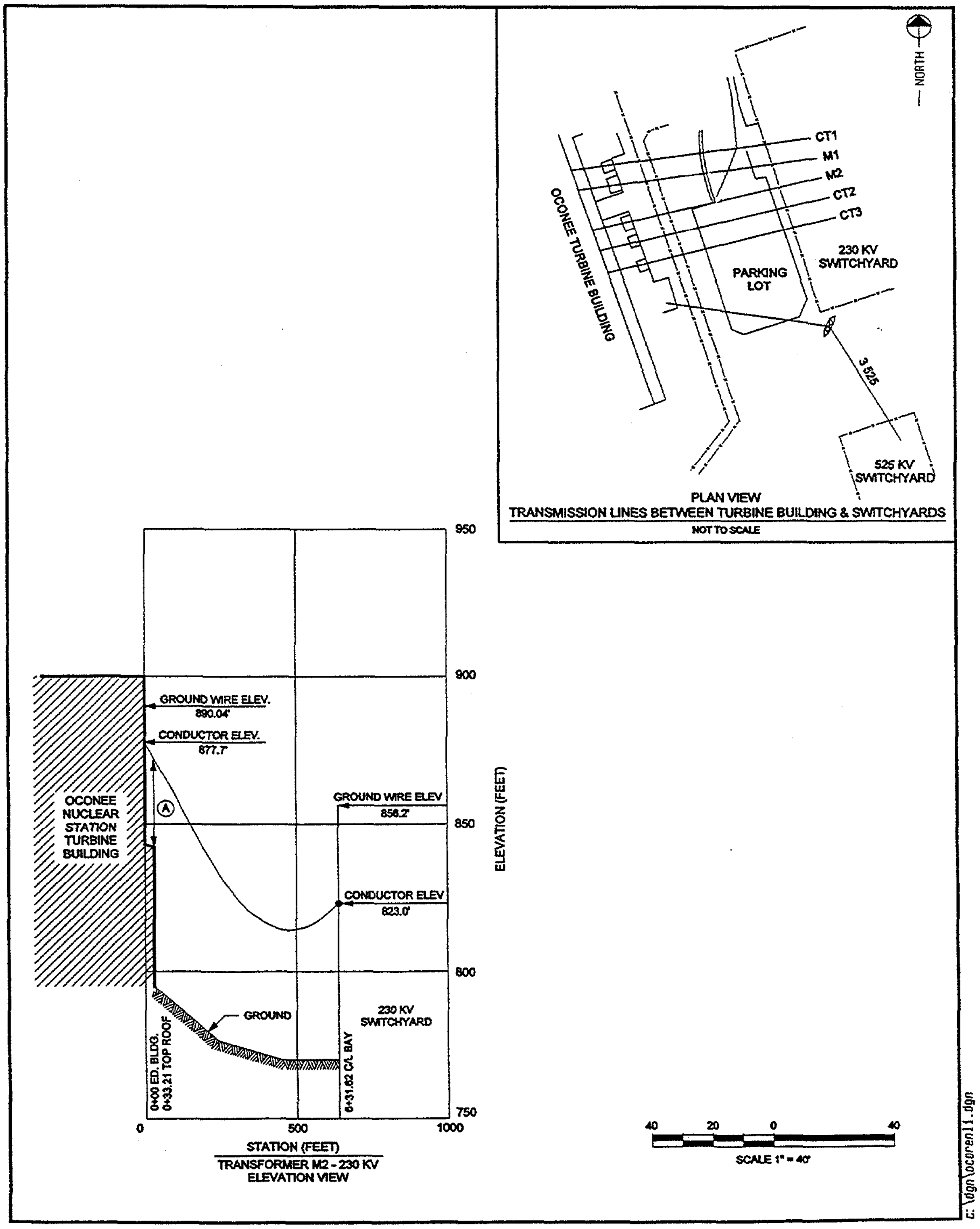
16 The project includes transmission lines, access roads, etc. proposed as part of the original licensing effort. (NUREG-1555, Draft SRP-ER, Introduction Chapter, Definitions, August 1997.)

525 kV Switching Stations located at Oconee are used to connect Oconee to the Duke Energy Transmission System. Additionally, the 525 kV Switching Station at Oconee is the 525 kV connection between Duke Energy and Georgia Power. All of these transmission lines are part of an extensive Duke Energy Transmission System that connects several electrical generation sources to the grid. These transmission lines will remain in service following the termination of operation and the decommissioning of Oconee, unless business needs require otherwise. These transmission lines were constructed to the standards of the National Electric Safety Code 6th Edition, published November 1961. There have been no upgrades in line voltage on these transmission lines since they were constructed.

4.9.5 Consideration of Alternatives For Reducing Adverse Impacts

The transmission lines that connect Oconee plant to the Duke Energy Transmission System meet or exceed the minimum vertical clearance requirements of the most recent (1997) Edition of the NESC. Therefore, pursuant to 10 CFR §51.53(c)(3)(ii)(H), it is not necessary to assess the impact of license renewal on the potential shock hazard from the transmission lines.

Figure 4.9-1 Transmission Lines from Oconee Turbine Building to the Duke Energy Transmission System (Oconee Switchyards)



4.10 Housing, land-use, public schools and public water supply impacts

4.10.1 Requirement [§51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on housing availability, land-use, and public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided. Additionally, the applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

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

> "Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See §51.53(c)(3)(ii)(I)."
>
> "An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See §51.53(c)(3)(ii)(I)."
>
> "Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See §51.53(c)(3)(ii)(I)."
>
> "Impacts may be of moderate significance at plants in low population areas. See §51.53(c)(3)(ii)(I)."
>
> "Significant changes in land-use may be associated with population and tax revenue changes resulting from license renewal. See §51.53(c)(3)(ii)(I)."

4.10.3 Estimates of Workforce During the License Renewal Term

The socioeconomic impacts of license renewal are addressed in the GEIS; in particular see Volume 1, Section 3.7, and Section 4.7. Volume 2 of the GEIS, APPENDIX C (SOCIOECONOMICS) includes the results of a case study, for the area around Oconee Nuclear Station, of the socioeconomic impacts associated with refurbishment activities and continued operation during the license renewal term.

In GEIS APPENDIX C, Section C.4.5, the impact of estimated increases in staff at Oconee is evaluated in terms of the population of Oconee County. Oconee Nuclear Station is located adjacent to the boundary between Oconee County and Pickens County. The 1990 census showed the population of Oconee and Pickens Counties to be 61,605 and 102,407 persons, respectively. The Census Bureau estimate of the 1996 population for Oconee and Pickens Counties is 62,643 and 103,983, persons respectively.

The GEIS assumes that an additional staff of 180 permanent workers will be required during the license renewal period. This evaluation also accounted for indirect employment and for in-migration of workers and their families to Oconee County. The evaluation found that the increase would represent less than 0.1 percent of Oconee County's population in 2013.

Duke has not identified any increases in staffing related to license renewal-related programs. Therefore, there would be no corresponding increase in direct or indirect workers in Oconee County due to the proposed action. Duke accepts the GEIS evaluation as a bounding value for the increase in staff at Oconee during the license renewal term.

4.10.4 Housing Availability - Background

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

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

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

4.10.5 Analysis of Impact of the Proposed Action on Housing Availability

The GEIS, Volume 2, APPENDIX C, Table C.66, indicates that in the year 2013, the projected direct and indirect plant related employment at Oconee will be 1314 persons. This is 3.6 percent of the total Oconee County employment, as indicated in GEIS Table C.67. The GEIS estimated that an additional 180 workers would be required at Oconee during the license renewal period and that this would cause only small new housing impacts. Duke accepts the GEIS evaluation and no further evaluation is required.

4.10.6 Land-Use - Background

The issue evaluated in this section concerns refurbishment-induced changes to local land-use and development patterns. Because the value attributed to land-use changes can vary for different individuals and groups, this analysis does not attempt to conclude whether such changes have positive or negative impacts. The impacts to off-site land-use are considered small if population growth results in very little new residential or commercial development compared with existing conditions and if the limited development results only in minimal changes in an area's basic land-use pattern.

Land-use impacts are considered to be moderate if plant-related population growth results in considerable new residential or commercial development and the development results in some changes to an area's basic land-use pattern. The impacts are considered to be large if population growth results in large-scale new residential or commercial development and the development results in major changes in an area's basic land-use pattern.

Based on predictions for the case study sites, refurbishment at all nuclear plants is expected to induce small or moderate land-use changes. There will be new impacts, but for almost all plants, refurbishment-related population growth would typically represent a much smaller percentage of the local area's total population than did original construction-related growth. Because future impacts are expected to range from small to moderate, and because land-use changes could be considered beneficial by some community members and adverse by others, this is a Category 2 issue. [Reference 2, GEIS Section 3.7.5]

4.10.7 Analysis of Impact of the Proposed Action on Land-Use

Appendix C of the GEIS contains an analysis of land-use for the area around Oconee. This analysis evaluated the direct and indirect land-use impacts resulting from the extension of the license, and concluded that:

> "...the direct land-use impacts of ONS's refurbishment and license renewal term on property in the immediate vicinity of the plant and on Oconee County are expected to be small."

> "In terms of land-use, the new indirect impacts of ONS's license renewal term are expected to be moderate. The effects of license renewal would probably be greater than the direct impacts of the plant's refurbishment and comparable to the indirect impacts of operations under the original 40-year license. ONS's property tax contributions would continue to help local governments improve and expand their municipal services, further defining the county's residential, commercial, and industrial land-use and development pattern. Residential land-use is expected to continue north of Seneca near Lake Keowee as sewer and water lines are extended beyond the city's boundaries. Industrial and commercial growth is expected to continue along Highway 123 in the triangle between Seneca, Walhalla, and Westminster. Because ONS helps promote the region's economic stability, provides a reliable source of power, and allows the county to lower property tax rates while expanding services, it also would continue to be an asset in recruiting industries to the area. Overall, the new indirect land-use impacts of ONS's license renewal term are likely to be similar to the impacts that the plant has had during operations thus far." [Reference GEIS, Volume 2, Appendix C, C.4.5.5.2 Predicted Impacts of License Renewal]

Duke accepts the GEIS evaluation and no further evaluation is required.

4.10.8 Analysis of Impact of Refurbishment Activities on Public Schools

There are no identified major refurbishment activities required for license renewal at Oconee. [See Section 3.2 Plant Modifications or Refurbishments Required for License Renewal.] Therefore, no analysis of the impact of this issue is required.

4.10.9 Public Water Supply - Background

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

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

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

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

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

The impact on public utilities attributable to population increases from the proposed action is evaluated in GEIS, Volume 2, Appendix C, Section C.4.5.4.2 (Predicted Impacts of License Renewal). The following excerpt is from that source:

> "The operations related in-migration is projected to be 41 persons. Adverse impacts, if any, to public services will be small during refurbishment and license renewal term operations. The positive effects on recreation will continue."

There are no identified major refurbishment activities required for license renewal at Oconee. [See Section 3.2] Duke accepts the GEIS evaluation and no further evaluation is required.

4.10.11 Consideration of Alternatives For Reducing Adverse Impacts

The impacts from the proposed action on housing availability, public schools, and public water supply were evaluated in the GEIS and determined to be small. The impacts of the proposed action on land-use were also evaluated in the GEIS. The direct land-use impacts were found to be small, while the indirect land-use impacts were found to be moderate. These identified impacts were found to be favorable and similar to the impacts that Oconee plant operations has had on the community to date. Duke agrees with this determination. Therefore, mitigation measures for reducing or avoiding adverse environmental effects need not be considered.

As discussed in GEIS Appendix C, Section C.4.5, one of the most significant impacts of Oconee, since the start of operations in 1973, has been the amount of property taxes paid by Duke Energy to Oconee County. In 1996, Oconee Nuclear Station accounted for over $10 million in tax revenue for Oconee County. License renewal would allow the county to continue to receive property taxes from the operating nuclear station for up to 20 additional years beyond the current license expiration.

4.11 Local transportation impacts

4.11.1 Requirement [§51.53(c)(3)(ii)(J)]

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

4.11.2 Finding from Table B-1, Appendix B to Subpart A

> "Transportation impacts are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See §51.53(c)(3)(ii)(J)."

4.11.3 Analysis of Environmental Impact

There are no identified major refurbishment activities required for license renewal at Oconee. [See Section 3.2 Plant Modifications or Refurbishments Required for License Renewal.] Therefore, no analysis of the impact of this issue is required.

4.12 Historic and archaeological properties

4.12.1 Requirement [§51.53(c)(3)(ii)(K)]

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

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

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

4.12.3 Background

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

4.12.4 Analysis of Environmental Impact

Duke Energy consulted with the South Carolina State Historic Preservation Office (SHPO) on this issue. The SHPO responded that it knows of no properties included in or eligible for inclusion in the National Register of Historic Properties that will be affected by Oconee license renewal. [See Reference 15]

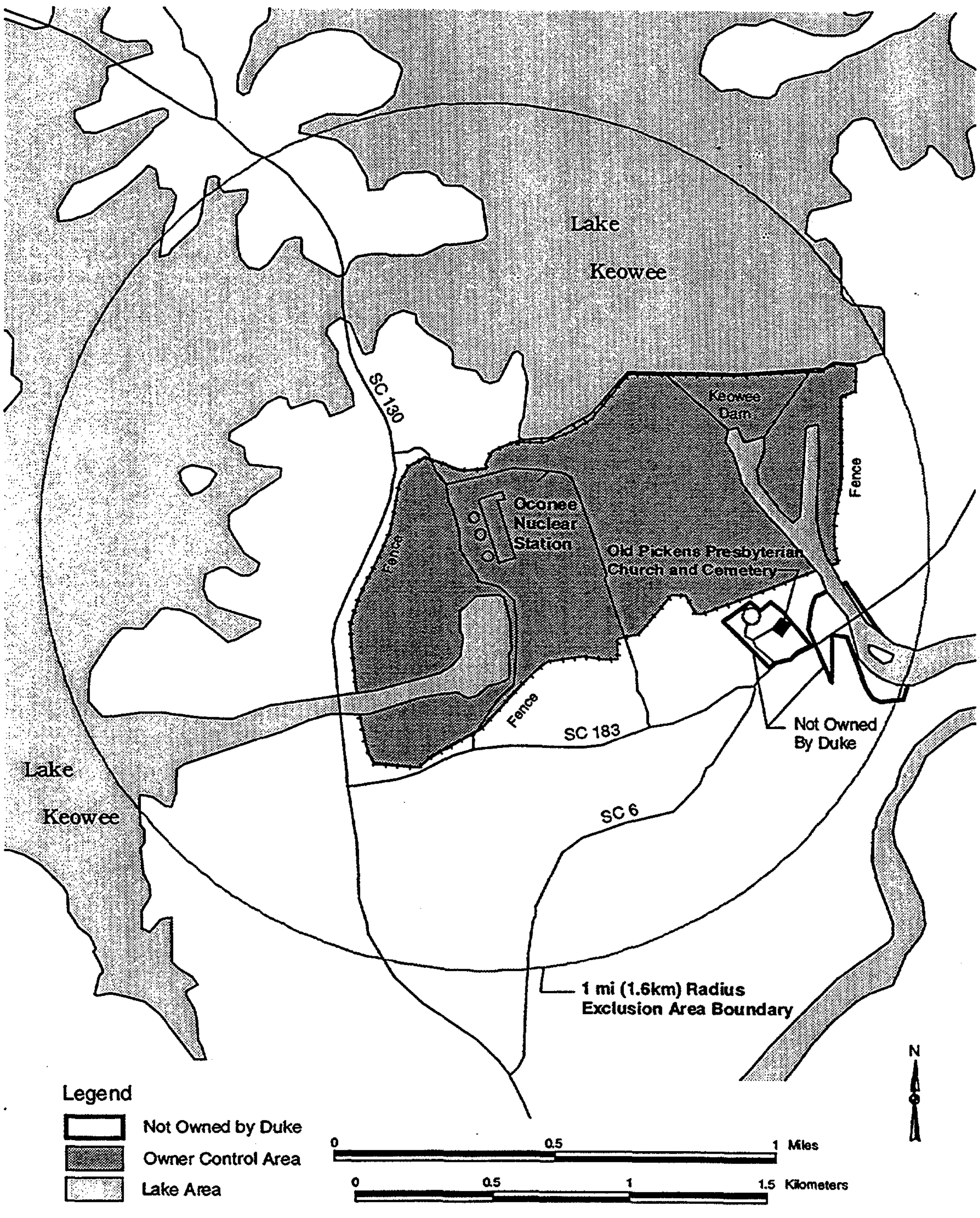
The Old Pickens Presbyterian Church (and Cemetery) is the only historic property within the 1-mile radius of Oconee. [See Figure 4.12-1] In recent years, a group of Oconee employees have worked with members of the Pickens Presbyterian Church, a local Garden Club, a Boy Scout troop, and US Forest Service employees in a cooperative effort to improve the wildlife habitat aspects of the grounds surrounding this church. The church is undergoing renovation, and the property has been listed on the National Register of Historic Places. Continued operation during the license renewal period will not affect this property. No other properties of this type are located within the Oconee site boundary.

4.12.5 Consideration of Alternatives For Reducing Adverse Impacts

Continued operation of Oconee during the period of the renewed license will have no impact on historic or archeological property.

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

Figure 4.12-1 Historic Properties Near Oconee Site



4.13 Severe accident mitigation alternatives (SAMA's)

4.13.1 Requirement [§51.53(c)(3)(ii)(L)]

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

4.13.2 Finding from Table B-1, Appendix B to Subpart A

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

4.13.3 Background

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

4.13.4 Analysis

Duke has performed a number of severe accident studies on Oconee and has implemented several plant enhancements to reduce the risk of severe accidents since the early 1980's. [Reference 16] The results of the Oconee-specific analyses for severe accidents show that the total core damage frequency is estimated at 8.9E-05 per year (internal and external events) and the risk is estimated at 5 person-rem per year. Environmental impacts due to potential severe accidents are considered to be of small significance. Attachment K of the Environmental Report provides a report that summarizes the studies conducted to date at Oconee.

4.13.5 Consideration of Alternatives For Reducing Adverse Impacts

For the current residual severe accident risk, a SAMA analysis has been performed using probabilistic risk assessments (PRA) techniques and making use of industry studies and NRC reports providing guidance on performing the cost-benefit analysis. This analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvements) in excess of $100 to $35,000 are not cost justified based on averted public health risk. Although risk assessment studies are subject to varying degrees of uncertainty in the estimated core damage frequency, person-rem risk, and in the cost to implement alternatives, the results of Duke's analysis show that the cost of implementing any of the alternatives is as much as several orders of magnitude higher than the estimated averted risk values. Therefore, no additional severe accident mitigation alternatives are cost-beneficial even when the uncertainties in the risk assessment process are considered. Attachment K provides a report that summarizes the evaluation of severe accident mitigation alternatives for Oconee.

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

4.14 Transportation of High Level Waste

4.14.1 Requirement [§51.53(c)(3)(ii)(M)]

The environmental effects of transportation of fuel and waste shall be reviewed in accordance with §51.52. The review of impacts shall also discuss the generic and cumulative impacts associated with transportation operation in the vicinity of a high-level waste repository site. The candidate site at Yucca Mountain should be used for the purpose of impact analysis as long as that site is under consideration for licensing.

This regulatory requirement is scheduled to be revised by the NRC, as discussed below.

4.14.2 Finding from 10 CFR 51, Appendix B to Subpart A, Table B-1

> "Table S-4 of this part contains an assessment of impact parameters to be used in evaluating transportation effects in each case. See §51.53(c)(3)(ii)(M)."

4.14.3 Duke Energy Response

As promulgated in 1996, 10 CFR § 51.53(c)(3)(ii)(M) requires license renewal applicants to address in their Environmental Report the generic and cumulative environmental impacts of transporting spent nuclear fuel (SNF) and high-level radioactive waste (HLW) to a DOE geologic repository that may be located at Yucca Mountain, Nevada. However, the Commission has recently authorized the commencement of a Part 51 rulemaking as a "long-term solution" intended to eliminate this requirement from Part 51. This rulemaking will amend Part 51 to re-categorize the HLW transportation issue as a generic (Category 1) issue for purposes of license renewal. [Reference 17] Once the Part 51 amendments become effective, a plant-specific analysis of the environmental impact of HLW and SNF transportation as part of a license renewal applicant's ER will no longer be required.

In the supplementary information accompanying the issuance of Section 51.53(c)(3)(ii)(M) in 1996, the NRC referred to insufficient information and unresolved issues concerning the magnitude of the cumulative impacts arising from the transportation of HLW in the vicinity of the repository; accordingly, the NRC declined to categorize this issue as Category 1 at that time. At the same time, however, the NRC also recognized the generic nature of this issue, and agreed to consider whether further changes to the rule "are desirable to generically address" the issue of cumulative SNF and HLW transportation impacts. [Reference 18]

Based on its additional consideration of this issue, plus its preliminary analysis of DOE information on HLW transportation impacts and the analysis provided in the GEIS, the NRC has recently determined that HLW transportation should be a Category 1 issue and that it "may be generically adopted in a license renewal application." [Reference 19]

For those license renewal applications filed with the NRC before the completion of the above-referenced Part 51 rulemaking, the Commission has directed that a discussion of this topic in the plant-specific ER be required only if a "delay due to the generic rulemaking might affect the licensing process for a license renewal." (SRM M970612). Although Duke's license renewal application for Oconee Nuclear Station was submitted to the NRC before completion of the rulemaking, it would be premature to say at this time that a delay in the completion of the rulemaking has affected the licensing process for Oconee license renewal. Accordingly, Duke has not addressed the existing requirements of Section 51.53(c)(3)(ii)(M) in this ER. Significantly, Duke anticipates that the NRC will initiate this rulemaking later in 1998, which should allow for completion of the rulemaking and promulgation of Part 51 amendments on a schedule that will not delay the Oconee license renewal process.

4.15 Irreversible or Irretrievable Resource Commitments

4.15.1 Requirement [§51.45(b)(5)]

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

4.15.2 Duke Energy Response

The March 1972 Final Environmental Impact Statement (FES) [Reference 1], prepared in connection with the issuance of the original operating licenses for Oconee, evaluated the irreversible and irretrievable commitment of resources associated with the construction and operation of Oconee.

The FES evaluation found that the operation of Oconee will result in some irreversible and irretrievable commitment of resources in terms of local environmental impacts and consumption of materials. The FES evaluation found that "the commitments of these resources are consistent with the objective of attaining the widest range of beneficial uses of the environment." [Reference 1, FES, page 154]

The FES found that there were environmental components of land, air, and water that were irreversibly and irretrievably committed. These were:

a) Land committed for lake bottom, structures, transmission lines, or for other use that would preclude reconversion for a long period of time;

b) Small streams utilized to create the lakes.

The continued operation of Oconee during the extended license term will result in consumption of materials that will be irreversible and irretrievable. These materials will be products of the environment, similar to those listed in the FES. The list includes:

a) Nuclear fuel which is spent and converted into waste radioactive material;

b) Materials used in the normal maintenance of the plant;

c) Elemental materials, including iron, zirconium, and aluminum, which will become, either by themselves or in combinations with other materials, radioactive.

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

4.16 Short-term Use Versus Long Term Productivity

4.16.1 Requirement [§51.45(b)(4)]

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

4.16.2 Duke Energy Response

The period of operation for license extension will not change the short-term uses of the environment from the uses evaluated in the FES. The March 1972 Final Environmental Impact Statement (FES) [Reference 1], prepared for the issuance of the original operating licenses for Oconee, evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of Oconee. The short-term period used in this evaluation was the forty year original license term. The additional twenty year period of operation will not change the evaluations performed in the FES.

The short-term uses of the environment for the period of the proposed action are:

(1) For land:

- (a) Continue to cover by water to maintain lakes.
- (b) Continue to cover for buildings, roads, transportation, communication, and other structures.
- (c) Continue to plant and maintain vegetation for general landscaping purposes and for environmental enhancement.

(2) For water:

- (a) Continue the impoundment of streams to create lakes.
- (b) Continue to be subject to heating.
- (c) Continue to receive the discharge of chemical and other wastes.

(3) For air:

- (a) Continue to be subject receiving gaseous wastes, including radioactive wastes.

As stated in the FES, except for items (1)(a) and (2)(a), the short-term uses of the environment are generally detrimental in some respects. The damage from these other short-term uses is not serious, and the original qualities could be restored in due course. These effects are local in nature and do not appreciably degrade the maintenance and enhancement of long-term productivity of the environment.

The evaluation of the FES for short-term uses (1)(a) and (2)(a) would remain valid for the license extension period. The FES found that the lakes created were :

> "... a beneficial feature. They constitute a new environment which acts to preserve and enhance the overall quality of the natural environment of the region. Furthermore, these same short-term uses have the benefit of controlling floods and thus further act to preserve environmental quality. Conversely, in examining the nature of the effects of building the lakes, it should be noted that if inundation of the land and steams be adverse to future usage, these features can be restored in future generations to their prior productivity." [Reference 1, FES, page 153]

The FES also discussed the "long term productivity inherent in the project." The FES found that :

> "Until effective means are found to utilize the heat that is necessarily wasted in the use thermal energy sources or until a scientific breakthrough actually occurs such as to make possible nonthermal electric power production, large bodies of water will remain important to this use. The environment created for the Station should survive several generations of developments in nuclear power production. Hence the new environment created for this Station establishes the region as a source of electric power for an indefinite future." [Reference 1, FES, page 153]

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

4.17 Unavoidable Adverse Impacts

4.17.1 Requirement [§51.45(b)(2)]

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

4.17.2 Duke Energy Response

Sections 4.2 to 4.14 of this report contain the results of Duke's review and the analyses of the thirteen specific Category 2 environmental impacts, as required by §51.53(c)(3)(ii). These reviews take into account the information that has been provided in the GEIS, Appendix B to Subpart A of Part 51, and information specific to Oconee.

This review and analysis did not identify any significant adverse environmental impacts associated with the continued operation of Oconee Nuclear Station. The evaluation of structures and components as required by §54.21 has been completed. No plant refurbishment activities, outside the bounds of normal plant component replacement and inspections, have been identified as necessary to support continued operation of Oconee beyond the end of the existing operating licenses. As a result of these reviews and analyses, Duke is not aware of any adverse environmental effects that cannot be avoided upon implementation of the proposed project.

4.18 Environmental Justice

4.18.1 Finding from 10 CFR 51, Appendix B to Subpart A, Table B-1

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

4.18.2 Background

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" 59 FR 7629 (Feb. 11, 1994), requires Federal agencies to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects" from their programs, policies, and activities on minority and low income populations. Former NRC Chairman Selin took the position that the NRC, although an independent agency, would comply with this Executive Order and would participate with an Interagency Working Group to develop implementation guidelines.

Guidance on Environmental justice was not available at the time the GEIS was developed, and therefore, is not addressed in the GEIS.

The Council on Environmental Quality (CEQ) is currently developing guidelines on how environmental justice is to be integrated into the National Environmental Policy Act process. When the final CEQ guidelines become available, the NRC has indicated that it will revise its interim guidance on this subject accordingly. Until that occurs, the only NRC guidance available to license renewal applicants on how to address environmental justice is the March 16, 1995 "Interim NRR Procedure for Environmental Justice Reviews" (Interim NRR Procedure). [Reference 20] This procedure is intended to "provide guidance for performing environmental justice reviews on an interim basis until CEQ guidance is received."

At the time this ER was prepared, neither the CEQ final guidance document nor NRC final guidance concerning environmental justice reviews for license renewal applications was available; therefore, Duke used the Interim NRR Procedure in conducting the review and analysis of this issue.

4.18.3 Environmental Impacts from the Proposed Action

As noted above, the consideration of environmental justice is required to assure that federal programs and activities will not have "disproportionately high and adverse human health or environmental effects…on minority populations and low income populations…" Duke's analyses of the thirteen (13) Category 2 issues defined in §51.53(c)(3)(ii) determined that there were no adverse impacts from the renewal of the Oconee licenses. Based on the review of these issues as discussed in Sections 14.2 through 14.14, no review for environmental justice is necessary. However, the following information is presented to assist the NRC review of this issue.

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

The NRC Interim NRR Procedure for Environmental Justice Reviews [Reference 20] was developed to provide interim guidance to the NRC Office of Nuclear Reactor Regulation staff on conducting environmental justice reviews. The criteria in this reference were used to determine if there was a sufficiently large enough minority or low-income population composition in the area adjacent to Oconee to warrant an environmental justice review. This reference requires the staff to:

1. **Identify the environmental impact site(s)** - The Interim NRR Procedure requires that the Staff, using input from the public scoping process and the evaluation of environmental impacts for the EIS, will determine the location of "environmental impact sites for all adverse human health or environmental impacts which are known to be significant or perceived as significant by groups and/or individuals." (Interim Procedure, Section 4, at p. 3) The size of the impact sites will vary depending upon the nature of the impacts, and "should be consistent with the areas used to review environmental impacts in the EIS."
2. **Determine the geographic area to be used for the comparative analysis** - The geographic area is a larger area that encompasses all the environmental impact sites (for example, a county or group of counties).
3. **Determine the minority and low-income compositions within a geographic area** - The minority categories are defined as Black; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; other non-white; and Hispanic origin.[17] The low income composition is determined by using the percentage of households within the geographic area that are below the poverty level. For performing environmental justice reviews, low-income is defined as being below the poverty level as defined by the Census Bureau.
4. **Compare these values to minority and low-income population composition within the environmental impacts site(s) -** The Interim NRR Procedure requires the determination of the minority and low income population in the geographic area using the most recent decennial census. An environmental justice review must be performed if either (a) or (b) is met:
    a) A minority population exists in an environmental impact site if (1) the percentage of minority of the total population within the environmental impact site exceeds the percentage of minority of the total population within the

17 Note that the values for the Hispanic populations may also be included in the values for the white, black, or minority populations.

geographic area by 10 percent or more, or (2) if the percentage of minority of the total population within the environmental impact site is at least 50 percent. A minority population is also defined to exist if more than one minority group is present and the minority population percentage, as calculated by aggregating all minority persons, meets either of the above stated thresholds.

b) A low-income population is considered to be present if the percentage of households below the poverty level in an environmental impact site exceeds the percentage of households below the poverty level for the total geographic area by 10 percent or more.

4.18.5 Environmental Impact Site

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

However, to assist the NRC Staff in its review of this issue, Duke has provided a review of the minority and low-income population within a 10 mile (16.1 km) radius of Oconee. This area was selected to be consistent with the area used for the Emergency Planning Zone at Oconee. There are forty-eight(48) block groups with area centroids in the 10 mile radius (16.1 km). [Figure 4.18-1 Census Block Groups-10 Mile and 15 Mile Radii]

4.18.6 Selection of Geographic Area

Oconee Nuclear Station is located near the boundary between Oconee and Pickens Counties. [See Figure 4.18-1] Although Oconee Nuclear Station is located in Oconee County, the larger geographic area for the evaluation was selected to be an area composed of portions of both counties. The geographic area used in this review is the area within a 15 mile (24.2 km) radius from Oconee. There are eighty-six (86) block groups with area centroids in the 15 mile radius (24.2 km). [Figure 4.18-1 Census Block Groups-10 Mile and 15 Mile Radii]

For comparison purposes, census data on minority populations and low-income populations are presented in the applicable tables for Oconee and Pickens Counties, and the state of South Carolina. Comparison of the data for minority populations and low-income populations shows that the data for the 15 mile (16.1 km) radius for minority populations and for low-income households are representative of that for Oconee and Pickens Counties.

4.18.7 Method to Determine Block Groups Within 10 and 15 Mile Radii

The 1990 decennial census is the most recent source for data at the block group (or even tract) level. Population and income information from the 1990 census for block groups with centroids located in a 10 mile (16.1 km) radius and a 15 mile (24.2 km) radius from Oconee were obtained from the US Census Bureau. The ARCVIEW Geographic Information System (GIS) was used to determine the census block groups with area centroids within the 10 mile (16.1 km) and 15 mile (24.2 km) radii from Oconee, and to extract the minority and low-income population data from data files containing US Census Bureau data. The information for these block groups was then reviewed with respect to the NRR criteria for minority and low-income populations.

4.18.8 Comparison of 1990 US Census Data to More Recent Data[18]

The 1990 decennial census is the most current data at the block group level. There are 1996 estimates at the county level for minority populations. A comparison was performed of the minority population percentages at the block group level for the 1990 Census data to US Census Bureau 1996 estimates of minority population percentages at the county level. As shown in Table 4.18-1, there is no significant difference between the 1990 data and the 1996 estimates.

The 1990 census data is the most current data source for households below the poverty level. There are county level estimates for total number of persons below the poverty level, performed in 1993, but no estimates at the household level. The 1993 estimates for persons below the poverty level are: Oconee County, 12.1 % below the poverty level and Pickens County 12.1% below the poverty level. These compare with the 1990 census data of 11.4 % of Oconee County households below the poverty level and 12.5% of Pickens County households below the poverty level. Since there is no 1996 block group data available for minority and for low-income populations, and since the more recent (1993) data reflects essentially the same percentages for minority and low-income populations, the 1990 data was used for the review.

18 Comparison of 1990 US Census data to more recent data was performed in response to an NRC staff comment on sections of draft Duke Power Environmental Report.

Table 4.18-1 Comparison of Minority Data - 1990 Census Data to 1996 Estimates

	Total Persons	% White	% Black	% American Indian, Eskimo, Aleut	% Asian or Pacific Islander	% Other	% Hispanic Origin
Pickens County (1990)	**93,894**	**91.6%**	**7.3%**	**0.2%**	**0.8%**	**0.1%**	**0.6%**
Pickens County (1996)	**103,983**	**91.1%**	**7.7%**	**0.2%**	**1.1%**	**N/A**	**0.9%**
Oconee County (1990)	**57,494**	**90.5%**	**8.8%**	**0.1%**	**0.3%**	**0.3%**	**0.9%**
Oconee County (1996)	**62,643**	**90.3%**	**9.2%**	**0.1%**	**0.4%**	**N/A**	**1.2%**

Notes:
(1) 1990 data from 1990 US Census Bureau C90STF1A Database
(2) 1996 data from US Census Bureau PPL-79 Estimates of Population of Counties by Race and Hispanic Origin: July 1, 1996

4.18.9 Minority Population Review

The minority population within a 10 mile (16.1 km) radius from Oconee does not meet the NRR criteria requiring an environmental justice review. The percentage of minority population within the 10 mile (16.1 km) radius does not exceed the percentage of minority within the total population of the geographic area by 10 percent or more. The percentage of minority population within the 10 mile (16.1 km) radius does not exceed 50 percent.

Table 4.18-2 compares the percentage of minority populations within a 10 mile (16.1 km) and a 15 mile (24.2 km) radius of Oconee, with the percentage of minority populations for Oconee County, Pickens County, and the state of South Carolina. Table 4.18-4 provides the percentages of minority populations for the individual block groups within a 10 mile radius of Oconee.

Within the 10 mile radius, there are ten block groups that have a percentage of minority that exceeds the percentage of minority population for the geographic area by 10 percent or more. Two of these block groups have minority populations in excess of 50 percent. Five of these block groups are located in Oconee County and five block groups are located in Pickens County. These block groups are located adjacent to and in the municipalities of Seneca and Clemson. [See Figure 4.18-2]

These block groups are located several miles away from the Oconee plant. There are no known environmental pathways by which these minority populations would be disproportionately and adversely affected by the renewal of the Oconee license. However, failure to obtain a renewed license for the plant could have a significant socioeconomic impact on these and other populations. The loss of local jobs and the loss of a significant portion of the $10,000,000/year tax revenue from Oconee Nuclear Station are likely consequences of a renewed license not being obtained.

4.18.10 Low Income Population Review

The low-income population (households) within a 10 mile (16.1 km) radius of Oconee does not meet the NRR criteria requiring an environmental justice review. The percentage of low-income households within the 10 mile (16.1 km) radius does not exceed the percentage of low-income households within the geographic area by 10 percent or more.

Table 4.18-3 compares the percentage of low-income households within a 10 mile (16.1 km) and 15 mile (24.2 km) radius of Oconee with the percentage of low-income households of Oconee County, Pickens County, and the state of South Carolina. Table 4.18-5 provides the percentages of low-income households for the individual block groups within a 10 mile radius of Oconee.

There are eight block groups within the 10 mile (16.1 km) radius with percentages of low income households 10 % or more greater than the percentage found in the larger geographic area. Two of these block groups are located in Oconee County and six block groups are located in Pickens County as shown on Figure 4.18-5.

Block Group 5, Census Tract 011201, is located within 10 miles of the Oconee plant. In this block group, 40% of the households are identified in the 1990 census as having incomes below the poverty level. The 15 mile (24.2 km) radius area has 14.8 % of households with incomes below the poverty level. Oconee and Pickens Counties combined have 13.2% of the households with incomes below the poverty level.

Except for the one block group described above, these other block groups are located several miles from the Oconee plant. There are no known environmental or socioeconomic pathways by which these low-income populations would be disproportionately and adversely effected by the renewal of the Oconee license.

4.18.11 Conclusion

As part of its environmental assessment of this proposed action, Duke has determined that no significant off-site impacts will be created by the renewal of the Oconee licenses. This conclusion is supported by the review performed of the thirteen (13) Category 2 issues defined in §51.53(c)(3)(ii). As the Interim NRR Procedure recognizes, if no significant off-site impacts occur in connection with the proposed action, then no member of the public will be substantially affected. Therefore, there can be no disproportionately high and/or adverse impacts or effects on any member of the public, including minority and low-income populations, resulting from the renewal of the Oconee licenses. In such instances, the NRC does not require an environmental justice review to be performed.

Duke has reviewed the minority and low-income populations within a 10 mile radius of Oconee Nuclear Station to assist the NRC in its review of the environmental justice issue. This review, which applied the criteria found in the NRC's Interim Procedure for Environmental Justice Reviews, determined that, based on this criteria, no environmental justice review is required.

Table 4.18-2 Comparison of % Minority Population - 10 Mile Radius vs. 15 Mile Radius

	Total Persons	% White	% Total Minority	% Black	% American Indian, Eskimo, Aleut	% Asian or Pacific Islander	% Other	% Hispanic Origin
Within 10 Mile (16.1 km) Radius (1)	61,377	87.9%	12.9%	10.7%	0.2%	1.1%	0.1%	0.8%
Within 15 Mile (24.2 km) Radius (1)	106,409	89.0%	11.7%	9.9%	0.2%	0.7%	0.1%	0.8%
Oconee County (2)	57,494	90.5%	10.4%	8.8%	0.1%	0.3%	0.3%	0.9%
Pickens County (2)	93,894	91.6%	9.0%	7.3%	0.2%	0.8%	0.1%	0.6%
Oconee + Pickens County	151,388	91.2%	9.5%	7.8%	0.2%	0.6%	0.2%	0.7%
South Carolina (2)	3,486703	69.0%	31.8%	29.8%	0.2%	0.6%	0.3%	0.9%

Notes:
(1) Source of Data: US Census Bureau 1990 C90STF3A Data
(2) Source of Data: US Census Bureau 1990 C90STF1A Data
(3) Table 4.18-4 provides data on the percentage of minorities in the individual block groups, within the 10 mile (16.1 km) radius

Table 4.18-3 Comparison of % Households Below Poverty Level - 10 Mile Radius vs. 15 Mile Radius

	Total Number of households	Number of households below poverty	Percent of households below poverty
Within 10 Mile (16.1 km) Radius (1)	**21,841**	**3,408**	**15.6%**
Within 15 Mile (24.2 km) Radius (1)	**38,767**	**5,745**	**14.8%**
Oconee County(1)	**22,537**	**3,038**	**13.5%**
Pickens County(1)	**33,424**	**4,653**	**13.9%**
Oconee + Pickens County	**55,961**	**7,691**	**13.7%**
South Carolina (2)	**1,258,783**	**199,131**	**15.8%**

Notes:
(1) Source of data US Census Bureau 1990 C90STF3A Database
(2) Source of data US Census Bureau 1990 C90STF1A Database
(3) Table 4.18-5 provides data on the percentage of low-income households in the individual block groups, within the 10 mile (16.1 km) radius.

Table 4.18-4 Percent of Minority Population - Block Groups within 10 Mile Radius of Oconee Nuclear Station

Source of Data: US Census Bureau 1990 C90STF3A Data

Block group	County	Block Group Total Persons	% White	% Black	% American Indian, Eskimo, Aleut	% Asian or Pacific Islander	% Other	% Hispanic Origin
450730302.00:2	Oconee	1121	100.0%	0.0%	0.0%	0.0%	0.0%	1.2%
450730302.00:3	Oconee	2118	99.7%	0.0%	0.0%	0.0%	0.3%	0.2%
450730303.00:1	Oconee	1482	100.0%	0.0%	0.0%	0.0%	0.0%	0.1%
450730303.00:2	Oconee	922	100.0%	0.0%	0.0%	0.0%	0.0%	0.5%
450730303.00:3	Oconee	1737	100.0%	0.0%	0.0%	0.0%	0.0%	0.3%
450730304.00:1	Oconee	680	99.0%	1.0%	0.0%	0.0%	0.0%	3.8%
450730304.00:4	Oconee	1185	97.6%	0.0%	0.0%	0.0%	2.4%	0.6%
450730304.00:5	Oconee	607	82.9%	17.1%	0.0%	0.0%	0.0%	3.0%
450730304.00:6	Oconee	917	93.7%	5.7%	0.0%	0.0%	0.7%	1.7%
450730304.00:7	Oconee	959	98.1%	1.9%	0.0%	0.0%	0.0%	4.0%
450730305.00:3	Oconee	1443	95.8%	3.7%	0.0%	0.5%	0.0%	0.9%
450730306.00:1	Oconee	951	86.2%	13.8%	0.0%	0.0%	0.0%	0.4%
450730306.00:2	Oconee	1672	95.8%	3.5%	0.0%	0.8%	0.0%	0.3%
450730306.00:3	Oconee	1261	99.4%	0.0%	0.0%	0.0%	0.6%	0.9%
450730306.00:4	Oconee	1302	91.2%	8.2%	0.6%	0.0%	0.0%	0.1%
450730306.00:5	Oconee	1282	97.6%	0.0%	0.0%	2.4%	0.0%	0.1%
450730307.00:1	Oconee	1267	35.2%	64.8%	0.0%	0.0%	0.0%	2.3%
450730307.00:2	Oconee	772	86.1%	13.9%	0.0%	0.0%	0.0%	0.1%
450730307.00:3	Oconee	1114	78.7%	20.4%	0.9%	0.0%	0.0%	1.1%
450730307.00:4	Oconee	1088	85.3%	14.0%	0.0%	0.7%	0.0%	1.7%
450730307.00:5	Oconee	1434	64.4%	35.6%	0.0%	0.0%	0.0%	0.7%
450730307.00:6	Oconee	1536	89.3%	10.2%	0.5%	0.0%	0.0%	0.4%
450730308.00:2	Oconee	1551	77.2%	22.8%	0.0%	0.0%	0.0%	1.0%
450730308.00:3	Oconee	783	93.2%	6.8%	0.0%	0.0%	0.0%	1.0%
450730308.00:4	Oconee	817	29.6%	70.4%	0.0%	0.0%	0.0%	0.1%
450730308.00:5	Oconee	1083	78.2%	21.8%	0.0%	0.0%	0.0%	0.6%
450770102.00:2	Pickens	260	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
450770102.00:3	Pickens	1226	97.9%	2.1%	0.0%	0.0%	0.0%	0.1%
450770103.00:1	Pickens	1011	100.0%	0.0%	0.0%	0.0%	0.0%	0.4%
450770103.00:2	Pickens	1404	99.9%	0.0%	0.1%	0.0%	0.0%	0.3%
450770103.00:3	Pickens	2159	98.7%	0.0%	0.9%	0.3%	0.1%	0.3%
450770111.01:1	Pickens	805	97.9%	2.1%	0.0%	0.0%	0.0%	0.1%
450770111.01:2	Pickens	897	86.2%	13.8%	0.0%	0.0%	0.0%	1.3%

Table 4.18-4 Percent of Minority Population - Block Groups within 10 Mile Radius of Oconee Nuclear Station (Continued)
Source of Data: US Census Bureau 1990 C90STF3A Data

Block group	County	Block Group Total Persons	% White	% Black	% American Indian, Eskimo, Aleut	% Asian or Pacific Islander	% Other	% Hispanic Origin
450770111.02:2	Pickens	871	93.0%	7.0%	0.0%	0.0%	0.0%	0.9%
450770111.02:3	Pickens	1727	72.7%	25.0%	0.8%	1.5%	0.0%	1.0%
450770111.02:4	Pickens	690	60.0%	35.2%	0.0%	4.8%	0.0%	0.3%
450770111.03:1	Pickens	1221	93.0%	6.5%	0.5%	0.0%	0.0%	0.2%
450770112.01:1	Pickens	2094	71.8%	25.5%	0.6%	2.1%	0.0%	1.2%
450770112.01:2	Pickens	564	71.1%	23.4%	0.0%	5.5%	0.0%	1.8%
450770112.01:3	Pickens	1206	90.9%	1.7%	0.7%	6.6%	0.0%	1.1%
450770112.01:4	Pickens	1119	93.9%	0.0%	1.2%	3.7%	1.3%	0.7%
450770112.01:5	Pickens	1647	89.7%	1.0%	0.0%	9.3%	0.0%	0.6%
450770112.02:1	Pickens	6756	88.4%	9.8%	0.0%	1.4%	0.4%	1.2%
450770112.03:1	Pickens	2041	89.0%	8.8%	0.0%	2.2%	0.0%	0.7%
450770112.03:2	Pickens	528	99.1%	0.0%	0.0%	0.9%	0.0%	1.5%
450770112.03:3	Pickens	858	95.1%	0.0%	0.0%	4.9%	0.0%	1.5%
450770112.03:4	Pickens	1209	74.4%	24.0%	0.0%	1.6%	0.0%	0.2%

Table 4.18-5 Percentage of Households Below Poverty Level - Block Groups within 10 Mile Radius of Oconee Nuclear Station
Source of Data: US Census Bureau 1990 C90STF3A Data

Block group	County	Block Group Total Number of households	Number of households below poverty	Percent of households below poverty
450730302.00:2	Oconee	425	55	12.9%
450730302.00:3	Oconee	977	39	4.0%
450730303.00:1	Oconee	543	59	10.9%
450730303.00:2	Oconee	339	45	13.3%
450730303.00:3	Oconee	702	81	11.5%
450730304.00:1	Oconee	309	46	14.9%
450730304.00:4	Oconee	450	47	10.4%
450730304.00:5	Oconee	266	42	15.8%
450730304.00:6	Oconee	313	19	6.1%
450730304.00:7	Oconee	392	84	21.4%
450730305.00:3	Oconee	565	54	9.6%
450730306.00:1	Oconee	392	49	12.5%
450730306.00:2	Oconee	636	38	6.0%
450730306.00:3	Oconee	551	60	10.9%
450730306.00:4	Oconee	455	31	6.8%
450730306.00:5	Oconee	525	25	4.8%
450730307.00:1	Oconee	489	175	35.8%
450730307.00:2	Oconee	316	22	7.0%
450730307.00:3	Oconee	506	138	27.3%
450730307.00:4	Oconee	409	38	9.3%
450730307.00:5	Oconee	563	102	18.1%
450730307.00:6	Oconee	647	85	13.1%
450730308.00:2	Oconee	588	96	16.3%
450730308.00:3	Oconee	331	44	13.3%
450730308.00:4	Oconee	338	13	3.8%
450730308.00:5	Oconee	336	59	17.6%
450770102.00:2	Pickens	95	8	8.4%
450770102.00:3	Pickens	448	65	14.5%
450770103.00:1	Pickens	346	14	4.0%
450770103.00:2	Pickens	548	47	8.6%
450770103.00:3	Pickens	725	44	6.1%
450770111.01:1	Pickens	343	34	9.9%
450770111.01:2	Pickens	330	47	14.2%
450770111.02:2	Pickens	476	123	25.8%
450770111.02:3	Pickens	759	120	15.8%

Table 4.18-5 Percentage of Households Below Poverty Level - Block Groups within 10 Mile Radius of Oconee Nuclear Station (Continued)
Source of Data: US Census Bureau 1990 C90STF3A Data

Block group	County	Block Group Total Number of households	Number of households below poverty	Percent of households below poverty
450770111.02:4	Pickens	285	89	31.2%
450770111.03:1	Pickens	461	88	19.1%
450770112.01:1	Pickens	965	393	40.7%
450770112.01:2	Pickens	299	95	31.8%
450770112.01:3	Pickens	458	141	30.8%
450770112.01:4	Pickens	453	109	24.1%
450770112.01:5	Pickens	648	259	40.0%
450770112.02:1	Pickens	44	13	29.5%
450770112.03:1	Pickens	722	19	2.6%
450770112.03:2	Pickens	208	11	5.3%
450770112.03:3	Pickens	333	35	10.5%
450770112.03:4	Pickens	532	108	20.3%

Figure 4.18-1 Census Block Groups - 10 Mile and 15 Mile Radii

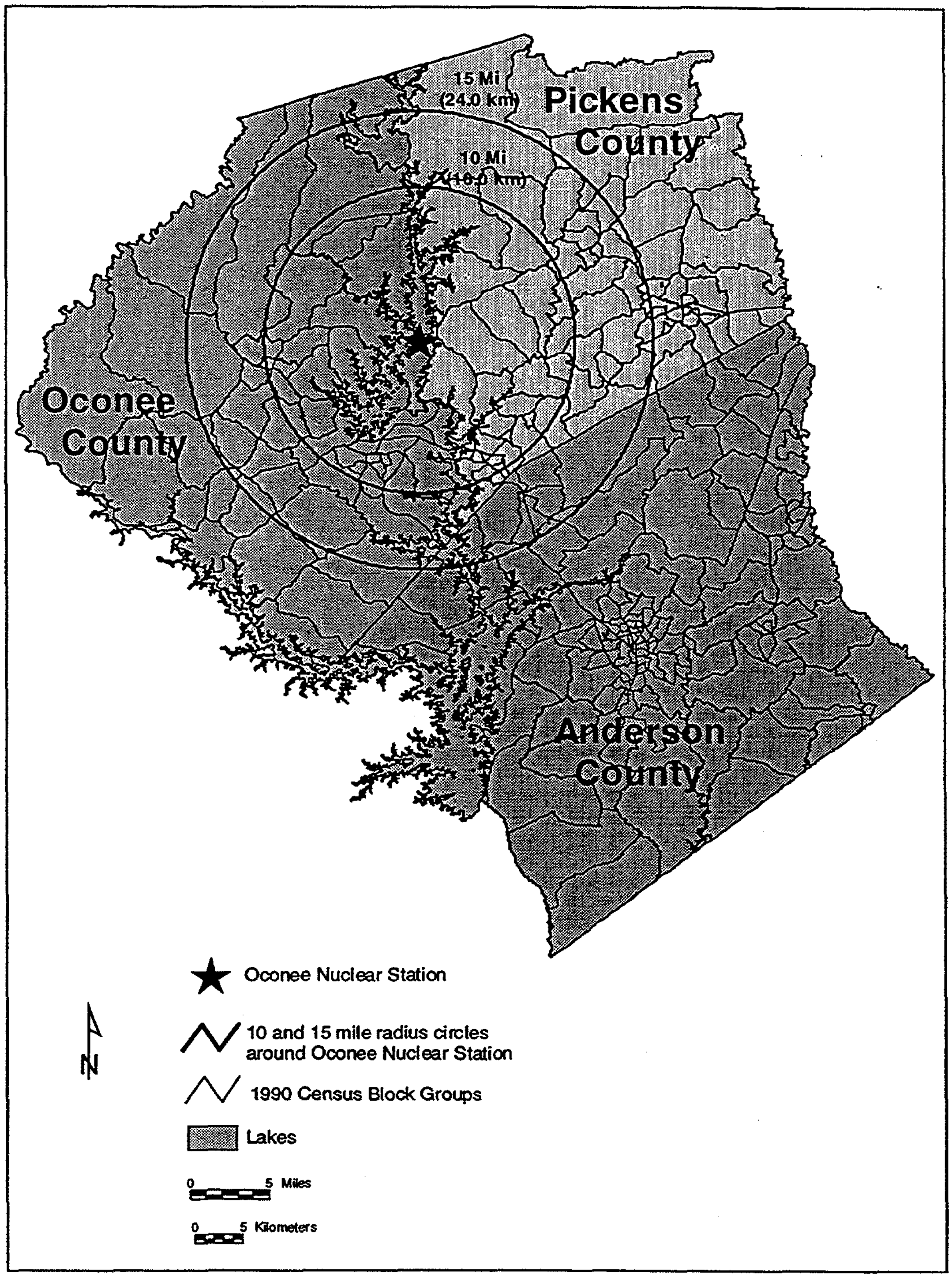


Figure 4.18-2 Block Groups - Minority Population Review

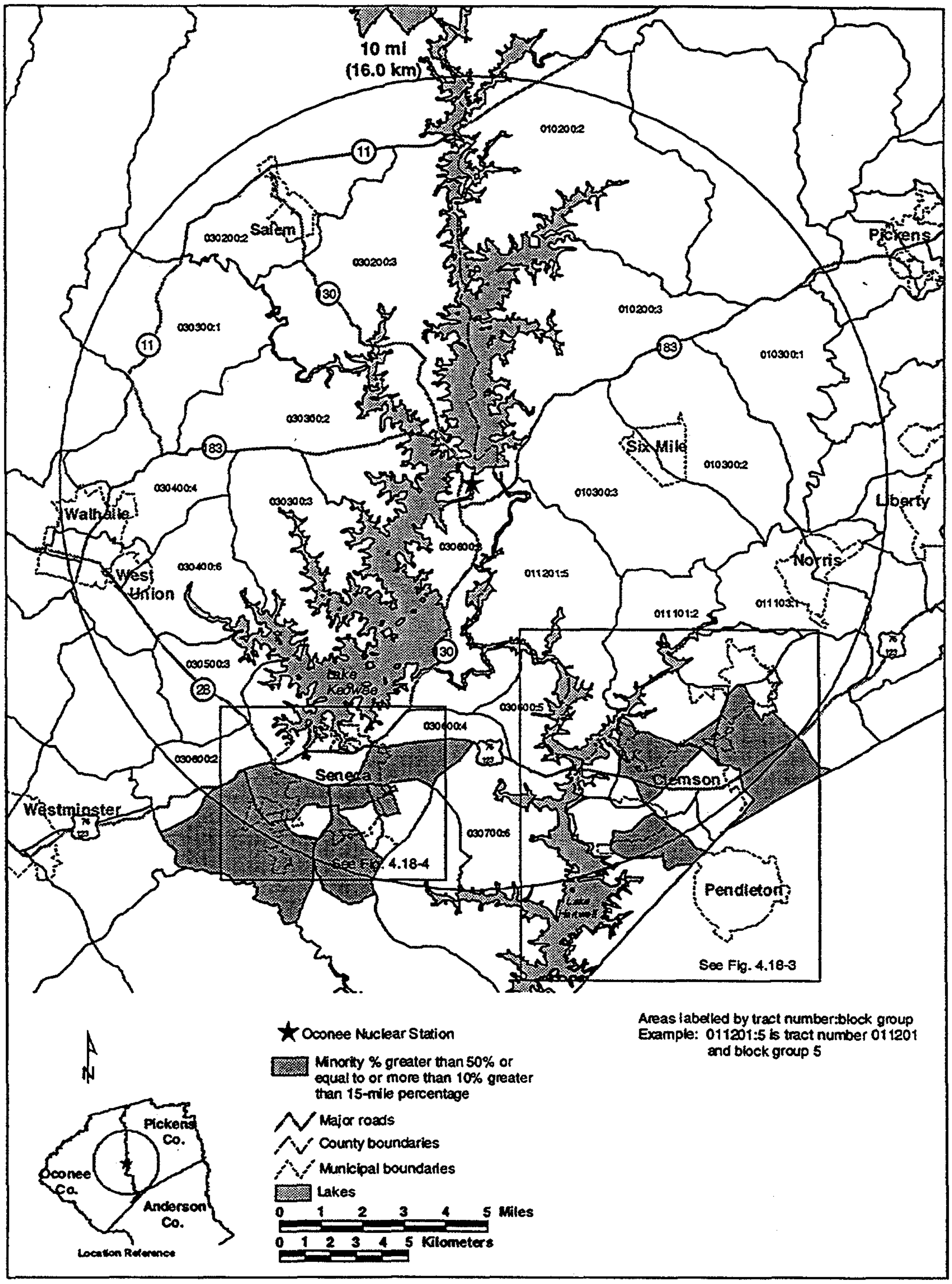


Figure 4.18-3 Block Groups - Minority Population Review

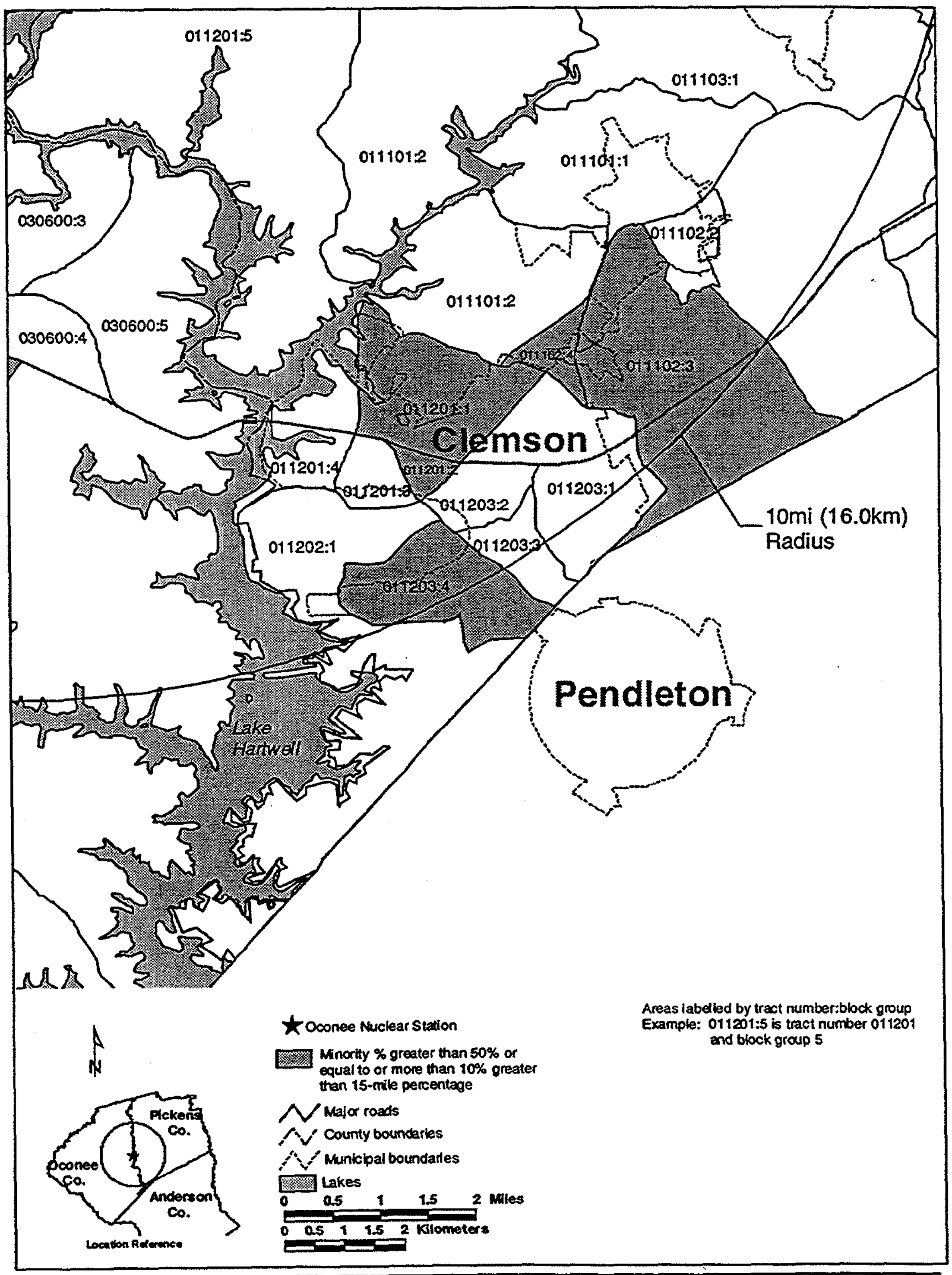


Figure 4.18-4 Block Groups - Minority Population Review

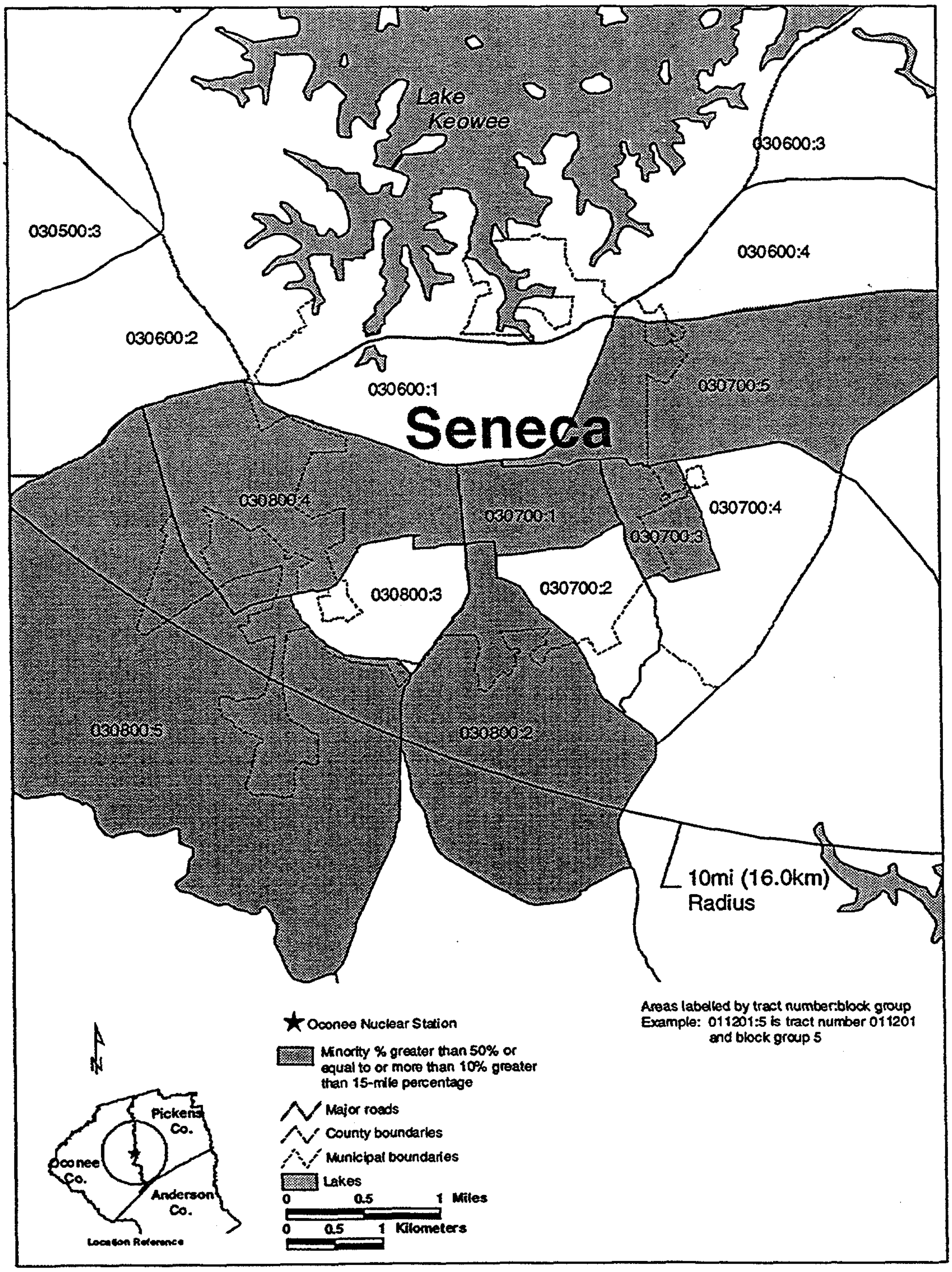


Figure 4.18-5 Block Groups - Low Income Household Review

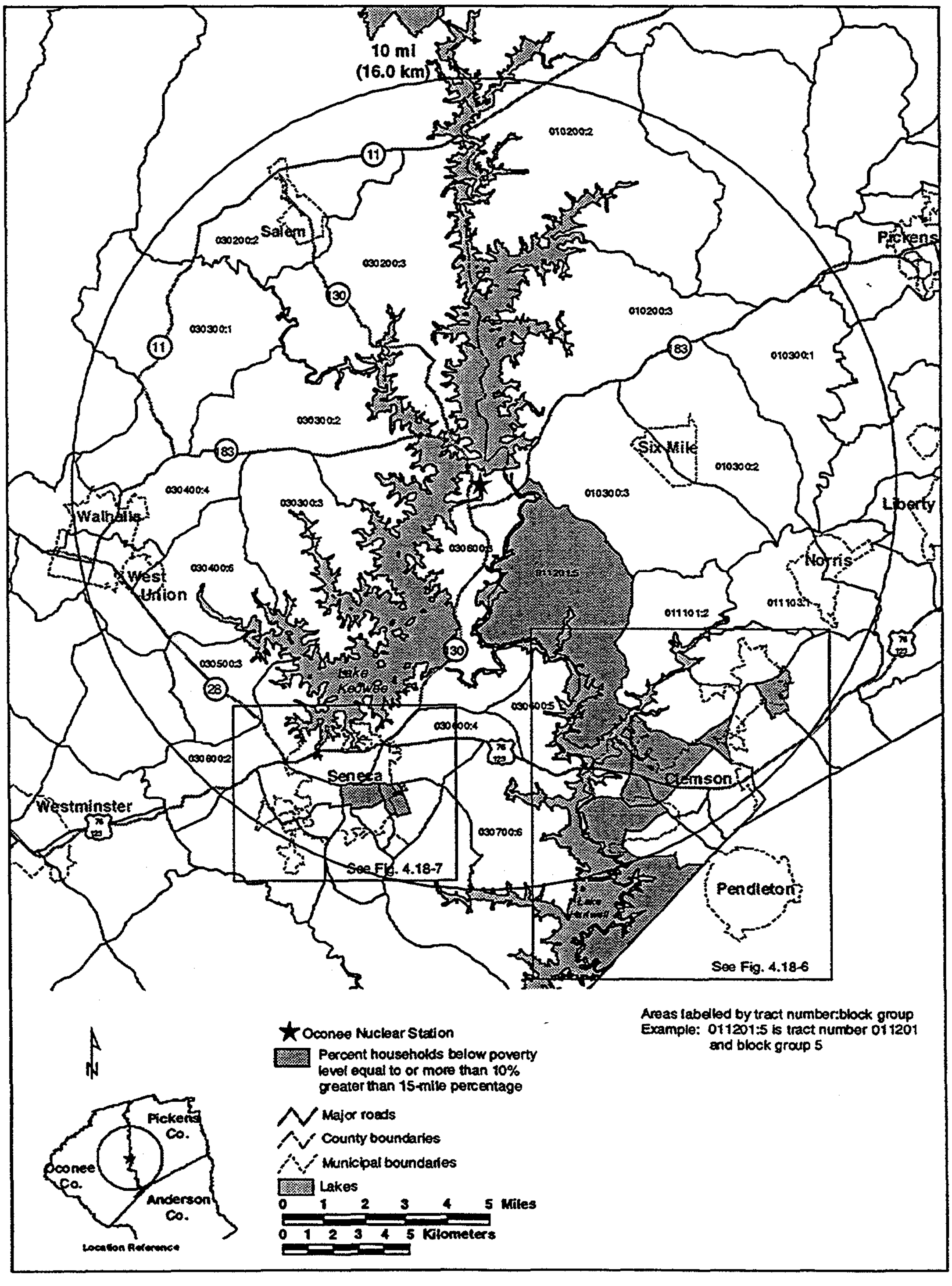


Figure 4.18-6 Block Groups - Low Income Household Review

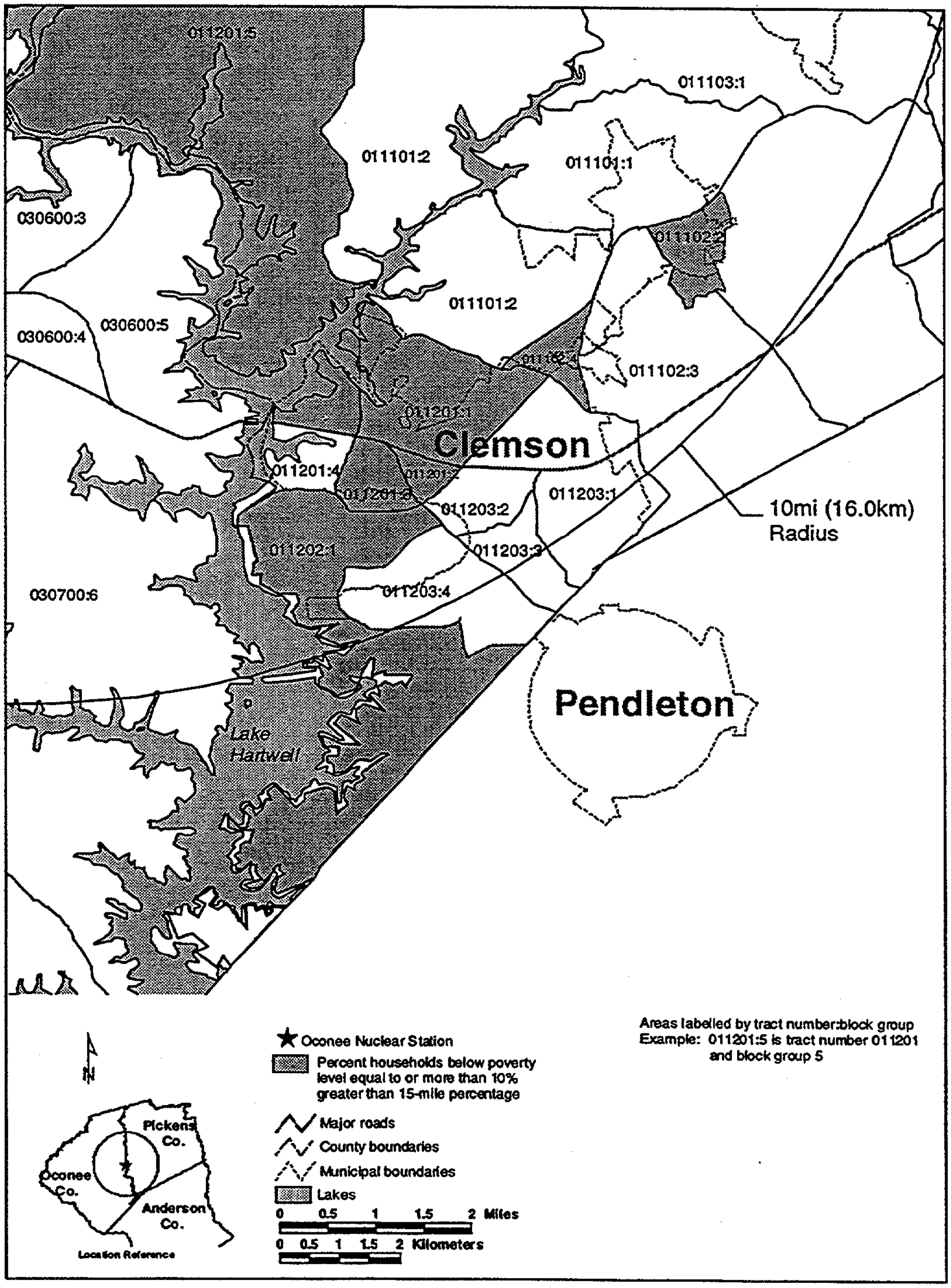
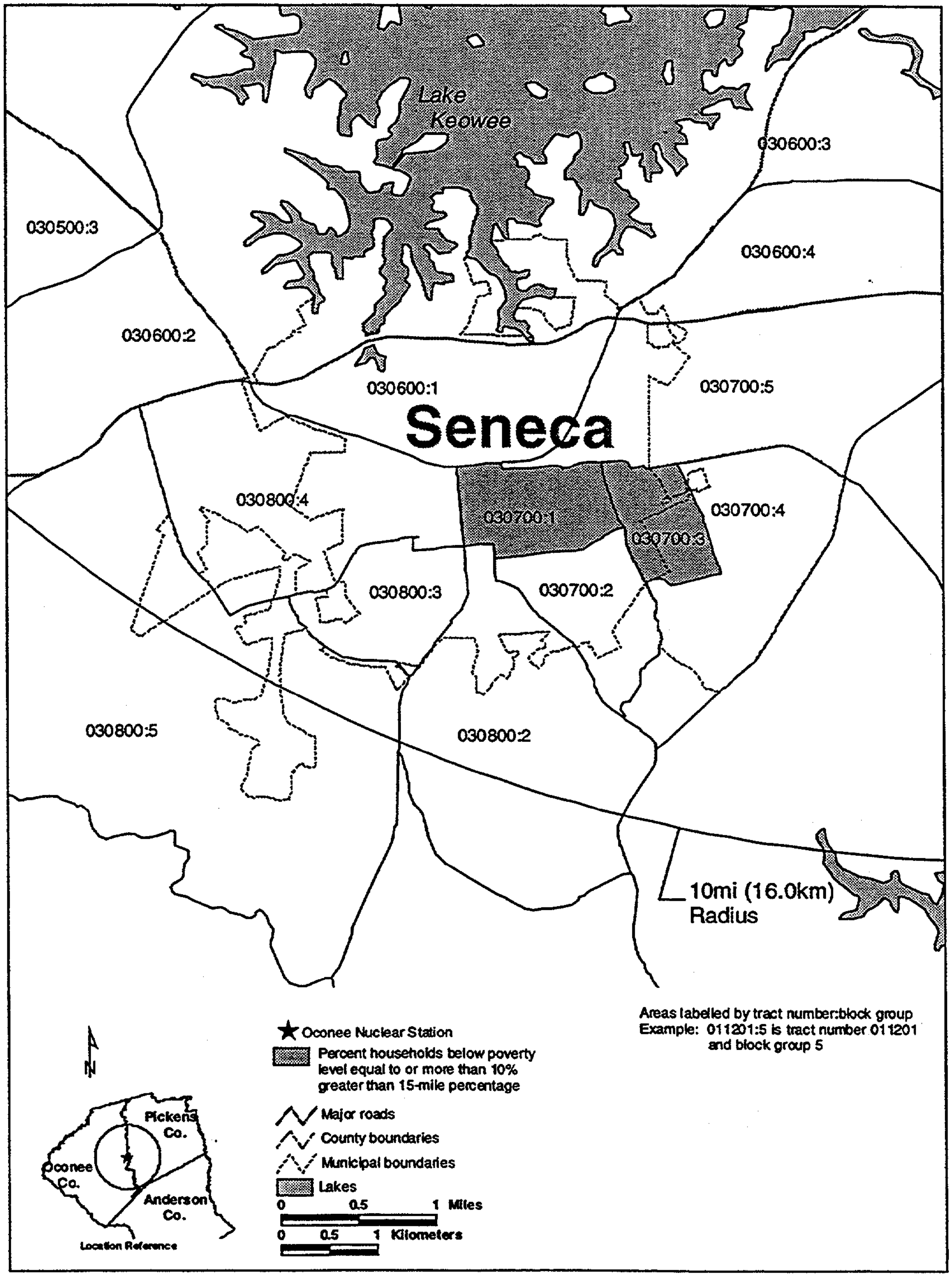


Figure 4.18-7 Block Groups - Low Income Household Review



4.19 New and Significant Information

4.19.1 Requirement [§51.53(c)(3)(iv)]

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

4.19.2 Description of Process

Duke Power has developed the following process in order to ensure that new and significant information regarding the environmental impacts of license renewal for Oconee was properly reviewed prior to submittal of the Environmental Report, and to ensure that new and significant information related to renewal of the Oconee licenses will be identified, reviewed, and addressed during the period of NRC review:

The process has two phases; a review of the environmental issues conducted prior to submittal of the ER, and reviews performed after submittal and during the period of NRC review.

4.19.2.1 REVIEW OF ENVIRONMENTAL ISSUES PRIOR TO ER SUBMITTAL

- A review has been performed of environmental issues applicable to license renewal at Oconee. This review was performed on the Category 1 issues appearing in 10 CFR 51, Subpart A, Appendix B, Table B-1 to verify that the conclusions of the GEIS remained valid with respect to Oconee.
- The review was performed by the appropriate personnel from Group Environment, Health & Safety[19] (Group EHS) and Oconee station personnel. The review will be documented in a report, *Review of Environmental Issues For License Renewal*.

4.19.2.2 REVIEW OF ENVIRONMENTAL ISSUES AFTER ER SUBMITTAL

- Annually, after the submittal of the Applicant's Environmental Report, the report, *Review of Environmental Issues For License Renewal*, will be reviewed by Group EHS and Oconee Site Environmental Management Team personnel to ensure that the initial determinations remain valid. The review will be documented in the report.
- This review process will be repeated at one year intervals until a determination on the Oconee license renewal application is made by the NRC.
- After the submittal of the ER, copies of the ER will be sent to SCDHEC, SCDNR, and USFWS. Discussions with these agencies will be conducted to discuss the license renewal process and to discuss new and significant information regarding the environmental impacts of license renewal. (Informal meetings have been held between

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19 Environmental issues are identified at the company level by Duke Power Group Environment, Health & Safety (Group EHS). This group addresses environmental issues for Duke Power nuclear, fossil, and hydro plants, as well as other Duke facilities.

Duke and the SCDNR, USFWS, and SCDHEC to inform these agencies of Duke's license renewal application submittal and to inform them of the license renewal process.)

- Revisions to the Environmental Report will be made if new issues are identified or if changes to conclusions made in this report are required.
- Time frames and responsibilities for resolution of issues that may be identified through this process will be assigned by the appropriate organization discussed in the following sections.

As a result of this review, Duke is not aware of any new and significant environmental impacts associated with the renewal of the Oconee operating licenses. As noted above, copies of the ER will be sent to the SCDHEC, SCDNR, and the USFWS. Duke will request a meeting with these agencies to discuss the environmental issues associated with license renewal at Oconee. The meetings and results of the discussions will be documented in the report.

4.19.3 Identification and Resolution of Environmental Issues

This section describes the process by which environmental issues are identified for environmental managers at Duke nuclear plants. This section also describes the processes used to track the resolution of environmental issues affecting Oconee.

4.19.3.1 IDENTIFICATION OF ENVIRONMENTAL ISSUES AT THE COMPANY LEVEL

The *Duke Power Environmental Manual* [Reference 21] describes company-wide environmental policies, practices, and standards. The purpose of the manual is to ensure compliance with environmental regulations by promoting consistency of interpretation, implementation, and communications. This manual describes the interface between the stations, Group Environment, Health, & Safety (GEHS), Duke Power Legal, and Duke Power Governmental Affairs. This manual ensures that Duke Power nuclear station environmental managers are made aware of changes in regulations by requiring all revisions to this manual to be reviewed by these managers.

Environmental issues are identified at the company level by Duke Power Group Environment, Health & Safety (Group EHS). This group addresses environmental issues for Duke nuclear, fossil, and hydro plants, as well as other Duke facilities. This group consists of scientists, engineers, and technical personnel involved in environmental compliance, environmental monitoring, environmental planning, natural resource management, environmental engineering, and health and safety issues. The Environmental Protection and Environmental Engineering groups within GEHS are involved in the development and review of regulations. The Environmental Protection group serves as the interface between the regulatory agencies and the Oconee site environmental organization.

4.19.3.2 OCONEE SITE ENVIRONMENTAL MANAGEMENT TEAM

The Oconee Site Environmental Management Team has the primary responsibility for ensuring compliance with environmental regulations and for enhancement of the systems related to environmental issues. Site Environmental Management is responsible for providing environmental support and direction to site groups/individuals for implementing and maintaining compliance/enhancements within their areas. Site Environmental Management provides regulatory interpretations to site groups to enable them to effectively carry out environmental processes. This team is responsible for making first line supervision aware of the appropriate environmental training needed for site personnel. Before changes are made to plant system processes, procedures, and modifications to plant equipment, these changes are reviewed by personnel on this team to determine if there are environmental related impacts from these proposed changes. This team also actively seeks ways to minimize environmental impacts through minimization of wastes generated at Oconee.

4.19.3.3 NUCLEAR PLANT SITE ENVIRONMENTAL MANAGERS MEETINGS

The environmental managers at Duke nuclear plants participate in a team to provide consistent work practices, to improve environmental performance, and to reduce costs. This process is known as the Environmental Management Business Excellence Steering Team (BEST). Members include the Site Environmental Managers of Duke Energy's three nuclear plants and the GEHS Environmental Protection Manager (or designee from GEHS). The team meets at least quarterly and maintains an action item list and minutes of meetings. The scope of review by this team covers all environmental and associated services, systems, processes, products and personnel at nuclear sites and within support organizations. This process helps ensure that items affecting individual plants are brought to the attention of the environmental managers at the other plants.

4.19.3.4 ENVIRONMENTAL PRACTICES AT OCONEE

Several years ago, Oconee established an Environmental Leadership Quality Steering Team (ELQST) to focus on environmental regulatory compliance issues, broad environmental policy direction, and initiatives to minimize plant impact on the environment. The ELQST provides assurance that:

1. Environmental issues at Oconee are addressed in the appropriate time frame;
2. Emerging environmental issues are identified in a timely manner and given the appropriate priority; and
3. Resources are assigned to the environmental issues that add the greatest value to sustaining the environment and achieving compliance, and are the most cost-effective, consistent with the Oconee Operational Plan.

Membership of the ELQST includes the Oconee Site Vice President and managers from several areas at Oconee. It meets periodically (approximately quarterly) to discuss environmental issues of interest and to assign actions as appropriate.

4.19.3.5 ENVIRONMENTAL WORK PRACTICES

Environmental Work Practices (EWP) provide guidance to the site on how environmental processes will be implemented. EWP's provide the guidance and direction that enable the site to comply with federal, state, and local regulations. These work practices are developed by Site Environmental Management with input from the work groups responsible for implementation of the work practice.

4.19.3.6 PROBLEM INVESTIGATION PROCESS

The operation, maintenance, and modification of a nuclear station may result in problems where equipment, process and/or personnel do not perform as expected, unexpected changes occur, or conditions are identified that are inconsistent with requirements or regulations. The Problem Investigation Process (PIP) is a process by which problems are identified, documented, and responded to with a level of effort and timeliness commensurate with their significance. In addition to tracking the resolution of events, the process is used as a predictive tool to help prevent future problems that may lead to environmental incidents.

4.19.3.7 NUCLEAR SYSTEM DIRECTIVES

The *Duke Power Nuclear Policy Manual* provides direction and requirements on various policy matters concerning operation and maintenance of Duke nuclear plants through Nuclear Station Directives (NSD's). NSD's provide minimum requirements to promote consistency among the nuclear sites, the Nuclear General Office and other departments, as applicable, in fulfilling licensing and administrative requirements. NSD's address the department's or company's position on issues as they arise in the nuclear industry or as Duke experience indicates the need for a more definitive policy statement. NSD's also provide instructions and minimum requirements for the implementation of various work activities.

NSD 111, Nuclear Environmental Management, outlines the philosophy, responsibilities, and methods Oconee, McGuire and Catawba Nuclear Stations will use to support the Environmental Leadership Principles of Duke Power Company. A copy of the current version of NSD-111 is provided as Attachment O. [Reference 22]

5. ALTERNATIVES CONSIDERED

5.1 Introduction

The NRC regulations require that an applicant's environmental report discuss alternatives to a proposed action. [§51.45(b)(3)] The intent of this review is to enable the Commission to consider the relative environmental consequences of the proposed action given the environmental consequences of other activities that also meet the purpose of the proposed action, as well as the environmental consequences of taking no-action at all. [Reference 2] For the purposes of license renewal, there are only two alternatives that meet the purpose of the action: the renewal of the operating licenses or the decision not to renew the operating licenses. This section identifies the alternatives considered.

5.2 Proposed Action

The proposed action is the renewal of the operating licenses of each of the three Oconee units. This action would provide the opportunity for Duke to continue to operate Oconee through the 20-year term of the renewed licenses, expiring in 2033 and 2034.

The review of the environmental impacts as required by §51.53(c)(3)(ii) was provided in Chapter 4. Based on these reviews, Duke has concluded that there would be no adverse impact to the environment from the continued operation of Oconee through the license renewal period (until 2034).

5.3 No-action Alternative

The no-action alternative to the proposed action is a decision not to renew the original operating license for each of the three units of Oconee Nuclear Station. In the event that the operating licenses of Oconee are not renewed, it is expected that Oconee will continue to operate up to the end of the existing operating licenses. A decision not to seek a renewal license would necessitate the replacement of the 2538 MW(e) with some other type of generation. The environmental impacts of the no-action alternative would be the impacts associated with the type of replacement power utilized. Because the environmental impacts would be transferred from one location to another, there would be no net benefit to the no-action alternative. The environmental impacts of these various types of replacement power are discussed in Chapter 6. In addition, there would likely be adverse financial and socioeconomic impacts from the decision not to renew the license, including local unemployment, loss of local property tax revenue, and higher energy costs.

5.4 Decommissioning

Every nuclear power plant is required to submit decommissioning plans within two years following permanent cessation of operation of each reactor or at least five years before expiration of each operating license, whichever occurs first, pursuant to the requirements of §50.54(b). Plant shutdown can occur anytime during the term of the operating license, regardless of whether or not the license has been renewed. The only difference between shutting down under the present operating licenses and shutting down during the renewal operating license period is the timing of the decommissioning activities. The environmental impacts of the termination of operations and decommissioning are addressed in Sections 8.4 of the GEIS. [Reference 2] In addition, NUREG-0586 [Reference 23] provides an analysis of the environmental impacts from decommissioning. The environmental impacts of the termination of operations and decommissioning of Oconee are expected to be comparable to those environmental impacts described in these two NRC documents.

The termination of Oconee operation would have a positive impact on the water resources in the area due to the discontinuation of the thermal discharges and other industrial and low-level radioactive liquid discharges. This positive impact would exist provided that another generating facility, using the same water resources, is not located on this site in the future.

As noted in Section 4.9 of this ER, the transmission lines attributable to Oconee (other than the transmission lines connecting the turbine buildings to the 230 kV and 525 kV switchyards) listed in the Oconee Final Environmental Statement [Reference 1, pages 32 and 35] are part of the Duke Energy Transmission System and would remain in service.

The termination of the operation of Oconee would eliminate the production of low level and high level radioactive waste; however, the decommissioning would generate a large volume of waste. The termination of plant operations could have significant adverse impacts on the economic structure and tax base of communities surrounding the plant, due to the loss of the taxes from the facility and to the loss of direct and indirect jobs associated with Oconee.

5.5 Alternatives

As stated in NUREG-1437, Vol. 1, Section 8.1, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable". [Reference 2] Accordingly, for the purposes of the review of alternative energy sources for Oconee, the following alternatives were <u>not</u> considered as reasonable replacement power:

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

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

- High land-use impacts - Some of the technologies listed above would require a large area of land and would thus require a green field siting plan. This would result in a greater environmental impact than continued operation of Oconee.
- Low capacity factors - Some of the technologies identified above are not capable of producing 2500 MW(e) of power due at high capacity factors. These generation technologies are used as peaking power sources, as opposed to base load power sources, and for this reason are unlike resources.
- Geographic availability of the resource - Some of the technologies are not feasible because there is no feasible location in the Duke Service area.
- Emerging technology - Some of the technologies have not been proven as a reliable and cost effective replacement of a large generation facility. Therefore, these technologies are typically used with smaller (lower MW(e)) generation facilities.
- Availability - There is no assurance of the availability of imported power.

For the purposes of this review of alternatives to the proposed action, conventional coal fired, oil and gas fired combined cycle, and nuclear base load generating sources are considered to be currently available conventional base load technologies that would be considered to replace Oconee generation upon the termination of operation. This assumption is based on the information concerning supply-side resources alternatives contained in Chapter 2 of the Duke Power Integrated Resource Plan for 1997. [Reference 24] The comparison of the environmental impacts of these technologies is discussed in detail in Chapter 6.

6. COMPARISON OF IMPACTS

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

- The goal of the proposed action (license renewal) is the production of 2500 MW(e) of base load generation. The alternatives that do not meet the goal are not considered in detail.
- A reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only those electric generation sources that are technically feasible and commercially viable. [Section 8.1, GEIS Reference 2].
- The time frame for the needed generation is 2013 through 2034.
- Power purchase is not considered as a reasonable alternative because there is no assurance that the capacity or energy would be available. [See Section 6.3 (Reasonable Alternative Energy Sources) for more detail.]
- The average annual capacity factor of Oconee Nuclear Station is 78%. The capacity factor is expected to remain at least this value throughout the plant's operating life.
- The Commission decision regarding the issuance of the renewal operating licenses for Oconee occurs within approximately five years after the submittal of the application for renewal.

6.1 Alternatives Not Within the Range of Reasonable Alternatives

As stated in NUREG-1437, Vol. 1, Section 8.1, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable". [Reference 2] The commonly known generation technologies considered reasonable by NRC are listed in the following paragraphs. However, these sources have been eliminated as "reasonable alternatives" to the proposed action because the generation of 2500 MW(e) of electricity as a base load supply utilizing these technologies is not technologically feasible. [Reference 2]

Wind

The average annual capacity factor for this technology was estimated at 21 % in 1995 and is projected to be 29% in 2010. This low capacity factor, compared with current base load technologies (Oconee's is 78%), results from the high degree of intermittency of wind energy in many locations (DOE/EIA-0561). Current energy storage technologies are too expensive to permit wind power plants to serve as large base load plants. Wind energy has a large land requirement, approximately 150,000 acres (61,000 ha) of land to generate 1000 MW(e) of electricity. This eliminates the possibility of co-locating a wind energy facility with a retired nuclear plant. A green field siting plan would be required. This would have a large impact upon much of the natural environment in the affected areas. [GEIS, Section 8, Reference 2]

Photovoltaic Cells

The average annual capacity factor for Photovoltaic (PV) Cells is estimated at 25% (Oconee's capacity factor is 78%). The use of PV cells for base load capacity requires very large energy storage devices that are not feasible to use to store sufficient electricity to meet the base load generating requirements. This is very high cost generation, which prevents it from being competitive. This technology also has a high land-use impact which, like the wind technology, results in a large impact to the natural environment. It is estimated that 35,000 acres (14,000 ha) of land would be required to generate 1000 MW(e). [GEIS, Section 8, Reference 2]

Solar Thermal Power

The average capacity factor for this technology is estimated to be between 25% and 40% annually (Oconee's is 78%). This technology, like PV cells, has high capital costs and lacks base load capability unless combined with natural gas backup. It requires very large energy storage capabilities. Based upon solar energy resources, the most promising region of the country for this technology is the West. Land-use requirements again are high, 14,000 acres (6000 ha) for 1000 MW(e), which would result in large environmental impacts to the affected area. [GEIS, Section 8, Reference 2]

Hydroelectric Generation

Hydroelectric generated power has an average annual capacity factor of 46% (Oconee's is 78%). The capacity factor depends, to a large degree, on a combination of head and available water flow. A large scale hydroelectric plant of l000 MW(e) would require approximately 1,000,000 acres (400,000 ha) of land, resulting in large environmental impacts. This option is not practical due to the large loss of environmental habitat. There is also no feasible location in the Duke service area. [GEIS, Section 8, Reference 2]

Geothermal

A geothermal electricity generating facility has an average annual capacity factor of approximately 90% and can be used to provide reliable base load power. Geothermal plants may be located only in certain areas, such as the western United

States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. This technology is not widely used as base load generation due to the limited geographic availability of the resource and the immature status of the technology. This technology is not applicable to the region where the replacement of 2500 MW(e) is needed. There is no feasible location for geothermal generation within the Duke service area. [GEIS, Section 8, Reference 2]

Wood Waste (Biomass)
A wood burning facility can provide base load power and operate with an average annual capacity factor of around 70 - 80% and with 20 - 25% efficiency. The cost of the fuels required for this type of facility is highly variable and very site specific. Among the factors influencing costs are the environmental considerations and restrictions which are influenced by public perceptions, easy access to fuel sources, and environmental factors. The rough cost for construction of this type of facility in the Oconee area, where 2500 MW(e) is needed, is approximately $2400/kW. Economics alone eliminate biomass technology as a reasonable alternative. [GEIS, Section 8, Reference 2]

Municipal Solid Waste (MSW)
The initial capital costs for this technology are much greater than the comparable steam-turbine technology found at wood waste facilities. This is due to the need for specialized MSW handling and waste separation equipment and stricter environmental emissions controls. These facilities are typically used when landfill space is not available for handling the waste disposal needs of a community. High costs prevent this technology from being economically competitive. Thus, municipal solid waste generation is not a reasonable alternative. [GEIS, Section 8, Reference 2]

Energy Crops
This technology is comparable to the wood waste facilities. This technology is not currently cost competitive with fossil-fired alternatives. Energy crops are considered an emerging technology, not economically practicable, and are not a reasonable alternative to the license renewal. [GEIS, Section 8, Reference 2]

Delayed Retirement of Non-Nuclear Units
Duke Power's 1997 Integrated Resource Plan (IRP) [Reference 24] discusses the strategy for meeting the overall future energy needs for the next 15 years. The IRP discusses decision dates (as opposed to retirement dates) for the following proposed combustion turbine generation requirements: 303 MW(e) in 2004; 88 MW(e) in 2005; 85 MW(e) in 2006. The IRP also discusses the retirement of the following fossil generation: 276 MW(e) in 2010 and 438 MW(e) in 2011. The

period of time evaluated by the IRP does not extend to the retirement dates for Oconee (2013 and 2014).

However, the delayed retirement of the above generation sources could not be used to replace the 2500 MW(e) generated at Oconee. Combustion turbines (CTs) and small fossil units are used for peaking and intermediate generation. Therefore, it would not be feasible for the combustion turbines and the fossil units listed above to replace base load generation. Additionally, it is unlikely that these fossil units could economically operate for an additional 20 years after the current decision dates.

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

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

Imported Power
Duke currently uses purchased power contracts and/or options as part of the Integrated Resources Plan (IRP). For the purposes of this evaluation, the power purchase option is not considered a reasonable replacement for the license renewal alternative. This is due to the fact that there is no assurance that sufficient capacity or energy would be available in the 2013 through 2034 time frame to replace the 2500 MW(e) base load generation.

Conservation
Demand-side measures have been included in the past IRP's and Duke currently has several general demand side actions planned. [Reference 24 1997 Short-Term Action Plan, Integrated Resource Planning] These measures are discussed below:

Focus on Education - To help maintain competitive electricity rates, Duke is shifting the energy efficiency focus from an emphasis on large, high-cost incentive-based energy efficiency options to less costly education-based options.

Implementation of Demand Side Competitive Bidding - Duke assessed the potential benefits of paying a third-party or customer to design and or market demand side resource options. Duke has entered into contracts with four of the bidders for a total projected resource of 4.7 megawatts.

Implement Demand Side Resources - Demand side options currently used at Duke include the following:

- Energy Efficiency - High Energy (HE) compressed air systems and HE motor systems and replacements
- Interruptibles - Residential load control rider - A/C and water heating, power service rider, generator control rider
- Load shifts - Residential water heating- controlled/submetered
- Strategic sales - Electrotechnology strategy, HE food service appliance, Nonresidential space heating
- Energy Efficiency and Strategic Sales - New residential housing program, existing residential housing program and nonresidential heat pump program.

Currently, the demand side measures are expected to account for 950 MW(e) in 1999. This number is projected to decrease to approximately 750 MW(e) in 2004. The demand side measures are included in the growth projections. For the purposes of this evaluation, the conservation option is not considered a reasonable replacement for the license renewal alternative.

6.2 Comparison of Environmental Impacts for Reasonable Alternatives

As stated in the GEIS, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable." [Reference 2, page 8-1] Below is a discussion of the supply side alternative energy technologies that Duke would likely utilize if the decision is made not to extend the license period for Oconee. These alternatives are considered to be within the range of alternatives capable of meeting the goal of 2500 MW(e) as base load generation (replacement power for Oconee).

For the purposes of this comparison of impacts of alternatives to the proposed action, conventional coal fired, oil and gas fired combined cycle, and nuclear base load generating sources are considered to be currently available conventional base load technologies that would be considered to replace Oconee generation upon its termination of operation. This assumption is based on the information concerning supply-side resources alternatives contained in Chapter 2 of the Duke Power Integrated Resource Plan for 1997. [Reference 24]

The environmental impacts discussed in this chapter are for the construction and operation of these generation facilities. The impacts discussed do not include the additional environmental impacts from obtaining and transporting the fuel sources associated with these facilities.

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

6.2.1 Conventional Coal Fired Units

The United States currently has an abundant supply of low cost coal. For this reason, fossil fired technology has been considered a reasonable alternative energy source. However, the Clean Air Act of 1990 has made it increasingly expensive to operate these types of facilities. The initial capital cost for construction of a conventional coal fired unit is approximately $800/kW; the operation and maintenance (O&M) costs are approximately $3.65/MW/hr. The environmental impacts from the construction and operation of a conventional coal fired plant are summarized in Table 6.4-1.

A trade-off of water quality impacts would be associated with a 2500 MW(e) base load coal unit. New base load coal units would likely utilize closed loop cooling towers which would lessen the thermal impact. However, evaporation from the cooling towers would be greater than the 16,000 gpm of forced evaporation associated with Oconee's surface discharge. There are no low-level radioactive waste discharges to surface water associated with a coal unit.

The solid wastes generated by a conventional coal fired plant would be flyash, bottom ash, Selective Catalytic Reduction (SCR) catalyst (used for NO_x control), and SO_2 scrubber sludge/waste. A coal facility of this size would generate approximately 700,000 tons per year of ash. Approximately 90% of this would be flyash and 10 % would be bottom ash, dependent on the type of coal burned, the type of emission control equipment used, etc. The SCR would generate approximately 8000 ft^3 of spent catalyst material per year. This catalyst material would have high concentrations of metals that are removed from the fly ash. A new coal fired facility would also require SO_2 scrubbers to be installed as emission control equipment. This would result in the generation of approximately 387,000 tons per year of scrubber sludge.

The largest environmental impact from this type of generation would result from the air emissions. A conventional coal fired facility of this size would emit roughly 13,000 tons per year of sulfur dioxide, 13,000 tons per year of nitrogen oxides, 1,800 tons per year of particulate matter, 1,800 tons per year of carbon monoxide, 210 tons per year of volatile organic compounds, and 18 million tons per year of carbon dioxide. Trace elements such as mercury, arsenic, chromium, beryllium, and selenium in the form of particulates and vapor would be emitted in small quantities.

This energy source is not the most economical option that exists today. For this reason, a conventional coal fired plant would not be considered as the first choice if license renewal were not pursued for Oconee.

The issue of "Global Warming" is an obstacle to the utilization of coal as a reliable and long term energy source. In a draft treaty developed December 10, 1997 in Kyoto Japan, the United States agreed to reduce the emissions of greenhouse gases (including CO_2) to 7% below the 1990 levels. This reduction would be phased in between the years of 2008 and 2012. If this treaty is ratified and the legislation is passed that requires a reduction of this magnitude, the expanded use of coal as a reliable energy source may become impracticable due to restrictions on the levels of CO_2 emitted and the expected carbon taxes or emission caps. Other obstacles to the utilization of coal as a reliable and long term energy source are the new EPA 8 hour ozone standard (which is impacted by NO_x emissions), the new EPA $PM_{2.5}$ (particulate matter with a nominal size of less than 2.5 microns), and Regional Haze rules (which are impacted by SO_2). Duke Energy does not believe it practical to consider the use of coal as a source of energy for alternative generation due to the adverse impacts of expected carbon taxes or emission caps.

In summary, a conventional coal fired coal facility could be a potential replacement for Oconee's 2500 MW(e) based load generation. However, the air quality impacts would be greater than the impacts from continued operation of Oconee, and the continued economic use of coal is uncertain due to the "global warming" issues. As shown in Table 6.4-1, the construction of a new facility would result in greater environmental impacts than the impacts associated with the proposed action (license renewal).

6.2.2 Oil and Gas (Combined Cycle)

Oil as a resource is not considered as a stand alone fuel because it is not price competitive when natural gas is readily available. The capital cost for this type of facility is roughly \$380/kW, with an operation and maintenance cost of approximately \$30/MW/hr when used in combination with natural gas. The environmental impacts from the construction and operation of this type of facility are detailed in Table 6.4-1.

A trade-off of water quality impacts would be associated with a 2500 MW(e) base load oil and gas combined cycle unit. New base load combined cycle units would likely utilize closed loop cooling towers which would lessen the thermal impact. However, evaporation from the cooling towers would be greater than the 16,000 gpm of forced evaporation

associated with Oconee's surface discharge. There are no low-level radioactive waste discharges to surface water associated with a combined cycle unit.
The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for NO_x control. The SCR would generate approximately 8000 ft^3 of spent catalyst material per year.

The largest environmental impact from operating this type of facility would be from the air emissions. The air emission values in Table 6.4-1 are based on burning oil throughout the year. Economically, it is not feasible to burn oil throughout the year. In reality, oil would be used as an alternative fuel to gas, provided gas was available. The emissions resulting from burning oil would be 13,000 tons per year of nitrogen oxides, 4,000 tons per year of sulfur dioxide, 2,500 tons per year of particulate matter, and 12.6 million tons per year of CO_2 (carbon dioxide). The use of oil as a stand-alone fuel source emits more CO_2 than the gas fired alternative. The new 8 hour ozone standard, the $PM_{2.5}$ standard, Regional Haze rules, and the "Global Warming" issue, as discussed above, may make it difficult to use oil as a fuel source.

This alternative energy source is typically used with natural gas as the primary fuel and with oil used as a backup. Used this way, combined cycle becomes a viable alternative energy source. The environmental impacts associated with a gas fired facility are detailed below.

6.2.3 Natural Gas (Combined Cycle)

The estimated capital cost for the construction of combined cycle gas turbines is roughly $380/kW, with an O&M cost of approximately $25/MW/hr. Note that this variable cost is largely dependent on the price of natural gas. Natural gas is currently the most economical of the base load generation technologies available to date. For this reason, natural gas is widely used. The environmental impacts resulting from the construction and operation of a 2500 MW(e) combined cycle facility are summarized in Table 6.4-1.

A trade-off of water quality impacts would be associated with a 2500 MW(e) base load natural gas combined cycle unit. New base load combined cycle units would likely utilize closed loop cooling towers which would lessen the thermal impact. However, evaporation from the cooling towers would be greater than the 16,000 gpm of forced evaporation associated with Oconee's surface discharge. There are no low-level radioactive waste discharges to surface water associated with a combined cycle unit.

The solid waste generated from this type of facility would be minimal. The largest environmental impact would result from the air emissions. These emissions are based on burning natural gas throughout the year. This type of facility would emit approximately 4,700 tons per year of nitrogen oxides, 310 tons per year of particulate matter, and 9.2

million tons per year of carbon dioxide. The new 8 hour ozone standard, $PM_{2.5}$, and Regional Haze rules will not be of concern with natural gas combined cycle because these units have low NO_x emissions and no SO_2 emissions.

One obstacle to the consideration of combined cycle generation using only natural gas is the availability of the gas. Based on current technology, a 2500 MW(e) facility would require approximately 100 billion cubic feet per year of natural gas. If legislation is passed, as discussed above, requiring the reduction of CO_2 levels, wide spread conversion to natural gas will be required in order to meet these standards. It is questionable if this resource will be available in the quantities that would be required to offset the CO_2 emissions from coal fired generation. Use of this resource in these quantities would require significant exploration and extraction of natural gas to meet the demand. Some estimate that 30-40 trillion cubic feet per year would be required to meet the demand for gas if coal were eliminated as a resource.

In summary, a natural gas fired combined cycle facility would be a viable replacement for Oconee's 2500 MW(e) base load generation. However, the air quality impacts would be far greater than the impacts from the continued operation of Oconee. As shown in Table 6.4-1, the construction of a new facility would result in greater environmental impacts than the impacts associated with the proposed action (license renewal).

6.2.4 Nuclear Power

The estimated capital cost for the construction of an Advanced Light Water Reactor (ALWR) nuclear facility is estimated at $1530/kW and the O&M cost is approximately $3.76/MW/hr. For this reason, this technology is not economically feasible as an alternative to the continued operation of Oconee with a renewed license. The environmental impacts from an ALWR would be similar to the impacts that exist for Oconee today. However, construction of an ALWR would require a green field site, which would have a larger impact on the environment than the license renewal option. The environmental impacts resulting from the construction and operation of a 2500 MW(e) ALWR are summarized in Table 6.4-1.

6.3 Proposed Action Vs No-Action

The proposed action is the renewal of the Oconee operating licenses. The Oconee-specific review of the thirteen environmental impacts, as required by §51.53(c)(3)(ii), concluded that there would be no adverse impact to the environment from the continued operation of Oconee through the license renewal period (until 2034).

The no-action alternative to the proposed action is the decision not to pursue renewal of the operating license for each of the three units of Oconee Nuclear Station. The environmental impacts of the no-action alternative would be the impacts associated with the construction and operation of the type of replacement power utilized. In effect, the environmental impacts would be transferred from being limited to the impacts of the continued operation of Oconee, to the environmental impacts associated with the construction and operation of a new generation facility. Therefore, the no-action alternative would have no net environmental benefits.

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

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

The United States civilian nuclear power plants represent close to 20% of the nation's energy supply. The average age of US commercial nuclear plants is between 20 and 25 years. Currently, the operating license of thirteen plants representing 11,700 MW(e) will expire in 2014. It is unlikely that many of these plants will operate much beyond 30 years, since the ability to recover investments in the plant and to remain competitive in a deregulated market diminishes rapidly in the last 10 years of the license. A trend has already been established, where early closure of nuclear facilities facing regulatory and economic uncertainties has resulted in the loss of approximately 6,000 MW(e) of emission free generating capacity over the past eight years. Making the decision to renew the operating license early in the life of the plant improves the economics of the remaining capital cost recovery and lengthens the time available to accumulate decommissioning funds. [*Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants,* Reference 25].

The *Joint DOE-Electric Power Research Institute Strategic Research and Development Plan to Optimize US Nuclear Power Plants* stated "… nuclear energy was one of the prominent energy technologies that could contribute to alleviate global climate change and also help in other energy challenges including reducing dependence on imported oil, diversifying the US domestic electricity supply system, expanding US exports of energy technologies, and reducing air and water pollution." The Department of Energy agreed with this perspective and stated "…it is important to maintain the operation of the current fleet of nuclear power plants throughout their safe and economic lifetimes." [Reference 25] The renewal of the Oconee operating licenses is consistent with these goals.

6.4 Summary

The proposed action is the renewal of the Oconee operating licenses. The proposed action would provide 2500 megawatts of base load power generation through 2034. The results of the review of alternatives to the proposed action are summarized in Table 6.4-1.

The environmental impacts of the continued operation of Oconee, providing 2500 megawatts of base load power generation through 2034, are superior to impacts associated with the best case assessed among reasonable alternatives. This is primarily due to the air emissions associated with the alternatives that do not exist with Oconee. As discussed in this chapter and as shown in Table 6.4-1, the continued operation of Oconee would create significantly less environmental impact than the construction and operation of new base load generation capacity.

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

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Table 6.4-1 Comparison of Environmental Impacts

Expected Environmental Impact[d]	Renewal of Oconee Operating License 2500 MW(e)	Conventional Coal Fired 2500 MW(e)	Combined Cycle Fuel Oil 2500 MW(e)	Combined Cycle Natural Gas 2500 MW(e)	Advanced Light Water Reactor 2500 MW(e)
Land-use	No additional impacts	500 to 2000 acres[a] needed	70 to 100 acres needed	70 to 100 acres needed	Approximately 400 acres needed
Ecology	No additional impact (impingement entrainment; waste heat to receiving water body have been evaluated and are minimal)	Habitat loss; impingement, entrainment; waste heat to receiving water body; cooling tower drift, fogging; bird collisions	Habitat loss; impingement, entrainment; waste heat to receiving water body; cooling tower drift, fogging; bird collisions	Habitat loss; impingement, entrainment; waste heat to receiving water body; cooling tower drift, fogging; bird collisions	Habitat loss; impingement, entrainment; waste heat to receiving water body; cooling tower drift, fogging; bird collisions
Aesthetics	No Change	Visual impacts from plant structures and emissions	Visual impacts from plant structures and emissions	Visual impacts from plant structures and emissions	Visual impacts from plant structures
Water Quality					
Impacts from site construction	None	Sediment from land clearing	Sediment from land clearing	Sediment from land clearing	Sediment from land clearing
Consumption	16,000 gpm (1994 to 1997)	>16,000 gpm[b]	> 16,000 gpm (includes demin water injection)	>16,000 gpm[b]	27,000 gpm[c] (1994 to 1997)
Pollutants	40 CFR 423 - Steam Electric Guidelines + low-level radwaste discharge	40 CFR 423 - Steam Electric Guidelines	40 CFR 423 - Steam Electric Guidelines	40 CFR 423 - Steam Electric Guidelines	40 CFR 423 - Steam Electric Guidelines + low-level radwaste discharge
Air Quality					
NO_x	None	13,000 tons/year	13,000 tons/year	4,700 tons/year	Very small emissions from non
SO_2	None	13,000 tons/year	4,000 tons/year	NA	-facility equipment(diesel
Particulate Matter	None	1,800 tons/year	2,500 tons/year	310 tons/year	generators)
CO_2	None	18 million tons/year	12.6 million tons/year	9.2 million tons/year	
Waste	spent fuel, low level waste, mixed waste	Large amounts of flyash and scrubber sludge	negligible	negligible	spent fuel, slightly more mixed waste and low-level waste than license renewal
Human Health	Substantial public health improvement compared with conventional fossil plant; safety risks to workers	Public risks (cancer, emphysema) from inhalation of toxins and particulate; safety risks to workers	Public risks (cancer, emphysema) from inhalation of toxins and particulate; safety risks to workers	Public risks (cancer, emphysema) from inhalation of toxins and particulate; safety risks to workers	<1% natural radiation source; safety risks to workers
Socioeconomic[e]	Moderate employment and tax revenue benefits	500 workers - moderate long term economic community benefits	400 workers - moderate long term economic community benefits	300 workers - moderate long term economic community benefits	1400 workers - substantial long term economic community benefits
Cultural	No Change	relatively small unless important site-specific resources affected by plant or transmission lines	relatively small unless important site-specific resources affected by plant or transmission lines	relatively small unless important site-specific resources affected by plant or transmission lines	relatively small unless important site-specific resources affected by plant or transmission lines

Table 6.4-1 Comparison of Environmental Impacts (Continued)

Notes:

a = varies based on possible site redevelopment. Major area involved in creation of cooling water source impoundment and ash landfill.
b = Closed loop cooling systems
c = based on evaporation rates at Catawba Nuclear Station's once through cooling tower system.
d = based in part on NUREG 1437, Vol. 1, Table 8.2
e = per the GEIS, the number of workers has been doubled from that required for a 1000 MW(e) facility.

7. STATUS OF COMPLIANCE

7.1 Requirement [§51.45(d)]

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

7.2 Environmental Permits

Table 7.2-1 lists the environmental permits held by Oconee and the compliance status of these permits. No Federal environmental permits have been identified as being required for re-issuance to support the renewal of the Oconee operating licenses. None of the state and local permits listed in Table 7.2-1 are required to be renewed to support the renewal of the Oconee operating licenses.

Table 7.2-1 Oconee Environmental Permits and Compliance Status

Oconee Environmental Permits	Federal Act	State or Local Permitting Agency	Date Permit Issued/ Compliance Status
National Pollutant Discharge Elimination System (NPDES) Permit # SC0000515	Federal Water Pollution Control Act (FWPCA) Section 402	South Carolina Department of Health and Environmental Control	5/1/1995/ In compliance
Part A Hazardous Waste Permit # SCD043979822 Interim Storage Facility for Mixed Wastes	Resource Conservation and Recovery Act (RCRA) Section 3005	South Carolina Department of Health and Environmental Control	3/9/1988/ In compliance
Operating Permit # 1820-0041 Air Quality	Clean Air Act- Section 112	South Carolina Department of Health and Environmental Control	4/22/1997/ In compliance
Landfill Permit # 373303-1601	RCRA Subtitle D	South Carolina Department of Health and Environmental Control	1/11/1995/ In compliance
Drinking Water Wells Permit # 202098AI and Permit # 204558	Safe Drinking Water Act 42 U.S.C.1412	South Carolina Department of Health and Environmental Control	In compliance
General Stormwater Permit SCR000000	FWPCA Section 402	South Carolina Department of Health and Environmental Control	10/1/1992/ In compliance
Infectious Waste Permit #SC37-0051G	N/A	South Carolina Department of Health and Environmental Control	5/6/1992/ In compliance
Environmental Laboratory Certification #37756001	N/A	South Carolina Department of Health and Environmental Control	1/30/1997/ In compliance
Underground Storage Tank Permit #06673	RCRA Subtitle I	South Carolina Department of Health and Environmental Control	1/1/1982/ In compliance
Underground Storage Tank Permit #11174	RCRA Subtitle I	South Carolina Department of Health and Environmental Control	11/3/1988/ In compliance
Underground Storage Tank Permit #11843	RCRA Subtitle I	South Carolina Department of Health and Environmental Control	11/3/1989/ In compliance

There are no zoning or land-use restrictions in Oconee County other than in municipalities. Oconee Nuclear Station is not located in a municipality.

7.3 Environmental Permits - Discussion of Compliance

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

Oconee has four treatment ponds for treating station wastewater. Three of the ponds treat conventional wastewater from the plant. The other treatment pond is for domestic sewage wastewater. The wastewater treatment systems are permitted by the South Carolina Department of Health and Environmental Control (SCDHEC). These ponds have a total of 12 groundwater monitoring wells to monitor for impacts to groundwater. These wells are sampled semi-annually. Monitoring results for all monitoring wells are in compliance with the maximum groundwater standards as set forth in South Carolina State Primary Drinking Water Regulations, R.61-58.5, except for pH, iron and manganese. The values for these parameters are in line with historical data and are believed to be due to natural background conditions.[20]

7.4 Other Permits and Licenses

The following additional permits and licenses are listed:

Facility Operating License No. DPR-38 for Unit 1, Docket #50-269
Facility Operating License No. DPR-47 for Unit 2, Docket #50-270
Facility Operating License No. DPR-55 for Unit 3, Docket #50-287

Independent Spent Fuel Storage Installation License No. SNM-2503, Docket #72-04

Federal Energy Regulatory Commission, Project 2503, Keowee-Toxaway Project, license issued September 1, 1966.

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

20 It is not uncommon for Piedmont soils to exceed groundwater standards for these parameters.

8. REFERENCES

1 *Final Environmental Statement Related to Operation of Oconee Nuclear Station Units 1, 2 and 3, Duke Power Company*, Docket Nos. 50-269, 50-270, 50-287, United States Atomic Energy Commission, Division of Radiological and Environmental Protection, March 1972.

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

3 *Watershed Water Quality Assessment, Savannah and Salkehatchie Basins, Technical Report No. 003-97*, SCDHEC, 1997. [A copy of portions of this report is included as Attachment A]

4 "Application for Renewed Operating Licenses Oconee Nuclear Station, Units 1, 2, and 3 Exhibit A License Renewal - Technical Information, OLRP-1001"

5 *Oconee Nuclear Station Environmental Summary Report 1971-1976*, Duke Power Company, Steam Production Department, November 1977.

6 Letter from William D. Adair, Duke Power System Environmentalist, to Howard Zeller, Environmental Protection Agency, Subject: Oconee Nuclear Station Fish Impingement and Entrainment Studies, dated March 24, 1976. [A copy is included as Attachment B]

7 Robert W. Reid, NRC to William O. Parker, Jr., Duke Power, dated March 2, 1979. [A copy is included as Attachment C]

8 Letter from William C. Botts, SCDHEC, to Robert Wylie, Duke Power Company, transmitting proposed draft NPDES Permit #SC0000515 for Oconee Nuclear Station, dated May 21, 1998. [A copy is included as Attachment D]

9 Excerpt from Proposed Draft NPDES Permit, #SC0000515, Rationale Section. [A copy is included as Attachment E]

10 *Endangered, Threatened, and Otherwise Noteworthy Plant and Animal Species of the Oconee Nuclear Station, Oconee and Pickens Counties, South Carolina*, prepared by L.L. Gaddy, Ph. D., June 1998. [A copy is included as Attachment F]

11 Letter from Jennifer R. Huff, Duke Power, to Roger L. Banks, USFWS, dated June 23, 1998. [A copy of this letter is included as Attachment G]

12 Letter from Jennifer R. Huff, Duke Power, to Ed Duncan, SCDNR, dated June 23, 1998. [A copy of this letter is included as Attachment H]

13 Letter from Dr. John F. Brown, State Toxicologist, South Carolina Department of Health and Environmental Control, to Thomas W. Yocum, Duke Power, dated October 25, 1996. [A copy is included as Attachment I]

14. Oconee Nuclear Station, *Updated Final Safety Analysis Report*, as revised.

15 Letter from Jennifer R. Huff to Nancy Brock, State Historic Preservation Office (SHPO), dated October 21, 1997. (Note: Response from SHPO is stamped on lower corner of letter) [A copy is included as Attachment J]

16 "Oconee Nuclear Station Severe Accident Mitigation Alternatives (SAMAs) Analysis," April 1998. [A copy is included as Attachment K]

17 January 13, 1998 NRC Staff Requirements Memorandum (SRM M970612) titled "Generic and Cumulative Environmental Impacts of Transportation of High-Level Waste in the Vicinity of an HLW Repository." [A copy is included as Attachment L]

18 61 Federal Register 66537, 66538 (Dec. 18, 1996). [A copy is included as Attachment M]

19 NRC SECY-97-279, page 2, accompanying SRM M970612, "Generic and Cumulative Environmental Impacts of Transportation of High-Level Waste in the Vicinity of an HLW Repository." [A copy is included as Attachment N]

20 Nuclear Regulatory Commission, "Interim NRR Procedure for Environmental Justice Reviews," dated March 16, 1995.

21 *Duke Power Environmental Manual*

22 *Duke Power Company Nuclear Policy Manual*, Station Directive 111 Nuclear Environmental Management. [A copy is included as Attachment O]

23. NUREG-0586, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, August 1988.

24 Duke Power Company, *1997 Short Term Action Plan, Integrated Resource Planning*, dated 1997.

25 *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants*, VOLUME 1, March 20, 1998.

ATTACHMENTS

Attachment A

Watershed Water Quality Assessment, Savannah and Salkehatchie Basins,
Technical Report No. 003-97

South Carolina Department of Health and Environmental Control (SCDHEC), 1997.
[Sections on Lake Keowee Area]

WATERSHED WATER QUALITY ASSESSMENT

SAVANNAH AND SALKEHATCHIE RIVER BASINS

TECHNICAL REPORT NO. 003-97
SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
COLUMBIA SC
December 1997

PREFACE

In 1993, the South Carolina Department of Health and Environmental Control (SCDHEC) published the first in a series of five watershed management documents. *Watershed Water Quality Management Strategy: Savannah-Salkehatchie Basin* communicated SCDHEC's innovative watershed approach, summarizing water programs and water quality in the basins. The approach continues to evolve and improve.

The watershed documents facilitate broader participation in the water quality management process. Through these publications, SCDHEC shares water quality information with internal and external partners, providing a common foundation for water quality improvement efforts at the local watershed or large-scale, often interstate, river basin level.

Water quality data from the Savannah and Salkehatchie River basins were collected and assessed at the start of this second five-year watershed management cycle. The assessment incorporates data from many more sites than were included in the first round. This updated atlas provides summary information on a watershed basis. A waterbody index allows the reader to locate information on specific waters of interest.

A brief summary of the water quality assessments included in the body of this document is provided following the Table of Contents. This summary lists all waters within the Savannah and Salkehatchie River basins that fully support recreational and aquatic life uses, followed by those waters not supporting uses. More comprehensive information can be found in the individual management unit and watershed sections.

As SCDHEC continues basinwide and statewide water quality protection and improvement efforts, we are counting on the support and assistance of all stakeholders in the Savannah and Salkehatchie River basins to participate in bringing about water quality improvements. We look forward to working with you.

Questions, comments, and suggestions regarding this document, and water quality in the Savannah and Salkehatchie River basins, may be directed to:

Watershed Manager
Savannah and Salkehatchie River Basins
SCDHEC Bureau of Water
2600 Bull St.
Columbia SC 29201
(803)734-5300

Savannah and Salkehatchie River Basins: Waters fully supporting uses

WATERSHED UNIT	STATION NUMBER	WATERBODY NAME	IMPROVING TRENDS	UNDESIRABLE TRENDS
03060101020	SV-337	LAKE JOCASSEE	decreasing turbidity, bacteria	increasing pH
	SV-334	LAKE JOCASSEE	increasing DO, decreasing nitrogen and bacteria	
03060101030	SV-741	*EASTATOE CK*		
	SV-676	*ROCKY BOTTOM CK*		
03060101040	SV-249	SENECA RVR	decreasing BOD, nitrogen, phosphorus	
	SV-360	LAKE ISSAQUEENA		
	SV-106	LAKE HARTWELL	decreasing BOD, phosphorus, bacteria	decreasing DO and pH, increasing turbidity
	SV-236	LAKE HARTWELL	decreasing BOD, phosphorus, bacteria	decreasing DO and pH
03060101050	SV-743	*FLAT SHOALS RIVER*		
	SV-742	*OCONEE CK*		
	SV-203	LITTLE RVR	decreasing BOD, phosphorus	
	SV-312	LAKE KEOWEE	decreasing BOD, nitrogen, phosphorus, turbidity, bacteria	
03060101060	SV-282	TWELVE MILE CK	decreasing BOD, nitrogen, phosphorus	
	SV-740	*RICES CK*		
03060101070	SV-739	*TWELVE MILE CK*		
	SV-107	TWELVE MILE CK	decreasing BOD, phosphorus	decreasing DO
03060102030	SV-308	E FORK CHATTOOGA RVR	decreasing BOD, phosphorus	increasing pH
	SV-227	CHATTOOGA RVR		increasing pH and turbidity
03060102060	SV-199	CHATTOOGA RVR		increasing pH and phosphorus
	SV-359	TUGALOO LAKE		
	SV-358	LAKE YONAH		
	SV-673	*BRASSTOWN CK*		
	SV-200	LAKE HARTWELL	decreasing BOD, phosphorus	
03060102120	SV-675	*CHAUGA RVR*		
	SV-344	CHAUGA RVR		
	SV-225	*TOXAWAY CK*		
03060103030	SV-100	LAKE RUSSELL	decreasing BOD, nitrogen, phosphorus, bacteria	decreasing DO, increasing pH
	SV-109	*LITTLE GENEROSTEE CK*		
	SV-357	LAKE RUSSELL		
	SV-098	LAKE RUSSELL	decreasing BOD, nitrogen, phosphorus, turbidity, bacteria	

Waterbody names in *italics* evaluated for aquatic life use support only
DO=dissolved oxygen, BOD=biochemical oxygen demand

Savannah and Salkehatchie River Basins: Waters fully supporting uses

WATERSHED UNIT	STATION NUMBER	WATERBODY NAME	IMPROVING TRENDS	UNDESIRABLE TRENDS
03060103070	SV-319	BROADWAY LAKE		
	SV-258	BROADWAY LAKE		
	SV-321	BROADWAY LAKE		
	SV-346	ROCKY RVR		
	SV-044	*HEN COOP CK*		
	SV-332	LAKE SECESSION		increasing nitrogen
03060103100	SV-291	THURMOND RESERVOIR	decreasing BOD, nitrogen, phosphorus	decreasing pH, increasing turbidity
	SV-294	THURMOND RESERVOIR	decreasing BOD, nitrogen, phosphorus	decreasing pH, increasing turbidity
03060103140	SV-733	*HOGSKIN CK*		
	SV-644	*GILL CK*		
	SV-171	*CALHOUN CK*		
	SV-192	LITTLE RVR		
03060103150	SV-732	*BIG CURLY TAIL CK*		
03060107010	SV-731	*HARD LABOR CK*		
03060107020	SV-729	*TURKEY CK*		
	SV-728	*LOG CK*		
	SV-727	*ROCKY CK*		
	SV-352	TURKEY CK		
03060107030	SV-068	BEAVERDAM CK	increasing DO, decreasing BOD and phosphorus	decreasing pH
03060107040	SV-063	*STEVENS CK*		
	SV-354	STEVENS CK		
	SV-726	*HORN CK*		
	SV-725	*CHEVES CK*		
03060106030	SV-251	SAVANNAH RVR	decreasing BOD, nitrogen, phosphorus, bacteria	decreasing pH
03060106050	SV-071	HORSE CK	decreasing BOD, nitrogen, phosphorus	decreasing pH, increasing turbidity
	SV-724	*LITTLE HORSE CK*		
	SV-073	LITTLE HORSE CK	decreasing phosphorus	decreasing pH, increasing turbidity and bacteria
	SV-250	HORSE CK	increasing DO, decreasing BOD and phosphorus	decreasing pH, increasing turbidity
03060106060	SV-323	SAVANNAH RVR	decreasing BOD, nitrogen, phosphorus, suspended solids, bact	decreasing pH
	SV-350	HOLLOW CK		
03060106100	SV-680	*UPPER THREE RUNS CK*		
	SV-723	*CEDAR CK*		

Waterbody names in *italics* evaluated for aquatic life use support only
DO=dissolved oxygen, BOD=biochemical oxygen demand

Savannah and Salkehatchie River Basins: Waters fully supporting uses

WATERSHED UNIT	STATION NUMBER	WATERBODY NAME	IMPROVING TRENDS	UNDESIRABLE TRENDS
03060106110	SV-326	FOUR MILE CK	decreasing BOD, nitrogen	increasing turbidity
	SV-327	STEEL CK	decreasing BOD, nitrogen, phosphorus, turbidity, bacteria	decreasing pH
03060106130	SV-175	LOWER THREE RUNS CK	decreasing BOD	decreasing pH, increasing turbidity and bacteria
03060106140	SV-745	*BRIER CK*		
03060109020	SV-355	SAVANNAH RVR		
03060109050	SV-744	*CYPRESS BRANCH*		
03050207010	CSTL-578	*BUCK CK*		
03050207020	CSTL-056	*TURKEY CK*		
	CL-064	*LAKE EDGAR BROWN*		increasing pH
03050207030	CSTL-577	*TOBY CK*		
	CSTL-579	*BIRDS BRANCH*		
03050207040	CSTL-053	*SAVANNAH CK*		
03050207060	CSTL-566	*LITTLE SALKEHATCHIE RIVER*		
03050207070	CSTL-576	*LEMON CK*		
03050208010	CSTL-585	*SANDY RUN CK*		
	CSTL-583	*BLACK CK*		
	CSTL-098	COMBAHEE RVR	decreasing BOD, nitrogen, phosphorus, suspended solids, bact	decreasing pH
03050208040	CSTL-069	ASHEPOO RVR		
	MD-251	ASHEPOO RVR		
03050208050	CSTL-540	*COOSAWHATCHIE RIVER*		
	CSTL-051	*JACKSON CK*		
03050208080	CSTL-582	*CYPRESS CK AT SC 3*		
03050208090	CSTL-107	COOSAWHATCHIE RVR	decreasing BOD, nitrogen, phosphorus	decreasing pH, increasing turbidity
	MD-116	BROAD RVR	decreasing phosphorus, turbidity	decreasing pH, increasing nitrogen and bacteria
	MD-172	BROAD RVR		decreasing DO, pH
	MD-117	CHECHESSEE RVR	decreasing phosphorus	decreasing DO, pH
	MD-176	COLLETON RVR	decreasing bacteria	decreasing pH
	MD-245	COLLETON RVR	decreasing BOD	increasing phosphorus and nitrogen
	MD-006	PORT ROYAL SOUND	decreasing phosphorus	increasing bacteria
03050208100	MD-194	WHALE BRANCH		decreasing DO and pH, increasing BOD, turbidity, and bact
	MD-005	BEAUFORT RVR	decreasing phosphorus	decreasing DO and pH, increasing nitrogen and bacteria
03050208110	MD-016	MAY RVR		decreasing pH
	MD-175	CALIBOGUE SOUND	decreasing phosphorus	decreasing pH, increasing nitrogen

Waterbody names in *italics* evaluated for aquatic life use support only
DO=dissolved oxygen, BOD=biochemical oxygen demand

Savannah and Salkehatchie River Basins: Waters not fully supporting evaluated uses

WATERSHED UNIT	STATION NUMBER	WATERBODY NAME	AQUATIC LIFE USES			RECREATIONAL USES		COMMENTS
			Status	Causes	Possible Source	Status	Possible Source	
03060101020	SV-335	LAKE JOCASSEE	N	copper, zinc	Point source			
	SV-336	LAKE JOCASSEE	N	copper	Point source			
03060101030	SV-230	BIG EASTATOE CK	N	zinc	Unknown			
	SV-341	LITTLE EASTATOE CK				P	NPS-agriculture	
	SV-338	LAKE KEOWEE	N	copper	Point source			increasing pH
03060101040	SV-205	SIX MILE CK				P	NPS-agriculture	
	SV-288	LAKE HARTWELL	N	copper	Unknown			decreasing DO
	SV-181	SIX & TWENTY CK				P	Point source	
	SV-339	LAKE HARTWELL	N	copper	Unknown			
03060101050	SV-343	LITTLE CANE CK				N	Point source	collection system
	SV-342	CANE CK				N	Point source	collection system
	SV-311	LAKE KEOWEE	P	zinc	Unknown			decreasing DO
03060101060	SV-206	N FORK TWELVE MILE CK				P	Unknown	decreasing pH, increasing turbidity & bacteria
03060101070	SV-239	GOLDEN CK				N	Point source	decreasing pH, increasing turbidity
	SV-738	*GOLDEN CK*	P	macroinvertebrates	Point source			
	SV-015	TWELVE MILE CK				N	Point source	increasing turbidity & bacteria
	SV-137	TWELVE MILE CK				N	NPS-agriculture	
	SV-136	UNNAMED				P	NPS-agriculture	decreasing DO, increasing bacteria
03060101080	SV-333	CONEROSS CK				P	Point source	decreasing pH
	SV-004	CONEROSS CK				P	Point source	increasing bacteria
	SV-322	CONEROSS CK				P	Point source	increasing bacteria
03060101090	SV-017	EIGHTEEN MILE CK				N	Point source	under enforcement
	SV-241	WOODSIDE BRANCH				N	Point source	under enforcement
	SV-245	EIGHTEEN MILE CK				N	Point source	under enforcement
	SV-135	EIGHTEEN MILE CK				N	Point source	under enforcement
	SV-268	EIGHTEEN MILE CK				N	Point source	under enforcement
03060101100	SV-735	*THREE AND TWENTY CK*	P	macroinvertebrates	NPS-sedimentation			
	SV-111	THREE & TWENTY CK				N	Point source	decreasing pH, increasing bacteria

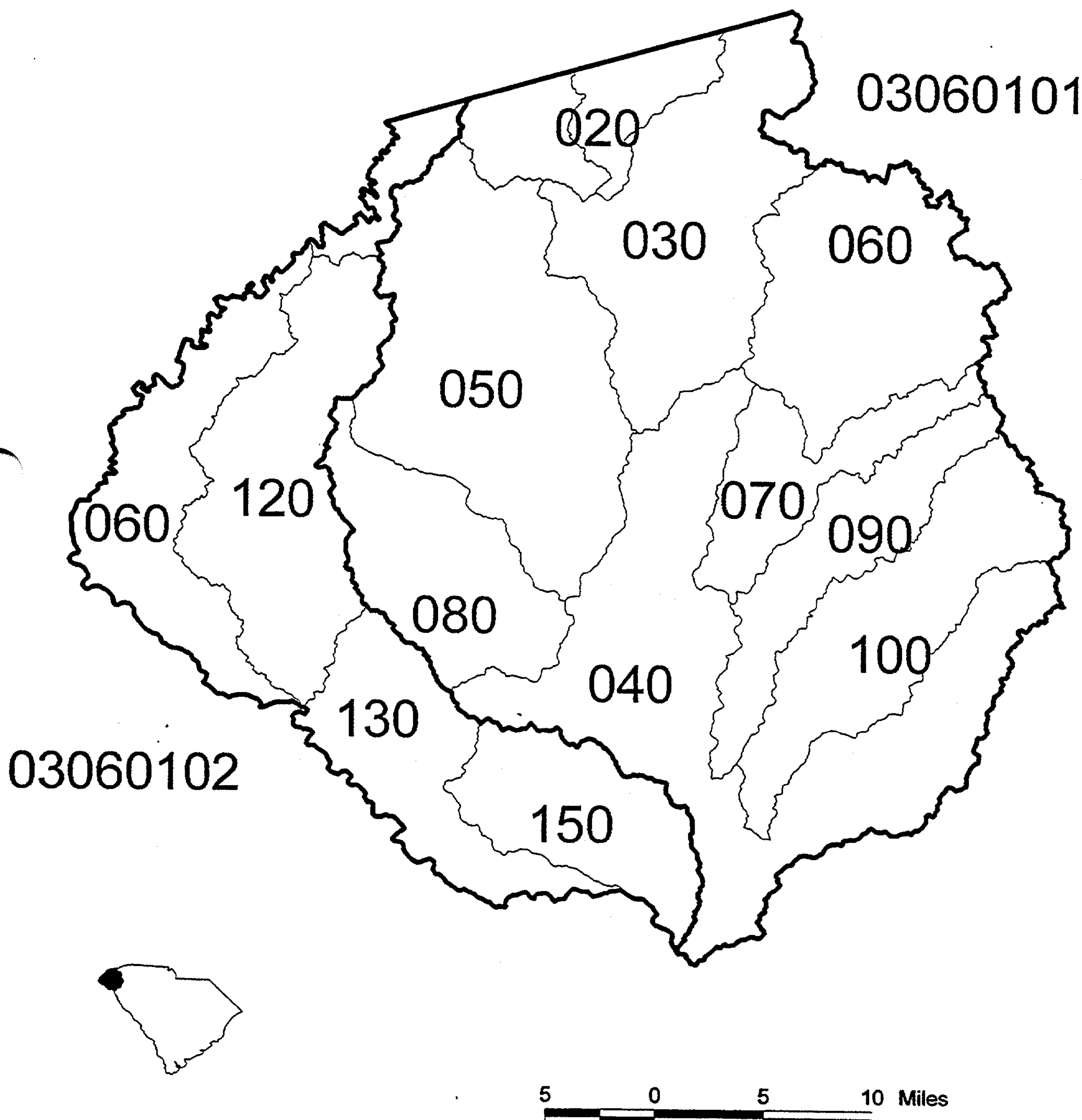
Recreational use assessment based on fecal coliform bacteria densities.
Waterbody names in *italics* evaluated for aquatic life use support only.
N=not supporting, P=partially supporting, *=eutrophication assessment

Savannah and Salkehatchie River Basins: Waters not fully supporting evaluated uses

WATERSHED UNIT	STATION NUMBER	WATERBODY NAME	AQUATIC LIFE USES			RECREATIONAL USES		COMMENTS
			Status	Causes	Possible Source	Status	Possible Source	
03060102130	SV-301	NORRIS CK				N	Point source	decreasing pH
	SV-108	CHOESTOEA CK				N	Point source	
03060102150	SV-345	BEAVERDAM CK	P	macroinvertebrates	NPS-sedimentation	N	NPS-agriculture	
03060103020	SV-340	LAKE HARTWELL	N	copper	Unknown			
03060103030	SV-316	BIG GENEROSTEE CK				N	Point source	plant upgrade underway
	SV-101	*BIG GENEROSTEE CK*	P	macroinvertebrates	Point source			plant upgrade underway
03060103070	SV-031	ROCKY RVR	N	copper	NPS-urban runoff	N	Point source	increasing turbidity
	SV-041	ROCKY RVR				N	Point source	increasing turbidity, bacteria
	SV-139	CUPBOARD CK	N	dissolved oxygen	Point source	N	Point source	point sources removed
	SV-140	CUPBOARD CK	N	dissolved oxygen	Point source	N	Point source	point sources removed
	SV-141	BROADWAY CK	P	macroinvertebrates	NPS-sedimentation	N	Point source	point sources removed
	SV-037	BETSY CK	N	copper	Point source			under enforcement
	SV-650	*ROCKY RVR*	P	macroinvertebrates	Point source			
	SV-043	CHEROKEE CK				P	Point source	
	SV-331	LAKE SECESSION	*	nutrients	Unknown	P	Point source	decreasing pH, increasing turbidity & bacteria
03060103080	SV-185	*WILSON CK*	P	macroinvertebrates	Unknown			
	SV-347	WILSON CK				P	Unknown	
03060103140	SV-164	LITTLE RVR				P	NPS-agriculture	
	SV-348	LITTLE RVR				P	NPS-agriculture	
	SV-052	SAWNEY CK				N	Point source	decreasing pH, increasing turbidity & bacteria
03060103150	SV-349	LONG CANE CK				N	NPS-agriculture	
	SV-734	*JOHNS CK*	P	macroinvertebrates	NPS-agriculture			
	SV-053B	BLUE HILL CK				N	Point source	collection system
	SV-054	*DOUBLE BR*	P	macroinvertebrates	NPS-land development			
	SV-318	LONG CANE CK				P	Point source	decreasing pH, increasing turbidity

Recreational use assessment based on fecal coliform bacteria densities.
Waterbody names in *italics* evaluated for aquatic life use support only.
N=not supporting, P=partially supporting, *=eutrophication assessment

Watershed Units
Upper Savannah River Basin



Southeast. Geographic regions included in the Savannah River Watershed range from the Blue Ridge (mountain) through the Piedmont, and the Upper and Lower Coastal Plains to the Coastal Zone.

The Tallulah River and Chattooga River, originating in Georgia and North Carolina, respectively, join to form the Tugaloo River on the South Carolina/Georgia State border. The Horsepasture River flows into the Toxaway River which flows over the North Carolina State boundary into South Carolina, where it merges with the Whitewater River and Thompson River to form Lake Jocassee, the Keowee River and eventually Lake Keowee. The Seneca River flows out of Lake Keowee to converge with the Tugaloo River and form the headwaters of the Savannah River, which serves as the physical boundary between the States of South Carolina and Georgia. The Savannah River then flows through Lake Hartwell, Lake Richard B. Russell, and Lake Thurmond and empties into the Atlantic Ocean at the port city of Savannah, Georgia.

The **Salkehatchie** River basin is contained within South Carolina and is described in Watershed Management Unit 0104. The Salkehatchie River basin originates in the Sandhills region and flows through the Lower Coastal Plain and Coastal Zone regions. The Salkehatchie River joins with the Little Salkehatchie River to form the Combahee River, which empties into St. Helena Sound and the Atlantic Ocean. Also included in this basin grouping are drainages from the Ashepoo River, the Coosawhatchie River, Broad River, and the New River.

Watershed Assessments

Ambient surface water monitoring data from 64 primary stations, 44 secondary stations, 52 watershed stations, and 1 inactive station in the Savannah and Salkehatchie River basins were reviewed for this assessment, along with 72 biological sites to assess macroinvertebrate communities. The time period used to assess standards compliance was 1992 through 1996. Water quality data are summarized in Appendix B. All current NPDES permits in the Savannah and Salkehatchie River basins are to be drafted and issued by September 30, 1998, and will all be reissued together in 2003.

Management Unit WMU-0101

Management Unit WMU-0101 is located in the northwest corner of South Carolina and extends from a common border with North Carolina and Georgia southeast into Anderson County. It contains Oconee County and a portion of Pickens County as well.

Population. The 1990 populations and projections for the year 2010 for counties within WMU-0101 are listed in the table below. Oconee County is expected to experience the greatest population change during this time period, with an increase of 26%.

County	*1990 Population*	*2010 Population*	*Change (%)*
Anderson	145,196	176,000	21
Oconee	57,494	72,300	26
Pickens	93,894	109,500	17

Climate. Normal yearly rainfall in the WMU-0101 area was 60.97 inches, according to the S.C. historic climatological record. Data compiled from National Weather Service stations in Longcreek, Salem, Walhalla, Clemson University and Pickens were used to determine the general climate information for the northwestern corner of the state. Within the four Savannah-Salkehatchie watershed management units, the highest level of rainfall occurred in WMU-0101, which is characteristic of the mountains and upper Piedmont region. The highest seasonal rainfall occurred in the spring with 17.29 inches; 14.88, 12.72 and 16.08 inches of rain fell in the summer, fall and spring, respectively. The average annual daily temperature was 59.7°F, the coolest in the state. Winter temperatures averaged 42.9°F, spring temperatures averaged 59.4°F and summer and fall mean temperatures were 75.6 and 60.8°F, respectively.

Fish Consumption Advisory. A fish consumption advisory has been issued by SCDHEC for LAKE HARTWELL advising people to limit the amount of fish consumed from these waters and their tributaries due to PCB and mercury contamination. In 1976, analysis of fish tissue by the SCDHEC and the USEPA revealed contamination by polychlorinated biphenyls (PCBs) above the USFDA recommended limits in certain areas of Lake Hartwell. As a result of these findings, a fish consumption advisory was issued for portions of Lake Hartwell to reduce human exposure. The SCDHEC and US Army Corps of Engineers have continued to conduct surveys of Lake Hartwell to evaluate PCB levels in fish tissue.

Portions of Lake Hartwell became eligible for Superfund support in 1990. The contamination originated from the historical industrial use of PCBs at the Cornell-Dubilier Marketing site, formerly owned by Sangamo, located on Town Creek. Contaminated sediments from this site have migrated downstream via Twelve Mile Creek to the Twelve Mile Creek Arm of Lake Hartwell which continues to have the highest level of PCBs. The manufacture and use of PCBs was banned in 1979, but PCBs are very resistant to degradation and therefore are very persistent in the environment.

A gradient of decreasing PCB concentration in fish tissue extends from the Twelve Mile Creek region down to the dam. The forage fish in the Twelve Mile Creek arm are highly contaminated with PCBs and play a major role in the accumulation of PCBs in the game fish population through the food chain.

Mercury has also been measured in fish tissue at levels that would warrant an advisory; however, the advisory issued due to PCBs is more restrictive and the original fish consumption advisory remains in effect. All fish taken from the Seneca River arm upstream of Highway 24 should be released and not eaten. All fish greater than three pounds taken from the remainder of Lake Hartwell should be released and not eaten. SCDHEC continues to issue fish consumption advisories for PCBs based on the USFDA action level of 2.0 parts per million. SCDHEC is, however, in the process of developing a risk based method for issuing future advisories.

03060101-020. Watershed 03060101-020 (map page 29) is located in Oconee and Pickens Counties and consists of LAKE JOCASSEE and its tributaries. The watershed includes the Toxaway River, Whitewater River and Thompson River, all which flow across the North Carolina border to form Lake Jocassee; the entire lake to the dam is included in the watershed.

The watershed occupies 39,724 acres of the Blue Ridge region of South Carolina. The predominant soil types consist of an association of the Ashe-Saluda series. The erodibility of the soil (K) averages 0.23; the slope of the terrain averages 45.2%, with a range of 10-65%. Land use/land cover in the watershed includes: 73% forested land, 22% water, 2% urban land, 2% scrub/shrub land, 1% agricultural land, and <1% barren land. The entire watershed is contained within Sumter National Forest.

Permitted Discharges

Permit #	Facility	Receiving Water	Type*	Flow (MGD)†
SC0037800	DUKE POWER/BAD CREEK	JOCASSEE LK	IN	0.18
SC0037800	DUKE POWER/BAD CREEK	JOCASSEE LK	IN	0.013
SC0037800	DUKE POWER/BAD CREEK	JOCASSEE LK	IN	2.9
SC0037800	DUKE POWER/BAD CREEK	JOCASSEE LK	IN	-----
SC0037800	DUKE POWER/BAD CREEK	JOCASSEE LK	IN	4.3

*IN=industrial †MGD=million gallons per day

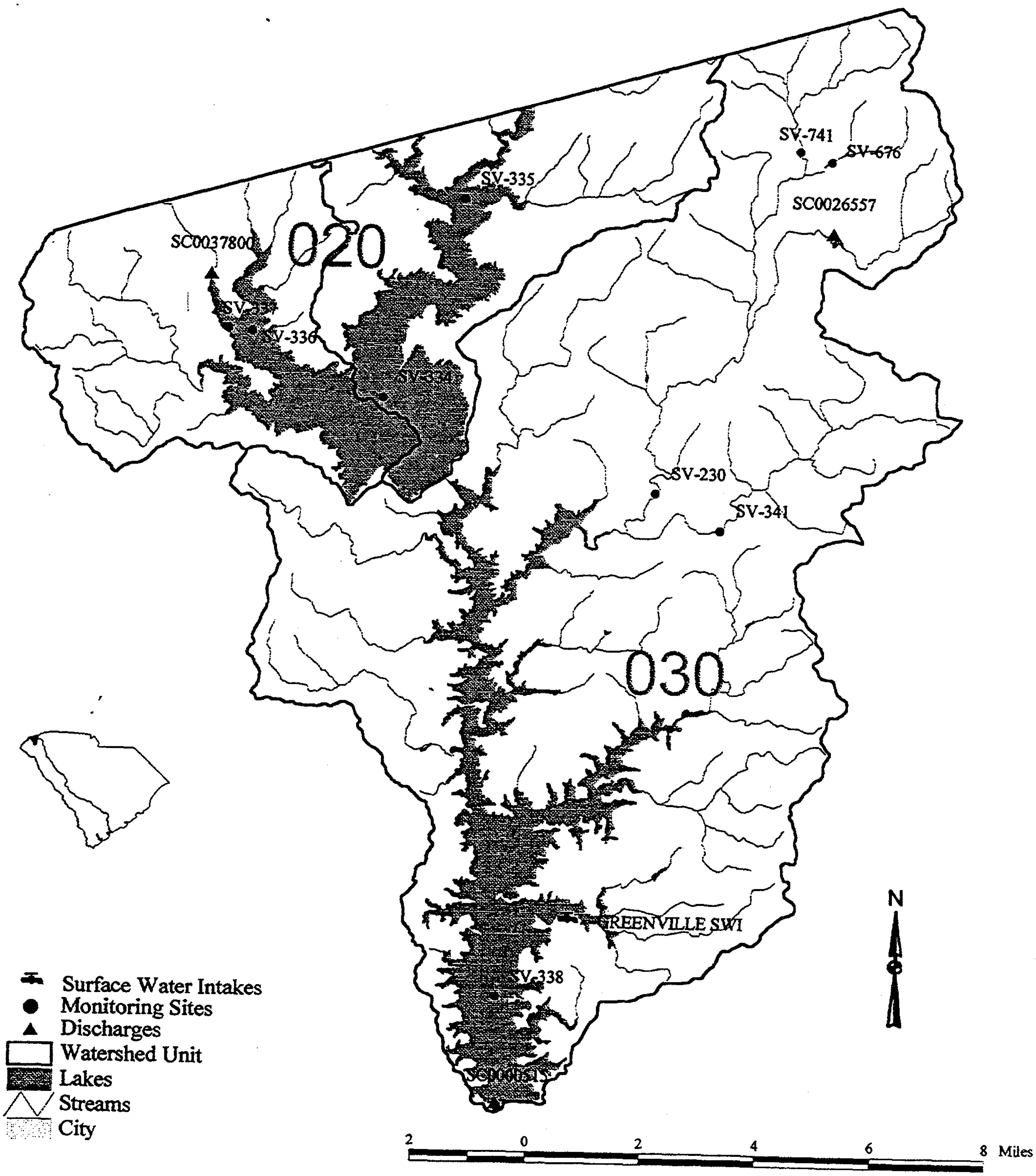
Monitoring Locations			
Station Number	**Type***	**Class†**	**Station Description**
SV-335	P	TPGT	Lake Jocassee at confluence of Toxaway, Horsepasture & Laurel Fork Creeks
SV-337	P	TPGT	Lake Jocassee outside of coffer dam at Bad Creek Project
SV-336	P	TPGT	Lake Jocassee at confluence of Thompson and Whitewater Rivers
SV-334	P	TPGT	Lake Jocassee, main body of lake

* P=primary, S=secondary, SS=watershed
† TPGT=trout put, grow and take; ORW=outstanding resource waters; FW=freshwaters

LAKE JOCASSEE is a 7565-acre impoundment on the Toxaway, Whitewater, and Thompson Rivers, with a maximum depth of approximately 324 feet (99 meters) and an average depth of approximately 157 feet (48 meters). A portion of the lake's watershed is in North Carolina. There are four monitoring sites on Lake Jocassee.

At the most uplake site (SV-335) aquatic life uses are not supported due to occurrences of copper and zinc in excess of the aquatic life acute standards, in addition to a high concentration of zinc and a very high concentration of lead measured in 1996. A significant increasing trend in dissolved oxygen concentration and a significant decreasing trend in total nitrogen concentration suggests improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

Watersheds 03060101-020, -030
Savannah and Salkehatchie River Basins



Further down the lake (SV-337), aquatic life uses are fully supported, but may be threatened by a very high concentration of zinc measured in 1993 and a very high concentration of lead measured in 1995, compounded by a significant increasing trend in pH. A significant decreasing trend in turbidity suggest improving conditions for this parameter. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

At the next site down lake (SV-336), aquatic life uses are not supported due to occurrences of copper in excess of the aquatic life acute standards. Recreational uses are fully supported at this site.

At the most down lake site (SV-334), aquatic life uses are fully supported. A significant increasing trend in dissolved oxygen concentration and a significant decreasing trend in total nitrogen concentration suggests improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

Eutrophication assessments indicate that Lake Jocassee is one of the least eutrophic large lakes in South Carolina, characterized by very low nutrient concentrations and very clear water. Preservation of this lake's desirable trophic condition is recommended.

Duke Energy operates a hydroelectric facility on Lake Jocassee.

03060101-030. Watershed 03060101-030 (map page 29) is located in Oconee and Pickens Counties and consists of the upper region of LAKE KEOWEE and its tributaries. This watershed contains a total of 34.18 stream miles. EASTATOE CREEK receives drainage from ROCKY BOTTOM CREEK and LITTLE EASTATOE CREEK, and joins with the Keowee River just below the Lake Jocassee dam to form the upper region of Lake Keowee. The watershed includes the headwaters of Lake Keowee extending down to the Keowee dam, one of two dams on this reservoir.

The watershed occupies 75,177 acres of the Blue Ridge region of South Carolina. The predominant soil types consist of an association of the Pacolet-Ashe-Hayesville series. The erodibility of the soil (K) averages 0.23; the slope of the terrain averages 27.8%, with a range of 2-80%. Land use/land cover in the watershed includes: 78.98% forested land, 10.96% water, 6.38% agricultural land, 3.29% scrub/shrub land, 0.30% urban land, and 0.10% barren land. Keowee Toxaway State Park is located in the upper reaches of the watershed.

Permitted Discharges

Permit #	Facility	Receiving Water	Type*	Flow (MGD)[†]
SC0000515	DUKE POWER/OCONEE NU		IN	2324.7
SC0000515	DUKE POWER/OCONEE NU		IN	3.7
SC0000515	DUKE POWER/OCONEE NU		IN	0.035
SC0000515	DUKE POWER/OCONEE NU		IN	0.007
SC0000515	DUKE POWER/OCONEE NU		IN	0.18
SC0026557	MCCALL ROYAL	REEDY CV CK	CO	0.012

*IN=industrial, CO=community [†]MGD=million gallons per day

Monitoring Locations			
Station Number	Type*	Class†	Station Description
SV-741	BIO	ORW	Eastatoe Creek at S-39-237
SV-676	BIO	ORW	Rocky Bottom Creek at US 178
SV-230	P	ORW	Eastatoe Creek at S-39-143
SV-341	SS/BIO	FW	Little Eastatoe Creek at S-39-49
SV-338	P	FW	Lake Keowee above SC Route 130 and dam
* P=primary, S=secondary, SS=watershed, BIO=macroinvertebrate † TPGT=trout put, grow and take; ORW=outstanding resource waters; FW=freshwaters			

Aquatic life uses are fully supported in **ROCKY BOTTOM CREEK** (SV-676) based on macroinvertebrate community data. Recreational use support was not assessed.

Aquatic life uses are fully supported in upper **EASTATOE CREEK** (SV-741) based on macroinvertebrate community data. Recreational use support was not assessed.

Aquatic life uses are not supported at the lower Eastatoe Creek site (SV-230) due to occurrences of zinc in excess of the aquatic life acute standards, including two very high concentrations. A significant increasing trend in dissolved oxygen concentration suggests improving conditions for this parameter. Recreational uses are fully supported at this site.

Aquatic life uses are fully supported in **LITTLE EASTATOE CREEK** (SV-341). Recreational uses are only partially supported at this site due to fecal coliform bacteria excursions.

LAKE KEOWEE is a 18,372-acre impoundment on the Keowee River, with a maximum depth of approximately 155 feet (47 meters) and an average depth of approximately 54 feet (17 meters). The lake's watershed comprises 273 square miles (707 km^2) in North and South Carolina. Eutrophication assessments indicate that Lake Keowee is the least eutrophic large lake in South Carolina, characterized by very low nutrient concentrations. Preservation of this lake's desirable trophic condition is recommended. Aquatic life uses are not supported in Lake Keowee (SV-338) due to occurrences of copper in excess of the aquatic life acute standards, including a high concentration of copper measured in 1995, compounded by a significant increasing trend in pH. A significant increasing trend in dissolved oxygen concentration and a significant decreasing trend in five-day biochemical oxygen demand suggest improving conditions for these parameters. Recreational uses are fully supported at this site.

Duke Energy operates a hydroelectric facility on Lake Keowee within this watershed.

A nonpoint source (NPS) monitoring project has been implemented in this watershed by the Friends of Lake Keowee Society through SCDHEC. The goal of the project is NPS education in the community. The project involves volunteer monitoring using a periphyton biomass technique to infer possible nutrient increases due to NPS pollution. Sampling stations will be placed near potential NPS input locations such as marinas and golf courses as well as at control stations. Area high school students will become involved in sampling and analysis in the final stages of the project. Project grant period: 2/01/97-1/31/98.

03060101-040. Watershed 03060101-040 (map page 33) is located in Pickens, Oconee and Anderson Counties and consists of the SENECA RIVER, which together with its tributaries form the upper region of LAKE HARTWELL. The Seneca River flows out of the Keowee dam to form the headwaters of the Seneca River region of Lake Hartwell, which extends down to its confluence with the Tugaloo River region of the lake. This watershed accepts the drainage of SIX MILE CREEK, which flows into the Seneca River just below the Little River dam, and from SIX AND TWENTY CREEK, which enters the watershed just above the confluence with the Tugaloo River. Town Creek flows into Six and Twenty Creek. There are a total of 29.93 stream miles in this watershed. Watershed 03060101-040 also accepts the drainage from Twelve Mile Creek (03060101-060,-070), Eighteen Mile Creek (03060101-090), Coneross Creek (03060101-080) and Lake Keowee (03060101-050) watersheds.

The watershed occupies 137,014 acres of the Piedmont region of South Carolina. The predominant soil types consist of an association of the Cecil-Hiwassee series. The erodibility of the soil (K-factor) averages 0.26; the slope of the terrain averages 10.7%, with a range of 2-25%. Land use/cover in the watershed includes: 44% forested, 19% agricultural, 15% water, 13% scrub/shrub, 8% urban land, and 1% barren land.

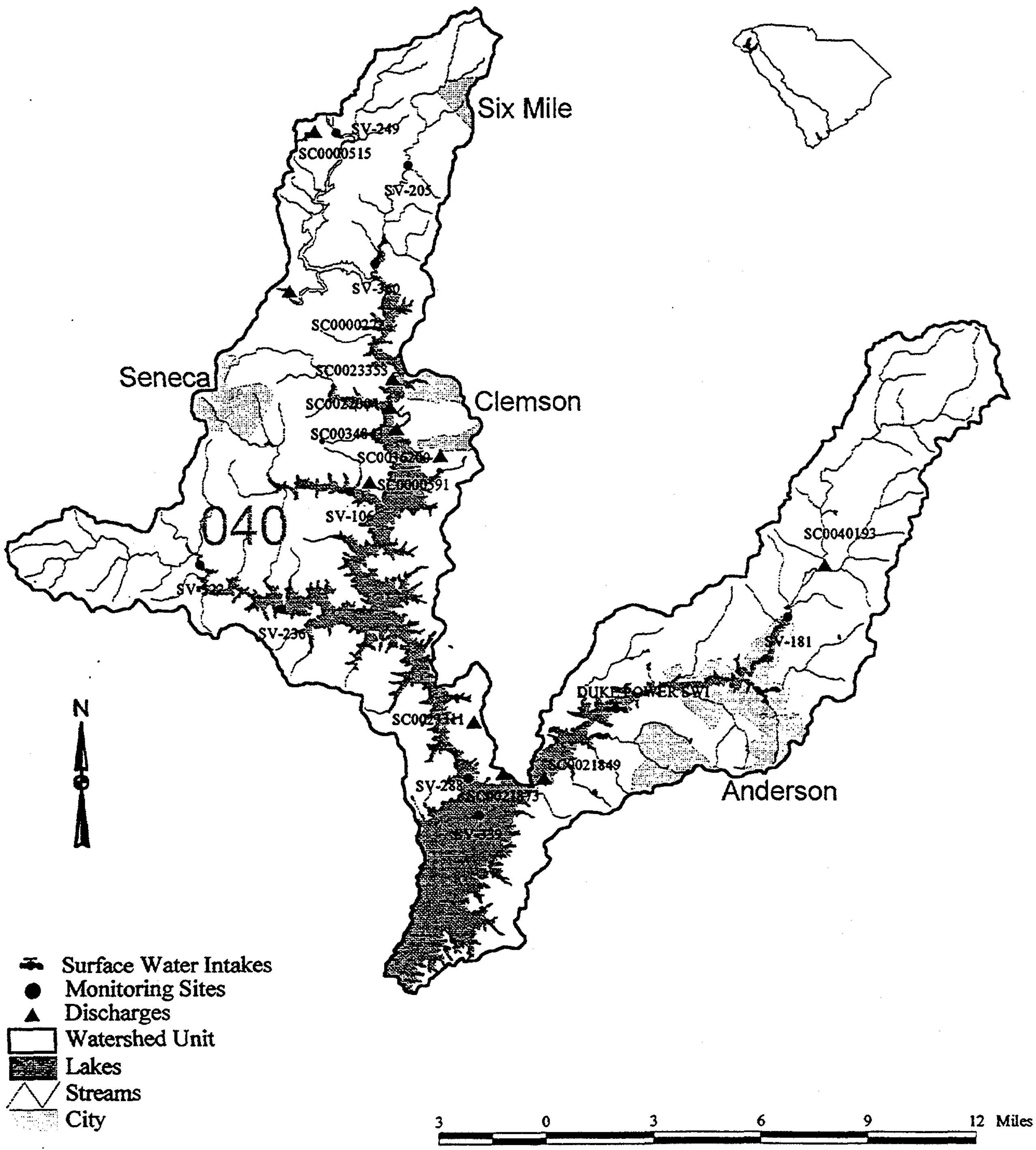
Permitted Discharges

Permit #	Facility	Receiving Water	Type*	Flow (MGD)†
SC0000132	AMERICAN HOUSE	PIKE CREEK	IN	0.033
SC0000272	COURTENAY UTIL INC/W	LITTLE RV	CO	0.0495
SC0000591	J P STEVENS/CLEMSON		IN	2.16
SC0020010	CLEMSON/MAIN PLANT	HARTWELL LK	MU	1
SC0021849	HARBOR GATE CONDOMIN	HARTWELL LK	CO	0.0375
SC0021873	SHOALS SEWER COMPANY	HARTWELL LK	CO	0.019
SC0022004	CLEMSON UNIVER/CENTR	HARTWELL LK	IN	14.11
SC0023141	ISSAQUEENA MOBILE HOM	HARTWELL LK	CO	0.024
SC0023311	DAYS INN/I-85 & SC H	HARTWELL LK	CO	0.025
SC0023353	MILLIKEN & CO/DEFORE	HARTWELL LK	IN	0.014
SC0023353	MILLIKEN & CO/DEFORE	HARTWELL LK	IN	MR
SC0034843	CLEMSON UNIVER/PHYSI	HARTWELL LK	CO	1.8
SC0036200	CLEMSON UNIVER/COOPE	HARTWELL LK	IN	0.003
SC0038652	DANIEL HIGH SCH/PICK	HARTWELL LK	CO	0.02
SC0040193	ANDERSON CO SWR AUTH	SIX & TWENTY	MU	0.5

*IN=industrial, CO=community, MU=municipal

†MGD=million gallons per day, MR=monitor and report

Watershed 03060101-040
Savannah and Salkehatchie River Basins



Monitoring Locations			
Station Number	**Type***	**Class†**	**Station Description**
SV-249	P	FW	Seneca River at SC 183, 3.8 miles WSW of Six Mile
SV-205	SS/BIO	FW	Six Mile Creek at S-39-160
SV-360	SS	FW	Lake Issaqueena forebay equidistant from dam and shorelines
SV-106	S	FW	Martin Creek arm of Lake Hartwell at S-37-65, N of Clemson
SV-236	P	FW	Lake Hartwell at S-37-184, 6.5 miles SSE of Seneca
SV-288	P	FW	L. Hartwell, Seneca R. Arm at USACE buoy betw. markers S-28A & S-29
SV-181	S	FW	6 & 20 Creek at S-04-29, 8.2 miles SE of Pendleton
SV-339	P	FW	L. Hartwell, Seneca R. Arm at USACE buoy betw. markers S-14 and S-15

* P=primary, S=secondary, SS=watershed, BIO=macroinvertebrate
† TPGT=trout put, grow and take; ORW=outstanding resource waters; FW=freshwaters

A fish consumption advisory has been issued by the Department for PCBs and includes portions of this watershed (see Fish Consumption Advisory, Management Unit WMU-0101).

Aquatic life uses are fully supported in the SENECA RIVER (SV-249), but may be threatened by a significant decreasing trend in dissolved oxygen concentration. Significant decreasing trends in five-day biochemical oxygen demand, total phosphorus and total nitrogen concentrations suggest improving conditions for these parameters. Recreational uses are fully supported at this site.

Aquatic life uses are fully supported in SIX MILE CREEK (SV-205) based on macroinvertebrate community, physical and chemical data. Recreational uses are only partially supported at this site due to fecal coliform bacteria excursions. This creek was Class B until April, 1992 and due to the implementation schedule the full effect of the more stringent fecal coliform bacteria limits may not be reflected in this assessment.

LAKE ISSAQUEENA (SV-360) is an 85-acre impoundment on Six Mile Creek, with a maximum depth of approximately 26 feet (8.0 meters) and an average depth of approximately nine feet (2.7 meters). Eutrophication assessments indicate that Lake Issaqueena is one of the least eutrophic small lakes in South Carolina, characterized by low nutrient concentrations and clear water. Preservation of this lake's desirable trophic condition is recommended. Aquatic life uses are fully supported in Lake Issaqueena (SV-360), but may be threatened by a very high concentration of zinc measured in 1996. Recreational uses are fully supported at this site.

Aquatic life uses are fully supported in **SIX AND TWENTY CREEK** (SV-181). A significant decreasing trend in total phosphorus concentration suggests improving conditions for this parameter. Recreational uses are only partially supported at this site due to fecal coliform bacteria excursions.

LAKE HARTWELL is a 56,000-acre impoundment on the Savannah River, with a maximum depth of approximately 175 feet (53 meters) and an average depth of approximately 46 feet (14 meters). The lake's watershed comprises 2090 square miles (5400 km^2) in Georgia and South Carolina. There are four monitoring sites on Lake Hartwell in this watershed unit.

At the most uplake site (SV-106), aquatic life uses are fully supported, but may be threatened by significant decreasing trends in dissolved oxygen concentration and pH, and a significant increasing trend in turbidity. Significant decreasing trends in five-day biochemical oxygen demand and total phosphorus concentrations suggest improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

At the next site down the lake (SV-236), aquatic life uses are fully supported, but may be threatened by significant decreasing trends in dissolved oxygen concentration and pH. Significant decreasing trends in five-day biochemical oxygen demand and total phosphorus concentrations suggest improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

Further down the lake (SV-288) aquatic life uses are not supported due to occurrences of copper in excess of the aquatic life acute standards, including a high concentration of copper in water measured in 1995. This is compounded by a significant decreasing trend in dissolved oxygen concentration and the measurement in sediment of four very high concentrations of chromium, one very high concentration of lead, one high and one very high concentration of nickel, and two high and two very high concentrations of zinc. Also in sediment P,P' DDE, a metabolite of DDT, was measured once, toxaphene was measured once, PCB-1242 was measured once, PCB-1248 was measured twice, and PCB-1254 was measured three times. Although the use of DDT was banned in 1973, and the manufacture and use of PCBs was banned in 1979, both are very resistant to degradation and therefore are very persistent in the environment. Significant decreasing trends in five-day biochemical oxygen demand and total phosphorus concentrations suggest improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

At the most down lake site (SV-339), aquatic life uses are not supported due to occurrences of copper in excess of the aquatic life acute standards, compounded by a very high concentration of lead measured in 1994. A significant decreasing trend in five-day biochemical oxygen demand suggests improving conditions for this parameter. Recreational uses are fully supported at this site.

Eutrophication assessments indicate that Lake Hartwell is one of the least eutrophic large lakes in South Carolina, characterized by low nutrient concentrations. Preservation of this lake's desirable trophic condition is recommended.

A nonpoint source demonstration project has been implemented in this watershed by Clemson University through SCDHEC. The goal of the project is to demonstrate best management practices (BMPs) for logging site preparation for re-planting trees. Before and after runoff samples are collected to show effectiveness of the BMPs. A program to educate loggers about these BMPs is part of the project. The project period is May 1995 through April 1998.

<u>03060101-050</u>. Watershed 03060101-050 (map page 37) is located in Oconee County and consists primarily of the LITTLE RIVER and its tributaries, which form an arm of LAKE KEOWEE. In this watershed, Oconee Creek and North Fork Creek join to form the Little River. A large portion of Lake Keowee, from the Keowee dam to the Little River dam, is contained in this watershed. Cane Creek and Little Cane Creek, together with Crooked Creek, form arms of Lake Keowee. The tributaries of Lake Keowee extend for a total of 59.59 stream miles.

The watershed occupies 104,698 acres of the Blue Ridge and Piedmont regions of South Carolina. The predominant soil types consist of an association of the Pacolet-Cecil-Hiwassee series. The erodibility of the soil (K-factor) averages 0.24; the slope of the terrain averages 19.3%, with a range of 2-80%. Land use/land cover in the watershed includes: 68% forested land, 12% agricultural land, 12% water, 4% urban land, 3% scrub/shrub land, and <1% barren land.

Permitted Discharges

Permit #	Facility	Receiving Water	Type*	Flow (MGD)†
SC0022322	LAKE KEOWEE DEVELOPM	KEOWEE LK	CO	0.9
SC0026603	SALEM HI&ELEM SCH	N FORK	CO	0.011
SC0026727	TAMASSEE DAR SCHOOL	DAVEY BR	CO	0.031

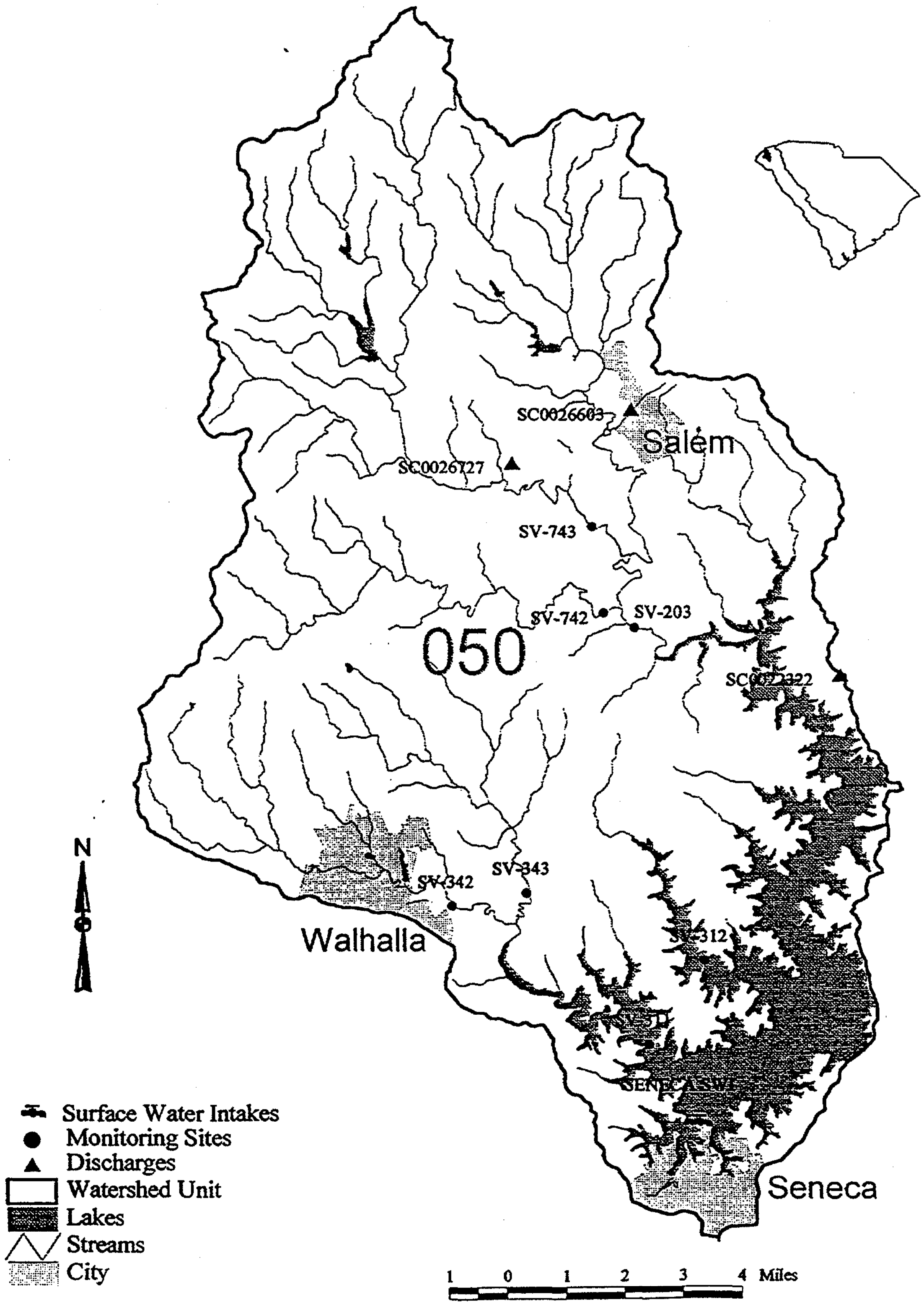
*IN=industrial, CO=community †MGD=million gallons per day

Monitoring Locations

Station Number	Type*	Class†	Station Description
SV-743	BIO	FW	Flat Shoals River at S-37-129
SV-742	BIO	FW	Oconee Creek at S-37-129
SV-203	S	FW	Little River at S-37-24, 7.1 miles NE of Walhalla
SV-312	P	FW	Lake Keowee at SC 188, Crooked Creek arm, 4.5 miles N of Seneca
SV-343	SS/BIO	FW	Little Cane Creek at S-37-133
SV-342	SS/BIO	FW	Cane Creek at S-37-133
SV-311	P	FW	Lake Keowee at SC 188, Cane Creek arm, 3.5 miles NW of Seneca

* P=primary, S=secondary, SS=watershed, BIO=macroinvertebrate
† TPGT=trout put, grow and take; ORW=outstanding resource waters; FW=freshwaters

Watershed 03060101-050
Savannah and Salkehatchie River Basins



Aquatic life uses are fully supported in **FLAT SHOALS RIVER** (SV-743) based on macroinvertebrate community data. Recreational use support was not assessed.

Aquatic life uses are fully supported in **OCONEE CREEK** (SV-742) based on macroinvertebrate community data. Recreational use support was not assessed.

Aquatic life and recreational uses are fully supported in **LITTLE RIVER** (SV-203). Significant decreasing trends in five-day biochemical oxygen demand and total phosphorus concentrations suggest improving conditions for these parameters.

Aquatic life uses are fully supported in **LITTLE CANE CREEK** (SV-343) based on macroinvertebrate community, physical and chemical data. Recreational uses are not supported at this site due to fecal coliform bacteria excursions.

Aquatic life uses are fully supported in **CANE CREEK** (SV-342) based on macroinvertebrate community, physical and chemical data. Recreational uses are not supported at this site due to fecal coliform bacteria excursions.

LAKE KEOWEE is a 18,372-acre impoundment on the Keowee River, with a maximum depth of approximately 155 feet (47 meters) and an average depth of approximately 54 feet (17 meters). The lake's watershed comprises 273 square miles (707 km^2) in North and South Carolina. There are two monitoring sites on Lake Keowee in this watershed unit.

At the uplake site (SV-312), aquatic life uses are fully supported. Significant decreasing trends in five-day biochemical oxygen demand, total phosphorus and total nitrogen concentrations, and turbidity suggest improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

At the down lake site (SV-311), aquatic life uses are only partially supported due to occurrences of zinc in excess of the aquatic life acute standards, including two very high concentrations, compounded by a very high concentration of copper measured in 1996 and a significant decreasing trend in dissolved oxygen concentration. Significant decreasing trends in five-day biochemical oxygen demand, total phosphorus and total nitrogen concentrations suggest improving conditions for these parameters. Recreational uses are fully supported at this site and a significant decreasing trend in fecal coliform bacteria concentration suggests improving conditions for this parameter.

Eutrophication assessments indicate that Lake Keowee is the least eutrophic large lake in South Carolina, characterized by very low nutrient concentrations. Preservation of this lake's desirable trophic condition is recommended.

Duke Energy operates a hydroelectric facility on Lake Keowee within this watershed.

A nonpoint source (NPS) monitoring project has been implemented in this watershed by the Friends of Lake Keowee Society through SCDHEC. The goal of the project is NPS education in the community. The project involves volunteer monitoring using a periphyton biomass technique to infer possible nutrient increases due to NPS pollution. Sampling stations will be placed near potential NPS input locations such as marinas and golf courses as well as at control stations. Area high school students will become involved in sampling and analysis in the final stages of the project. Project grant period: 2/01/97-1/31/98.

03060101-060. Watershed 03060101-060 (map page 40) is located in Pickens County and consists of the upper reach of **TWELVE MILE CREEK** and its tributaries. Middle Fork Twelve Mile Creek and **NORTH FORK TWELVE MILE CREEK** join to form Twelve Mile Creek, which flows through the watershed and is joined, along the way, by Town Creek, Wolf Creek and Rices Creek; the drainage from all these streams flows into the lower reaches of Twelve Mile Creek (03060101-070), and into Lake Hartwell. There are a total of 51.64 stream miles in this watershed.

The watershed occupies 74,972 acres of the Piedmont region of South Carolina. The predominant soil types consist of an association of the Cecil-Hiwassee-Pacolet series. The erodibility of the soil (K-factor) averages 0.25; the slope of the terrain averages 13.7%, with a range of 2-80%. Land use/land cover in the watershed includes: 64% forested land, 24% agricultural land, 6% urban land, 5% scrub/shrub land, <1% barren land, and <1% water.

Permitted Discharges

Permit #	Facility	Receiving Water	Type*	Flow (MGD)†
SC0000370	ALICE MFG/ELLJEAN	RICES CK	IN	0.04
SC0000370	ALICE MFG/ELLJEAN	RICES CK	IN	0.022
SC0000370	ALICE MFG/ELLJEAN	RICES CK	IN	0.032
SC0000434	SPANGLERS GROCERY	PRATERS CK	IN	0.009
SC0021661	PICKENS/TOWN CREEK	TOWN CK	MU	0.6
SC0021679	PICKENS/WOLF CREEK	WOLF CK	MU	0.5
SC0026492	RYOBI MOTOR PRODUCTS	TOWN CK	IN	MR
SC0047716	PICKENS/12 MILE CK (proposed)	12 MILE CK	MU	1

*IN=industrial, CO=community, MU=municipal

†MGD=million gallons per day, MR=monitor and report

Monitoring Locations			
Station Number	Type*	Class†	Station Description
SV-206	S/BIO	FW	North Fork Twelve Mile Creek at US 178, 2.9 miles N of Pickens
SV-282	S	FW	Twelve Mile Creek at S-39-273, 2.8 miles SSW of Pickens
SV-740	BIO	FW	Rices Creek at S-39-158
SV-739	BIO	FW	Twelve Mile Creek at S-39-137

* P=primary, S=secondary, SS=watershed, BIO=macroinvertebrate

† TPGT=trout put, grow and take; ORW=outstanding resource waters; FW=freshwaters

Appendix B
Water Quality Data

Monitoring Station Descriptions
Dissolved Oxygen, pH, and Bacteria Data
Phosphorus, Nitrogen, and Turbidity Data
Metals Data

ABBREVIATIONS

Station Information:

STATION NUMBER	Station ID
TYPE	SCDHEC station type code

- P = Primary station, sampled monthly all year round
- S = Secondary station, sampled monthly May - October
- P* = Secondary station upgraded to primary station parameter coverage and sampling frequency for basin study
- SS = Special station added for the Savannah-Salkehatchie basin study
- I* = Currently inactive station which had some data within the period reviewed
- BIO= Indicates macroinvertebrate community data assessed

WATERBODY NAME	Stream or Lake Name
CLASS	Stream classification at the point where monitoring station is located

Parameter Abbreviations and Parameter Measurement Units:

DO	Dissolved Oxygen (mg/l)	NH3	Ammonia (mg/l)
BOD	Five-Day Biochemical Oxygen Demand (mg/l)	CD	Cadmium (ug/l)
pH	pH (SU)	CR	Chromium (ug/l)
TP	Total Phosphorus (mg/l)	CU	Copper (ug/l)
TN	Total Nitrogen (mg/l)	PB	Lead (ug/l)
TURB	Turbidity (NTU)	HG	Mercury (ug/l)
TSS	Total Suspended Solids (mg/l)	NI	Nickel (ug/l)
BACT	Fecal Coliform Bacteria (#/100 ml)	ZN	Zinc (ug/l)

ABBREVIATIONS

Statistical Abbreviations:

N	For standards compliance, number of surface samples collected between January, 1992 and December, 1996 For trends, number of surface samples collected between January, 1982 and December, 1996
EXC.	Number of samples contravening the appropriate standard
%	Percentage of samples contravening the appropriate standard
MEAN EXC.	Mean of samples which contravened the applied standard
MED	For heavy metals with a human health criterion, this is the median of all surface samples between January, 1992 and December, 1996. DL indicates that the median was the detection limit.
MAG	Magnitude of any statistically significant trend, average change per year, expressed in parameter measurement units

Key to Trends:

D	Statistically significant decreasing trend in parameter concentration
I	Statistically significant increasing trend in parameter concentration
*	No statistically significant trend
(Blank)	Insufficient data to test for long term trends

MONITORING STATION DESCRIPTIONS, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	TYPE	WATERBODY NAME	CLASS	STATION DESCRIPTION	COUNTY
03060101020					
SV-335	P	LAKE JOCASSEE	TPGT	LK JOCASSEE AT TOXAWAY, HORSE PASTURE, & LAUREL FORK	OCONEE
SV-337	P	LAKE JOCASSEE	TPGT	LK JOCASSEE OUTSIDE COFFER DAM AT BAD CK PROJECT	OCONEE
SV-336	P	LAKE JOCASSEE	TPGT	LK JOCASSEE AT CONFLUENCE OF THOMPSON AND WHITEWATER RVRS	OCONEE
SV-334	P	LAKE JOCASSEE	TPGT	LK JOCASSEE, MAIN BODY	OCONEE
03060101030					
SV-741	BIO	EASTATOE CK	ORW	EASTATOE CREEK AT S-39-237	PICKENS
SV-676	BIO	ROCKY BOTTOM CK	ORW	ROCKY BOTTOM CK AT US 178	PICKENS
SV-230	P	BIG EASTATOE CK	TPGT	BIG EASTATOE CREEK AT S-39-143	PICKENS
SV-341	SS/BIO	LITTLE EASTATOE CK	TPGT	LITTLE EASTATOE CREEK AT S-39-49	PICKENS
SV-338	P	LAKE KEOWEE	FW	LK KEOWEE ABOVE SC ROUTE 130 AND DAM	OCONEE
03060101040					
SV-249	P	SENECA RVR	FW	SENECA RVR AT SC 183 3.8 MI WSW SIX MILE	OCONEE
SV-205	SS/BIO	SIX MILE CK	FW	SIX MILE CREEK AT S-39-160	PICKENS
SV-360	SS	LAKE ISSAQUEENA	FW	LAKE ISSAQUEENA, FOREBAY EQUIDISTANT FROM DAM AND SHORELINE	PICKENS
SV-106	S	LAKE HARTWELL	FW	MARTIN CK ARM OF LAKE HARTWELL AT S-37-65 N OF CLEMSON	OCONEE
SV-236	P	LAKE HARTWELL	FW	LAKE HARTWELL AT S-37-184 6.5 MI SSE OF SENECA	OCONEE
SV-288	P	LAKE HARTWELL	FW	L HARTWELL, SENECA R ARM AT USACE BUOY BTWN S-28A & S-29	ANDERSON
SV-181	S	SIX & TWENTY CK	FW	6 & 20 CK AT S-04-29 8.2 MI SE OF PENDLETON	ANDERSON
SV-339	P	LAKE HARTWELL	FW	LK HARTWELL, SENECA RVR ARM AT USACE BUOY BTWN S-14 AND S-15	ANDERSON
03060101050					
SV-743	BIO	FLAT SHOALS RIVER	FW	FLAT SHOALS RIVER AT S-37-129	OCONEE
SV-742	BIO	OCONEE CK	FW	OCONEE CREEK AT S-37-129	OCONEE
SV-203	S	LITTLE RVR	FW	LITTLE RVR AT S-37-24 7.1 MI NE OF WALHALLA	OCONEE
SV-312	P	LAKE KEOWEE	FW	LK KEOWEE AT SC 188 - CROOKED CK ARM 4.5 MI N SENECA	OCONEE
SV-343	SS/BIO	LITTLE CANE CK	FW	LITTLE CANE CREEK AT S-37-133	OCONEE
SV-342	SS/BIO	CANE CK	FW	CANE CREEK AT S-37-133	OCONEE
SV-311	P	LAKE KEOWEE	FW	LK KEOWEE AT SC 188 - CANE CK ARM 3.5 MI NW SENECA	OCONEE
03060101060					
SV-206	S/BIO	N FORK TWELVE MILE CK	FW	N FORK 12 MI CK AT US 178 2.9 MI N OF PICKENS	PICKENS
SV-282	S	TWELVE MILE CK	FW	12 MI CK AT S-39-273 2.8 MI SSW OF PICKENS	PICKENS
SV-740	BIO	RICES CK	FW	RICES CREEK AT S-39-158	PICKENS
SV-739	BIO	TWELVE MILE CK	FW	TWELVE MILE CREEK AT S-39-137	PICKENS

MONITORING STATION DESCRIPTIONS, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	TYPE	WATERBODY NAME	CLASS	STATION DESCRIPTION	COUNTY
03060101070					
SV-239	S	GOLDEN CK	FW	GOLDEN CK AT S-39-222 1.2 MI NW OF LIBERTY	PICKENS
SV-738	BIO	GOLDEN CK	FW	GOLDEN CREEK AT GOLDEN CK RD.	PICKENS
SV-015	S	TWELVE MILE CK	FW	TWELVE MI CK AT S-39-51 N OF NORRIS	PICKENS
SV-137	S	TWELVE MILE CK	FW	12 MI CK AT S-39-337	PICKENS
SV-136	S	UNNAMED	FW	FIRST CK AFTER LEAVING CENTRAL AT CLVT ON MAW BRDG RD	PICKENS
SV-107	S	TWELVE MILE CK	FW	TWELVE MI CK AT SC 133	PICKENS
03060101080					
SV-333	P	CONEROSS CK	FW	CONEROSS CK AT S-37-13	OCONEE
SV-004	P	CONEROSS CK	FW	CONEROSS CK AT SC 59	OCONEE
SV-322	I*	CONEROSS CK	FW	CONEROSS CK AT S-37-54 (LAKE HARTWELL)	OCONEE
03060101090					
SV-017	S	EIGHTEEN MILE CK	FW	18 MI CK AT UNNUMBERED CO RD 2.25 MI SSW OF EASLEY	PICKENS
SV-241	S	WOODSIDE BRANCH	FW	WOODSIDE BR AT US 123 1.5 MI E OF LIBERTY	PICKENS
SV-245	S	EIGHTEEN MILE CK	FW	18 MI CK AT S-39-27 3.3 MI S OF LIBERTY	PICKENS
SV-135	P/BIO	EIGHTEEN MILE CK	FW	18 MI CK AT S-39-93 SW OF CENTRAL	ANDERSON
SV-268	P	EIGHTEEN MILE CK	FW	EIGHTEEN MILE CK AT 2-04-1098	ANDERSON
03060101100					
SV-735	BIO	THREE AND TWENTY CK	FW	THREE AND TWENTY CREEK AT S-04-29	ANDERSON
SV-111	S	THREE & TWENTY CK	FW	THREE & TWENTY CREEK AT S-04-280	ANDERSON
03060102030					
SV-308	S/BIO	E FORK CHATTOOGA RVR	ORW	E FK OF CHATTOOGA RVR AT SC 107 2 MI S OF ST LINE	OCONEE
SV-227	P/BIO	CHATTOOGA RVR	ORW	CHATTOOGA RVR AT SC 28 3.5 MI NW MT REST	OCONEE
03060102060					
SV-199	P	CHATTOOGA RVR	ORW	CHATTOOGA RVR AT US ROUTE 76	OCONEE
SV-359	SS	TUGALOO LAKE	FW	TUGALOO LAKE, FOREBAY EQUIDISTANT FROM SPILLWAY & SHORELINE	OCONEE
SV-358	SS	LAKE YONAH	FW	LAKE YONAH, 50% BTWN CENTER OF SPILLWAY AND OPPOSITE SHORE	OCONEE
SV-673	BIO	BRASSTOWN CK	FW	BRASSTOWN CK AT S-37-48	OCONEE
SV-200	S	LAKE HARTWELL	FW	TUGALOO RVR ARM OF LAKE HARTWELL AT US 123	OCONEE
03060102120					
SV-675	BIO	CHAUGA RVR	ORW	CHAUGA RVR AT S-37-193	OCONEE
SV-344	SS	CHAUGA RVR	FW	CHAUGA RIVER AT S-37-34	OCONEE
SV-225	BIO	TOXAWAY CK	FW	TOXAWAY CK AT S-37-34	OCONEE
03060102130					
SV-301	S	NORRIS CK	FW	NORRIS CK AT S-37-435 1 MI S OF WESTMINSTER	OCONEE
SV-108	SS/BIO	CHOESTOEA CK	FW	CHOESTOEA CREEK AT S-37-49	OCONEE

MONITORING STATION DESCRIPTIONS, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	TYPE	WATERBODY NAME	CLASS		STATION DESCRIPTION	COUNTY
03060103140						
SV-164	SS/BIO	LITTLE RVR	FW		LITTLE RIVER AT S-01-24	ABBEVILLE
SV-733	BIO	HOGSKIN CK	FW		HOGSKIN CREEK AT SC 184	ABBEVILLE
SV-348	SS/BIO	LITTLE RVR	FW		LITTLE RIVER AT S-01-32	ABBEVILLE
SV-644	BIO	GILL CK	FW		GILL CK AT S-01-32	ABBEVILLE
SV-052	P	SAWNEY CK	FW		SAWNEY CK AT CO RD 1.5 MI SE OF CALHOUN FALLS	ABBEVILLE
SV-171	BIO	CALHOUN CK	FW		CALHOUN CK AT S-01-40	ABBEVILLE
SV-192	SS	LITTLE RVR	FW		LITTLE RIVER AT S-33-19	MCCORMICK
03060103150						
SV-349	SS/BIO	LONG CANE CK	FW		LONG CANE CREEK AT S-01-159	ABBEVILLE
SV-734	BIO	JOHNS CK	FW		JOHNS CREEK AT S-01-159	ABBEVILLE
SV-053B	S	BLUE HILL CK	FW		BLUE HILL CK ON S MAIN ST ABBEVILLE	ABBEVILLE
SV-054	BIO	DOUBLE BR	FW		DOUBLE BR AT S-01-33	ABBEVILLE
SV-732	BIO	BIG CURLY TAIL CK	FW		BIG CURLY TAIL CREEK AT US FOREST RD 509	ABBEVILLE
SV-318	P/BIO	LONG CANE CK	FW		LONG CANE CK AT S-33-117 7.0 MI NW MCCORMICK	MCCORMICK
03060107010						
SV-151	P/BIO	HARD LABOR CK	FW		HARD LABOR CREEK AT S-24-164 BRIDGE	GREENWOO
SV-731	BIO	HARD LABOR CK	FW		HARD LABOR CREEK AT S-33-23	MCCORMICK
SV-351	SS/BIO	CUFFYTOWN CK	FW		CUFFYTOWN CREEK AT S-33-138	MCCORMICK
SV-730	BIO	ROCKY CK	FW		ROCKY CK AT S-33-87	MCCORMICK
SV-330	P	STEVENS CK	FW		STEVENS CREEK AT S-33-21	MCCORMICK
03060107020						
SV-729	BIO	TURKEY CK	FW		TURKEY CREEK AT S-19-100	EDGEFIELD
SV-728	BIO	LOG CK	FW		LOG CREEK AT S-19-315	EDGEFIELD
SV-727	BIO	ROCKY CK	FW		ROCKY CK AT S-19-61	EDGEFIELD
SV-352	SS	TURKEY CK	FW		TURKEY CREEK AT S-33-227/S-19-68	EDGEFIELD
03060107030						
SV-068	S	BEAVERDAM CK	FW		BEAVERDAM CK AT S-19-35 3.8 MI NW OF EDGEFIELD	EDGEFIELD
SV-353	SS/BIO	BEAVERDAM CK	FW		BEAVERDAM CREEK AT FOREST SERVICE ROAD 621 OFF S-19-68	EDGEFIELD
03060107040						
SV-063	BIO	STEVENS CK	FW		STEVENS CK AT SC 23	MCCORMICK
SV-354	SS	STEVENS CK	FW		STEVENS CREEK AT S-33-88/S-19-143	EDGEFIELD
SV-726	BIO	HORN CK	FW		HORN CREEK AT S-19-143	EDGEFIELD
SV-725	BIO	CHEVES CK	FW		CHEVES CREEK AT S-19-34	EDGEFIELD
03060106030						
SV-251	P	SAVANNAH RVR	FW		SAVANNAH RVR AT US 1 1.5 MI SW N. AUGUSTA	AIKEN

DISSOLVED OXYGEN, pH, AND BACTERIA DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION		DO	DO	DO	MEAN	TRENDS						pH	pH	pH	MEAN	TRENDS			BACTERIA			MEAN	BACT TRENDS		
NUMBER	WATERBODY NAME	N	EXC.	%	EXC.	DO	N	MAG	BOD	N	MAG	N	EXC.	%	EXC.	PH	N	MAG	N	EXC.	%	EXC.		N	MAG
3060101020																									
SV-335	LAKE JOCASSEE	61	0	0		I	75	0.06	*	69		58	0	0		*	73		58	0	0		D	70	0.0
SV-337	LAKE JOCASSEE	62	0	0		*	76		*	69		58	0	0		I	74	0.03	57	0	0		D	70	0.0
SV-336	LAKE JOCASSEE	60	0	0		*	73		*	68		56	0	0		*	71		57	0	0		*	70	
SV-334	LAKE JOCASSEE	62	0	0		I	75	0.05	*	69		58	0	0		*	72		56	0	0		D	69	0.0
3060101030																									
SV-230	BIG EASTATOE CK	56	0	0		I	78	0.08	*	78		56	0	0		*	78		55	2	4	500	*	78	
SV-341	LITTLE EASTATOE CK	12	0	0								12	0	0					12	3	25	1567			
SV-338	LAKE KEOWEE	62	0	0		I	75	0.17	D	70	-0.05	58	0	0		I	75	0.05	57	0	0		*	71	
3060101040																									
SV-249	SENECA RVR	58	1	2	2.7	D	147	-0.03	D	170	-0.06	56	1	2	5.95	*	164		57	1	2	730	*	171	
SV-205	SIX MILE CK	12	0	0								12	0	0					12	2	17	8000			
SV-360	LAKE ISSAQUEENA	6	0	0								6	0	0					6	0	0				
SV-106	LAKE HARTWELL	24	0	0		D	67	-0.05	D	68	-0.08	24	0	0		D	69	-0.06	24	0	0		D	70	0.0
SV-236	LAKE HARTWELL	31	0	0		D	73	-0.08	D	72	-0.10	31	0	0		D	75	-0.09	31	0	0		D	73	0.0
SV-288	LAKE HARTWELL	57	0	0		D	152	-0.03	D	170	-0.07	56	1	2	9.75	*	174		55	1	2	2000	D	168	0.0
SV-181	SIX & TWENTY CK	24	0	0		*	69		*	71		24	0	0		*	71		24	4	17	2012	*	70	
SV-339	LAKE HARTWELL	57	0	0		*	68		D	69	-0.06	55	0	0		*	67		55	0	0		*	68	
3060101050																									
SV-203	LITTLE RVR	29	0	0		*	72		D	74	-0.06	29	0	0		*	73		29	2	7	1225	*	74	
SV-312	LAKE KEOWEE	62	0	0		*	146		D	168	-0.07	58	0	0		*	164		56	0	0		D	170	0.0
SV-343	LITTLE CANE CK	12	0	0								12	0	0					12	6	50	960			
SV-342	CANE CK	12	0	0								12	0	0					12	6	50	1517			
SV-311	LAKE KEOWEE	65	0	0		D	158	-0.03	D	168	-0.06	60	0	0		*	177		58	0	0		D	171	0.0
3060101060																									
SV-206	N FORK 12 MILE CK	23	0	0		*	68		D	68	-0.06	23	0	0		D	69	-0.02	23	4	17	4408	I	68	8.33
SV-282	TWELVE MILE CK	1	0	0		*	58		D	49	-0.15	1	0	0		*	60		1	0	0		*	49	
3060101070																									
SV-239	GOLDEN CK	23	0	0		*	67		*	67		23	0	0		D	69	-0.02	23	14	61	2317	*	68	
SV-015	TWELVE MILE CK	13	0	0		*	58		D	60	-0.07	13	0	0		*	57		13	7	54	1913	I	58	22.0
SV-137	TWELVE MILE CK	13	0	0		*	58		D	60	-0.06	13	0	0		*	58		13	5	38	1030	*	59	
SV-136	UNNAMED	22	0	0		D	67	-0.03	D	68	-0.05	22	0	0		*	67		22	4	18	560	I	67	16.0
SV-107	TWELVE MILE CK	13	0	0		D	65	-0.04	D	58	-0.10	12	0	0		*	63		12	0	0		*	57	

DISSOLVED OXYGEN, pH, AND BACTERIA DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION		DO	DO	DO	MEAN	TRENDS						pH	pH	pH	MEAN	TRENDS			BACTERIA			MEAN	BACT TRENDS		
NUMBER	WATERBODY NAME	N	EXC.	%	EXC.	DO	N	MAG	BOD	N	MAG	N	EXC.	%	EXC.	PH	N	MAG	N	EXC.	%	EXC.		N	MAG
3060101080																									
SV-333	CONEROSS CK	58	0	0		I	69	0.05	*	69		58	0	0		D	70	-0.03	57	11	19	866	*	69	
SV-004	CONEROSS CK	53	0	0		*	98		D	96	-0.09	53	1	2	8.7	*	101		53	9	17	858	I	96	14.55
SV-322	CONEROSS CK	45	0	0		*	146		D	160	-0.05	45	2	4	8.65	*	167		45	5	11	894	I	162	2.25
3060101090																									
SV-017	EIGHTEEN MILE CK	24	0	0		I	73	0.10	D	70	-0.40	24	0	0		*	75		24	15	63	876	D	69	-270.0
SV-241	WOODSIDE BRANCH	24	0	0		I	69	0.15	D	70	-0.43	24	0	0		*	71		24	10	42	3339	D	69	-427.14
SV-245	EIGHTEEN MILE CK	24	0	0		*	73		D	71	-0.09	24	0	0		*	73		24	11	46	1702	D	69	-25.98
SV-135	EIGHTEEN MILE CK	53	0	0		*	101		D	99	-0.04	53	1	2	10.8	D	101	-0.02	53	28	53	1852	I	98	20.0
SV-268	EIGHTEEN MILE CK	58	0	0		I	70	0.26	*	70		57	0	0		*	69		58	17	29	2099	*	70	
3060101100																									
SV-111	THREE & TWENTY CK	30	0	0		I	68	0.05	D	68	-0.08	30	0	0		D	68	-0.03	30	16	53	1105	I	67	33.88
3060102030																									
SV-308	E FORK CHATTOOGA R	23	0	0		*	67		D	69	-0.03	23	0	0		I	68	0.05	23	1	4	1300	*	68	
SV-227	CHATTOOGA RVR	58	0	0		*	144		D	168	-0.05	58	0	0		I	164	0.03	57	1	2	2800	*	168	
3060102060																									
SV-199	CHATTOOGA RVR	58	0	0		*	69		*	68		58	0	0		I	69	0.03	57	3	5	7653	*	68	
SV-359	TUGALOO LAKE	6	0	0								6	0	0					6	0	0				
SV-358	LAKE YONAH	6	0	0								6	0	0					6	0	0				
SV-200	LAKE HARTWELL	28	0	0		*	71		D	72	-0.04	28	1	4	5.65	*	74		28	1	4	1100	*	73	
3060102120																									
SV-344	CHAUGA RVR	12	0	0								12	0	0					12	1	8	1600			
3060102130																									
SV-301	NORRIS CK	22	0	0		*	65		D	68	-0.05	22	0	0		D	69	-0.03	22	17	77	868	*	68	
SV-108	CHOESTOEA CK	11	0	0								11	0	0					11	6	55	4253			
3060102150																									
SV-345	BEAVERDAM CK	13	0	0								13	0	0					13	5	38	3820			
3060103020																									
SV-340	LAKE HARTWELL	57	0	0		*	69		*	69		55	0	0		*	68		55	0	0		*	69	
3060103030																									
SV-316	BIG GENEROSTEE CK	24	0	0		I	63	0.20	D	63	-0.46	24	0	0		D	61	-0.02	24	15	63	4315	I	62	87.75
SV-100	LAKE RUSSELL	58	6	10	4.567	D	146	-0.03	D	172	-0.05	57	1	2	5.8	I	166	0.01	58	0	0		D	171	-0.2
SV-357	LAKE RUSSELL	6	0	0								6	0	0					6	0	0				
SV-098	LAKE RUSSELL	61	0	0		*	151		D	172	-0.07	56	0	0		*	168		56	1	2	800	D	171	-0.17

DISSOLVED OXYGEN, pH, AND BACTERIA DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	WATERBODY NAME	DO N	DO EXC.	DO %	MEAN EXC.	TRENDS DO	N	MAG	BOD	N	MAG	pH N	pH EXC.	pH %	MEAN EXC.	TRENDS PH	N	MAG	BACTERIA N	EXC.	%	MEAN EXC.	BACT TRENDS	N	MAG
3060103070																									
SV-031	ROCKY RVR	58	0	0		*	150		D	172	-0.05	57	0	0		*	171		58	17	29	2022	*	171	
SV-041	ROCKY RVR	29	1	3	4.5	I	76	0.15	D	75	-0.26	29	0	0		*	77		29	8	28	4215	I	74	16.4
SV-139	CUPBOARD CK	23	11	48	4.159	D	73	-0.16	D	70	-0.20	23	5	22	9.49	D	74	-0.07	23	19	83	125599	I	75	90.0
SV-140	CUPBOARD CK	24	12	50	4.079	*	75		*	71		24	0	0		D	75	-0.01	24	18	75	2487	I	75	46.33
SV-141	BROADWAY CK	41	0	0		*	85		*	71		40	0	0		D	87	-0.02	24	12	50	1712	I	70	24.0
SV-319	BROADWAY LAKE	6	0	0								6	0	0					6	0	0				
SV-258	BROADWAY LAKE	6	0	0								6	0	0					6	0	0				
SV-321	BROADWAY LAKE	8	0	0								8	0	0					8	0	0				
SV-346	ROCKY RVR	12	0	0								12	0	0					12	1	8	9000			
SV-037	BETSY CK	11	1	9	1.3	*	56		D	53	-0.15	11	0	0		*	58		4	1	25	640	I	52	25.86
SV-043	CHEROKEE CK	23	0	0		I	68	0.05	D	70	-0.07	23	0	0		*	68		23	5	22	528	*	67	
SV-331	LAKE SECESSION	61	0	0		*	69		D	62	-0.10	57	5	9	8.72	D	68	-0.06	55	6	11	1158	I	62	4.6
SV-332	LAKE SECESSION	57	1	2	4.35	*	65		*	62		53	2	4	7.1	*	67		53	1	2	630	*	62	
3060103080																									
SV-347	WILSON CK	12	0	0								12	0	0					12	3	25	523			
3060103100																									
SV-291	THURMOND RESERVOIR	56	0	0		*	154		D	171	-0.05	56	0	0		D	182	-0.08	57	0	0		*	171	
SV-294	THURMOND RESERVOIR	56	0	0		*	146		D	171	-0.06	56	1	2	5.95	D	172	-0.05	57	1	2	600	*	170	
3060103140																									
SV-164	LITTLE RVR	12	0	0								12	0	0					12	2	17	540			
SV-348	LITTLE RVR	12	0	0								12	0	0					12	3	25	787			
SV-052	SAWNEY CK	52	4	8	3.975	I	96	0.08	D	99	-0.26	52	0	0		D	96	-0.04	53	14	26	1636	I	98	19.8
SV-192	LITTLE RVR	12	0	0								12	1	8	5.9				12	1	8	600			
3060103150																									
SV-349	LONG CANE CK	12	0	0								12	0	0					12	10	83	673			
SV-053B	BLUE HILL CK	23	0	0		I	68	0.03	D	69	-0.25	23	0	0		D	68	-0.03	23	20	87	12226	I	69	126.67
SV-318	LONG CANE CK	56	0	0		*	147		D	171	-0.06	56	1	2	11.2	D	173	-0.04	57	10	18	939	D	171	-11.43
3060107010																									
SV-151	HARD LABOR CK	54	0	0		I	87	0.29	D	87	-0.45	55	1	2	5.95	D	88	-0.03	55	21	38	1087	D	88	-180.0
SV-351	CUFFYTOWN CK	12	0	0								12	1	8	5.95				12	2	17	575			
SV-330	STEVENS CK	56	0	0		*	97		D	96	-0.05	56	0	0		D	97	-0.07	57	9	16	713	I	100	4.25
3060107020																									
SV-352	TURKEY CK	12	0	0								12	0	0					12	0	0				

PHOSPHORUS, NITROGEN, AND TURBIDITY DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	WATERBODY NAME	TRENDS TP	N	MAG	TN	N	MAG	TURB	N	MAG	TSS	N	MAG	NH3 N	NH3 EXC.
3060101020															
SV-335	LAKE JOCASSEE	*	71		D	39	-0.01	*	71						
SV-337	LAKE JOCASSEE	*	70		*	33		D	71	-0.08				57	0
SV-336	LAKE JOCASSEE	*	70		*	34		*	71					52	0
SV-334	LAKE JOCASSEE	*	71		D	37	-0.01	*	71					52	0
														57	0
3060101030															
SV-230	BIG EASTATOE CK	*	81		*	58		*	79		*	58		53	0
SV-341	LITTLE EASTATOE CK													10	0
SV-338	LAKE KEOWEE	*	69		*	41		*	71					52	0
3060101040															
SV-249	SENECA RVR	D	172	0.0	D	122	-0.02	*	170					53	0
SV-205	SIX MILE CK													12	0
SV-360	LAKE ISSAQUEENA													6	0
SV-106	LAKE HARTWELL	D	73	0.0				I	68	0.07				2	0
SV-236	LAKE HARTWELL	D	77	0.0				*	71					12	0
SV-288	LAKE HARTWELL	D	169	0.0				*	168					52	0
SV-181	SIX & TWENTY CK	D	72	0.0				*	71						
SV-339	LAKE HARTWELL	*	73		*	53		*	69					55	0
3060101050															
SV-203	LITTLE RVR	D	73	0.0				*	73					10	0
SV-312	LAKE KEOWEE	D	173	0.0	D	121	-0.02	D	167	-0.03				52	0
SV-343	LITTLE CANE CK													11	0
SV-342	CANE CK													11	0
SV-311	LAKE KEOWEE	D	170	0.0	D	118	-0.02	*	169					53	0
3060101060															
SV-206	N FORK 12 MILE CK	D	70	0.0				I	69	0.7					
SV-282	TWELVE MILE CK	D	51	-0.01	D	125	-0.01	*	50						
3060101070															
SV-239	GOLDEN CK	*	70					I	68	1.08					
SV-015	TWELVE MILE CK	D	61	0.0				I	59	1.03				12	0
SV-137	TWELVE MILE CK	D	61	0.0				*	58					12	0
SV-136	UNNAMED	D	70	-0.02				*	68						
SV-107	TWELVE MILE CK	D	61	0.0				*	57					10	0

PHOSPHORUS, NITROGEN, AND TURBIDITY DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION NUMBER	WATERBODY NAME	TRENDS TP	N	MAG	TN	N	MAG	TURB	N	MAG	TSS	N	MAG	NH3 N	NH3 EXC.
3060101080															
SV-333	CONEROSS CK	*	74		*	62		*	70					55	0
SV-004	CONEROSS CK	D	106	-0.01	*	44		*	95					49	0
SV-322	CONEROSS CK	D	159	-0.01	*	128		*	160					40	0
3060101090															
SV-017	EIGHTEEN MILE CK	D	75	-0.01				*	71						
SV-241	WOODSIDE BRANCH	D	73	-0.07				D	71	-0.5					
SV-245	EIGHTEEN MILE CK	D	76	-0.01				*	70						
SV-135	EIGHTEEN MILE CK	D	105	0.0	*	51		I	99	1.13				53	0
SV-268	EIGHTEEN MILE CK	*	72		I	67	0.05	I	70	1.83				56	0
3060101100															
SV-111	THREE & TWENTY CK	*	67					*	68					12	0
3060102030															
SV-308	E FORK CHATTOOGA R	D	71	0.0				*	68						
SV-227	CHATTOOGA RVR	D	173	0.0	D	113	-0.01	I	167	0.03				55	0
3060102060															
SV-199	CHATTOOGA RVR	I	72	0.0	*	36		*	69					54	0
SV-359	TUGALOO LAKE													6	0
SV-358	LAKE YONAH													6	0
SV-200	LAKE HARTWELL	D	75	0.0				*	72					11	0
3060102120															
SV-344	CHAUGA RVR													11	0
3060102130															
SV-301	NORRIS CK	D	69	0.0				*	67						
SV-108	CHOESTOEA CK													10	0
3060102150															
SV-345	BEAVERDAM CK													11	0
3060103020															
SV-340	LAKE HARTWELL	*	73		*	57		*	69					52	0
3060103030															
SV-316	BIG GENEROSTEE CK	D	65	-0.05				D	62	-0.43					
SV-100	LAKE RUSSELL	D	173	0.0	D	129	-0.02	*	171					54	0
SV-357	LAKE RUSSELL													6	0
SV-098	LAKE RUSSELL	D	170	0.0	D	135	-0.02	D	171	-0.08				55	0

METALS DATA, SAVANNAH AND SALKEHATCHIE RIVER BASINS

STATION		CD	CD	CD	CR	CR	CR	CU	CU	PB	PB	PB	HG	HG	HG	NI	NI	ZN	ZN
NUMBER	WATERBODY NAME	N	EXC.	MED.	N	EXC.	MED.	N	EXC.	N	EXC.	MED.	N	EXC.	MED.	N	EXC.	N	EXC.
3060101020																			
SV-335	LAKE JOCASSEE	18	0	DL	18	0	DL	18	2	18	1	DL	18	0	DL	18	0	18	2
SV-337	LAKE JOCASSEE	16	0	DL	17	0	DL	17	0	17	1	DL	17	0	DL	17	0	17	1
SV-336	LAKE JOCASSEE	16	0	DL	16	0	DL	16	2	16	0	DL	16	0	DL	16	0	16	0
SV-334	LAKE JOCASSEE	18	0	DL	18	0	DL	18	1	18	0	DL	18	0	DL	18	0	18	0
3060101030																			
SV-230	BIG EASTATOE CK	18	0	DL	18	0	DL	18	0	18	0	DL	18	0	DL	18	0	18	2
SV-341	LITTLE EASTATOE CK	3	0	DL	3	0	DL	3	1	3	0	DL	3	0	DL	3	0	3	0
SV-338	LAKE KEOWEE	19	0	DL	19	0	DL	19	2	19	0	DL	19	0	DL	19	0	19	0
3060101040																			
SV-249	SENECA RVR	20	0	DL	20	0	DL	20	1	20	0	DL	20	0	DL	20	0	20	0
SV-205	SIX MILE CK	4	0	DL	4	0	DL	4	0	4	0	DL	4	0	DL	4	0	4	1
SV-360	LAKE ISSAQUEENA	2	0	DL	2	0	DL	2	0	2	0	DL	2	0	DL	2	0	2	1
SV-106	LAKE HARTWELL	1	0	DL	1	0	DL	1	0	1	0	DL	1	0	DL	1	0	1	0
SV-236	LAKE HARTWELL	2	0	SL	2	0	DL	2	0	2	0	DL	2	0	DL	2	0	2	0
SV-288	LAKE HARTWELL	18	0	DL	18	0	DL	18	3	18	0	DL	18	0	DL	17	0	18	0
SV-339	LAKE HARTWELL	19	0	DL	19	0	DL	19	3	19	1	DL	19	0	DL	19	0	19	0
3060101050																			
SV-203	LITTLE RVR	3	0	DL	3	0	DL	3	0	3	0	DL	3	0	DL	3	0	3	0
SV-312	LAKE KEOWEE	19	0	DL	19	0	DL	19	0	19	0	DL	19	0	DL	19	0	19	0
SV-343	LITTLE CANE CK	3	0	DL	3	0	DL	3	0	3	0	DL	3	0	DL	3	0	3	0
SV-342	CANE CK	3	0	DL	3	0	DL	3	0	3	0	DL	3	0	DL	3	0	3	0
SV-311	LAKE KEOWEE	20	0	DL	20	0	DL	20	1	20	0	DL	19	0	DL	20	0	20	2
3060101070																			
SV-015	TWELVE MILE CK	4	0	DL	4	0	DL	4	0	4	0	DL	4	0	DL	4	0	4	0
SV-137	TWELVE MILE CK	4	0	DL	4	0	DL	4	0	4	0	DL	4	0	DL	4	0	4	0
SV-107	TWELVE MILE CK	3	0	DL	3	0	DL	3	0	3	0	DL	3	0	DL	3	0	3	0
3060101080																			
SV-333	CONEROSS CK	19	0	DL	19	0	DL	19	0	19	0	DL	19	0	DL	19	0	19	0
SV-004	CONEROSS CK	16	0	DL	16	0	DL	16	0	16	0	DL	16	0	DL	16	0	16	0
SV-322	CONEROSS CK	15	0	DL	15	0	DL	15	0	15	0	DL	15	0	DL	15	0	15	1
3060101090																			
SV-135	EIGHTEEN MILE CK	17	0	DL	17	1	DL	17	0	17	0	DL	17	0	DL	17	0	17	2
SV-268	EIGHTEEN MILE CK	19	0	DL	19	0	DL	19	1	19	0	DL	19	0	DL	19	0	19	0
3060101100																			
SV-111	THREE & TWENTY CK	4	0	DL	4	0	DL	4	0	4	0	DL	4	0	DL	4	0	4	0
3060102030																			
SV-227	CHATTOOGA RVR	19	0	DL	19	1	DL	19	2	19	0	DL	19	0	DL	19	0	19	2

Attachment B

Letter from William D. Adair, Duke Power System Environmentalist,
to
Howard Zeller, U.S. Environmental Protection Agency,
Subject: Oconee Nuclear Station Fish Impingement and Entrainment Studies,
dated March 24, 1976.

A 0 1 1 0 5 0 1 8 9 7

DUKE POWER COMPANY
STEAM PRODUCTION DEPT.
GENERAL OFFICES
422 SOUTH CHURCH STREET
CHARLOTTE, N. C. 28242

P. O. BOX 2178

TELEPHONE: AREA 704
373-4011

Environmental Laboratories
Rt. 3, Box 90
Huntersville, N. C. 28078

March 24, 1976

Mr. Howard Zeller
Environmental Protection Agency
1421 Peachtree Street, N.E.
Suite 300
Atlanta, Georgia 30309

SUBJECT: Oconee Nuclear Station
Fish Impingement and Entrainment Studies

Dear Mr. Zeller:

According to arrangements made during a telephone conversation on March 3, 1976 with Dr. Paul Frye, please find enclosed a summary of extensive fish impingement studies performed at Oconee Nuclear Station from May 1974 through May 1975. As Dr. Frye requested, a copy of this summary data has also been sent to him in addition to Oconee Semi-Annual Reports (or excerpts from reports) which provide further information regarding both impingement and entrainment of fishes at Oconee.

Entrainment data, summarized in Section 1.4 of the Oconee Semi-Annual Report, indicate that there have been no fish eggs or larvae collected after extensive sampling which began May, 1973.

As can be seen from the impingement data, impingement of game and sport fish has been low. Small bluegill and yellow perch were the fishes most commonly impinged prior to the introduction of threadfin shad into Lake Keowee. Since threadfin have become established, we have a situation which is typical of cooling reservoirs in the southeastern U. S. Threadfin compromise the majority of those fishes impinged (over 90% on most occasions) and contribute most to seasonal trends - i.e. high impingement rates in winter and low in summer. In view of the species and number of fishes affected it is doubtful that impingement at Oconee exerts any significant impact on resident fish populations of Lake Keowee.

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If you have any questions regarding this material, please feel free to contact me.

Yours very truly,

William D. Adair
System Environmentalist

WDA/sm

cc: L. Tebo
P. Benton
P. Frye
W. S. Lee
* W. L. Porter
L. C. Dail
J. J. Sevic
C. A. Dewey
C. S. Carter
W. O. Parker
W. A. Haller
C. Jeter
J. Smith

A Summary of
Fish Impingement Studies - Oconee Nuclear Station

Oconee is a three generating unit Nuclear Station with a total capacity of approximately 2625 MWe. The intake structure includes 24 stationary intake screens and 12 intake pumps with a total pumping capacity of 128 m^3/sec. The intake cove at Oconee is approximately 25 ha and is separated from the main body of Lake Keowee by a skimmer wall. Intake velocities at Oconee are as follows:

	Units 1, 2 & 3 (cm/sec)		
	2 pumps	3 pumps	4 pumps
Velocities at full pond	36.27	31.70	26.82
Velocities at maximum drawdown	51.51	45.11	38.05

Because of the difficulty and time involved, two screens from each unit (25% of the total screen area) were removed and inspected at two week intervals. After each inspection, screens were cleaned thoroughly and replaced; each inspection represented the total impingement per screen occurring over a two week period. Impinged fish were identified, measured, counted, and degree of decomposition noted. When exceptionally large numbers of fishes were collected, total numbers were estimated from a subsample.

The fish impingement monitoring program, as described above, was initiated at Oconee May 16, 1974 and continued through May 9, 1975. Data are summarized in the attached tables taken from three Oconee Nuclear Station Semi-Annual Reports which cover the entire study period (Tables 1.4-6 through 1.4-9, May-June 1974; Table 1.4-2, July-December 1974; Table 1.4-2, January-May 1975). Initially the position of the fish on the screen was reported (Tables 1.4-6 through 1.4-9). This effort yielded little valuable information, and it was deleted from subsequent reports. Temperature and dissolved oxygen data at the intakes are also reported in the tables.

Also attached is Table 1.4-4 from the Oconee Semi-Annual Report for the period ending December 31, 1974. This table summarizes data collected September 16-19, 1974, when all 24 intake screens at Oconee were inspected by SCUBA divers.

This inspection was carried out to insure that impingement rates were similar among all screens and that monitoring impingement at representative screens from each unit is a realistic method for estimating total impingement. The number of impinged fishes at all screens was low (ranging from 0 to 38) and significant differences among screens were not apparent.

As can be seen from these data, very few game and sport fish have been impinged. The following species and genera were identified from the impingement studies:

Threadfin shad, *Dorosoma petenense*
Gizzard shad, *Dorosoma cepedianum*
Trout, *Salmo* spp.
Carp, *Cyprinus carpio*
Catfish, *Ictalurus* spp.
Warmouth, *Lepomis gulosus*
Bluegill, *Lepomis macrochirus*
Pumpkinseed, *Lepomis gibbosus*
Largemouth bass, *Micropterus salmoides*
White crappie, *Pomoxis annularis*
Crappie, *Pomoxis* spp.
Yellow perch, *Perca flavescens*

Threadfin shad, stocked in February 1974, were not represented in the samples to any extent until November 1974. Prior to this, yellow perch and bluegill comprised the majority of those fishes that were identifiable (22.2% and 72.6%, respectively). By December, threadfin shad had become the dominant species collected and remained so through winter 1975. Throughout the year threadfin shad accounted for 49.3% of the total identifiable fish collected. After threadfin became established in Lake Keowee they accounted for a much greater proportion of the total impingement. Those fish indicated as unidentified in the summary tables are thought to be virtually all threadfin shad. Threadfin are more likely to be unidentifiable because they are delicate and are more rapidly decomposed than other fishes. Assuming this, the threadfin account for approximately 98% of all fishes impinged from January through May 1975.

In general, impingement rates were lower in spring and summer than in fall and winter. The estimated number of fish impinged/screen/day ranged from

15 in summer 1974 to 393 in winter 1975. This represents an estimated total daily impingement rate of 372 during summer 1974 and 9425 during winter 1975. An estimated total of 1,064,262 fishes were impinged at Oconee throughout the study period.

Table 1.4-6

Species, number, and lengths of impinged fishes observed on intake screens 1A1, 1A2, 2A1, 2A2, 3A1, and 3A2 after screens were pulled on May 16, 1974

Screen No. 1A1 Temperature Profile: Surface 14.3C, 5 Ft. 14.2C, 10 Ft. 14.1C, 20 Ft. 14.0C, Bottom _____.

5-16-74 Dissolved Oxygen - 7.2 mg/1

Panel No.	No./Species		Length	Decomposition	Position
1	1	Bluegill	4-6 cm	3	M
1	1	Bluegill	4-6 cm	2	M
1	1	Yellow Perch	6-8 cm	2	LM
1	1	Bluegill	4-6 cm	2	LM
1	1	Yellow Perch	6-8 cm	2	UR
2	1	Bluegill	4-6 cm	3	UR
2	1	Yellow Perch	6-8 cm	1	UR
2	1	Bluegill	4-6 cm	3	LR
2	1	Bluegill	4-6 cm	3	UR
2	2	Bluegill	6-8 cm	3	M
2	2	Yellow Perch	4-6 cm	3	M
2	1	Yellow Perch	4-6 cm	3	M
3	1	Bluegill	2-4 cm	3	R. Lip
3	1	Yellow Perch	4-6 cm	2	M. Lip
3	1	Bluegill	2-4 cm	3	M
3	2	Bluegill	2-4 cm	3	UL
3	1	Yellow Perch	4-6 cm	1	UL
3	1	Bluegill	4-6 cm	3	LM
3	1	Bluegill	4-6 cm	3	L. Lip
4	1	Largemouth Bass	6-8 cm	2	R. Lip
4	1	Yellow Perch	4-6 cm	2	R. Lip
4	1	Yellow Perch	4-6 cm	3	LR
4	1	Yellow Perch	6-8 cm	3	LR

Degrees of Decomposition

1. No sign of decomposition
2. Slightly decomposed
3. Badly decomposed-identifiable
4. Badly decomposed-unidentifiable

Position on Screen

UL-upper left
UM-upper middle
UR-upper right
M-middle
LL-lower left
LM-lower middle
LR-lower right
L. Lip-left lip
M. Lip-middle lip
R. Lip-right lip

Table 1.4-6 (Continued)

Screen No. 1A1

5-16-74

Panel No.	No./Species		Length	Decomposition	Position
4	1	Yellow Perch	8-10 cm	3	M
4	1	Yellow Perch	6-8 cm	3	M
4	1	Bluegill	6-8 cm	3	M
4	1	Yellow Perch	2-4 cm	3	M
4	4	Yellow Perch	4-6 cm	3	M
4	3	Bluegill	4-6 cm	3	M
4	1	Bluegill	2-4 cm	3	M
4	1	Yellow Perch	6-8 cm	3	M
4	1	Yellow Perch	4-6 cm	2	M
4	1	Bluegill	2-4 cm	3	M
4	1	Yellow Perch	2-4 cm	2	M
4	1	Yellow Perch	6-8 cm	2	UM
4	1	Yellow Perch	4-6 cm	3	UM
5	2	Bluegill	2-4 cm	3	UL
5	5	Bluegill	4-6 cm	3	UL
5	1	Yellow Perch	6-8 cm	2	LM
5	1	Yellow Perch	4-6 cm	3	LM
5	1	Yellow Perch	6-8 cm	2	UM
5	1	Yellow Perch	4-6 cm	3	UM
5	3	Bluegill	2-4 cm	3	UM
5	1	Bluegill	2-4 cm	3	UR
5	1	Yellow Perch	6-8 cm	2	UR
5	7	Bluegill	2-4 cm	3	UR
5	1	Bluegill	4-6 cm	3	LR
5	1	Bluegill	2-4 cm	3	LR
5	1	Largemouth Bass	4-6 cm	3	M. Lip
5	1	Yellow Perch	4-6 cm	3	M. Lip

Table 1.4-6 (Continued)

Screen No. 1A1

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
6	1 Bluegill	2-4 cm	3	R. Lip
6	1 Yellow Perch	4-6 cm	3	UM
6	1 Yellow Perch	4-6 cm	3	UL
	Screen 1A1, Total Fish = 74			

Table 1.4-6 (Continued)

Screen No. 1A2

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
1	1 Yellow Perch	6-8 cm	2	UR
1	1 Yellow Perch	6-8 cm	3	LL
2	1 Yellow Perch	6-8 cm	3	M
2	1 Yellow Perch	4-6 cm	2	LM
2	1 Yellow Perch	4-6 cm	2	LL
2	1 Bluegill	6-8 cm	3	UL
3	1 Bluegill	4-6 cm	3	LR
3	1 Bluegill	4-6 cm	3	LL
4	1 Yellow Perch	10-12 cm	3	UL
4	1 Bluegill	10-12 cm	1	L. Lip
5	1 Yellow Perch	8-10 cm	1	R. Lip
6	1 Yellow Perch	4-6 cm	1	UL
	Screen 1A2, Total Fish = 12			

Table 1.4-6 (Continued)

Screen No. 2A1

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
1	0			
2	0			
3	0			
4	0			
5	0			
6	1 Yellow Perch	6-8 cm	3	LM
	Screen 2A1, Total Fish = 1			

Table 1.4-6 (Continued)

Screen No. 2A2

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
1	0			
2	0			
3	0			
4	0			
5	0			
6	0			
	Screen 2A2, Total Fish = 0			

Table 1.4-6 (Continued)

Screen No. 3A1

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
1	0			
2	0			
3	1 Yellow Perch	6-8 cm	2	UR
4	1 Yellow Perch	6-8 cm	2	UM
4	1 Yellow Perch		3	UM
4	1 Yellow Perch		3	L. Lip
4	0			
5	0			
6	0			
	Screen 3A1, Total Fish = 4			

Table 1.4-6 (Continued)

Screen No. 3A2

5-16-74

Panel No.	No./Species	Length	Decomposition	Position
1	0			
2	1 Yellow Perch	6-8 cm	2	M
2	1 Yellow Perch	8-10 cm	2	M
2	1 Yellow Perch	6-8 cm	2	UL
3	1 Yellow Perch	6-8 cm	2	UM
4	0			
5	0			
6	0			
	Screen 3A2, Total Fish = 4			
	5-16-74, Screens 1A1 thru 3A2 Total Fish = 95			

Table 1.4-7

Species, number, and lengths of impinged fishes observed on intake screens 1A1, 1A2, 2A1, 2A2, 3A1, and 3A2 after screens were pulled on May 30, 1974

Screen No. 1A1 Temperature Profile: Surface 15.8 C, 5 Ft. 15.8 C, 10 Ft. 15.9 C, 20 Ft. 15.8 C, Bottom 15.8 C.

5-30-74 Dissolved Oxygen - 7.2 mg/l

Panel No.	No./Species		Length	Decomposition	Position
1	3	Bluegill	2-4 cm	3	LM
1	1	Bluegill	4-6 cm	3	L. Lip
1	3	Bluegill	4-6 cm	3	M
1	2	Yellow Perch	4-6 cm	3	M
1	2	Bluegill	4-6 cm	3	LM
1	1	Yellow Perch	6-8 cm	3	L. Lip
1	2	Yellow Perch	4-6 cm	3	LM
1	1	Bluegill	4-6 cm	3	M
1	1	Bluegill	10-12 cm	3	UR
1	1	Bluegill	4-6 cm	3	LR
1	1	Yellow Perch	4-6 cm	3	LR
1	4	Bluegill	4-6 cm	3	UR
1	2	Bluegill	4-6 cm	3	RM
1	2	Bluegill	4-6 cm	3	RM
1	1	Bluegill	8-10 cm	3	UR
1	1	Bluegill	2-4 cm	3	RM
1	1	Yellow Perch	2-4 cm	3	LR
1	1	Bluegill	4-6 cm	3	LR
1	6	Bluegill	4-6 cm	3	RM
1	2	Bluegill	4-6 cm	2	RM
1	1	Bluegill	6-8 cm	2	RM
1	1	Yellow Perch	2-4 cm	2	UR
1	1	Yellow Perch	4-6 cm	2	UR

Degrees of Decomposition

1. No sign of decomposition
2. Slightly decomposed
3. Badly decomposed-identifiable
4. Badly decomposed-unidentifiable

Position on Screen

UL-upper left
UM-upper middle
UR-upper right
M-middle
LL-lower left
LM-lower middle
LR-lower right
L. Lip-left lip
M. Lip-middle lip
R. Lip-right lip

Table 1.4-7 (Continued)

Screen No. 1A1

5-30-74

Panel No.	No./Species		Length	Decomposition	Position
2	3	Bluegill	4-6 cm	3	UR
2	4	Yellow Perch	4-6 cm	2	M
2	2	Bluegill	4-6 cm	3	LR
2	1	Bluegill	4-6 cm	3	LR
2	1	Yellow Perch	4-6 cm	2	LR
2	2	Yellow Perch	4-6 cm	2	LM
2	4	Bluegill	4-6 cm	3	UM
2	3	Bluegill	2-4 cm	3	UM
2	2	Bluegill	4-6 cm	3	LM
2	1	Bluegill	6-8 cm	3	M
2	5	Yellow Perch	4-6 cm	3	M
2	2	Bluegill	4-6 cm	3	M
2	2	Bluegill	4-6 cm	3	M
2	2	Bluegill	2-4 cm	3	M. Lip
2	1	Yellow Perch	6-8 cm	2	M. Lip
2	1	Yellow Perch	2-4 cm	3	LM
2	1	Yellow Perch	4-6 cm	1	UM
2	2	Yellow Perch	2-4 cm	3	UM
2	5	Yellow Perch	2-4 cm	2	LL
3	1	Bluegill	4-6 cm	3	LL
3	1	Bluegill	6-8 cm	3	LL
3	16	Bluegill	4-6 cm	3	LM
3	12	Yellow Perch	4-6 cm	3	LM
3	1	Largemouth Bass	6-8 cm	1	UL
3	6	Yellow Perch	4-6 cm	2	LM
3	11	Bluegill	4-6 cm	3	UL
3	5	Bluegill	4-6 cm	3	LM
3	4	Bluegill	4-6 cm	3	LM

Table 1.4-7 (Continued)

Screen No. 1A1

5-30-74

Panel No.	No.	Species	Length	Decomposition	Position
3	16	Bluegill	4-6 cm	3	UM
3	1	Bluegill	4-6 cm	2	UM
3	9	Yellow Perch	4-6 cm	3	M
3	5	Yellow Perch	4-6 cm	2	M
3	1	Largemouth Bass	8-10 cm	2	R. Lip
3	18	Bluegill	4-6 cm	3	UR
3	2	Yellow Perch	2-4 cm	1	UR
3	13	Yellow Perch	4-6 cm	3	UR
3	11	Bluegill	4-6 cm	3	UR
3	1	Bluegill	6-8 cm	3	UR
4	11	Yellow Perch	4-6 cm	3	M
4	3	Yellow Perch	4-6 cm	2	L. Lip
4	4	Yellow Perch	4-6 cm	2	LM
4	11	Bluegill	4-6 cm	3	LM
4	1	Bluegill	6-8 cm	2	LM
4	5	Yellow Perch	4-6 cm	2	LM
4	14	Yellow Perch	4-6 cm	3	LM
4	2	Bluegill	4-6 cm	2	M. Lip
4	2	Yellow Perch	4-6 cm	2	M. Lip
4	49	Bluegill	4-6 cm	3	M
4	2	Bluegill	8-10 cm	3	M
4	14	Yellow Perch	4-6 cm	2	UM
4	20	Yellow Perch	4-6 cm	3	UM
4	2	Yellow Perch	8-10 cm	2	UR
4	13	Bluegill	4-6 cm	3	UR
4	9	Yellow Perch	4-6 cm	3	UR
4	8	Yellow Perch	4-6 cm	2	UR
4	6	Bluegill	4-6 cm	3	UR

Table 1.4-7 (Continued)

Screen No. 1A1

5-30-74

Panel No.	No./Species		Length	Decomposition	Position
4	4	Yellow Perch	4-6 cm	2	UR
4	1	Yellow Perch	6-8 cm	3	R. Lip
4	1	Bluegill	4-6 cm	3	R. Lip
5	7	Bluegill	4-6 cm	3	UR
5	9	Yellow Perch	4-6 cm	3	UR
5	1	Yellow Perch	8-10 cm	2	UR
5	13	Yellow Perch	4-6 cm	2	UL
5	16	Bluegill	4-6 cm	3	UL
5	12	Bluegill	4-6 cm	3	UM
5	39	Yellow Perch	4-6 cm	3	M
5	6	Yellow Perch	4-6 cm	2	UM
5	3	Bluegill	4-6 cm	3	M. Lip
5	5	Yellow Perch	4-6 cm	3	M. Lip
5	2	Yellow Perch	2-4 cm	3	M. Lip
5	5	Yellow Perch	4-6 cm	2	UR
5	15	Yellow Perch	4-6 cm	3	UR
5	1	Bluegill	8-10 cm	2	UR
5	24	Bluegill	4-6 cm	3	UM
5	7	Yellow Perch	4-6 cm	3	LR
5	6	Yellow Perch	4-6 cm	2	R. Lip
5	4	Yellow Perch	4-6 cm	2	LR
5	15	Yellow Perch	4-6 cm	3	LR
5	3	Bluegill	4-6 cm	3	LR
5	1	Largemouth Bass	6-8 cm	3	M
6	2	Yellow Perch	4-6 cm	3	UM
6	6	Yellow Perch	4-6 cm	3	M
6	3	Bluegill	4-6 cm	3	M. Lip
6	3	Yellow Perch	2-4 cm	3	M. Lip

Table 1.4-7 (Continued)

Screen No. 1A1

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
6	1 Yellow Perch	4-6 cm	3	UR
6	9 Yellow Perch	4-6 cm	2	R. Lip
6	1 Largemouth Bass	6-8 cm	2	R. Lip
6	1 Yellow Perch	6-8 cm	2	LR
6	1 Yellow Perch	2-4 cm	2	LR
6	1 Largemouth Bass	4-6 cm	3	M
6	1 Bluegill	4-6 cm	2	LR
6	2 Yellow Perch	4-6 cm	3	M
	Screen 1A1, Total Fish = 626			

Table 1.4-7 (Continued)

Screen No. 1A2

5-30-74

Panel No.	No.	Species	Length	Decomposition	Position
1	1	Yellow Perch	2-4 cm	3	LM
1	3	Bluegill	2-4 cm	3	UL
1	1	Bluegill	2-4 cm	3	M. Lip
1	1	Bluegill	6-8 cm	3	M
1	1	Bluegill	2-4 cm	3	M
1	4	Bluegill	4-6 cm	3	M
1	1	Yellow Perch	4-6 cm	3	M
1	1	Yellow Perch	2-4 cm	1	LM
1	1	Bluegill	4-6 cm	1	UR
2	2	Bluegill	2-4 cm	2	UR
2	1	Bluegill	2-4 cm	2	M
2	2	Bluegill	4-6 cm	3	MR
2	1	Bluegill	4-6 cm	2	MR
2	1	Bluegill	2-4 cm	3	MR
2	4	Bluegill	2-4 cm	3	UR
2	1	Yellow Perch	2-4 cm	3	M
2	2	Yellow Perch	4-6 cm	3	M
2	1	Yellow Perch	4-6 cm	1	UM
2	2	Bluegill	2-4 cm	3	UM
2	3	Yellow Perch	2-4 cm	3	M
2	4	Bluegill	2-4 cm	3	M
2	1	Yellow Perch	4-6 cm	2	M
2	3	Bluegill	2-4 cm	3	UM
2	1	Bluegill	2-4 cm	3	L. Lip
2	2	Yellow Perch	2-4 cm	2	UL
2	3	Yellow Perch	4-6 cm	2	UL
2	1	Yellow Perch	2-4 cm	2	LL
2	1	Yellow Perch	4-6 cm	2	LL

0 0 1 1 0 5 0 1 9 1 6

Table 1.4-7 (Continued)

Screen No. 1A2

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
2	1 Yellow Perch	4-6 cm	3	M
2	2 Yellow Perch	4-6 cm	3	LM
2	1 Bluegill	4-6 cm	3	LL
3	1 Yellow Perch	6-8 cm	2	LL
3	1 Bluegill	4-6 cm	2	L. Lip
3	1 Yellow Perch	4-6 cm	2	UL
3	1 Yellow Perch	6-8 cm	2	UL
3	1 Yellow Perch	8-10 cm	2	UL
3	2 Bluegill	4-6 cm	2	UL
3	2 Bluegill	4-6 cm	3	UL
3	3 Yellow Perch	4-6 cm	2	LM
3	1 Yellow Perch	4-6 cm	3	UM
3	2 Bluegill	4-6 cm	2	UL
3	8 Yellow Perch	4-6 cm	2	UL
3	2 Yellow Perch	2-4 cm	3	UL
3	1 Bluegill	4-6 cm	1	M
3	4 Yellow Perch	4-6 cm	3	M
3	3 Yellow Perch	4-6 cm	3	M
3	1 Yellow Perch	2-4 cm	2	M
3	2 Yellow Perch	4-6 cm	3	UM
3	14 Bluegill	4-6 cm	3	M
3	1 Yellow Perch	4-6 cm	2	UR
3	5 Yellow Perch	4-6 cm	2	UR
3	1 Yellow Perch	4-6 cm	2	UM
3	3 Bluegill	4-6 cm	3	LR
3	1 Yellow Perch	4-6 cm	3	LR
3	2 Bluegill	4-6 cm	3	UR
3	2 Yellow Perch	4-6 cm	3	LR

Table 1.4-7 (Continued)

Screen No. 1A2

5-30-74

Panel No.	No./Species		Length	Decomposition	Position
4	2	Yellow Perch	2-4 cm	2	L. Lip
4	2	Yellow Perch	4-6 cm	2	UM
4	3	Yellow Perch	4-6 cm	2	M. Lip
4	3	Bluegill	2-4 cm	2	M
4	1	Bluegill	2-4 cm	2	LM
4	1	Bluegill	2-4 cm	3	UM
4	1	Yellow Perch	4-6 cm	2	LR
4	1	Bluegill	2-4 cm	2	UR
4	2	Bluegill	2-4 cm	3	UM
5	2	Yellow Perch	2-4 cm	2	R. Lip
5	2	Bluegill	2-4 cm	2	R. Lip
5	2	Bluegill	2-4 cm	3	L. Lip
5	2	Bluegill	2-4 cm	1	L. Lip
6	1	Yellow Perch	2-4 cm	2	L. Lip
6	1	Bluegill	2-4 cm	2	L. Lip
6	1	Yellow Perch	2-4 cm	1	M. Lip
6	2	Yellow Perch	2-4 cm	2	M. Lip
	Screen 1A2, Total Fish = 148				

Table 1.4-7 (Continued)

Screen No. 2A2

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
No fish on screen 2A1 or 2A2 for two week period.				

Table 1.4-7 (Continued)

Screen No. 3A1

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
1	1 Bluegill	2-4 cm	3	UL
1	1 Yellow Perch	6-8 cm	3	M
1	2 Yellow Perch	8-10 cm	3	UM
1	1 Yellow Perch	6-8 cm	3	LL
2	3 Bluegill	2-4 cm	3	UR
2	3 Bluegill	2-4 cm	3	M
2	1 Bluegill	2-4 cm	3	LM
2	1 Bluegill	2-4 cm	3	UL
2	1 Bluegill	4-6 cm	3	UL
2	1 Bluegill	4-6 cm	3	LM
2	2 Yellow Perch	6-8 cm	3	UM
2	1 Yellow Perch	4-6 cm	3	M. Lip
3	1 Yellow Perch	6-8 cm	2	UL
3	1 Yellow Perch	4-6 cm	3	UM
3	3 Bluegill	4-6 cm	3	UM
3	1 Bluegill	2-4 cm	3	LM
3	1 Yellow Perch	2-4 cm	3	LM
3	1 Bluegill	2-4 cm	3	M
3	1 Bluegill	2-4 cm	3	LM
3	1 Unidentified	2-4 cm	4	LM
3	1 Yellow Perch	4-6 cm	3	UR
3	1 Bluegill	6-8 cm	3	UR
3	1 Bluegill	2-4 cm	3	UR
3	2 Bluegill	4-6 cm	3	UR
3	1 Yellow Perch	4-6 cm	3	UR
3	1 Bluegill	4-6 cm	3	M. Lip
3	1 Yellow Perch	4-6 cm	3	M. Lip
3	1 Bluegill	4-6 cm	3	UR

Table 1.4-7 (Continued)

Screen No. 3A1

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
3	1 Bluegill	2-4 cm	3	R. Lip
3	1 Bluegill	2-4 cm	3	LR
4	1 Yellow Perch	4-6 cm	2	LR
4	1 Yellow Perch	6-8 cm	3	R. Lip
4	1 Bluegill	4-6 cm	2	LR
4	2 Yellow Perch	4-6 cm	3	LR
4	5 Bluegill	4-6 cm	3	UR
4	2 Yellow Perch	4-6 cm	3	R. Lip
4	1 Bluegill	2-4 cm	3	M. Lip
4	1 Bluegill	4-6 cm	3	M. Lip
4	1 Bluegill	4-6 cm	3	LM
4	1 Bluegill	4-6 cm	3	UL
4	1 Bluegill	4-6 cm	Live	M. Lip
5	1 Bluegill	4-6 cm	3	UR
5	3 Bluegill	4-6 cm	3	M
5	3 Bluegill	4-6 cm	3	UM
	Screen 3A1, Total Fish = 63			

Table 1.4-7 (Continued)

Screen No. 3A2

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
1	2 Yellow Perch	2-4 cm	3	M
1	1 Yellow Perch	4-6 cm	3	M
1	1 Bluegill	4-6 cm	3	LM
1	1 Yellow Perch	4-6 cm	1	LM
1	3 Yellow Perch	4-6 cm	3	LM
2	1 Yellow Perch	4-6 cm	3	M
2	1 Bluegill	2-4 cm	3	M
2	3 Bluegill	2-4 cm	3	UM
2	1 Yellow Perch	2-4 cm	3	LM
2	1 Yellow Perch	2-4 cm	3	M
2	1 Yellow Perch	4-6 cm	3	LM
2	1 Yellow Perch	4-6 cm	3	M
3	1 Bluegill	6-8 cm	3	UR
3	1 Warmouth	6-8 cm	3	M. Lip
3	2 Bluegill	2-4 cm	3	M
3	1 Yellow Perch	2-4 cm	1	LM
3	1 Yellow Perch	2-4 cm	3	M
3	3 Yellow Perch	2-4 cm	3	LM
3	1 Yellow Perch	2-4 cm	3	UL
4	1 Bluegill	2-4 cm	3	UR
4	1 Bluegill	2-4 cm	3	M
4	2 Yellow Perch	2-4 cm	3	M
4	2 Yellow Perch	2-4 cm	3	LM
4	1 Bluegill	2-4 cm	3	LM
4	1 Yellow Perch	6-8 cm	3	LM
4	1 Largemouth Bass	2-4 cm	3	LM
4	1 Largemouth Bass	2-4 cm	3	R. Lip
5	1 Bluegill	4-6 cm	3	UR

Table 1.4-7 (Continued)

Screen No. 3A2

5-30-74

Panel No.	No./Species	Length	Decomposition	Position
5	3 Bluegill	4-6 cm	3	M
5	1 Bluegill	4-6 cm	3	M. Lip
5	1 Largemouth Bass	4-6 cm	3	M
5	1 Yellow Perch	4-6 cm	3	M
5	1 Yellow Perch	6-8 cm	3	UL
5	1 Yellow Perch	4-6 cm	3	UL
5	1 Yellow Perch	4-6 cm	3	LM
5	1 Yellow Perch	4-6 cm	3	M. Lip
5	2 Bluegill	4-6 cm	3	UL
6	1 Unidentified	4-6 cm	4	M. Lip
6	2 Bluegill	4-6 cm	3	L. Lip
6	1 Yellow Perch	4-6 cm	3	L. Lip
	Screen 3A2, Total Fish = 54			
	5-30-74, Screens 1A1 thru 3A2 Total Fish = 891			

A 0 1 1 0 5 0 1 9 2 3

Table 1.4-8

Species, number, and lengths of impinged fishes observed on intake screens 1A1, 1A2, 2A1, 2A2, 3A1, and 3A2 after screens were pulled on June 13, 1974.

Screen No. 1A1

Temperature Profile: Surface 18.5 C, 5 Ft. 18.5 C, 10 Ft. 18.0 C, 20 Ft. 17.0 C, Bottom 16.5 C.

Dissolved Oxygen - 6.7 mg/1

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
No Fish on screen 1A1				

Degrees of Decomposition

1. No sign of decomposition
2. Slightly decomposed
3. Badly decomposed-identifiable
4. Badly decomposed-unidentifiable

Position on Screen

UL-upper left
UM-upper middle
UR-upper right
M-middle
LL-lower left
LM-lower middle
LR-lower right
L. Lip-left lip
M. Lip-middle lip
R. Lip-right lip

Table 1.4-8 (Continued)

Screen No. 1A2

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
No Fish on screen 1A2				

Table 1.4-8 (Continued)

Screen No. 2A1

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
No fish on screen 2A1				

Table 1.4-8 (Continued)

Screen No. 2A2

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
No fish on screen 2A2				

Table 1.4-8 (Continued)

Screen No. 3A1

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
1	1 Yellow Perch	6-8 cm	3	M
2	2 Bluegill	4-6 cm	3	M
2	1 Yellow Perch	4-6 cm	3	M
2	1 Bluegill	4-6 cm	3	M
3	5 Bluegill	4-8 cm	3	M
3	3 Bluegill	4-6 cm	3	M
3	2 Yellow Perch	4-6 cm	3	M
4	1 Bluegill	2-4 cm	3	M
4	1 Bluegill	2-4 cm	3	UL
4	1 Bluegill	4-6 cm	3	UR
5	1 Yellow Perch	6-8 cm	3	UL
5	1 Bluegill	4-6 cm	3	LR
5	2 Bluegill	2-4 cm	3	UR
5	1 Bluegill	4-6 cm	3	UR
5	2 Bluegill	4-6 cm	3	M
5	3 Bluegill	4-6 cm	3	M. Lip
5	2 Bluegill	4-6 cm	3	M
5	1 Bluegill	4-6 cm	2	M. Lip
6	1 Bluegill	4-6 cm	3	M
	Screen 3A1, Total Fish = 32			

Table 1.4-8 (Continued)

Screen No. 3A2

6-13-74

Panel No.	No./Species	Length	Decomposition	Position
1	1 Yellow Perch	6-8 cm	3	UR
2	1 Bluegill	4-6 cm	3	UR
2	1 Bluegill	4-6 cm	3	M
2	1 Yellow Perch	4-6 cm	1	M
2	1 Bluegill	4-6 cm	3	LM
2	1 Bluegill	6-8 cm	3	LM
2	3 Bluegill	2-4 cm	3	LM
3	1 Bluegill	4-6 cm	2	L. Lip
3	1 Bluegill	6-8 cm	3	LM
3	1 Bluegill	4-6 cm	3	M
4	1 Yellow Perch	6-8 cm	3	LM
4	2 Bluegill	4-6 cm	3	M
4	1 Yellow Perch	6-8 cm	3	M
4	2 Bluegill	4-6 cm	3	M
4	1 Bluegill	4-6 cm	3	M
4	1 Yellow Perch	4-6 cm	3	M
4	2 Bluegill	2-4 cm	3	LM
5	1 Yellow Perch	6-8 cm	3	L. Lip
5	1 Bluegill	6-8 cm	3	M. Lip
5	1 Yellow Perch	4-6 cm	3	LR
5	1 Yellow Perch	4-6 cm	3	M
5	1 Bluegill	4-6 cm	3	M
5	1 Yellow Perch	4-6 cm	3	R. Lip
6	1 Bluegill	2-4 cm	3	M
	Screen 3A2, Total Fish = 29			

6-13-74, Screens 1A1 thru 3A2
Total Fish = 61

Attachment C

Letter from Robert W. Reid, NRC
to
William O. Parker, Jr., Duke Power,
Transmitting Oconee Nuclear Station License Amendments deleting Aquatic Surveillance Program and Special Studies requirements,
dated March 2, 1979.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 2, 1979

Dockets Nos. 50-269
50-270
and 50-287

Mr. William O. Parker, Jr.
Vice President - Steam Production
Duke Power Company
422 South Church Street
P. O. Box 2178
Charlotte, North Carolina 28242

Dear Mr. Parker:

The Commission has issued the enclosed Amendments Nos. 69 , 69, and 66 for Licenses Nos. DPR-38, DPR-47 and DPR-55 for the Oconee Nuclear Station, Units Nos. 1, 2 and 3. These amendments consist of changes to the Station's common Appendix B Environmental Technical Specifications in partial response to your request dated December 2, 1977, as supplemented September 11, 1978.

These amendments revise the Environmental Technical Specifications by deleting the Aquatic Surveillance Program and special study programs.

These amendments do not involve significant new safety information of a type not considered by a previous Commission safety review of the facility. They do not involve a significant increase in the probability or consequences of an accident, do not involve a significant decrease in a safety margin, and therefore do not involve a significant hazards consideration. We have also concluded that there is reasonable assurance that the health and safety of the public will not be endangered by this action.

Copies of the Environmental Impact Appraisal and the Notice of Issuance/Negative Declaration are also enclosed.

Sincerely,

Robert W. Reid

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Enclosures:
1. Amendment No. 69 to DPR-38
2. Amendment No. 69 to DPR-47
3. Amendment No. 66 to DPR-55
4. Environmental Impact Appraisal
5. Notice/Negative Declaration

cc w/enclosures: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DUKE POWER COMPANY

DOCKET NO. 50-269

OCONEE NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 69
License No. DPR-38

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Duke Power Company (the licensee) dated December 2, 1977, as supplemented September 11, 1978, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 3.B of Facility Operating License No. DPR-38 is hereby amended to read as follows:

   3.B <u>Technical Specifications</u>

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No.69 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Attachment:
Changes to the Technical Specifications

Date of Issuance: March 2, 1979

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENVIRONMENTAL IMPACT APPRAISAL BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 69 TO FACILITY OPERATING LICENSE NO. DPR-38

AMENDMENT NO. 69 TO FACILITY OPERATING LICENSE NO. DPR-47

AMENDMENT NO. 66 TO FACILITY OPERATING LICENSE NO. DPR-55

DUKE POWER COMPANY

OCONEE NUCLEAR STATION, UNITS NOS. 1, 2 AND 3

DOCKETS NOS. 50-269, 50-270 AND 50-287

Introduction

By letter dated December 2, 1977, as supplemented September 11, 1978, Duke Power Company (the licensee) requested changes to their Environmental Technical Specifications (ETS) for Oconee Nuclear Station. We have discussed these proposals with the licensee and are deferring action on their request to delete limiting conditions for operation from the ETS, to which the licensee has agreed.

This amendment deletes the specifications for the General Aquatic Surveillance Program and special studies. Water temperature, chemistry, and fisheries studies were begun on Lake Keowee prior to 1971, when Lake Keowee reached full-pond elevation. Phytoplankton, zooplankton, and benthos studies were begun around mid-1973. The purpose of these studies is to detect and quantify the effects of the operation of Oconee Nuclear Station (ONS) on the aquatic environment and to verify the findings of the Final Environmental Statement (FES).

Appraisal

Dissolved Oxygen:

The FES stated that reduction of oxygen concentration in the surface waters near the plant discharge could occur during periods when the plant was drawing oxygen deficient water from the hypolimnion and discharging it to the surface. The lowest value observed during the

1974 through 1976 period was 3.4 mg/liter. The FES indicated that the dissolved oxygen concentration could fall below 1.0 mg/liter in the discharge area. The study indicated that oxygen concentrations were considerably higher than those estimated in the FES.

Thermal:

Appendix III-1 of the FES predicted the thermal plume for various season and lake conditions. The study resulted in general confirmation of the thermal plume as well as other thermal predictions of the FES. The thermal study resulted in the following conclusions:

a) a distinct thermal "plume" from the Station discharge was evident from September through March of each year, resulting in localized vertical thermal gradients or stratification;

b) a thermal plume was not apparent from April through August of each year;

c) maximum summer temperatures in the lake's surface waters were only slightly different from preoperational values;

d) winter minimum temperatures, except in the immediate vicinity of the ONS discharge, were mainly a function of meteorological conditions each year; there was no significant "carryover" in the lake's heat content from one year to the next;

e) ONS's use of bottom waters resulted in a less distinct summer thermocline in the lake, and complete destratification of the top 20 or 25 m of the water column earlier (mid-September) than observed in preoperational years; and

f) maximum temperatures of the deep (20 to 30 m) waters of the lake in September of 1975 and 1976 were about ten degrees Celsius (18 deg. F) warmer than in the preoperational period.

Aquatic Chemistry:

The FES stated that the plant would discharge small quantities of chemicals into Hartwell Reservoir and that these discharges were not expected to have discernible effects in the reservoir. The results of the monitoring program generally confirm this prediction. The results of the monitoring program can be summarized as follows:

a) Lake Keowee has low dissolved and suspended solids and nutrient concentrations, low hardness, and is mildly acidic;

b) the mineral composition of the lake during the ONS operational period was very similar to that of the Keowee River prior to its impoundment;

c) based on the nitrogen/phosphorus ratios observed, phosphorus appeared to be the limiting nutrient for primary production in Lake Keowee; total phosphorus, ammonia and nitrate-nitrite concentrations have steadily decreased since the reservoir was impounded, probably due to natural "aging;" and

d) seasonal fluctuations in the concentrations of ammonia, nitrate-nitrite, manganese and iron, among others, were less pronounced during the ONS operational period than they were previously, attributed to the induced mixing and resultant higher dissolved oxygen content of the lake caused by ONS's use of bottom waters.

Fisheries Studies:

The FES predicted that some fishes would be impinged on the intake screens, and that shad could possibly die in large numbers during the winter months. The FES also discussed in detail the potential thermal effects on fishes due to the heated discharge.

The studies indicate that the overall effect of the Station on the fish populations was small and they generally confirm the findings of the FES. No gas bubble disease was observed in any of the fish sampled in the program. Very little impingement and entrainment was observed. Fishes tended to reproduce in the shallower areas of the lake and not in the long, deep intake canal; therefore, entrainment of young fish forms into the plant was small.

The studies of species composition and general distribution of fish in the lake indicate no adverse effects resulting from the operation of the Station. While abundance of many species has changed during the study period, these changes could not be distinguished from those predicted to occur naturally.

Phytoplankton and Zooplankton:

The FES stated that the plant may cause shifts in the dominance of green algae to the undesirable blue-green types in small areas of the lake. The FES also suggested that some suppression of photosynthesis could occur for organisms passing through the condensers. The study showed that there was neither a shift to obnoxious blue-green algae types, nor was there any appreciable decrease in photosynthesis rates as a result of entrainment.

The FES stated that during the months of August and September, the lengthy exposure to temperatures approaching or exceeding the thermal tolerance limits could cause a reduction in zooplankton organisms in the thermal plume. The zooplankton abundance in the surface water near the Station discharge was similar to the abundance in the intake cove, but substantially lower than in most other areas of the lake. This is because the skimmer wall allows only deep water, which has lower concentrations of organisms, into the intake canal. The design minimizes the impact on these organisms. The actual entrainment had little effect on the viability of these organisms. Overall, the effect of the plant on these populations was less than that predicted in the FES.

Benthos and Periphyton:

The FES stated that the discharge flow could cause some scouring and would probably eliminate all benthic organisms in the immediate discharge area. The study showed that there was little, if any, effect on the benthic population. Bottom type and depth appeared to be the important factors determining the type of benthos population. Further, no substantial changes in taxonomic composition of benthos were observed over the operational period.

Periphyton was studied because of its value as an indicator of major spatial or temporal changes in water quality. The results of the program indicate that, although year-to-year and spatial differences were observed, the operation at the Station did not significantly change the trophic status or water quality of Lake Keowee with respect to the periphyton community.

Conclusion and Basis for Negative Declaration

We conclude that the impact of the Oconee Nuclear Station on the aquatic environment is within the bounds of the FES, as indicated above, and that the environmental impact of the Station has stabilized. As a consequence, the General Aquatic Surveillance Program and Special Study Programs of the ETS are no longer needed and may be terminated immediately.

On the basis of the foregoing analysis, we conclude that there will be no environmental impact attributable to the proposed action. The changes assessed herein are to the environmental monitoring programs and do not involve any change in plant design or operation or involve an increase in effluent types or quantities. The impact of the overall plant has already been predicted and described in the Commission's FES for ONS. On this basis and in accordance with 10 CFR §51.5, the Commission concludes that no environmental impact statement for the proposed action need be prepared and a negative declaration to this effect is appropriate.

Dated: March 2, 1979

Attachment D

Letter from William C. Botts, SCDHEC,
to
Robert Wylie, Duke Power Company,
Transmitting proposed draft National Pollution Discharge Elimination System (NPDES)
Permit #SC0000515 for Oconee Nuclear Station,
dated May 21, 1998.

D H E C
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

ENVIRONMENTAL PROTECTION SECTION
MAY 28 1998
☐ FILE
☐ TICKLER DATE
☐ COPY
☐ ROUTE

May 21, 1998

Mr. Robert Wylie
Duke Power Company
Group Environmental, Health & Safety
13339 Hagers Ferry Rd.
Huntersville, NC 28078-7929

Re:Draft NPDES Permit #SC0000515
Duke Power/Oconee Station
Oconee County

Dear Mr. Wylie:

The South Carolina Department of Health and Environmental Control intends to issue a National Pollutant Discharge Elimination System (NPDES) permit to the above referenced facility in the near future.

The enclosed proposed draft permit shows the proposed conditions to be incorporated as part of the NPDES permit. In order that you understand your responsibilities included in the provisions of this permit, particular attention should be given to the following sections:

1. Part I.A.: This section(s) contains listings of effluent characteristics, discharge limitations, and monitoring requirements. The effective dates for various requirements are listed.

2. Part I.B.: This section(s) contains listings of groundwater monitoring requirements.

3. Part I.C.: This section contains the schedule of compliance applicable to your facility. If your facility is presently in compliance, no schedule is included. If you have a schedule of compliance, please note Part I.C.2. which contains your responsibilities for reporting compliance requirements.

Whether you have specific objections to the proposed draft permit or are satisfied with its conditions, your comments are needed in writing to this office before June 8, 1998. If you have any questions concerning the enclosed conditions or the procedures associated with the permit program, please contactme at (803/734-5248).

Sincerely,

William C. Botts

William C. Botts
Environmental Engineer Associate
Industrial, Agricultural, & Storm
Water Permitting Division

cc: George Tomlin, Appalachia I EQC
NPDES Administration
Facilities Compliance
Darryl Williams, Region IV EPA

Attachment E

Excerpt from Proposed Draft NPDES Permit
#SC0000515, Rationale Section

8. Detection Limit: N/A
9. Conclusion: Based on a comparison between the reported 2C results and applicable criteria and appli reasonable potential procedures, no limit for BETA is proposed.

Temperature

1. Form 2C value: 34°C maximum 30 day summer temperature.
2. Previous Permit: 37.8°C maximum temperature (under certain conditions a 39.4°C maximu temperature was allowed), 12.2°C temperature rise maximum when the intake temperature is great than 20°C.
3. Effluent guidelines: Not applicable.
4. Water Quality Criteria: The receiving water temperature may not be increased by more than 2.8°C exceed a maximum of 32.2°C, unless a Section 316(a) determination has been completed.
5. Human Health Consideration: Not applicable.
6. Detection Limit: Not applicable.
7. Conclusion: The facility submitted the results of a 316(a) demonstration in January 1995. Based o the study, the Department granted the 316(a) variance. In the reapplication received April 7, 1998, th permittee requested a continuation of the variance. Information supporting the continuation wa provided May 12, 1998. The Department proposes to allow the variance for the life of this permit. A in the previous permit, the discharge maximum shall not exceed 103 degrees Fahr. and the rise ove intake must not exceed 22 degrees Fahr.

Outfall 002

Description of Discharge: Outfall 002 consists of wastewater from several sources including low volume wastes fron the conventional wastewater treatment system discharge, yard drains, air handling units, oil and chemical products areas turbine building sumps, and condenser unwatering; sanitary sewage treated and discharged wastewaters via interna Outfall 003); metal cleaning wastes (MGD treated and discharged wastewaters via internal Outfall 005); intake dan underdrain (0.09 MGD); indigenous springs (0.007 MGD) and landfill leachate (0.0023 MGD of treated and discharge wastewaters via Outfall 006).

Applicable effluent guidelines standards of performance for this facility are the Steam Electric Point Source Categor for existing sources, which provides the following limitations:

1. The pH of all discharges, except once through cooling water shall be within the range of 6.0 standard unit to 9.0 standard units.

2. There shall be no discharge of PCBs.

3. Low volume wastes

Parameter	Maximum for any 1 day (mg/l)	Average of daily values for 30 consecutive days[2] shall not exceed (mg/l)

Attachment F

Endangered, Threatened, and Otherwise Noteworthy Plant and Animal Species of the Oconee Nuclear Station, Oconee and Pickens Counties, South Carolina,
prepared by
L.L. Gaddy, Ph. D., June 1998

ENDANGERED, THREATENED, AND OTHERWISE NOTEWORTHY PLANT AND ANIMAL SPECIES OF THE OCONEE NUCLEAR STATION, OCONEE AND PICKENS COUNTIES, SOUTH CAROLINA

prepared by

L. L. Gaddy, Ph. D.

245 The Wild Wood Way

Walhalla, South Carolina 29691

for

Duke Energy Corporation

Charlotte, North Carolina

June 1998

INTRODUCTION

This report presents the results of an inventory of endangered, threatened, and otherwise noteworthy plant and animal species of Duke Energy's Oconee Nuclear Station. The study area for this investigation was a one mile-radius circle centered on the Number Two Reactor inside the Oconee Nuclear Station. The study area included all lands at Oconee Nuclear Station and additional lands along the Keowee River and along Lake Keowee (see Map 1).

Field work was conducted in May and June of 1998. A habitat analysis of the study area was conducted using false color infrared photography, black and white photography, and topographic maps of the site. Habitats that appeared to be potential areas of occurrences for the species listed in Table 1 were completely surveyed on foot in the field. More cursory inventories were done of successional forests and highly-disturbed areas.

RESULTS

Three state-listed plants species and one species not previously known in South Carolina were found in the course of the inventory (Table 1). Additionally, four significant natural areas which harbored state-listed plants, old-growth trees, or other noteworthy natural features were located (Map 1).

Table 1. Endangered, threatened, and otherwise noteworthy plant and animal species occurring or historically-occurring in the vicinity of the Oconee Nuclear Station.

SCIENTIFIC NAME	COMMON NAME	STATUS[1]	OCCURRENCE[2]
PLANTS			
Carex laxiflora	loose-flowered sedge	SR	PRESENT
Carex prasina	drooping sedge	SL	PRESENT
Echinacea laevigata	smooth coneflower	FE	HISTORICAL
Nestronia umbellula	Indian olive	SL	PRESENT
Orobanche uniflora	one-flowered broomrape	SL	HISTORICAL
Pachysandra procumbens	Allegheny spurge	SL	HISTORICAL
Viola tripartita	three-parted violet	SL	PRESENT
ANIMALS			
Sigmora robusta	a millipede	SL	HISTORICAL

[1] SR-new state record for species found during this inventory; SL-listed as "rare, threatened, or endangered" by the State of South Carolina (see Appendix); FE-federally-listed as endangered by the Fish and Wildlife Service.

[2] PRESENT indicates that species was found on Oconee Nuclear Station property or within a one-mile radius of Oconee Nuclear Station during the course of this inventory or has recently been reported from the area by biologists; HISTORICAL indicates that species has been reported from the general area in the past but was not located within a one-mile radius of Oconee Nuclear Station during this inventory.

Populations of the state-listed three-parted violet (Viola tripartita) were found in three different areas in rich deciduous woods. This yellow violet is uncommon in the Blue Ridge and upper Piedmont of South Carolina. The populations located within the study area ranged from five to 25 plants (Map 1).

A population of Indian olive (Nestronia umbellula), also state-listed in South Carolina, was found along the nature trail in Natural Area 1 (see Map 1 and discussion of Natural Area 1 below). About 50 plants of Indian olive were found in a blueberry (Vaccinium spp.) thicket at this site. (Robert Siler, a Duke Engineering & Services biologist, brought this population to my attention).

Drooping sedge (Carex prasina), uncommon in the Blue Ridge and Piedmont of South Carolina, is also listed and monitored by the South Carolina Department of Natural Resources. One population of about 10 plants was found in small seepage bogs east of SC 183 in Natural Area 3 (see Map 1 and discussion of natural areas below).

Finally, the first substantiated South Carolina record for loose-flowered sedge (Carex laxiflora) was found in the southern portion of the study area in Natural Area 4 (see Map 1 and discussion of natural areas below). About 25 plants of Carex laxiflora were located during this inventory on a rich, north-facing slope. Carex laxiflora is reported from South Carolina in Radford et al., 1968, the authoritative guide to the flora of Carolinas; however, over the last decade, field research has revealed that several other species of sedges were probably incorrectly identified as this species, which heretofore was unknown from South Carolina (see Gaddy, 1995). Only two records of the sedge were known from the southern Blue Ridge, both in North Carolina (the closest record to South Carolina for the species was Windy Falls on the Horsepasture River--a site also within the Keowee-Toxaway River drainage). Because this is the first record for the species in South Carolina, a specimen was collected for deposit in the Clemson University Herbarium.

Four significant natural areas were also encountered during the survey of the study area. They have been included on Map 1 to facilitate their location. Natural Area 1 is the nature trail area north of the World of Energy. Here, relatively undisturbed deciduous woods dominated by white oak (Quercus alba), red oak (Quercus rubra), southern red oak (Quercus falcata), and hickories (Carya spp.). Dogwood (Cornus florida), mountain laurel (Kalmia latifolia), and the uncommon buckthorn (Rhamnus caroliniana) are found in the understory. This site harbors a rich herbaceous flora which includes good populations of uncommon wildflower species such as Indian pink (Spigelia marilandica), American liverleaf (Hepatica americana), Indian olive (Nestronia umbellula) (see above), and three-parted violet (Viola tripartita). Smaller populations of many other showy spring herbs are also found here.

Natural Area 2 is an area of old-growth Piedmont mixed hardwoods on a north-facing slope and ridge east of SC 183 (Map 1). Here, a forest of mixed oak and tulip poplar appears not to have been disturbed in recent history. Black oak (Quercus velutina) up to 40 inches in diameter at breast height (4.5 feet) (dbh), southern red oak (Quercus falcata) to 36 inches in dbh, white oak (Quercus alba) up to 30 inches in dbh, and tulip poplar (Liriodendron tulipifera) over 24 inches in dbh all were seen here. The area of old-growth is not extensive but is significant considering the fact that old-growth Piedmont forests are rare. Buckthorn (Rhamnus carolinana) and three-parted violet (Viola tripartita) were also found in the natural area.

Natural Area 3 is a small, north-facing ravine in the southwestern portion of the study area. A stand of 100-year old white oak (Quercus alba), some of which have recently been cut, is found here on slopes overlooking several interesting bogs. Good populations of cinnamon fern (Osmunda cinnamomea), southern lady fern (Athyrium asplenoides), and New York fern (Thelypteris noveboracensis) surround several small bogs which harbor a small population of the rare drooping sedge (Carex prasina). The northern end of this ravine harbors a small beaver pond/marsh complex with bur-reed (Sparganium americanum), sedges (Carex spp.), tag alders (Alnus serrulata), and black willows (Salix nigra) (see Map 1).

Finally, Natural Area 4 is an extensive north-facing bluff with mature white oak (Quercus alba), red oak (Quercus rubra), beech (Fagus grandifolia), and tulip poplar (Liriodendron tulipifera) (largest trees over 30 inches in dbh). Found in the southern portion of the study area south of SC 183, this site also harbors mountain laurel (Kalmia latifolia), dogwood (Cornus florida), redbud (Cercis candadensis) (one tree eight inches in dbh), and chalk maple (Acer leucoderme) in the understory. The herbaceous flora is rich with three-parted violet (Viola tripartita), loose-flowered sedge (Carex laxiflora) (discussed above), black cohosh (Cimicifuga racemosa), maidenhair fern (Adiantum pedatum), and American liverleaf (Hepatica americana).

LITERATURE CITED

Gaddy, L. L. 1995. Carex radfordii (Sect. Laxiflorae: Cyperaceae), a new species from the southern Appalachians. Novon 5:259-261.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press. Chapel Hill. 1183 p.

APPENDIX

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 12559
217 Fort Johnson Road
Charleston, South Carolina 29422-2559

April 17, 1998

Ms. Jennifer Huff
Duke Power
Mail Code EC124
P.O. Box 1006
Charlotte, North Carolina 28201-1006

Re: Oconee Nuclear Station - FERC Relicense
FWS Log No. 4-6-98-227

Dear Ms. Huff:

As per your request, we are providing a list of the federally endangered (E) and threatened (T) species which potentially occur in Oconee County, South Carolina to aid you in determining the impacts your project may have on protected species. In-house surveys should be conducted by comparing the habitat requirements for the attached listed species with available habitat types at the project site. Field surveys for the species should be performed if habitat requirements overlap with that available at the project site. Surveys for protected plant species must be conducted by a qualified biologist during the flowering or fruiting period(s) of the species. Please notify this office with the results of any surveys for the below list of species and an analysis of the "effects of the action," as defined by 50 CFR 402.02 on any listed species including consideration of direct, indirect, and cumulative effects.

We also recommend you contact the S.C. Department of Natural Resources (SCDNR), Data Manager, Wildlife Diversity Section, Columbia, SC 29202, concerning known populations of federal and/or state endangered or threatened species, and other sensitive species in the project area.

These lists should be used only as a guideline, not as the final authority. The lists include known occurrences and areas where the species has a high possibility of occurring. Records are updated continually and may be different from the following.

SOUTH CAROLINA COUNTY DISTRIBUTION RECORDS OF
ENDANGERED and THREATENED SPECIES

E - Endangered
T - Threatened

Oconee County

	Status	Certainty of occurrence
Indiana bat (Myotis sodalis)	E	Known
American peregrine falcon (Falco peregrinus anatum)	E	Possible
Bald eagle (Haliaeetus leucocephalus)	T	Known
Smooth coneflower (Echinacea laevigata)	E	Known
Small whorled pogonia (Isotria medeoloides)	T	Known
Persistent trillium (Trillium persistens)	E	Known

Your interest in ensuring the protection of endangered and threatened species is appreciated. If you have any questions please contact Ms. Lori Duncan of my staff at (803) 727-4707 ext. 21. In future correspondence concerning the project, please reference FWS Log No. 4-6-98-227.

Sincerely yours,

Roger L. Banks
Field Supervisor

RLB/LWD

cc: Federal Energy Regulatory Commission, Washington, DC

Pickens County

American peregrine falcon (Falco peregrinus anatum)	E	Known
Bald eagle (Haliaeetus leucocephalus)	T	Possible
Bog turtle (Clemmys muhlenbergii)	PT(S/A)	Known
Smooth coneflower (Echinacea laevigata)	E	Known
Dwarf-flowered heartleaf (Hexastylis naniflora)	T	Possible
Black-spored quillwort (Isoetes melanospora)	E	Known
Mountain sweet pitcher-plant (Sarracenia rubra ssp. jonesii)	E	Known

KEY

ELCODE - element code, indicating taxonomic class in cols 1 and 2:

- AA - Animals, Amphibians
- AB - Animals, Birds
- AF - Animals, Fish
- AM - Animals, Mammals
- AR - Animals, Reptiles
- I - Invertebrate Animals
- PD - Plants, Dicots
- PG - Plants, Gymnosperms
- PM - Plants, Monocots
- PP - Plants, Pteridophytes (ferns)
- N - Non-vascular Plants

GRANK/SRANK - the Nature Conservancy rating of degree of endangerment:

- G1 - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction
- G2 - Imperiled globally because of rarity or factor(s) making it vulnerable
- G3 - Either very rare throughout its range or found locally in a restricted range, or having factors making it vulnerable
- G4 - Apparently secure globally, though it may be rare in parts of its range
- G5 - Demonstrably secure globally, though it may be rare in parts of its range
- GH - Of historical occurrence throughout its range, with possibility of rediscovery
- GX - Extinct throughout its range
- G? - Status unknown

- S1 - Critically imperiled state-wide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation
- S2 - Imperiled state-wide because of rarity or factor(s) making it vulnerable
- S3 - Rare or uncommon in state
- S4 - Apparently secure in state
- S5 - Demonstrably secure in state
- SA - Accidental in state (usually birds or butterflies that are far outside normal range)
- SE - Exotic established in state
- SH - Of historical occurrence in state, with possibility of rediscovery
- SN - Regularly occurring in state, but in a migratory, non-breeding form
- SR - Reported in state, but without good documentation
- SX - Extirpated from state
- S? - Status unknown

STATUS - legal status:

- FE - Federal Endangered
- FT - Federal Threatened
- NC - Of Concern, National (unofficial - plants only)
- RC - Of Concern, Regional (unofficial - plants only)
- SE - State Endangerd (official state list - animals only)
- ST - State Threatened (official state list - animals only)
- SC - Of Concern, State
- SX - State Extirpated
- PE/PT/C - Proposed or candidate for federal listing

All information is based on the existing S.C. Heritage Trust database, and we do not assume that it is complete. Areas not yet inventoried by our biologists may contain significant species or communities. Also, our data are always in need of updating because as natural populations change over time, species must be added, dropped, or reclassified.

RARE, THREATENED, AND ENDANGERED SPECIES OF OCONEE COUNTY

ANIMALS:

STATUS	GRANK	SRANK	SCIENTIFIC NAME	COMMON NAME
SC	G5	S?	ACCIPITER COOPERII	COOPER'S HAWK
SC	G3	S?	ALASMIDONTA VARICOSA	BROOK FLOATER
SC	G3G4	S1	ANEIDES AENEUS	GREEN SALAMANDER
SC	G5	S2S3	CLETHRIONOMYS GAPPERI	SOUTHERN RED-BACKED VOLE
SC	G5T4	S2S3	CLETHRIONOMYS GAPPERI CAROLINENSIS	CAROLINA RED-BACKED VOLE
SE	G4	S2?	CORYNORHINUS RAFINESQUII	RAFINESQUE'S BIG-EARED BAT
SC	G4	S?	CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER
SC	G3G4	S?	DESMOGNATHUS AENEUS	SEEPAGE SALAMANDER
SC	G2G3	S?	ELLIPTIO LANCEOLATA	YELLOW LANCE
SC	G5	S1?	ETHEOSTOMA ZONALE	BANDED DARTER
ST	G3	S1	MYOTIS LEIBII	EASTERN SMALL-FOOTED MYOTIS
SC	G5	S3?	MYOTIS LUCIFUGUS	LITTLE BROWN MYOTIS
SC	G4	S3S4	MYOTIS SEPTENTRIONALIS	NORTHERN MYOTIS
FE/SE	G2	S1	MYOTIS SODALIS	INDIANA MYOTIS
SC	G5	S3S4	NEOTOMA FLORIDANA	EASTERN WOODRAT
SC	G5T4	S3S4	NEOTOMA FLORIDANA HAEMATOREIA	SOUTHERN APPALACHIAN WOODRAT
SC	G5	S?	PARASCALOPS BREWERI	HAIRY-TAILED MOLE
SC	G5	S?	RANA PALUSTRIS	PICKEREL FROG
SC	G5	S3	RANA SYLVATICA	WOOD FROG
SC	G5	S1	RHINICHTHYS ATRATULUS	BLACKNOSE DACE
SC	G?	S?	SIGMORIA ARCUATA	A MILLIPEDE
SC	G?	S?	SIGMORIA ROBUSTA	A MILLIPEDE
SC	G5	S3S4	SOREX HOYI	PYGMY SHREW
SC	G5	S4	SPILOGALE PUTORIUS	EASTERN SPOTTED SKUNK
SC	G5	S3	SYLVILAGUS AQUATICUS	SWAMP RABBIT
SC	G4	S2?	SYLVILAGUS OBSCURUS	APPALACHIAN COTTONTAIL
SC	G5	S3?	TAMIASCIURUS HUDSONICUS	RED SQUIRREL
SC	G5	S4	TYTO ALBA	BARN-OWL
SC	G5	S?	ZAPUS HUDSONIUS	MEADOW JUMPING MOUSE

PLANTS:

STATUS	GRANK	SRANK	SCIENTIFIC NAME	COMMON NAME
SC	G5	S1S2	ACER PENSYLVANICUM	STRIPED MAPLE
SC	G4	S2	ACONITUM UNCINATUM	BLUE MONKSHOOD
SC	G5	S?	ALLIUM CERNUUM	NODDING ONION
SC	G4?	S?	AMORPHA GLABRA	SMOOTH INDIGOBUSH
SC	G5	S2	ARISTOLOCHIA MACROPHYLLA	PIPEVINE
RC	G4	S1	ASPLENIUM MONANTHES	SINGLE-SORUS SPLEENWORT
SC	G5	S1S2	ASPLENIUM RESILIENS	BLACK-STEM SPLEENWORT
SC	G5	S2	ASPLENIUM RHIZOPHYLLUM	WALKING-FERN SPLEENWORT
SC	G5	S?	ASPLENIUM TRICHOMANES	MAIDENHAIR SPLEENWORT
SC	G2G3	S?	ASTER GEORGIANUS	GEORGIA ASTER
SC	G5	S?	ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER
SC	G5	S1	BETULA ALLEGHANIENSIS	YELLOW BIRCH
SC	G4	S1	BOYKINIA ACONITIFOLIA	BROOK SAXIFRAGE
SC	G2	S?	CARDAMINE CLEMATITIS	MOUNTAIN BITTER CRESS
SC	G4?	S?	CARDAMINE DISSECTA	DIVIDED TOOTHWORT
SC	G3	S?	CARDAMINE FLAGELLIFERA	BITTER CRESS
SC	G5	S?	CAREX AMPHIBOLA	NARROWLEAF SEDGE
SC	G3	S?	CAREX AMPLISQUAMA	FORT MOUNTAIN SEDGE
SC	G4	S?	CAREX APPALACHICA	APPALACHIAN SEDGE
SC	G4	S?	CAREX AUSTROCAROLINIANA	A SEDGE
NC	G3	S1	CAREX BILTMOREANA	BILTMORE SEDGE
SC	G5	S?	CAREX GRACILLIMA	GRACEFUL SEDGE
SC	G3	S?	CAREX MANHARTII	MANHART SEDGE
SC	G4	S?	CAREX OLIGOCARPA	EASTERN FEW-FRUIT SEDGE
SC	G5	S1	CAREX PEDUNCULATA	LONGSTALK SEDGE
SC	G5	S?	CAREX PLANTAGINEA	PLANTAIN-LEAVED SEDGE
SC	G4	S?	CAREX PRASINA	DROOPING SEDGE

SC	G5	S?	CAREX SCABRATA	ROUGH SEDGE
SC	G5	S?	CAREX STRICTA	TUSSOCK SEDGE
SC	G4Q	S?	CAREX WOODII	PRETTY SEDGE
RC	G5	S2	CASTILLEJA COCCINEA	SCARLET INDIAN-PAINTBRUSH
SC	G5	S2	CAULOPHYLLUM THALICTROIDES	BLUE COHOSH
SC	G4	S?	CHELONE LYONII	PINK TURTLEHEAD
SC	G5	S?	CIRCAEA LUTETIANA	SOUTHERN BROADLEAF ENCHANTER'S NIGHTSHAD
SC	G5T5	S1	CIRCAEA LUTETIANA SSP CANADENSIS	ENCHANTER'S NIGHTSHADE
SC	G3	S?	COLLINSONIA VERTICILLATA	WHORLED HORSE-BALM
SC	G5	S?	COMPTONIA PEREGRINA	SWEET FERN
SC	G5	S?	CYPRIPEDIUM PUBESCENS	LARGE YELLOW LADY'S-SLIPPER
SC	G5	S?	CYSTOPTERIS BULBIFERA	BULBLET FERN
SC	G5	S?	CYSTOPTERIS PROTRUSA	LOWLAND BRITTLE FERN
SC	G4	S?	DICENTRA EXIMIA	WILD BLEEDING-HEART
RC	G4	S1	DIPHYLLEIA CYMOSA	UMBRELLA-LEAF
SC	G5	S1	DIPLAZIUM PYCNOCARPON	GLADE FERN
SC	G4	S1	DRYOPTERIS GOLDIANA	GOLDIE'S WOODFERN
SC	G5	S?	DRYOPTERIS INTERMEDIA	EVERGREEN WOODFERN
FE	G2	S1	ECHINACEA LAEVIGATA	SMOOTH CONEFLOWER
SC	G5	S1	EUONYMUS ATROPURPUREUS	WAHOO
SC	G5?	S?	EUPATORIUM FISTULOSUM	HOLLOW JOE-PYE WEED
RC	G3	S1	FOTHERGILLA MAJOR	MOUNTAIN WITCH-ALDER
SC	G5	S?	GALEARIS SPECTABILIS	SHOWY ORCHIS
SC	G5	S1	GAULTHERIA PROCUMBENS	TEABERRY
SC	G5	S?	GAYLUSSACIA BACCATA	BLACK HUCKLEBERRY
SC	G5	S?	HACKELIA VIRGINIANA	VIRGINIA STICKSEED
SC	G5	S?	HEPATICA ACUTILOBA	LIVERLEAF
SC	G4	S?	HEUCHERA PARVIFLORA	LITTLE-LEAVED ALUMROOT
SC	G5	S?	HYDROCOTYLE AMERICANA	AMERICAN WATER-PENNYWORT
FT	G2G3	S1	ISOTRIA MEDEOLOIDES	SMALL WHORLED POGONIA
SC	G4	S?	JUGLANS CINEREA	BUTTERNUT
SC	G4	S?	JUNCUS GYMNOCARPUS	NAKED-FRUITED RUSH
SC	G5	S?	JUNCUS SUBCAUDATUS	WOODS-RUSH
SC	G5	S?	JUNIPERUS COMMUNIS	GROUND JUNIPER
SC	G3	S?	KRIGIA MONTANA	FALSE DANDELION
SC	G5	S?	LIPARIS LILIIFOLIA	LARGE TWAYBLADE
SC	G4	S?	LISTERA SMALLII	KIDNEY-LEAF TWAYBLADE
SC	G5?	S2	LONICERA FLAVA	YELLOW HONEYSUCKLE
SC	G4	S1S2	LYGODIUM PALMATUM	CLIMBING FERN
RC	G2	S1	LYSIMACHIA FRASERI	FRASER LOOSESTRIFE
SC	G5	S?	MENISPERMUM CANADENSE	CANADA MOONSEED
SC	G5	S?	MITELLA DIPHYLLA	TWO-LEAF BISHOP'S-CAP
SC	G5	S?	MONARDA DIDYMA	OSWEGO TEA
RC	G3	S1	MONOTROPSIS ODORATA	SWEET PINESAP
SC	G4	S2	NESTRONIA UMBELLULA	NESTRONIA
SC	G5	S?	OROBANCHE UNIFLORA	ONE-FLOWERED BROOMRAPE
SC	G5	S?	OSMORHIZA CLAYTONII	HAIRY SWEET-CICELY
RC	G4G5	S1	PACHYSANDRA PROCUMBENS	ALLEGHENY-SPURGE
RC	G4	S2S3	PANAX QUINQUEFOLIUS	AMERICAN GINSENG
RC	G4	S1	PARNASSIA ASARIFOLIA	KIDNEYLEAF GRASS-OF-PARNASSUS
SC	G5	S1	PELLAEA ATROPURPUREA	PURPLE-STEM CLIFF-BRAKE
SC	G5	S1	PHACELIA BIPINNATIFIDA	FERNLEAF PHACELIA
SC	G5	S1	PHILADELPHUS HIRSUTUS	STREAMBANK MOCK-ORANGE
SC	G2	S?	PLAGIOCHILA CADUCILOBA	GORGE LEAFY LIVERWORT
SC	G2G3	S?	PLAGIOMNIUM CAROLINIANUM	MOUNTAIN WAVY-LEAF MOSS
SC	G5	S1	POLYGALA PAUCIFOLIA	GAY-WING MILKWORT
RC	G3G5	S1	PYCNANTHEMUM MONTANUM	SINGLE-HAIRED MOUNTAIN-MINT
SC	G5	S?	RHIZOMNIUM APPALACHIANUM	LARGE-LEAVED MNIUM
SC	G5	S?	RHODODENDRON CATAWBIENSE	CATAWBA RHODODENDRON
NC	G2	S1	RUDBECKIA HELIOPSIDIS	SUN-FACING CONEFLOWER
SC	G4	S1	SANICULA TRIFOLIATA	LARGE-FRUITED SANICLE
SC	G5	S?	SAXIFRAGA MICRANTHIDIFOLIA	LETTUCE-LEAF SAXIFRAGE
NC	G2	S2	SHORTIA GALACIFOLIA	OCONEE-BELLS
SC	G5	S1	SOLIDAGO BICOLOR	WHITE GOLDENROD

SC	G3	S1	STACHYS CLINGMANII	CLINGMAN'S HEDGE-NETTLE
SC	G5TU	S1	STACHYS TENUIFOLIA VAR LATIDENS	BROAD-TOOTHED HEDGE-NETTLE
RC	G4	S2	STEWARTIA OVATA	MOUNTAIN CAMELLIA
SC	G4?	S?	THERMOPSIS MOLLIS	SOFT-HAIRED THERMOPSIS
SC	G5T5	S?	TIARELLA CORDIFOLIA VAR CORDIFOLIA	HEART-LEAVED FOAM FLOWER
SC	G5	S?	TRAUTVETTERIA CAROLINIENSIS	CAROLINA TASSEL-RUE
RC	G4	S1	TRICHOMANES BOSCHIANUM	BRISTLE-FERN
RC	G4G5	S2	TRICHOMANES PETERSII	DWARF FILMY-FERN
SC	G3	S?	TRILLIUM DISCOLOR	FADED TRILLIUM
SC	G5	S?	TRILLIUM GRANDIFLORUM	LARGE-FLOWER TRILLIUM
FE	G1	S1	TRILLIUM PERSISTENS	PERSISTENT TRILLIUM
SC	G3	S?	TRILLIUM RUGELII	SOUTHERN NODDING TRILLIUM
SC	G3	S?	TRILLIUM SIMILE	A TRILLIUM
SC	G5	S?	TRILLIUM UNDULATUM	PAINTED TRILLIUM
SC	G4	S2	TRIPHORA TRIANTHOPHORA	NODDING POGONIA
SC	G5	S?	VIOLA CONSPERSA	AMERICAN BOG VIOLET
SC	G5TU	S?	VIOLA PUBESCENS VAR LEIOCARPON	YELLOW VIOLET
SC	G5	S?	VIOLA TRIPARTITA	THREE-PARTED VIOLET
SC	G5T?	S?	VIOLA TRIPARTITA VAR GLABERRIMA	THREE-PARTED VIOLET
SC	G5T3?	S?	VIOLA TRIPARTITA VAR TRIPARTITA	THREE-PARTED VIOLET
RC	G2?	S2	WALDSTEINIA LOBATA	PIEDMONT STRAWBERRY
SC	G4	S1	XEROPHYLLUM ASPHODELOIDES	EASTERN TURKEYBEARD

RARE, THREATENED, AND ENDANGERED SPECIES OF PICKENS COUNTY

ANIMALS:

STATUS	GRANK	SRANK	SCIENTIFIC NAME	COMMON NAME
SC	G5T5	S5	ACRIS CREPITANS CREPITANS	NORTHERN CRICKET FROG
SC	G3G4	S1	ANEIDES AENEUS	GREEN SALAMANDER
FT	G3	S1	CLEMMYS MUHLENBERGII	BOG TURTLE
SE	G4	S2?	CORYNORHINUS RAFINESQUII	RAFINESQUE'S BIG-EARED BAT
SC	G5	S?	CROTALUS HORRIDUS	TIMBER RATTLESNAKE
SC	G5	S1	ETHEOSTOMA FLABELLARE	FANTAIL DARTER
ST	G5T5	S?	EUMECES ANTHRACINUS PLUVIALIS	SOUTHERN COAL SKINK
SC	G5	SH	FELIS CONCOLOR	MOUNTAIN LION
FE	G5TH	S1	FELIS CONCOLOR COUGUAR	EASTERN COUGAR
SC	G5	S2	LAMPROPELTIS TRIANGULUM	MILK SNAKE
SC	G5	S?	LASIURUS CINEREUS	HOARY BAT
SC	G2G3	S?	MACROMIA MARGARITA	MARGARET'S RIVER CRUISER
SC	G5	S4	MICROTUS PENNSYLVANICUS	MEADOW VOLE
ST	G3	S1	MYOTIS LEIBII	EASTERN SMALL-FOOTED MYOTIS
SC	G5	S3?	MYOTIS LUCIFUGUS	LITTLE BROWN MYOTIS
SC	G4	S3S4	MYOTIS SEPTENTRIONALIS	NORTHERN MYOTIS
SC	G5	S3S4	NEOTOMA FLORIDANA	EASTERN WOODRAT
SC	G5T4	S3S4	NEOTOMA FLORIDANA HAEMATOREIA	SOUTHERN APPALACHIAN WOODRAT
SC	G1G3	S1S3	POLYCENTROPUS CARLSONI	CARLSON'S POLYCENTROPUS CADDISFLY
SC	G5	S?	RANA PALUSTRIS	PICKEREL FROG
SC	G5	S3	RANA SYLVATICA	WOOD FROG
SC	G?	S?	SIGMORIA ARCUATA	A MILLIPEDE
SC	G5	S3S4	SOREX HOYI	PYGMY SHREW
SC	G5	S4	SPILOGALE PUTORIUS	EASTERN SPOTTED SKUNK
SC	G5	S3	SYLVILAGUS AQUATICUS	SWAMP RABBIT
SC	G4	S2?	SYLVILAGUS OBSCURUS	APPALACHIAN COTTONTAIL
SC	G5	S3?	TAMIASCIURUS HUDSONICUS	RED SQUIRREL
SC	G5	S4	TYTO ALBA	BARN-OWL
SC	G5	S3?	URSUS AMERICANUS	BLACK BEAR
SC	G5	S?	ZAPUS HUDSONIUS	MEADOW JUMPING MOUSE

PLANTS:

STATUS	GRANK	SRANK	SCIENTIFIC NAME	COMMON NAME
SC	G4	S2	ACONITUM UNCINATUM	BLUE MONKSHOOD
SC	G5	S1	AGRIMONIA PUBESCENS	SOFT GROOVEBUR
SC	G5	S?	ALLIUM CERNUUM	NODDING ONION
SC	G4?	S?	AMORPHA GLABRA	SMOOTH INDIGOBUSH
SC	G?	S?	ANEURA MAXIMA	
SC	G5	S2	ARISTOLOCHIA MACROPHYLLA	PIPEVINE
RC	G4	S1	ASPLENIUM MONANTHES	SINGLE-SORUS SPLEENWORT
SC	G4	S1	ASPLENIUM PINNATIFIDUM	LOBED SPLEENWORT
SC	G5	S2	ASPLENIUM RHIZOPHYLLUM	WALKING-FERN SPLEENWORT
SC	G5	S?	ASPLENIUM TRICHOMANES	MAIDENHAIR SPLEENWORT
NC	G3	S1	ASTER AVITUS	ALEXANDER'S ROCK ASTER
SC	G2G3	S?	ASTER GEORGIANUS	GEORGIA ASTER
SC	G5	S?	ASTER LAEVIS	SMOOTH BLUE ASTER
SC	G5	S?	ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER
SC	G5	S?	ASTER SPECTABILIS	SHOWY ASTER
SC	G5	S1	BETULA ALLEGHANIENSIS	YELLOW BIRCH
SC	G4	S?	CAREX APPALACHICA	APPALACHIAN SEDGE
SC	G4	S?	CAREX AUSTROCAROLINIANA	A SEDGE
SC	G5	S?	CAREX EBURNEA	EBONY SEDGE
SC	G5	S1	CAREX PEDUNCULATA	LONGSTALK SEDGE
SC	G5	S?	CAREX PLANTAGINEA	PLANTAIN-LEAVED SEDGE
SC	G4	S?	CAREX PRASINA	DROOPING SEDGE
SC	G5	S?	CAREX SCABRATA	ROUGH SEDGE
RC	G5	S2	CASTILLEJA COCCINEA	SCARLET INDIAN-PAINTBRUSH
SC	G5	S2	CAULOPHYLLUM THALICTROIDES	BLUE COHOSH
SC	G1	S?	CHEILOLEJEUNEA EVANSII	

SC	G4	S?	CHELONE LYONII	PINK TURTLEHEAD
SC	G5	S?	CIMICIFUGA AMERICANA	MOUNTAIN BUGBANE
SC	G5T5	S1	CIRCAEA LUTETIANA SSP CANADENSIS	ENCHANTER'S NIGHTSHADE
RC	G4	S1	CLADRASTIS KENTUKEA	YELLOWWOOD
SC	G3	S?	COLLINSONIA VERTICILLATA	WHORLED HORSE-BALM
NC	G3	S1	COREOPSIS LATIFOLIA	BROAD-LEAVED TICKSEED
SC	G5	S?	CYPRIPEDIUM PUBESCENS	LARGE YELLOW LADY'S-SLIPPER
SC	G5	S?	CYSTOPTERIS PROTRUSA	LOWLAND BRITTLE FERN
SC	G3?	S?	DANTHONIA EPILIS	BOG OAT-GRASS
SC	G5	S?	DESCHAMPSIA FLEXUOSA	CRINKLED HAIRGRASS
NC	G3	S1	DRABA APRICA	OPEN-GROUND WHITLOW-GRASS
SC	G5	S?	DRYOPTERIS INTERMEDIA	EVERGREEN WOODFERN
FE	G2	S1	ECHINACEA LAEVIGATA	SMOOTH CONEFLOWER
SC	G5	S1	EUONYMUS ATROPURPUREUS	WAHOO
SC	G5?	S?	EUPATORIUM FISTULOSUM	HOLLOW JOE-PYE WEED
RC	G3	S1	FOTHERGILLA MAJOR	MOUNTAIN WITCH-ALDER
SC	G5	S?	GALEARIS SPECTABILIS	SHOWY ORCHIS
SC	G5	S1	GAULTHERIA PROCUMBENS	TEABERRY
SC	G5	S?	GAYLUSSACIA BACCATA	BLACK HUCKLEBERRY
SC	G4	S1	HELIANTHUS PORTERI	PORTER'S GOLDENEYE
SC	G5	S?	HEPATICA ACUTILOBA	LIVERLEAF
SC	G4	S?	HEUCHERA PARVIFLORA	LITTLE-LEAVED ALUMROOT
SC	G5	S?	HYDROCOTYLE AMERICANA	AMERICAN WATER-PENNYWORT
SC	G1G2	S?	HYMENOPHYLLUM TAYLORIAE	TUNBRIDGE FERN
NC	G4G5	S1	HYMENOPHYLLUM TUNBRIGENSE	TUNBRIDGE FERN
SC	G4G5	S?	IPOMOPSIS RUBRA	RED STANDING-CYPRESS
SC	G4?	S?	ISOETES CAROLINIANA	ENGELMANN'S QUILLWORT
FE	G1	S1	ISOETES MELANOSPORA	BLACK-SPORED QUILLWORT
SC	G3	S2	ISOETES PIEDMONTANA	PIEDMONT QUILLWORT
SC	G4	S?	JUGLANS CINEREA	BUTTERNUT
SC	G4	S?	JUNCUS GEORGIANUS	GEORGIA RUSH
SC	G4	S?	JUNCUS GYMNOCARPUS	NAKED-FRUITED RUSH
SC	G4	S?	JUNGERMANNIA FOSSOMBRONIOIDES	
SC	G3	S?	KRIGIA MONTANA	FALSE DANDELION
SC	G5	S1?	LILIUM CANADENSE	CANADA LILY
SC	G5?	S2	LONICERA FLAVA	YELLOW HONEYSUCKLE
SC	G1	S?	LOPHOCOLEA APPALACHIANA	
SC	G4	S1S2	LYGODIUM PALMATUM	CLIMBING FERN
RC	G2	S1	LYSIMACHIA FRASERI	FRASER LOOSESTRIFE
SC	G5	S?	MENISPERMUM CANADENSE	CANADA MOONSEED
SC	G4	S?	MINUARTIA UNIFLORA	ONE-FLOWER STITCHWORT
SC	G5	S?	MONARDA DIDYMA	OSWEGO TEA
RC	G3	S1	MONOTROPSIS ODORATA	SWEET PINESAP
SC	G4	S2	NESTRONIA UMBELLULA	NESTRONIA
SC	G5	S?	OENOTHERA PERENNIS	SMALL SUNDROPS
SC	G5	S?	OROBANCHE UNIFLORA	ONE-FLOWERED BROOMRAPE
RC	G4G5	S1	PACHYSANDRA PROCUMBENS	ALLEGHENY-SPURGE
RC	G4	S2S3	PANAX QUINQUEFOLIUS	AMERICAN GINSENG
RC	G3G4	S2	PARNASSIA GRANDIFOLIA	LARGE-LEAVED GRASS-OF-PARNASSUS
SC	G5	S1	PELLAEA ATROPURPUREA	PURPLE-STEM CLIFF-BRAKE
SC	G5	S?	PELLAEA WRIGHTIANA	CLIFF-BRAKE FERN
SC	G1Q	S?	PELLIA APPALACHIANA	
SC	G5	S1	PHILADELPHUS HIRSUTUS	STREAMBANK MOCK-ORANGE
SC	G2	S?	PLAGIOCHILA CADUCILOBA	GORGE LEAFY LIVERWORT
SC	G5	S1	PLATANTHERA LACERA	GREEN-FRINGE ORCHIS
SC	G5	S1	POLYGALA PAUCIFOLIA	GAY-WING MILKWORT
SC	G1Q	S?	PORELLA JAPONICA SSP APPALACHIANA	
RC	G3G5	S1	PYCNANTHEMUM MONTANUM	SINGLE-HAIRED MOUNTAIN-MINT
SC	G5	S?	RHODODENDRON CATAWBIENSE	CATAWBA RHODODENDRON
SC	G5T?	S?	RUELLIA CAROLINIENSIS SSP CILIOSA	A PETUNIA
SC	G5	S?	SANGUISORBA CANADENSIS	CANADA BURNET
FE	G3T1	S?	SARRACENIA RUBRA SSP JONESII	MOUNTAIN SWEET PITCHER-PLANT
SC	G3	S1	SAXIFRAGA CAREYANA	CAREY SAXIFRAGE
SC	G5	S?	SAXIFRAGA MICRANTHIDIFOLIA	LETTUCE-LEAF SAXIFRAGE

SC	G5T?	S?	SCIRPUS CESPITOSUS VAR CALLOSUS	TUSSOCK BULRUSH
RC	G2	S2	SENECIO MILLEFOLIUM	PIEDMONT RAGWORT
NC	G2	S2	SHORTIA GALACIFOLIA	OCONEE-BELLS
SC	G5TU	S1	STACHYS TENUIFOLIA VAR LATIDENS	BROAD-TOOTHED HEDGE-NETTLE
RC	G4	S2	STEWARTIA OVATA	MOUNTAIN CAMELLIA
SC	G5T5	S?	TIARELLA CORDIFOLIA VAR CORDIFOLIA	HEART-LEAVED FOAM FLOWER
SC	G5	S?	TRAUTVETTERIA CAROLINIENSIS	CAROLINA TASSEL-RUE
RC	G4	S1	TRICHOMANES BOSCHIANUM	BRISTLE-FERN
RC	G4G5	S2	TRICHOMANES PETERSII	DWARF FILMY-FERN
SC	G3	S?	TRILLIUM DISCOLOR	FADED TRILLIUM
SC	G3	S?	TRILLIUM RUGELII	SOUTHERN NODDING TRILLIUM
SC	G4	S2	TRIPHORA TRIANTHOPHORA	NODDING POGONIA
SC	G5TU	S?	VIOLA PUBESCENS VAR LEIOCARPON	YELLOW VIOLET
SC	G5	S?	VIOLA TRIPARTITA	THREE-PARTED VIOLET
SC	G5T3?	S?	VIOLA TRIPARTITA VAR TRIPARTITA	THREE-PARTED VIOLET
SC	G4	S1	XEROPHYLLUM ASPHODELOIDES	EASTERN TURKEYBEARD
SC	G5	S?	XYRIS TORTA	TWISTED YELLOW-EYED-GRASS

Attachment G

Letter from Jennifer R. Huff, Duke Power,
to
Roger L. Banks, USFWS,
dated June 23, 1998.

Duke Power
A Duke Energy Company

Duke Power
Energy Center
P.O. Box 1006
Charlotte, NC 28201-1006
Mail Code EC12Y

June 23, 1998

Mr. Roger L. Banks
US Fish and Wildlife Service
PO Box 12559
Charleston, SC 29422-2559

Subject: Oconee Nuclear Station - NRC License Renewal
FWS Log No. 4-6-98-227

Dear Mr. Banks:

Duke Power Company is in the process of preparing a license renewal package for Oconee Nuclear Station. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts to rare and endangered species resulting from continued operation of the facility or refurbishment activities.

Duke Power Company hired Dr. L.L. Gaddy to survey a one-mile radius around the facility to identify any rare or endangered species. Enclosed please find the results of this survey titled *"Endangered, Threatened and Otherwise Noteworthy Plant and Animal Species of the Oconee Nuclear Station."*

Dr. Gaddy located four state-listed plant species within the one-mile radius. The locations of these plants are shown on Map 1 of the attached report. These areas are remote from the actual operation of the plant and there are no plans for future refurbishment activities in these locations. Therefore, Duke Power does not believe that continued operation of the facility will adversely impact these species. We ask that you provide your comments regarding both the survey report and our determination of no adverse impact.

Please do not hesitate to contact me at 704/373-4392 if you have any questions.

Sincerely:

Jennifer R. Huff

Jennifer R. Huff
Scientist

Enclosure

cc: Mr. Ed Duncan, SCDNR

cc: Dr. L.L. Gaddy

Attachment H

Letter from Jennifer R. Huff, Duke Power,
to
Ed Duncan, South Carolina Department of Natural Resources,
dated June 23, 1998.

Duke Power
A Duke Energy Company

Duke Power
Energy Center
P.O. Box 1006
Charlotte, NC 28201-1006

Mail Code EC12Y

June 23, 1998

Mr. Ed Duncan
South Carolina Department of Natural Resources
PO Box 12559
Charleston, SC 29422-2559

Subject: Oconee Nuclear Station - NRC License Renewal
Rare and Endangered Species Survey

Dear Mr. Duncan:

Duke Power Company is in the process of preparing a license renewal application for Oconee Nuclear Station. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts to rare and endangered species resulting from continued operation of the facility or refurbishment activities.

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Please do not hesitate to contact me at 704/373-4392 if you have any questions.

Sincerely:

Jennifer R. Huff

Jennifer R. Huff
Scientist

Enclosure

cc: Mr. Roger Banks, USFWS

cc: Dr. L.L. Gaddy

Attachment I

Letter from Dr. John F. Brown, State Toxicologist, South Carolina Department of Health and Environmental Control,
to
Thomas W. Yocum, Duke Power,
Discussing public health considerations of thermophilic microorganisms, dated October 25, 1996.

South Carolina
DHEC
Department of Health and Environmental Control

ENVIRONMENTAL ENGINEERING AND PLANNING SECTION
OCT 31 1996
FILE
DATE
COPY
ROUTE

October 25, 1996

Mr. Thomas W. Yocum
Environmental Engineering
Duke Power/MG03CI
1339 Hagers Ferry Rd.
Huntersville, NC 28078-7829

Dear Mr. Yocum:

Thank you for the telephone discussions and for technical documents you sent relative to public health considerations of thermophilic microorganisms. I have reviewed this material and related technical information in my own library.

While some microorganisms associated with thermal water discharges, especially related to air conditioning cooling towers, have been demonstrated to have deleterious human health effects, these events have occurred rarely and none have been identified with heated water sources associated with nuclear power plants, to my knowledge.

Pathogenic species of Legionella bacteria and Naegleria amoeba have been identified in heated cooling waters associated with nuclear plants. In most cases, the heated waters showed a very small increase (approximately 10-fold) over unheated source waters, but were higher in source waters in a few cases.

The most likely exposure to Legionella aerosol would be to workers within the plant. This would not impact the general public beyond the plant boundaries. A similar exposure possibility exists for Naegleria amoeba, with a slightly greater exposure potential for swimmers.

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

Please contact me at 803/737-4170 if you desire additional discussion of this matter.

Sincerely,

John F. Brown, DVM, PhD

John F. Brown, DVM, PhD
State Toxicologist

Attachment J

Letter from Jennifer Rudisill, Duke Power,
to
Nancy Brock, State Historic Preservation Office (SHPO),
dated October 21, 1997.

97-OCON- NRC - NP
80F

2323

Duke Power
A Duke Energy Company

Duke Power
Group Environment, Health & Safety
13339 Hagers Ferry Road
Huntersville, NC 28078-7929

ENVIRONMENTAL ENGINEERING
AND PLANNING SECTION
OCT 24 1997
☐ FILE
☐ TICKLER DATE
☐ COPY
☐ ROUTE

RECEIVED
OCT - 3 1997
S. C. DEPARTMENT OF
ARCHIVES & HISTORY

September 30, 1997

Ms. Nancy Brock
South Carolina Department of Archives
and History
PO Box 11669
Columbia, SC 292111

Subject: Oconee Nuclear Station
Historic and Archaeological Properties

Dear Ms. Brock:

Duke Power is currently preparing an application for renewal of Oconee Nuclear Station's operating license. One of the Nuclear Regulatory Commission's (NRC) requirements is that Duke must identify impacts to cultural resources resulting from the renewal of the license. Duke does not believe that there will be any impacts to cultural resources due to the fact that refurbishment is not anticipated to require any land-disturbing activities.

I have enclosed information about the relicensing process from Oconee's Environmental Report and the NRC's generic environmental report.

After you review the enclosed information, please send me a letter stating that impacts to cultural resources will be minimal and that there is no need for mitigation. Please do not hesitate to contact me at (704) 875-5966 if you have any questions or would like to discuss further.

Thank you for your assistance in this matter.

Sincerely:

Jennifer A. Rudisill
Resource Management

Enclosures (2)

"We know of no properties included in or eligible for inclusion in the National Register of Historic Places which will be affected by this project." 10/21/97
Nancy Brock
Review & Compliance Programs
Coordinator
State Historic Preservation
Office

Attachment K

"Oconee Nuclear Station Severe Accident Mitigation Alternatives (SAMAs) Analysis"
April 1998.

OCONEE NUCLEAR STATION

Severe Accident Mitigation Alternatives (SAMAs) Analysis

April 1998

TABLE OF CONTENTS

1.0 Introduction and Background

This report presents the "consideration of alternatives to mitigate severe accidents" for Oconee Nuclear Station, in compliance with environmental review requirements in 10CFR51.53(c)(3)(ii)(L). For this analysis, SAMAs (severe accident mitigation alternatives) will include a review of potential design alternatives (SAMDAs - severe accident mitigation design alternatives) along with any procedural, non-hardware, alternatives. The objective of the SAMAs review is to facilitate the consideration of cost-beneficial plant modifications that could reduce the risk of severe accidents for plant operation during the license renewal period. This is achieved by identifying potential plant enhancements that could provide substantial severe accident benefit and then assessing the need and viability of those enhancements from a cost-benefit standpoint. The severe accident benefit is assessed in terms of the person-rem averted by the proposed alternative. The cost-benefit analysis is performed using 1998 dollars for the cost of alternatives and the present worth of averted costs.

As background, Duke has been actively involved since before 1980 in the development of plant-specific probabilistic risk assessments (PRA), individual plant examinations (IPE/IPEEE), and component/system reliability studies to evaluate severe accidents at Oconee (see Section 2.0). These studies have led to changes in the plant configuration and enhancements in plant procedures to reduce vulnerability of the plant to certain accident sequences.

This report presents an assessment of additional alternatives that could be implemented based on the current Oconee risk profile. Section 3.0 discusses the methodology used by Duke to perform this assessment. The methodology selected for this analysis involves reviewing the current risk profile using the Oconee PRA Revision 2 results and identifying: (a) the severe accident sequences dominating the core damage frequency (CDF), and (b) the severe accident sequences dominating the person-rem risk. In Sections 4.0 and 5.0, the list of potential alternatives are screened using a high-level cost-benefit comparison. A more detailed cost-benefit analysis is performed on those candidates that survive the initial screening analysis.

In addition, Duke has implemented two ongoing programs—the Maintenance Rule Program and the Severe Accident Management Guideline Program to manage severe accident risk. These are described in Section 2.2.

2.0 Risk Reduction Measures Previously Considered

The following paragraphs provide brief descriptions of previous studies that have been performed by Duke to identify potential plant enhancements at Oconee. The Oconee PRA study, that was published in 1980, was performed prior to the existence of regulatory guidance. The IPE and IPEEE studies were performed in response to Generic Letter 88-20, as supplemented. The Keowee PRA and High Pressure Injection reliability study were performed at Duke's initiative to assess the reliability of these systems and any potential plant enhancements that needed to be implemented to further reduce the risk associated with the failure of these systems.

2.1 Past Studies

Oconee PRA

In 1980, Duke and Oconee Nuclear Station were selected to undertake an industry PRA project, managed by the Nuclear Safety Analysis Center (NSAC) of the Electric Power Research Institute (EPRI). The NSAC study was published in June 1984 as NSAC-60 [Reference 2.1]. This analysis was one of the first plant-specific PRA projects undertaken in the industry. A very detailed review of NSAC-60 was performed which included meetings and site visits by the NRC and Brookhaven National Laboratory with Duke. The results of this review were completed and published in March 1986. The staff concluded that the Oconee PRA study "is an excellent piece of work. The same tools were used as for the Reactor Safety Study (event trees/fault trees), but the Oconee PRA also added to the state of the art. The Oconee PRA study successfully identified the major failure combinations that can lead to core damage", and Duke is taking initiative in making plant enhancements as a result of the study [Reference 2.2, pages xv, xvi, xvii]. Duke issued several letters to the NRC providing information on the plant enhancements identified and the status of implementation as a result of NSAC-60. Table 2-1 identifies the plant enhancements implemented as part of the NSAC-60 study.

Oconee IPE

In January 1987, Duke initiated a large-scale review and update of the initial study. The major objectives of the review and update were to incorporate plant changes made since the time of the original study, improve on assumptions made in the original study, make use of plant experience/data from the 1980s, and utilize improvements in PRA methodology and up-to-date techniques.

On November 23, 1988, the NRC issued Generic Letter 88-20 [Reference 2.3], which requested that licensees conduct an Individual Plant Examination (IPE) in order to identify potential severe accident vulnerabilities at their plant. The Oconee response to GL 88-20 was provided by letter dated November 30, 1990 [Reference 2.4]. Oconee's response included the updated Oconee PRA (Revision 1) study. The Oconee PRA

Revision 1 study and the IPE process resulted in a comprehensive, systematic examination of Oconee with regard to potential severe accidents. The Oconee study was a full-scope, Level 3 PRA with analysis of both the internal and external events. This examination identified the most likely severe accident sequences, both internally and externally induced, with quantitative perspectives on their likelihood and fission product release potential. The results of the study have prompted changes in equipment, plant configuration and enhancements in plant procedures to reduce vulnerability of the plant to some accident sequences of concern which are identified in Table 2-1.

By letter dated April 1, 1993 [Reference 2.5], the NRC provided an evaluation of the internal events portion of the above Oconee IPE submittal. The conclusion of the NRC letter [page 14] states:

> The staff finds the licensee's IPE submittal for internal events including internal flooding essentially complete, with the level of detail consistent with the information requested in NUREG-1335. Based on the review of the submittal and the associated supporting information, the staff finds reasonable the licensee's IPE conclusion that no fundamental weakness or severe accident vulnerabilities exist at Oconee. The staff notes:
>
> (1) DPC personnel were considerably involved in the development and application of PSA techniques to the Oconee facility, and that the associated walkdowns and documentation reviews constituted a viable process for confirming that the IPE represents the as-built, as-operated plant.
> (2) The front-end IPE analysis appears complete, with the level of detail consistent with the information requested in NUREG-1335. In addition, the employed analytical techniques reflect commonly accepted practices and are capable of identifying potential core damage vulnerabilities.
> (3) The back-end analysis addressed the most important severe accident phenomena normally associated with large dry containments, for instance, DCH, ISGTR, and hydrogen combustion. No obvious or significant problems or errors were identified.
> (4) The HRA allowed the licensee to develop a quantitative understanding of the contribution of human errors to CDF and containment failure probabilities.
> (5) Based on the licensee's IPE process used to search for DHR vulnerabilities, and review of Oconee plant-specific features, the staff finds the DHR evaluation consistent with the intent of the USI A-45 (Decay Heat Removal Reliability)
> (6) The licensee's response to CPI Program recommendations, which include searching for vulnerabilities associated with containment performance during severe accidents, is reasonable and consistent with the intent of Generic Letter 88-20 Supplement 3.
>
> In addition, and consistent with the intent of Generic Letter 88-20, the staff believes the licensee's peer review process provided assurance that the IPE

analytical techniques had been correctly applied and that documentation is accurate.

Based on the above findings, the staff concludes that the licensee demonstrated an overall appreciation of severe accidents, has an understanding of the most likely severe accident sequences that could occur at the Oconee facility, has gained a quantitative understanding of core damage and fission product release, responded to safety improvement opportunities. The staff, therefore, finds the Oconee IPE process acceptable in meeting the intent of Generic Letter 88-20. The staff also notes that the licensee's intent to continue use of the IPE as a "living" document, will enhance plant safety and provides additional assurance that any potential unrecognized vulnerabilities would be identified and evaluated during the lifetime of the plant.

Oconee IPEEE

In response to Generic Letter 88-20, Supplement 4, Duke completed an Individual Plant Examination of External Events (IPEEE) for severe accidents. This IPEEE was submitted to the NRC by letter dated December 28, 1995 [Reference 2.6]. The report, which is currently undergoing NRC review, contains a summary of the methods, results and conclusions of the Oconee IPEEE program. The IPEEE process and supporting Oconee PRA include a comprehensive, systematic examination of severe accident potential resulting from external initiating events. The Oconee IPEEE has identified the severe accident sequences of significance resulting from the external initiating events with quantitative perspectives on their likelihood. Significantly, no fundamental plant weaknesses or vulnerabilities with regard to external events were identified during the IPEEE examination. However, enhancements to plant hardware and procedural guidelines have been recommended. These potential enhancements are currently being reviewed and some have been implemented.

In December 1995, when Duke issued the Oconee IPEEE Report, a full scope relay chatter review was still in progress and the results of the relay review were to be submitted as an addendum. In December 1997, the Oconee Supplemental IPEEE Report was issued to present the results of the relay review as it affects the previously submitted seismic analysis as well as other enhancements to the seismic analysis [Reference 2.7]. Several enhancements to plant hardware and procedural guidelines were recommended as a result of the IPEEE submittals (see Table 2-1). All enhancements are currently being reviewed and some have been implemented.

Keowee PRA (Oconee AC Power Reliability Study)

In July 1995, Duke issued a detailed analytical reliability study of the Keowee hydroelectric generating facility [Reference 2.8], which serves as the primary source of emergency AC power for Oconee. This analysis supports the conclusion that Keowee is a reliable source of emergency power for Oconee for conditions involving the loss of on-site power and off-site power. The Duke recommended plant action resulting from this study is continued operational/maintenance practices promoting high reliability, recognizing the vulnerability of the system during conditions of severe weather, optimizing maintenance unavailability of the underground power, and satisfactory cause-and-effect analysis of equipment failures.

Oconee High Pressure Injection (HPI) Reliability Study

In December 1997, Duke issued a detailed reliability study of the Oconee High Pressure Injection (HPI) system [Reference 2.9], which is used during the normal operation of the plant and as an accident mitigation system for certain accidents. This study concluded that the reliability of the HPI system for the various design basis accident mitigation functions is estimated to be very high, particularly in the injection mode. Based on the findings of this study, several recommendations were made to further improve the HPI system reliability.

2.2 Ongoing Initiatives

The following two programs are ongoing initiatives at Duke to further reduce the risk associated with the plant operation of Oconee. The first program discussed is the Oconee ORAM-Sentinel which has been implemented at Duke's own initiative. The second program, the Severe Accident Management Guidelines Program, is in response to a regulatory requirement for closure of the severe accident regulatory issue (SECY 88-147, Generic Letter 88-20).

Oconee Maintenance Rule (ORAM-SENTINEL) Program

As part of this program, risk significant structures, systems, and components (SSCs) in the plant are identified, performance goals on the SSCs are set, actual performance is monitored, and corrective actions are taken where actual performance fails to meet performance goals.

This program is expected to ensure that the reliability of risk significant structures, systems, and equipment in the plant is maintained at their desired high values and that the severe accident risk is small.

Oconee Severe Accident Management Guideline (SAMG) Program

Another severe accident initiative that has been undertaken by Duke is the development and implementation of Severe Accident Management Guidelines (SAMG). In December 1997, Duke completed all the training and procedures for the SAMG program. This formal program makes use of available plant resources to manage severe accidents, should they occur. It includes diagnostic tools and severe accident management guidelines documents for developing strategies during an event to arrest core damage progression and mitigate fission product releases in the event of a severe accident. SAMG training is given to Emergency Response Organization personnel to provide an understanding of severe accident phenomenon and the use of the tools and guideline documents.

This SAMG program achieves an incremental risk reduction capability without reliance on additional hardware and resources.

TABLE 2-1 Risk Reduction Measures Implemented At Oconee

Past Studies	Alternatives Implemented As A Result Of Findings From Study
From NSAC-60 study there existed plant vulnerabilities related to Turbine Building Flood scenarios	Alternatives implemented as a result of the Turbine Building Flood analysis included: • Penetrations in the Turbine Building/Auxiliary Building wall, up to a height of 20 feet above the basement floor, were provided with watertight seals. • Three doors between the Turbine Building basement and Auxiliary Building Basement were strengthened and secured and three were replaced with watertight flood doors. • Two water level alarms have been installed in the Turbine Building basement to alert of flooding. • Automatic high pressure service water (HPSW) backup to the LPSW cooling has been provided for the HPI motors. • The trash screen in front of the turbine building drain has been redesigned to mitigate clogging. • Override switches have been installed to allow all CCW pump discharge valves to be closed from the Control Rooms, and procedure changes have been made to direct this action following a "flood alert" alarm. • To limit the backflow from the CCW system during flood, valve alignments on the CCW side of the condensate coolers for all three units were changed. • Valves have been closed to prevent draining the upper surge tanks to the hotwells following a complete loss of instrument air, and procedure changes have been made to quarterly check that these valves are closed. • Valves with a common power supply have been given diverse power supplies. • Procedure changes have been made to include a warning that the LPI pumps must not run for more than 30 minutes at shut-off head following a small break LOCA. • A five foot high hydrostatic barrier walls have been installed around the grade level doors of the SSF to prevent flooding from Jocassee Dam failure. • A Loss of LPSW abnormal procedure has been created to help cope with this type of scenario.
The Oconee IPE study	Alternatives implemented as a result of the Oconee IPE results included modifications to procedures to: • isolate HPSW to the CCW pumps during a turbine flooding event in order to double the amount of time the elevated storage tank inventory will last. • allow using backup AC power from the 4.16 KV main feeder bus of Unit 2 to the SSF components such as the ASW system following a Turbine Building flooding event which could result in a failure of the total loss of the EFW system. • enhance the reliability of long term HPI cooling following a postulated large Turbine Building flooding event. • provide guidance on alternative HPI suction alignment upon common cause failure of HP-24 and HP-25.
The Oconee IPEEE supplemental study	Alternatives implemented or still under consideration as a result of the Oconee IPEEE supplemental results include numerous modifications to plant based on fire, tornado and seismic analysis which are contained in the Oconee IPEEE Supplemental Report [Reference 2.7]. Some of those plant enhancements already completed include such items as installing missing bolts to anchorage legs of cabinets, enhancing supports on certain vital cabinets and panels, adding mounting screws to panels/equipment, etc.

3.0 Methodology For Identifying Additional SAMAs

The methodology selected for this analysis involves identifying those severe accident mitigation alternatives which would have the most significant impact on reducing core damage frequency and person-rem risk. The approach used in this analysis consists of:

- developing the information on the current risk profile from the Oconee PRA/IPE Revision 2 results showing the distribution of the core damage frequency and person-rem risk (see Sections 4.1 and 5.1),
- identifying potential severe accident candidates for consideration of additional severe accident mitigation alternatives, and screening out those potential severe accident mitigation alternatives with low or marginal benefit (see Sections 4.2 and 5.2),
- further eliminating those alternatives whose implementation would not be expected to be cost-beneficial (see Sections 4.3 and 5.3),
- performing a cost-benefit analysis on the final set of potential alternatives to determine whether or not the implementation of the alternatives would be cost-beneficial (see Sections 4.4 and 5.4),
- finally, integrating the overall results and current initiative, and determining whether any further severe accident mitigation alternatives should be applied for license renewal (see Sections 6.0 and 7.0).

The current severe accident risk results are available from the 1996 update of the Oconee PRA Revision 2 [Reference 3.1]. As before, this update constitutes a full-scope Level 3 PRA with the analysis of both internal and external events. This Oconee PRA Revision 2 update provides a relatively current profile of the severe accident risk for Oconee characterized by (i) core damage frequency - the risk of core damage severe accidents which could release substantial fission products and (ii) person-rem risk - the risk of release of significant fission products offsite given a core damage accident.

4.0 SAMAs Considered For Core Damage Frequency Reduction

The following sections explain how the current Oconee PRA results are evaluated for potential SAMAs to reduce core damage frequency. Section 4.1 describes the current Oconee core damage frequency profile. Section 4.2 defines the process of selecting the top cut sets for consideration of SAMAs based on contribution to core damage frequency. Section 4.3 provides the analysis of potential SAMAs where the seismic and non-seismic initiators are examined separately since there is a distinct difference in the amount of plant damage in the event of such accident initiators. After examining the cut sets, an additional approach to identifying potential SAMAs beyond those selected from evaluating the cut set listings is applied by reviewing the basic event importance ranking. This basic event importance ranking provides a means of determining if some individual basic events contribute significantly to the core damage frequency that may not have been identified in the cut set review. Finally, section 4.4 provides the cost-benefit analysis for selected SAMAs.

The contributions from the averted onsite exposure cost and the averted offsite property damage cost are considered small for this SAMDA benefit analysis. Using the data from NUREG/BR-0184 and considering that the range of core damage frequency reduction expected from the candidate SAMDAs is in the range of 0-3% (0 to 2.69E-06 per year) it is seen that the averted risk contribution for the onsite exposure is approximately $1000 and that the offsite property damage is approximately $10,000 for the 20 year license renewal period. Even if these additional averted risk values are included in the final results of the analysis, the conclusions are the same, the cost to implement any of the SAMDAs would far exceed the benefit.

4.1 Current Oconee Core Damage Frequency Profile

The current calculated total (internal and external initiating events) core damage frequency for Oconee is 8.9E-05 per year (Oconee PRA/IPE Revision 2). The following shows how this total core damage frequency is distributed among the identified internal and external events.

NOTE: Since the issuance of the Oconee PRA Revision 2 report, the total core damage frequency has been recalculated: (i) the IPEEE supplemental report updated the seismic core damage frequency to be 3.5E-05 per year, and (ii) the HPI reliability study updated the total core damage frequency (excluding seismic) to be 4.3E-05 per year. However, for this analysis the results of the Oconee PRA Revision 2 are used since these interim studies do not include the Level 2 and 3 calculations.

The internal events represent about 29% of the total core damage frequency as follows:

Initiating Events	Frequency
Transients (Reactor Trips, Loss of Main Feedwater, Loss of Operating 4 kV ac Bus, Loss of LPSW, etc.)	8.2E-06 /ry
LOCAs (Small, Medium, and Large)	6.8E-06 /ry
Internal Flood	9.5E-06 /ry
Anticipated Transient Without Scram	1.7E-07 /ry
Steam Generator Tube Rupture	4.1E-07 /ry
Reactor Pressure Vessel Rupture	1.0E-06 /ry
Interfacing-Systems LOCA	6.9E-09 /ry
Total Internal	**2.6E-05 /ry**

The external events represent about 71% of the total core damage frequency as follows:

Initiating Events	Frequency
Seismic	3.9E-05 /ry
Tornado	1.4E-05 /ry
External Flood	5.9E-06 /ry
Fire	4.5E-06 /ry
Total External	**6.3E-05 /ry**

As can be seen from the distribution, the leading contributor to the total core damage frequency is the seismic initiator.

4.2 Identification Of Potential SAMAs

The process of identifying a preliminary list of potential severe accident sequences for consideration of additional alternatives makes use of the most recent update of the Oconee PRA Level 1 results. The Oconee PRA Revision 2 report lists the top 100 cut sets (severe accident sequences) based on internal initiators and a top 100 list of cut sets for external initiators ranked by contribution to total core damage frequency. This list of 200 severe accident sequences includes all potential core damage accident sequences with at least a 0.06% contribution to the total core damage frequency. Therefore, this list will be the starting point for identifying which severe accident sequences contribute the most to the core damage frequency for Oconee which may need to be considered for additional severe accident mitigation alternatives (SAMAs).

As previously stated, the preliminary list of 200 internal and external cut sets contain severe accident sequences contributing at least 0.06%. Additionally, some cut sets contributing as little as 0.05% to the total core damage frequency are also included. This is a comprehensive list of potential severe accident sequences identified for the Oconee plant. Furthermore, most of the accident sequences contained in this listing are very small contributors to the total core damage frequency (< 1%), indicating that little benefit can be gained in reducing the core damage frequency for these sequences. For this analysis, a core damage frequency cutoff value of 4.5E-07 (for internal initiators) and 8.5E-07 (for external initiators) is applied as a method of screening out those severe accident sequences for consideration of SAMAs. It is assumed that the implementation of alternatives for sequences with core damage frequency contributions below these cutoff values will provide low or marginal benefit. This assumption is conservative because there are no SAMAs identified as cost-beneficial to implement for the cut sets above the cutoff values, and it is expected this will be the case for the cut sets below the cutoff values.

4.3 Analysis Of Potential SAMAs

The approach selected for this portion of the analysis (potential SAMAs to reduce core damage frequency) is to calculate the value of the averted risk to the public for each alternative. It relies on the NRC's Regulatory Analysis Guide [Reference 4.1] to convert public health risk (person-rem) into dollars to estimate the cost of the public health consequences. The requirement established in this guide is to use $2000 per person-rem to convert public heath consequences to dollars (not indexed to inflation). Therefore, the value (or safety improvement) of implementing an alternative is expressed in terms of averted cost to the public (public benefit).

This analysis divides the potential severe accident sequences for consideration of SAMAs into two sections: (1) seismic initiator plant damage states (PDS), and (2) non-seismic initiator cut sets.

<u>Seismic Initiators</u>

In the Oconee IPEEE study, the seismic analysis was conducted by considering a distribution of equipment failure probabilities over various earthquake levels. The IPEEE analysis generates many cut sets that are grouped into particular plant damage states (PDSs). Therefore, the seismic initiator cut sets given in Table 6.1.3-2 of Reference 3.1 are the total probability of the cut sets in each PDS category rather than the individual cut set probabilities as in the case of the non-seismic events.

The following paragraphs explain how the Oconee-specific parameters are derived in order to calculate the averted cost to the public for the seismic initiator severe accident sequences.

The Oconee PRA Level 2-3 analysis maps each seismic initiator PDS into the various containment failure modes and release categories, and then presents the public health risk (person-rem) on a frequency weighted basis. The estimated maximum amount of annual person-rem risk associated with a particular seismic initiator cut set is calculated from the person-rem risk and core damage frequency for the PDS attributable to the seismic initiator. For example, the "seismic initiator causes PDS 7PI" severe accident sequence core damage frequency is estimated to be 1.96E-05 per year. The public health risk results from the Level 3 analysis estimates the total annual person-rem risk for PDS 7PI to be 0.93 person-rem, with a core damage frequency contribution of 3.55E-05 per year. Therefore, the total person-rem risk attributable to the "seismic initiator causes PDS 7PI" is determined by dividing the severe accident sequence core damage frequency by the total core damage frequency for PDS 7PI and then multiplying by the total person-rem for PDS 7PI. This is demonstrated below:

Total Person-rem Risk = (1.96E-05 ÷ 3.55E-05) × 0.93 person-rem = <u>0.51 person-rem</u>

Some risk will always exist, even when increasing the seismic ruggedness of many plant components/systems, because there is no way to completely eliminate the risk associated with seismic events. However, for this analysis an assumption is made that the implementation of plant enhancements for seismic events will completely eliminate the risk. The following equation is used to determine the value of the averted risk to the public:

Value Of Averted Risk = (Total Person-rem Risk) × ($2000/person-rem) (Eq. 4-1)

The above equation calculates the value of averted risk on an annual basis. Therefore, a method of "discounting" is used to calculate the "present value" or "present worth of averted risk" based on a specified period of time. For this analysis, a discount factor of 7% as described in the NRC Regulatory Analysis Technical Evaluation Handbook [Reference 4.2] is used to determine the present worth of averted risk over the 20 year license renewal period for Oconee. This results in a multiplication factor of approximately 11:

Present Worth Of Averted Risk = (11) × (Value Of Averted Risk) (Eq. 4-2)

The above methodology is repeated for each of the remaining seismic initiator severe accident plant damage listed in the top 100 external cut sets [Table 6.1.3-2 of Reference 3.1]. The results are presented in Table 4-1.

The seismic analysis contained in the Oconee supplemental IPEEE report has identified what plant enhancements can be made to reduce core damage frequency. The sensitivity studies performed in the IPEEE analysis show that most of the seismic upgrades to plant components will result in a small core damage frequency reduction (1E-06 - 4E-06) for each major enhancement. Considering that the averted risk value is approximately $51,100 (see Table 4-1), the risk reduction achievable is indeed small and that the cost of substantial upgrades in the plant systems seismic ruggedness is very large. Therefore, seismic related SAMAs are eliminated from further consideration.

Non-Seismic Initiators

The following paragraphs explain how the Oconee-specific parameters are derived, in order to calculate the averted cost to the public for the non-seismic initiators.

The non-seismic initiator severe accident sequences (cut sets) are assigned a PDS based on the type of plant damage and potential containment release characteristics. Since most of the alternatives under consideration in this analysis have the potential to impact more than one PDS, it is necessary to review the most risk significant PDSs affected by each SAMA. For example, the severe accident sequences "LOCA cut sets with failure of operators to initiate high pressure recirculation" are mapped into several PDSs. Since several PDSs (10AI, 5AI, 16OI, 11OI, 5OI, etc.) have the potential to be impacted by the implementation of the alternative (automatic swap over to high pressure recirculation), an assumption is made to use the PDS with the highest conditional person-rem risk selected from among the top cut sets. In this case, the PDS 5OI has the highest estimated conditional person-rem risk of 7.41E+04 person-rem [Reference 3.1]. Since this is the conditional person-rem risk for a particular PDS, the Fussell-Vesely (F-V) value for a basic event [Table 6.1.3-3 of Reference 3.1] provides a means of determining the fraction of the total risk that is attributable to the severe accident sequences "LOCA cut sets with failure of operators to initiate high pressure recirculation." Therefore, the following equation is used to conservatively estimate the total person-rem risk attributable to each of the non-seismic initiator severe accident sequences under consideration for SAMAs in this portion of the analysis:

Total Person-rem Risk = **(F-V)** × **(Total CDF)** × **(PDS Person-rem)** (Eq. 4-3)

Using the above example yields,

Total Person-rem Risk = (4.62E-02) × (8.92E-05 per year) × (7.41E+04 person-rem)
= <u>0.31 person-rem</u>

Some risk will always exist, even when implementing an alternative, because the system is not expected to be 100% reliable. However, for this analysis an assumption is made that the implementation of an alternative for a severe accident sequence will completely eliminate the risk. The equations presented above (Eq. 4-1 and Eq. 4-2) are used here to determine the "**Value Of Averted Risk**" and the "**Present Worth Of Averted Risk**" to the public. These values represent the upper limit of "averted risk". Table 4-2 provides a list of the nine SAMAs considered to reduce core damage frequency along with the F-V value, total person-rem risk, and present worth of averted risk calculated for each candidate applying the method discussed above.

As seen from Table 4-2, the nine potential SAMA candidates have a present worth of averted risk in the range of $100 to $15,800. For example, the tornado initiator sequence listed in Table 4-2 [an F4 intensity tornado strikes Oconee, damaging the east and west penetration room and the Borated Water Storage Tank (BWST)] has a calculated present worth of averted risk of $15,800. For the type of extensive plant damage associated with F4 intensity tornadoes striking the plant, major plant enhancements will need to be made in order to mitigate the consequences of such an event. The expected cost for such improvements will far exceed the calculated $15,800 present worth of averted risk.

The cost to implement most of the alternatives listed in Table 4-2 for Oconee will be greater than $1 million, based on the review of other industry cost estimate studies [Reference 4.3] applicable to Oconee. Comparing these cost estimates to the present worth of averted risk presented in Table 4-2, shows that the cost to implement most of these alternatives will far exceed the present worth averted risk. However, for three potential SAMAs listed in Table 4-2:

1. building a higher flood barrier for the standby shutdown facility (SSF),
2. manning the SSF 24 hours a day with a trained operator, and
3. building a protective barrier for upper surge tanks or 4160 volt switchgear to withstand tornado damage

cost estimates have been performed for Oconee to determine whether or not the alternative is cost-beneficial. There are two reasons why these alternatives are selected for Oconee specific cost estimates. First, there is no readily available information on estimated cost to implement similar types of alternatives; and second, the basic events associated with these alternatives are seen to have a Fussell-Vesely (F-V) importance measure of several percent, as seen from Table 6.1.3-3 of Reference 3.1.

Basic Event Importance Ranking

This portion of the analysis presents another approach to identifying potential SAMAs beyond those selected from evaluating the cut set listings. This involves (1) reviewing the basic event importance ranking list [Table 6.1.3-3 of Reference 3.1] for events of significant F-V values, which are not captured in Table 4-2, and (2) identifying any additional SAMAs that could be implemented to reduce the core damage frequency contribution from these events. This will provide a more complete review of potential SAMAs which should be considered for implementation.

A review of the importance ranking of the basic events reveals that two external initiating events (seismic and tornadoes) contribute significantly to the core damage frequency. Since seismic and tornado initiators are acts of nature, their frequency of occurrence cannot be reduced.

A possible way of reducing the frequency of the initiating event "random failure of Jocassee Dam" is to redesign and strengthen the dam. The cost to perform this modification will far exceed the benefit of core damage frequency reduction.

Another initiating event that has a high F-V value is reactor/turbine trip. When Oconee went on line in 1974, the number of reactor trips that occurred were in the range of 10-30 reactor trips per year. Duke has aggressively investigated the causes of these reactor trip initiating events, made any necessary equipment enhancements, and improved operator training to reduce the occurrence of these events. This strategy has reduced the current number of reactor trip initiating events to 1-2 events per year. Duke continues to investigate reactor trip initiating events to identify the cause of such events and make any necessary improvements to equipment and/or operator training, to further reduce the likelihood of such an event being repeated.

Furthermore, the importance ranking shows that internal floods contribute significantly to the core damage frequency. As a result of the original Oconee PRA to address the internal flood initiators. Many enhancements to the plant have been implemented to reduce the likelihood and consequences of internal floods. Duke continues, through the PRA update process, to investigate other improvements that can be made to further reduce the risk significance of these events.

Another initiating event showing up as important in the importance ranking is turbine building fire. The IPEEE fire analysis looked at ways to reduce the plant's vulnerability to fire initiating events. Numerous recommendations from the fire analysis have been made to improve fire protection and reduce the chance of a fire occurring. Duke continues to place emphasis on the control of combustible materials, workers awareness of jobs that may present a fire hazard, and adequate fire protection.

Duke has and continues to investigate ways of reducing the frequency of initiating events and mitigating the potential damages associated with such events. Based on the findings of these investigations, plant enhancements that could reduce the impact of such events have been implemented where reasonably possible. (See Table 2.1)

The remaining basic events listed in the importance table [Reference 3.1], were reviewed for potential SAMAs. Duke determined that the cost to implement any alternatives to mitigate or eliminate the consequences of the events would far exceed the averted risk benefit. Therefore, no additional SAMAs are considered for implementation.

4.4 Cost-Benefit Analysis For Selected SAMAs

In Section 4.3, three alternatives were identified for cost estimate analyses due to the lack of industry generic information on the cost of implementation and the basic event importance measure associated with these alternatives. Cost estimates provided are budgetary grade 1998 dollars. Design assumptions were made based on normal nuclear construction practices and historical durations for projects as these. The cost of alternatives in 1998 dollars is compared with the present worth of the averted risk previously determined.

Increasing The Height Of The SSF Flood Barrier

The current five foot high flood barrier surrounding the Oconee SSF is considered to be effective 80% of the time (60% for seismically caused Jocassee Dam failure). If the flood barrier is increased to 10 feet in height, then a more severe flood could be mitigated. The estimated cost to increase the height of the SSF flood barrier in 1998 dollars is approximately $500,000. The cost of implementing this alternative is greater than the present worth of averted risk ($1800 from Table 4-2). Thus, this alternative is not justified from a public risk perspective.

Manning SSF 24 Hours A Day With Trained Operator

The assumption in the Oconee PRA is that if the SSF is not aligned for Reactor Coolant Makeup (RCM) pump system operation within 10-15 minutes following a loss of reactor coolant pump seal cooling, then a seal LOCA will occur. Since the SSF is not manned continuously, it is assumed the SSF activation may not occur about 10% of the time. This failure probability could be reduced if the SSF is continuously manned. The estimated net present value to implement this alternative at Oconee is greater than $5 million. This value is based on a nonlicensed operator in place in the SSF, 24 hours a day (five shifts). The cost of implementing this alternative is greater than the present worth of averted risk ($10,800 from Table 4-2). Thus, this alternative is not justified from a public risk perspective.

Installing Protective Barrier For Upper Surge Tanks Or 4160 Volt Switchgear To Withstand Tornado Winds

The upper surge tanks at Oconee are located on top of the Turbine Building and the 4160 volt switchgear is located within the Turbine Building with no engineered protection from tornadoes. Tornadoes with wind speeds up to 260 mph (F4 intensity) could damage these tanks or the 4160 volt switchgear. The failure probability of the upper surge tanks and the 4160 volt switchgear could be reduced if a protective barrier were installed around these components to withstand tornado damage from an F4 intensity tornado. Only one of these structures would need to be installed to accomplish the same goal of enhancing the plant to handle a tornado event with such postulated damages. An assumption is made that the cost to implement the alternative to build a protective barrier for the 4160 volt switchgear will be comparable to the cost of building a protective barrier for the upper surge tanks. Therefore, the cost to install a protective barrier for the upper surge tanks is estimated; this same cost estimate will also be applicable to building a protective structure for the 4160 volt switchgear. The estimated cost to implement either of these alternatives is approximately $1 million per unit. The cost of implementing this alternative is greater than the present worth of averted risk ($15,800 from Table 4-2). Thus, neither of these alternatives is justified from a public risk perspective.

TABLE 4-1 Top 15 Seismic Initiator Severe Accident Sequences

Seismic Initiator Severe Accident Sequences	Total Person-rem Risk	Present Worth Of Averted Risk
Seismic initiator causes PDS 27PI	1.01	$ 22,200
Seismic initiator causes PDS 7PI	0.51	$ 11,200
Seismic initiator causes PDS 8PI	0.19	$ 4200
Seismic initiator causes PDS 8PL	0.18	$ 4000
Seismic initiator causes PDS 14PI	0.13	$ 2900
Seismic initiator causes PDS 5OI	0.07	$ 1500
Seismic initiator causes PDS 16OI	0.06	$ 1300
Seismic initiator causes PDS 2OI	0.06	$ 1300
Seismic initiator causes PDS 7PS	0.04	$ 900
Seismic initiator causes PDS 4PI	0.03	$ 700
Seismic initiator causes PDS 1PI	0.02	$ 400
Seismic initiator causes PDS 1AI	< 0.01	< $ 100
Seismic initiator causes PDS 7OI	0.01	$ 200
Seismic initiator causes PDS 14OI	< 0.01	$ 100
Seismic initiator causes PDS 1CI	< 0.01	< $ 100

TOTAL ≈ 2.34 person-rem $ 51,100

TABLE 4-2 Top 9 SAMAs Considered To Reduce CDF

Severe Accident Sequence (F-V, Basic Event)	Potential Alternative	Annual Total [1] Person-rem Risk	Present Worth Of Averted Risk	Cost of Alternative (1998 dollars)
A tornado strikes Oconee damaging east and west penetration room, and damages the BWST (2.14E-02, BEFPIPEDEX)	Strengthen East and West Penetration Rooms, and BWST to withstand tornado winds	0.72	$ 15,800	>$1 M
Turbine Building fire or random failure of Jocassee Dam initiating event and failure of operators to align SSF Reactor Coolant Makeup system for operation (1.42E-01, BSFFAILDEX + NSF0RCMDHE)	Man SSF 24 hours a day with a trained operator)	.49	$10,800	>$5 M
Large, non-isolable turbine building flood, operators fail to refill elevated water storage tank, train 2 refrigerant compressor fails to start (6.53E-02, WHSEWSTDHE)	Install an automatic backup system to refill elevated water storage tank for HPI cooling	0.43	$ 9500	>$1 M
Tornado initiator causes a LOCA with failure of all power and upper surge tanks (6.02E-02, BEFUSTWDEX) OR (5.14E-02, BAC4160DEX)	Install protective barrier around upper surge tanks for tornadoes OR Upgrade 4160 volt switchgear in Turbine Building to withstand F4 Intensity tornadoes	0.40	$ 8800	>$1 M
LOCA cut sets with failure of operators to initiate high pressure recirculation (4.62E-02, HHPHPR0DHE)	Install automatic swap over to high pressure recirculation	0.31	$ 6800	>$1 M
Large, non-isolable turbine building flood, failure to swap HPI to SFP during a flood, train 2 refrigerant compressor fails to start (3.25E-02, IBSBWSTDHE)	Install automatic swap of High Pressure Injection to Spent Fuel Pool	0.21	$ 4600	>$1 M
Random failure of Jocassee Dam exceeds 5 ft. SSF flood barrier (2.94E-02, XEFLOODDEX)	Increase the height of the SSF flood barrier	0.08	$ 1800	$500 K
Failure of reactor pressure vessel with failure to prevent core damage following an reactor pressure vessel failure (1.12E-02, RPV)	Replace reactor vessel with stronger vessel	< 0.01	$ 100	>$1 M

[1] Total Person - risk includes internal and external events

5.0 SAMAs Considered For Person-rem Risk Reduction

5.1 Current Oconee Person-rem Risk Profile

In the event of a severe accident, a certain amount of person-rem risk would be associated with various types of containment failure. The containment failure modes of concern are those that have the potential for early release of fission products to the public such as early containment failures, isolation failures, and containment bypass (SGTR and ISLOCA).

The results of the updated Oconee PRA show that the two most likely containment failure modes are benign failures by basemat melt through and late containment failures. These two containment failure modes occur many hours and even days after core melt has occurred, allowing time for mitigative actions to be taken such as recovering vital pieces of equipment for core debris cooling and containment heat removal, and implementing evacuation strategies. For the Oconee containment, the conditional probability of having an early release of fission products to the public from early containment failures, isolation failures, and containment bypass following a severe accident is estimated to be less than 4%.

The current Oconee annual person-rem risk result for the 50 mile population is 5 whole body person-rem. The internal events account for approximately 1 whole body person-rem per year at 50 miles. The external events account for approximately 4 whole body person-rem per year at 50 miles. For external events, the major source of risk is seismic. This risk is dominated by postulated earthquakes with accelerations (0.3g - 0.5g) much greater than the Oconee design basis earthquake. In general, the risk measures calculated show very low risk for the health and safety of the public.

5.2 Identification Of Potential Containment-Related SAMAs

For this portion of the analysis, other industry studies were used to obtain a preliminary list of containment improvement alternatives to be considered for Oconee. The Watts Bar SAMDA analysis [Reference 4.3] identified several potential alternatives that would enhance the ability of the containment to withstand challenges associated with late hydrogen burn, late overpressurization, basemat melt through, and containment bypass. The following nine design changes were identified for the Watts Bar analysis:

- Install deliberate ignition system - provide an AC- and DC-independent system to burn combustible gases generated in containment during a severe accident to eliminate containment failures due to hydrogen combustion.
- Install reactor cavity flooding system - provide the capability to flood the reactor cavity of the containment to reduce the possibility of direct core debris contact with containment.

- Install filtered containment vent system - provide the capability to vent the containment to an external filter to reduce the frequency of and consequences of late containment failures.
- Install core retention device - to prevent direct impingement of core debris onto the containment during a high pressure melt ejection.
- Install containment inerting system - to inert the containment atmosphere to prevent combustion of hydrogen and carbon monoxide during severe accidents.
- Install additional containment bypass instrumentation - install additional pressure-monitoring instrumentation between the first two isolation valves on low-pressure injection lines, residual heat removal suction lines, and high-pressure injection lines. This would improve the ability to detect leakage or open valves which decrease the frequency of interfacing systems LOCA (ISLOCAs).
- Install reactor depressurization system - provides capability to rapidly depressurize the reactor coolant system to reduce the threat of high pressure melt ejection and allow injection from low pressure systems.
- Install independent containment spray system - provides a redundant containment spray system.
- Install AC-independent air return fan power supplies - provides a redundant power supply to air return fans.

The following five additional alternatives considered for containment performance improvement were obtained from NUREG-1560 [Reference 5.1]:

1. Add procedures for direct reactor coolant system depressurization to prevent early containment failure associated with reactor vessel breach at high reactor coolant system pressure.
2. Add emphasis on isolation procedures in operator training.
3. Add procedures to cope with and reduce induced steam generator tube rupture (SGTR).
4. Add alternative, independent source of feedwater to reduce induced SGTR.
5. Add emphasis on increasing the likelihood of maintaining a coolable debris bed to prevent late containment failure due to overpressurization.

Combining the information gathered from the two studies mentioned above provides a preliminary list of 14 containment performance improvement alternatives to be considered for Oconee.

The following is the process used to refine the list of 14 containment performance improvement alternatives identified for consideration at Oconee:

- identify any alternatives that have already been implemented at Oconee, and
- identify any alternatives that are not applicable to Oconee's containment.

The current Oconee procedures satisfy the intent of Alternatives 1 and 2. Following the IPE study, the plant procedure was modified to address the induced SGTR (Alternative 3). A significant part of the Severe Accident Management Guidance Program (SAMG) at Oconee emphasizes the importance of and provides guidance to the operators on depressurizing the reactor coolant system to prevent high pressure melt ejection. Also, the SAMG program provides guidance on putting water into the containment using plant resources to increase the likelihood of maintaining a coolable debris bed in the event of a severe accident. Alternative 5 has been addressed through the SAMG program.

Several of the remaining alternatives listed above on improving containment performance concerning hydrogen burns can be eliminated for this Oconee analysis. The results of the Oconee PRA Level 2 analysis shows that the Oconee containment will more than likely survive a hydrogen combustion in the event of a severe accident due to the strength of the containment. The mean failure pressure for the Oconee containment is calculated to be 144 psig [Reference 2.4]. In the event of a severe accident at Oconee, the containment pressure at which the containment atmosphere becomes steam inerted is approximately 25 psig based on 75% zirc-water reaction. For a base pressure of 25 psig, the maximum containment pressure expected due to a hydrogen burn is 110-120 psig, well below the 144 psig mean value. Therefore, the alternatives presented above that are related to addressing containment failure due to hydrogen burns need not be considered for the Oconee containment (such as install deliberate ignition system and install containment inerting system).

The alternative to "install AC-independent air return fans" is intended for an ice condenser type containment, where the containment is very compartmentalized and an effective way of ensuring that the containment atmosphere is well mixed for hydrogen concerns is by use of air return fans. By contrast, the Oconee containment is a very large and open containment where it is expected that mixing will occur during an accident. Therefore, this alternative is eliminated from further consideration in this analysis since very little benefit will be gained from the implementation of this alternative.

Thus, the preliminary list of 14 containment performance improvement alternatives considered for Oconee is reduced to seven potential candidates for cost-benefit analysis. The following section discusses the method used to determine if any of these seven alternatives are cost-beneficial to implement for the Oconee containment.

5.3 Analysis Of Potential Containment-Related SAMAs

The method used in this portion of the analysis is similar to the one presented in Section 4.3.

The following explains how the Oconee-specific parameters are derived in order to calculate the averted cost to the public based on implementation of containment performance improvements. The Oconee PRA Level 3 analysis calculates the estimated person-rem risk associated with each type of containment failure mode following a severe accident. As can be seen in Table 5-1, the results of the Oconee PRA analysis show that there are three containment failure modes contributing more to the annual person-rem risk than any of the other potential failure modes (ISLOCA - 1.24 person-rem, Isolation failures - 1.11 person-rem, and Late containment failures - 1.59 person-rem). These are evaluated in detail below.

The PRA Level 3 analysis reveals that over 70% of the large early release frequency (LERF) is attributable to seismic initiators, with the dominant sequence being a seismic initiator causing the auxiliary building to fall resulting in an ISLOCA and power failure. This event contributes an estimated 1.0 person-rem to the total 1.24 person-rem for ISLOCAs. Because of the catastrophic nature of this accident sequence, ISLOCA mitigation measures such as installation of additional containment bypass instrumentation to detect ISLOCAs would not be effective. Furthermore, the estimated cost to implement additional containment bypass instrumentation is on the order of several million dollars [Reference 4.3]. For this analysis, if the assumption is made that the implementation of a containment performance improvement alternative will completely eliminate the ISLOCA risk, the averted risk value is $27,300. Therefore, the estimated cost to implement additional containment bypass instrumentation to detect ISLOCAs far exceeds the theoretical maximum present worth of averted risk. This makes the alternative very cost prohibitive even if Oconee's actual cost is significantly less than the referenced estimate.

The Oconee PRA results show that the isolation containment failure mode is dominated by external events (seismic and tornado). These sequences involve the failure of piping penetrations into the containment. The only feasible containment performance improvement alternative considered for this type of containment failure mode is adding emphasis on isolation procedures in operator training. This has already been implemented at Oconee per the Oconee IPE study.

The late containment failure mode for the Oconee plant is associated with sequences where reactor building cooling units are lost at the start and no recovery is possible. This leads to a buildup of pressure from steam and non-condensible gases over many hours until the containment fails. A containment performance improvement alternative that could reduce the person-rem risk associated with such failures is the installation of an independent containment spray system. From Reference 4.3 the estimated cost to implement such an alternative will be at least several million dollars. The present worth of averted risk for implementation of this alternative is estimated by assuming all 1.59 person-rem risk is eliminated for late containment failures. Multiplying the 1.59 person-rem risk by $2000/person-rem yields an estimated averted risk value of $3180, and multiplying this value by the discount multiplication factor of 11 gives an estimated present worth of $35,000. Therefore, the cost to implement this alternative containment performance improvement will far exceed the value of the averted risk. Some benefit in reducing the early containment failure may be seen from this alternative but this would be expected to be small compared to the late containment failure benefit

Furthermore, when considering the implementation of alternatives, it is important to evaluate the potential negative impacts of implementing alternatives as well as the positive benefits. For example, the containment performance improvement alternative considered in Table 5-1 (installing a reactor cavity flooding system) is intended to reduce the likelihood of basemat melt through by flooding the core material after reactor vessel failure. Even though the implementation of this alternative may reduce the likelihood of basemat melt through, it also has the potential to increase the probability of containment failure due to overpressurization from steam generation.

Table 5-1provides a list of the seven selected containment performance improvement alternatives considered for implementation at Oconee, along with the percentage of the time a containment failure mode may occur given a severe accident, the total person-rem, and present worth of averted risk estimates associated with each containment failure mode.

As seen from Table 5-1, the seven potential containment-related SAMAs have an averted risk worth in the range of $3100 to $35,000.

The cost to implement any of the containment performance improvement alternatives listed in Table 5-1 for Oconee will range anywhere from a few million dollars to tens of millions of dollars based on the review of other industry cost estimate studies [Reference 4.3]. Comparing these cost estimates to the averted risk worth presented in Table 5-1 reveals that the cost to implement these alternatives will far exceed the averted risk worth. This conclusion applies even for those alternatives providing benefit to more than one type of containment failure mode.

For example, the three alternatives (install independent containment spray system, reactor depressurization system, and filtered containment vent) provide some benefit to more than one type of containment failure mode. As stated earlier, the installation of an independent containment spray system provides more late containment failure benefit than early containment failure benefit. But if this alternative is assumed to completely eliminate late and early containment failures, the cost of implementation would far exceed the averted risk value of ($27,300 + $11,200). This same conclusion is applied to the filtered containment vent alternative based on the cost of implementation versus the total averted risk value for early and late containment failures ($27,300 + $11,200). For the installation of a reactor coolant system depressurization system this alternative may contribute to reducing early containment failures along with the benefit of reducing SGTRs. However, if the total person-rem for these two containment failure modes is assumed to be completely eliminated by implementing the alternative, the cost of installing such a device still far exceeds the total worth of averted risk ($11,200 + $3100). Therefore, all the containment performance improvement alternatives involving hardware changes are considered to be cost prohibitive based on the benefit of averted risk worth.

5.4 Cost-Benefit Analysis For Containment-Related SAMAs

In Section 5.3 none of the containment performance improvement alternatives are considered to be cost effective to implement for Oconee. Therefore, detailed cost estimate analyses are not necessary for any of the containment performance improvement alternatives considered for this analysis.

TABLE 5-1 Potential Containment SAMAs Considered To Reduce Person-rem Risk

Containment Failure Mode (CFM)	Potential Containment Performance Alternatives To Mitigate CFM	Percentage Of Time Severe Accidents Will End In Particular CFM	Total Person-rem Risk	Present Worth Of Averted Risk	Cost of Alternative (1998 dollars)
Late Containment Failures	Install independent containment spray system Install filtered containment vent system	25 %	1.59	$ 35,000	>$1 M
Containment Bypass ISLOCA SGTR	Install additional containment bypass instrumentation (ISLOCA) Add independent source of feedwater to reduce induced SGTR Install reactor depressurization system	< 1 % (ISLOCA and SGTR combined)	1.24 - ISLOCA 0.14 - SGTR	$ 27,300 (ISLOCA) $ 3100 (SGTR)	>$1 M
Early Containment Failures	Install filtered containment vent system Install reactor depressurization system Install independent containment spray system	< 1 %	0.51	$ 11,200	>$1 M
Basemat Melt Through	Install reactor cavity flooding system Install core retention device	46 %	0.33	$ 7300	>$1 M

6.0 Overall Results

Duke has evaluated potential plant enhancements that would further reduce the probability of severe accidents and the associated person-rem risk. The incremental safety benefit of implementing these plant enhancements has been analyzed by performing a public risk analysis. The results of the public risk analysis show that none of the hardware changes for severe accident mitigation alternatives considered for core damage frequency and person-rem reduction would be cost-beneficial to implement. Most of the alternatives considered are associated with severe accident sequences of either low contribution to core damage frequency (< 5% of the total) or low risk (< 1 person-rem). From the results obtained, it is apparent that the dominant severe accident sequences are seismic initiators based on their total contribution to core damage frequency and person-rem risk. However, even the alternatives considered for these type initiators are found to be cost prohibitive based on the cost to implement the alternatives far exceeding the value of the public health risk averted.

In addition, Duke recently implemented two programs to manage the risk associated with severe accidents. The Maintenance Rule Program is currently aiding in identifying risk significant structures, systems and components to minimize failures that are maintenance preventable. Most recently, Duke's implementation of the Severe Accident Management Guidance (SAMG) Program provides guidance on arresting core damage and mitigating fission product releases to the public in the event of a severe accident. Some of the severe accident management guidance provided by the SAMG program include:

- depressurizing the reactor coolant system prior to reactor vessel failure, thus preventing a high pressure melt ejection and SGTRs,
- venting containment prior to containment failure due to overpressurization (controlled release versus an uncontrolled release of fission products),
- inject water into reactor building (containment) to cool core debris, etc.

The following table summarizes the severe accident mitigation alternatives and containment performance improvements considered for Oconee and the status of implementation:

TABLE 6-1 Summary Of Potential Alternatives Considered For Oconee To Reduce Core Damage Frequency & Person-rem Risk

Potential Alternative	Implemented or Not Implemented	Reason Not Implemented
Increase seismic ruggedness of many plant components/systems	Not Implemented	Not Cost Beneficial. The risk reduction achievable is small and that the cost of substantial upgrades in the plant systems seismic ruggedness is very large
Install automatic swap over to high pressure recirculation	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Increase SSF flood barrier to 10 ft.	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Man SSF 24 hours a day with a trained operator	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Strengthen East and West Penetration Rooms, and BWST to withstand tornado winds	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Build protective barrier around upper surge tanks or 4160 switchgear for tornadoes	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Replace reactor vessel with stronger vessel	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Install automatic swap of High Pressure Injection to Spent Fuel Pool	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Install an automatic backup system to refill elevated water storage tank	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Install additional containment bypass instrumentation (ISLOCA)	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. SAMG Program addresses this issue.
Add independent source of feedwater to reduce induced SGTR	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk
Add procedures for direct RCS depressurization	Existing procedures adequate	
Add emphasis on isolation procedures in operator training	Existing procedures adequate	
Add procedures to cope with and reduce induced SGTR	Existing procedures adequate	
Add emphasis on increasing the likelihood of maintaining a coolable debris bed	Implemented through SAMG	

TABLE 6-1 Summary Of Potential Alternatives Considered For Oconee To Reduce Core Damage Frequency & Person-rem Risk (continued)

Potential Alternative	Implemented or Not Implemented	Reason Not Implemented
Install reactor depressurization system	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. SAMG Program emphasize depressurizing RCS.
Install filtered containment vent system	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. SAMG Program provides guidance on venting strategy to minimize releases to public.
Install independent containment spray system	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. In addition, the alternative primarily reduces late containment failure. These occur many hours after core damage begins allowing plenty of time for recovery of containment heat removal equipment and implementation of SAMG strategies.
Install reactor cavity flooding system	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. SAMG Program provides guidance on putting water into containment for cooling the core debris. In addition, this alternative has the potential to increase the likelihood of containment failures at Oconee due to overpressurization from steam generation.
Install core retention device	Not Implemented	Not cost beneficial. Very expensive with extremely small impact on public health risk. SAMG Program provides guidance on putting water into containment for cooling the core debris.

7.0 Conclusions

Duke has performed a number of severe accident studies on Oconee and has implemented several plant enhancements to reduce the risk of severe accidents since the early 1980's. The results of the Oconee-specific analyses for severe accidents show that the total core damage frequency is estimated at 8.9E-05 per year, and the risk is estimated at 5 person-rem per year.

For the current residual severe accident risk, a SAMA analysis has been performed using PRA techniques and making use of industry studies and NRC reports providing guidance on performing cost-benefit analysis. This Oconee specific analysis demonstrates that plant enhancements (severe accident mitigation and containment performance improvement) in excess of $100 to $35,000 are not cost justified based on averted public health risk.

The contributions from the averted onsite exposure cost and the averted offsite property damage cost are considered small for this SAMDA benefit analysis. Using the data from NUREG/BR-0184 and considering that the range of core damage frequency reduction expected from the candidate SAMDAs is in the range of 0-3% (0 to 2.69E-06 per year) it is seen that the averted risk contribution for the onsite exposure is approximately $1000 and that the offsite property damage is approximately $10,000 for the 20 year license renewal period. Even if these additional averted risk values are included in the final results of the analysis, the conclusions are the same, the cost to implement any of the SAMDAs would far exceed the benefit.

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

It is recognized that risk assessment studies are subject to varying degrees of uncertainty in the estimated core damage frequency, person-rem risk, and cost to implement alternatives. The results of this analysis show that the cost of implementing any of the alternatives is as much as several orders of magnitude higher than the estimated averted risk values. Therefore, no additional severe accident mitigation alternatives are cost-beneficial even when the uncertainties in the risk assessment process are considered.

8.0 References

Section 2.0

2.1 NSAC/60, A Probabilistic Risk Assessment of Oconee Unit 3, Duke Power and the Nuclear Safety Analysis Center, Palo Alto, CA, June 1984.

2.2 A Review of the Oconee-3 Probabilistic Risk Assessment Performed By Brookhaven National Laboratory, NUREG/CR-4374, U. S. Nuclear Regulatory Commission, Washington, D. C., March 1986.

2.3 Generic Letter 88-20, Individual Plant Examination for Severe Accident Vulnerabilities, USNRC, November 1988.

2.4 Tuckman (Duke) letter dated November 30, 1990 to Document Control Desk (NRC), Oconee Units 1, 2, and 3 Individual Plant Examination (IPE) Submittal, Oconee Nuclear Station, Docket Nos., 50-269, -270, -287.

2.5 Wiens (NRC) letter dated April 1, 1993 to J. W. Hampton (Duke), Evaluation of the Oconee, Units 1, 2, and 3 Individual Plant Examination (IPE) - Internal Events, Oconee Nuclear Station, Docket Nos., 50-269, -270, -287.

2.6 Hampton (Duke) letter dated December 28, 1995 to Document Control Desk (NRC), Individual Plant Examination of External Events (IPEEE) Submittal, Oconee Nuclear Station, Docket Nos., 50-269, -270, -287.

2.7 McCollum, Jr. (Duke) letter dated December 18,1997 to Document Control Desk (NRC), Individual Plant Examination of External Events (Generic Letter 88-20, Supplement 4), Oconee Nuclear Station, Docket Nos., 50-269, -270, -287.

2.8 Hampton (Duke) letter dated July 6, 1995 to Document Control Desk (NRC), Keowee PRA, Oconee Nuclear Station, Docket Nos., 50-269, -270, -287.

2.9 McCollum, Jr. (Duke) letter dated December 18, 1997 to Document Control Desk (NRC), High Pressure Injection (HPI) Reliability Study, Oconee Nuclear Station, Docket Nos. 50-269, -270, -287.

Section 3.0

3.1 W. Hampton (Duke) letter dated February 13, 1997 to Document Control Desk (NRC), Probabilistic Risk Assessment, Individual Plant Examination, Oconee Nuclear Station, Docket Nos. 50-269, -270, -287.

Section 4.0

4.1 Regulatory Analysis Guidelines of the U. S. Nuclear Regulatory Commission, NUREG/BR-0058, Revision 2, Final Report, U. S. Nuclear Regulatory Commission, Washington, D. C., November 1995.

4.2 Regulatory Analysis Technical Evaluation Handbook, NUREG/BR-0184, Revision 2, Final Report, U. S. Nuclear Regulatory Commission, Washington, D. C., January 1997.

4.3 Final Environmental Statement: Related To The Watts Bar Nuclear Plant Units 1 and 2, NUREG—0498 Supplement 1, U. S. Nuclear Regulatory Commission, Washington, D. C., April 1995, Docket Nos. 50-390 and 50-391.

Section 5.0

5.1 Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance, NUREG-1560, Summary Report, U. S. Nuclear Regulatory Commission, Washington, D. C., October 1996.

Attachment L

January 13, 1998 NRC Staff Requirements Memorandum (SRM M970612) titled "Generic and Cumulative Environmental Impacts of Transportation of High-Level Waste in the Vicinity of an HLW Repository."

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

OFFICE OF THE SECRETARY

January 13, 1998

COMMISSION VOTING RECORD

DECISION ITEM: SECY-97-279

TITLE: GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)

The Commission (with Commissioners Dicus, Diaz, and McGaffigan agreeing) approved the subject paper as recorded in the Staff Requirements Memorandum (SRM) of January 13, 1997. Chairman Jackson also approved immediate implementation of Option 3, but did not approve implementation of Option 2.

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Commissioners, and the SRM of January 13, 1997.

John C. Hoyle
Secretary of the Commission

Attachments:
1. Voting Summary
2. Commissioner Vote Sheets
3. Final SRM

cc: Chairman Jackson
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
OGC
EDO
PDR
DCS

VOTING SUMMARY - SECY-97-279

RECORDED VOTES

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIP	COMMENTS	DATE
CHRM. JACKSON	X	X			X	12/18/97
COMR. DICUS	X				X	12/22/97
COMR. DIAZ	X				X	12/19/97
COMR. McGAFFIGAN	X				X	12/16/97

COMMENT RESOLUTION

In their vote sheets, Commissioners Dicus, Diaz, and McGaffigan approved the staff's recommendation to implement Option 3 immediately and to implement Option 2 if necessary should a license renewal application be received before the rulemaking is completed. Chairman Jackson approved the immediate implementation of Option 3, but disapproved using Option 2 because she believed the rulemaking could be completed in a timely manner. Subsequently, the comments of the Commission were incorporated into the guidance to staff as reflected in the SRM issued on January 13, 1997.

NOTATION VOTE

RESPONSE SHEET

TO: John C. Hoyle, Secretary

FROM: COMMISSIONER DICUS

SUBJECT: **SECY-97-279 - GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)**

Approved __x__ Disapproved _____ Abstain _____

Not Participating _____ Request Discussion _____

COMMENTS: Please see attached comments.

Greta Joy Dicus
SIGNATURE

Release Vote / x /

December 22, 1997
DATE

Withhold Vote / /

Entered on "AS" Yes _x_ No ____

Commissioner Dicus' Comments on SECY-97-279

I approve staff's recommendation to implement Option 3 immediately as a long-term solution and to implement Option 2 if a license renewal application is received before the rulemaking activity is completed. The staff should immediately notify the Commission if their ongoing supplemental analysis no longer supports a reasonable technical and legal determination that transportation of HLW is a Category 1 issue and may be generically adopted in a license renewal application.

NOTATION VOTE

RESPONSE SHEET

TO: John C. Hoyle, Secretary

FROM: COMMISSIONER DIAZ

SUBJECT: **SECY-97-279 - GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)**

Approved X Disapproved ____ Abstain ____

Not Participating ____ Request Discussion ____

COMMENTS:

I approve the staff's immediate implementation of Option 3, rulemaking for Section 51.53(c)(3)(ii)(M), as a long term solution to this issue. The staff should implement Option 2 if a license renewal application is received before the rulemaking activity is completed.

SIGNATURE

12.19.97

DATE

Release Vote /___/

Withhold Vote /___/

Entered on "AS" Yes ____ No ____

NOTATION VOTE

RESPONSE SHEET

TO: John C. Hoyle, Secretary

FROM: COMMISSIONER MCGAFFIGAN

SUBJECT: **SECY-97-279 - GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)**

Approved X Disapproved _____ Abstain _____

Not Participating _____ Request Discussion _____

COMMENTS:

I approve the staff's proposed Option 3 - to immediately proceed with expedited rulemaking to modify 10 CFR 51.53(c)(3)(ii)(M) - and the staff proposed Option 2 which would allow near-term license renewal applicants to rely strictly on the staff's supplemental analysis reflected in NUREG-1437 to fulfill their obligations under the existing section 10 CFR 51.53(c)(3)(ii)(M).

Edward McGaffigan Jr.
SIGNATURE

December 16, 1997
DATE

Release Vote /X/

Withhold Vote / /

Entered on "AS" Yes X No ____

Attachment M

61 Federal Register 66537, 66538
dated Dec. 18, 1996.

§ 868.92 Explanation of service fees and additional fees.

(a) * * *

(2) The cost of per diem, subsistence, mileage, or commercial transportation to perform the service for rice inspection only in § 868.91, Table 1. See § 868.90, Table 1, footnote 1, for fees for inspection of commodities other than rice.

* * * * *

Dated: December 13, 1996.

Michael V. Dunn,

Assistant Secretary, Marketing and Regulatory Programs.

[FR Doc. 96-32080 Filed 12-17-96; 8:45 am]

BILLING CODE 3410-EN-P

NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

RIN 3150-AD63

Environmental Review for Renewal of Nuclear Power Plant Operating Licenses

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission is amending its regulations on the environmental review of applications to renew the operating licenses of nuclear power plants to make minor clarifying and conforming changes and add language inadvertently omitted from Table B-1 of the rulemaking published June 5, 1996 (61 FR 28467). This final rule also presents an analysis of the comments received and the staff responses to the comments requested in the final rule published June 5, 1996. After reviewing the comments received, the NRC has determined that no substantive changes to the final rule are warranted.

EFFECTIVE DATE: This final rule shall be effective on January 17, 1997.

ADDRESSES: Copies of comments received and all documents cited in the supplementary information section of 61 FR 28467 may be examined at the NRC Public Document Room, 2120 L Street NW. (Lower Level) Washington, DC, between the hours of 7:45 am and 4:15 pm on Federal workdays.

FOR FURTHER INFORMATION CONTACT: Donald P. Cleary, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone: 301-415-6263; e-mail DPC@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Introduction

The Commission has amended its environmental protection regulations in 10 CFR Part 51 to improve the efficiency of the process of environmental review for applicants seeking to renew a nuclear power plant operating license for up to an additional 20 years. The final rule containing these amendments was published in the Federal Register on June 5, 1996 (61 FR 28467). The amendments are based on the analyses reported in NUREG-1437, "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (May 1996). At several stages in the development of the rule the Commission sought public comment by means of notices in the Federal Register and public workshops. The history of this rulemaking is summarized in the June 5, 1996 notice (61 FR 28469). Prior to the final rule becoming effective, the Commission believed it appropriate to seek comments on the treatment of low-level waste storage and disposal impacts, the cumulative radiological effects from the uranium fuel cycle, and the effects from the disposal of high-level waste and spent fuel. In a supplemental notice published on July 18, 1996 (61 FR 37351), the Commission extended the comment period for these issues to August 5, 1996, and indicated that the final rule would become effective on September 5, 1996, absent notice from the Commission to the contrary. The Commission has reviewed the comments submitted and finds no need to amend the substantive provisions of the rule.

This final rule amends the June 5, 1996 rule with minor nonsubstantive changes. The changes are: addition of five Ground-water Use and Quality issues inadvertently left out of Table B-1 in the June 5, 1996 notice (see, 61 FR 29278, July 29, 1996); minor conforming changes to reflect recent amendments to §§ 51.53 and 51.95 effected by a separate rulemaking ("Decommissioning of Nuclear Power Reactors," July 29, 1996 (61 FR 39278)); substitution of one sentence under Findings for the issue "Offsite radiological impacts (spent fuel and high-level waste disposal)" in Table B-1, in order to more accurately represent a U.S. Environmental Protection Agency (EPA) regulatory position; a word substitution in 10 CFR 51.53(c)(3)(ii)(M), in order to clarify the information on the environmental effect of transportation of fuel and waste to and from a nuclear power plant that is to be submitted with a license renewal application; and minor clarifying changes to the text in Table B-1 concerning chronic effects of electromagnetic fields.

II. Analysis of Public Comments

A. Commenters.

In response to the Federal Register notice for the final rule published on June 5, 1996 (61 FR 28467), 11 organizations and 1 private citizen submitted written comments. The 11 organizations included the EPA; the States of Maryland, Massachusetts, and Vermont; the Nuclear Energy Institute, and 6 licensees. Commenters expressed concerns about specific aspects of the rule and several commenters referred to material in NUREG-1437 which they believe to be inaccurate or ambiguous. Other than one State, the commenters expressed that the rule should be revised to address their concerns. The seven commenters from the nuclear power industry stated that their concerns should be addressed by supplemental rulemaking and should not delay the effective date of the rule as published in 61 FR 28467. The Commission assumes that EPA, two States, and the private individual intend for their concerns to be addressed by revising the final rule and final GEIS now rather than by supplemental rulemaking. These specific concerns and how and when they should be resolved are addressed below.

B. Radioactive Waste Storage and Disposal, and Cumulative Radiological Effects of the Uranium Fuel Cycle

Comment. The two commenting States expressed concern over the prospect of long-term storage of high-level waste (HLW) at reactor sites. One State also expressed concern over the prospect of long-term storage of low-level waste (LLW) at reactor sites. This State believes that "the Commission should establish a policy which would condition license renewal to a resolution of radioactive waste disposal issues." One State believes that provisions in NRC's regulations for addressing significant new information and the 10-year cycle for reviewing the continued appropriateness of the conclusions codified by the rule are not adequate with respect to the issues of on-site storage and disposal of HLW; and, therefore, site-specific environmental review should be required for these issues, i.e., these issues should be designated Category 2. A third State believes that a Category 1 designation is appropriate for these issues, i.e., findings for the issue codified in the rule may be adopted in site-specific license renewal reviews, and supports the provision in the rule for periodic evaluation of these issues.

Response. As stated at 61 FR 28477, the Commission acknowledges that there is uncertainty in the schedule of availability of disposal facilities for LLW and HLW. The Commission understands the continuing concern of the States and of the public over the prospects for timely development of waste disposal facilities. The uncertainty in the schedule of availability of disposal facilities is especially of concern because of the waste currently being generated during the initial licensing term of power reactors. The Commission, however, continues to believe that there is sufficient understanding of and experience with the storage of LLW and HLW to conclude that the waste generated at any plant as a result of license renewal can be stored safely and without significant environmental impacts prior to permanent disposal. The Commission believes that conditioning individual license renewal decisions on resolution of radioactive waste disposal issues is not warranted because the Commission has already made a generic determination, codified in 10 CFR 51.23, that spent fuel generated at any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond a license renewal term and that there will be a repository available within the first quarter of the twenty-first century. The waste confidence decision is discussed in Chapter 6 of NUREG–1437, "Generic Environmental Impact Statement for License Renewal for Nuclear Plants," May 1996. The Commission similarly believes that enough is known regarding the effects of permanent disposal to reach the generic conclusion in the rule. The rule is not based on the assumption that Yucca Mountain will be licensed. Also from a regulatory policy perspective, the Commission disagrees with the view of one state that each renewal applicant should come forward with an analysis of the HLW storage and disposal environmental effects. This is a national problem of essentially the same degree of complexity and uncertainty for every renewal application and it would not be useful to have a repetitive reconsideration of the matter.

The Commission further believes that the provisions in the present rule and elsewhere in the Commission's regulations adequately provide for the introduction and consideration of new significant information in license renewal reviews, and that the 10 year review cycle for the rule and the GEIS adequately provides for Commission reassessment of the status of LLW and HLW disposal programs. The Commission recognizes that the possibility of significant unexpected events remains open. Consequently, the Commission will review its conclusions on these waste findings should significant and pertinent unexpected events occur (see also, 49 FR 34658 (August 31, 1984)). In view of the Commission's favorable conclusions regarding prospects for safe and environmentally acceptable waste disposal, it sees no need for conditioning licenses as recommended. The Category 1 designations for these three issues [low-level waste storage and disposal, offsite radiological impacts (spent fuel and high-level waste disposal), and on-site spent fuel] in the final rule has not been changed in response to these comments.

Comment. Six industry organizations specifically commented on the treatment of the LLW and HLW issues in 61 FR 28467 and in the GEIS. Except for the treatment of the environmental impacts of transportation of radiological material to and from the plant, the industry commenters agree with the Commissions findings on waste issues. Transportation (radiological and nonradiological environmental impacts) is designated Category 2 in the final rule. This designation requires some additional review of the environmental impacts of transportation.

The industry commenters argue that the requirements for the review of transportation impacts for license renewal described in the final rule are unclear, and that there are good reasons to change the transportation issue from a Category 2 to a Category 1 designation. The requirements for the review of transportation issues in the final rule were found by the commenters to be unclear with respect to (1) the use and legal status of 10 CFR 51.52, Table S–4, in the plant-specific license renewal review; (2) the conditions that must be met before an applicant may adopt Table S–4; and (3) the extent to which the "generic" effects of transporting spent fuel to a high-level waste repository should be considered in a plant-specific license renewal review. In addition, several commenters suggested that DOE should have the responsibility of considering the cumulative environmental impacts from transportation.

Response. The Commission does not believe that changes to the rule in response to industry comments are warranted at this time. However, in order to clarify the rule's requirements, the following guidance is provided on the issue of transportation impacts. As a result of this rulemaking, 10 CFR 51.53(c)(3)(ii)(M) requires applicants to review the environmental effects of transportation in accordance with § 51.52 (Table S–4) and to discuss the generic and cumulative impacts associated with transportation infrastructure in the vicinity of a high-level waste repository site. The candidate site at Yucca Mountain should be used for the purpose of impact analysis as long as that site is under consideration for licensing. The amendments to 10 CFR Part 51 in this rulemaking do not alter the existing provisions of § 51.52. If an applicant's reactor meets all the conditions in § 51.52(a) the applicant may use the environmental impacts of transportation of fuel and waste to and from the reactor set forth in Summary Table S–4 to characterize the transportation impacts from the renewal of its license. However, because Table S–4 does not take into account the generic and cumulative (including synergistic) impacts of transportation infrastructure construction and operation in the vicinity of the Yucca Mountain repository site, such information would have to be provided by these applicants.

For reactors not meeting the conditions of § 51.52(a), the applicant must provide a full description and detailed analysis of such environmental effects associated with transportation in accordance with § 51.52(b). Industry commenters pointed out that the conditions in paragraph (a) are not likely to be satisfied by many plants now using higher burn-up fuel. In such cases, applicants may incorporate in their analysis the discussion presented in the GEIS in Section 6.2.3 "Sensitivity to Recent Changes in the Fuel Cycle," and Section 6.3 "Transportation." This category of applicants also would have to consider the generic and cumulative impacts of transportation operation in the vicinity of the Yucca Mountain repository site. These impacts may be attributed to an individual plant on a reactor-year basis.

As part of its efforts to develop regulatory guidance for this rule, the Commission will consider whether further changes to the rule are desirable to generically address: (1) The issue of cumulative transportation impacts and (2) the implications that the use of higher burn-up fuel have for the conclusions in Table S–4. After consideration of these issues, the Commission will determine whether the issue of transportation impacts should be changed to Category 1.

As to the NRC's duty to consider the cumulative transportation impacts of license renewal, the Commission

Attachment N

SECY-97-279, accompanying SRM M970612, "Generic and Cumulative Environmental Impacts of Transportation of High-Level Waste in the Vicinity of an HLW Repository."

OFFICE OF THE SECRETARY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 13, 1998

MEMORANDUM TO: L. Joseph Callan
Executive Director for Operations

FROM: John C. Hoyle, Secretary

SUBJECT: STAFF REQUIREMENTS - SECY-97-279 - GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)

The Commission has approved the staff's proposal to implement Option 3 to amend 10 CFR 51.53(c)(3)(ii)(M) as a long-term solution to categorize the impacts of transportation of HLW as a Category 1 issue. The staff's proposal to require licensees to provide a discussion in the plant-specific environmental report (Option 2) should be implemented only if a license renewal application is received before the rulemaking activity is completed and a delay due to the generic rulemaking might affect the licensing process for a license renewal. The staff should notify the Commission if implementation of Option 2 is later deemed necessary for this reason.

cc: Chairman Jackson
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
OGC
CIO
CFO
OCA
OIG
Office Directors, Regions, ACRS, ACNW, ASLBP (via E-Mail)
PDR
DCS

SECY NOTE: THIS SRM, SECY-97-279, AND THE COMMISSION VOTING RECORD CONTAINING THE VOTE SHEETS OF ALL COMMISSIONERS WILL BE MADE PUBLICLY AVAILABLE 5 WORKING DAYS FROM THE DATE OF THIS SRM.

December 3, 1997 SECY-97-279

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: GENERIC AND CUMULATIVE ENVIRONMENTAL IMPACTS OF TRANSPORTATION OF HIGH-LEVEL WASTE (HLW) IN THE VICINITY OF AN HLW REPOSITORY (SRM M970612)

PURPOSE:

To provide the Commission regulatory options for license renewal applicants to address the cumulative and generic environmental impacts of transportation of HLW activities in the vicinity of an HLW repository. This paper is provided in response to a staff requirements memorandum (SRM) dated June 26, 1997, and WITS item 9700218.

BACKGROUND:

The Commission revised its environmental protection regulations (10 CFR Part 51) for license renewal on December 18, 1996 (61 FR 66537). Since the final rule was published, the staff met with two potential license renewal applicants and the Nuclear Energy Institute (NEI) to discuss the format and content of the environmental report (ER) to be included in a license renewal application. The staff discussed a number of issues during these meetings and provided guidance in all but one area, the generic and cumulative impacts of transportation of HLW. Section 51.53 (c)(3)(ii)(M) states, in part,

> The review of impacts shall also discuss the generic and cumulative impacts associated with transportation operation in the vicinity of a high-level waste repository site. The candidate site at Yucca Mountain should be used for the purpose of impact analysis as long as that site is under consideration for licensing.

Contact: Claudia M. Craig, NRR
301-415-1053

During the meetings, industry representatives stated that individual license renewal applicants should not be responsible for the analysis of generic and cumulative environmental effects resulting from transportation of HLW in the vicinity of an HLW repository. The industry representatives stated that the Department of Energy (DOE) has the responsibility for considering the cumulative environmental impacts of transportation of HLW. The industry representatives believe that the issue should be reexamined and categorized as a Category 1 issue, which will not require a plant-specific evaluation in a license renewal applicant's ER. The two licensees requested guidance from the staff to determine the level of effort needed to address this issue in the ER. As a result, the staff began a review of available information to determine whether the impacts of transportation of HLW could be recategorized as a generic Category 1 issue for 10 CFR Part 51.

In the Statements of Consideration for the final 10 CFR Part 51 rulemaking in 1996, the Commission stated that it believed there was insufficient information and that unresolved issues could exist regarding the magnitude of cumulative impacts from the transportation of HLW in the vicinity of an HLW repository; it therefore declined to reach a Category 1 conclusion at that time (61 FR 28480). However, the Commission recognized the generic nature of the issue and stated that as part of its efforts to develop regulatory guidance for the rule, it would consider whether further changes to the rule were desirable to generically address the issue of cumulative impacts of transportation of HLW and the impacts that the use of higher burn-up fuel would have on the conditions listed in Table S-4 of 10 CFR Part 51. The Commission stated that although DOE will have title to the spent fuel and HLW and must consider the environmental impacts of transportation of HLW in the National Environmental Policy Act (NEPA) review for an HLW repository, the Commission still has an obligation under NEPA to consider the impacts of transportation of HLW in its environmental review for renewal of an operating license (61 FR 66538).

At the Commission briefing of June 12, 1997, the staff provided a status of license renewal activities. In the SRM dated June 26, 1997, from that meeting, the staff was directed to provide a schedule for completing the analysis of DOE information on HLW transportation impacts and to provide the Commission options for addressing the generic and cumulative HLW environmental impacts within the framework of a license renewal application. In a memorandum dated July 17, 1997, the staff replied to the Commission that completion of the analysis was scheduled for October 1997, while the Commission paper outlining the regulatory options was scheduled for completion in November 1997, barring complications in obtaining further data from DOE. By memorandum dated November 21, 1997, the staff informed the Commission of the results of the supplemental analysis. The analysis provided additional information regarding the generic and cumulative impacts of the transportation of HLW and addressed the implications of higher fuel enrichment and burn-up for the environmental effects resulting from transportation of fuel and waste, Table S-4. While the evaluation of the supplemental analysis is ongoing, the staff's preliminary view is that the supplemental analysis and the analysis provided in NUREG-1437, "Generic Environmental Impact Statement [GEIS] for License Renewal of Nuclear Plants," May 1996, support a reasonable technical and legal determination that transportation of HLW is a Category 1 issue and may be generically adopted in a license renewal application.

DISCUSSION:

The following options are available to address the generic and cumulative impacts of transportation of HLW in the vicinity of an HLW repository for license renewal applicants. One or more options may be implemented, depending on when a license renewal application is submitted.

Option 1 - Grant an Exemption (near-term applicants)
The Commission may exempt a license renewal applicant from addressing the HLW transportation requirements of 10 CFR 51.53(c)(3)(ii)(M) in the ER. Exemptions are allowed under 10 CFR 51.6 if the Commission determines it is authorized by law and is otherwise in the public interest. As discussed at the Commission meeting of June 12, 1997, the obligation to examine environmental issues under NEPA fundamentally belongs to the NRC. NRC's regulations in 10 CFR Part 51 require that licensees submit information to the NRC that supports and shortens the NRC's NEPA review process. An exemption from this requirement is slightly different than the traditional exemption from other requirements in NRC's regulations. The Commission's basis for granting an exemption in this case would be that the issue is clearly generic and will be addressed as such by the NRC. Therefore, granting an exemption will not alleviate the obligations of the NRC to address the impacts of transportation of HLW in the vicinity of Yucca Mountain as part of its NEPA review; however, it will exempt a license renewal applicant from providing information in a plant-specific application. An exemption would be an additional action with regard to the review of the ER and the license renewal application. An evaluation and an environmental assessment would be developed to support the exemption.

This option was initially raised by the industry and discussed because at the time there was no analysis of the generic and cumulative impacts of transportation of HLW and it was unclear what information to support such an analysis was available from DOE. With the completion of the staff's supplemental analysis, which will be placed in the Public Document Room, and the information contained in NUREG-1437, information is available upon which a more complete analysis may be based. Licensees may reference and adopt the staff's analyses if the assumptions and analyses are applicable to the particular plant. Therefore, the staff does not believe that an exemption will be needed.

Option 2 - Provide a Discussion in the Plant-Specific ER (near-term applicants)
The Commission would require applicants to address the issue of generic and cumulative impacts associated with transportation of HLW in the vicinity of an HLW repository site as required by the rule. The applicant would provide the best available information on the basis of its evaluation of the applicability of the supplemental analysis, NUREG-1437, and DOE documentation to its site and would address any changes or site-specific information the staff may need in support of its evaluation. The impacts of the transportation of HLW would be discussed in a broad sense by the licensee, recognizing the generic nature of the issue and the role of DOE in the HLW transportation process. The NRC staff, in its evaluation, would supplement the applicant's analysis with additional information and include information as it becomes available from DOE.

Referencing and adopting the staff's analyses would be one acceptable way that an applicant could meet the requirements of the rule. The applicant would also be free to develop its own analysis on the basis of available DOE information. This option would allow licensees to meet the requirements of the rule in the near term by providing the Commission with information to support its evaluation. The staff is in favor of this option for license renewal applications that are submitted before final resolution through rulemaking is completed.

Option 3 - Rulemaking (long-term solution)
The Commission may amend 10 CFR 51.53(c)(3)(ii)(M) to categorize the impacts of transportation of HLW as a Category 1 issue. Category 1 issues allow an applicant to adopt the staff's generic analysis and do not require a plant-specific review in the ER. The basis for the rulemaking would be the staff's supplemental analysis and NUREG-1437 and would address both the generic and cumulative impacts of the transportation of HLW and the Table S-4 issues. Because this rulemaking would not be considered a candidate for a direct final rule, rulemaking would take approximately 1 year. The schedule is highly dependent on the extent of the public comments and any technical or legal challenges that may arise. The rulemaking could be initiated immediately, or could be initiated at the prescribed 10-year GEIS update interval (next update due in 2006) and could be concurrent with other options if a license renewal application is submitted before the rulemaking is completed. The staff is in favor of initiating rulemaking immediately to resolve the issue. This step would conserve both licensee and NRC resources in developing and reviewing the issue in plant-specific ERs.

RESOURCES:

The resources associated with Option 1 would be consistent with the resources needed to process other exemption requests, approximately .5 staff months. The resources associated with Option 2 would be included in the overall review of the license renewal application. The resources associated with rulemaking in Option 3, recognizing the uncertainties associated with the extent of the public comments and any legal or technical challenges, are estimated at 3 staff months.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection to its contents.

The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections to its contents.

RECOMMENDATION:

The staff recommends implementing Option 3 immediately as a long-term solution and implementing Option 2 if a license renewal application is received before the rulemaking activity is completed.

L. Joseph Callan
Executive Director
for Operations

RECOMMENDATION:

The staff recommends implementing Option 3 immediately as a long-term solution and implementing Option 2 if a license renewal application is received before the rulemaking activity is completed.

L. Joseph Callan
Executive Director
for Operations

DOCUMENT NAME: G:\OPTIONS.PAP *See previous concurrence

OFFICE	(A)BC:PGEB	(A)D:DRPM	D:NRR	D:RES	OGC
NAME	TEssig*	JRoe*	SCollins	MKnapp*	HNewsome*
DATE	10/ 30 /97	10 / 31 /97	/ /97	11 / 14 /97	11 / 17 /97
OFFICE	CIO	CFO	NMSS	EDO	
NAME		KOlive*	CPaperiello*	LJCallan	
DATE	/ /97	11/ 7 /97	11 / 14 /97	/ /97	

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Attachment O

Duke Power Company Nuclear Policy Manual, Station Directive 111 Nuclear Environmental Management

Duke Power
A Duke Energy Company

NUCLEAR POLICY MANUAL

Nuclear System Directive: 111. Nuclear Environmental Management

REVISION NUMBER	ISSUE DATE
0	09/17/96
1	03/17/98

CATAWBA	MCGUIRE	OCONEE
Approved by/Date:	Approved by/Date:	Approved by/Date:
G. R. Peterson/03-17-98	H. B. Barron/03-17-98	W. R. McCollum/03-17-98
Site V. President	Site V. President	Site V. President
Effective Date	Effective Date	Effective Date
03/31/98	03/31/98	03/31/98

Issued by: J.J. Fisicaro
Manager, Nuclear Assessment and Issues Division

111. NUCLEAR ENVIRONMENTAL MANAGEMENT

REVISION NO.	PAGES or SECTIONS REVISED AND DESCRIPTION
0	Initial Issue
1	111.2 - Added Environmental Leadership Principles.
	111.2 - In section 2, added Safety as an owner of environmental processes.
	111.3.1 - Deleted detail list of SMT composition since this may be slightly different at each site.
	111.4.2 - Added "and the Duke Intranet" since this service is now available.

111. TABLE OF CONTENTS

111. NUCLEAR ENVIRONMENTAL MANAGEMENT

111.1 INTRODUCTION

The purpose of this NSD is to outline the philosophy, responsibilities, and methods Oconee, McGuire and Catawba Nuclear Stations will use to support the Environmental Leadership Principles of Duke Power Company.

The environmental commitment of the Nuclear Generation Department embodies Duke Power's philosophy that all employees are accountable for environmental compliance and protection of the environment.

This environmental commitment applies to all personnel working at the nuclear sites, regardless if the personnel are permanently assigned or temporarily assigned to work on site or are vendor personnel working on site.

111.2 PHILOSOPHY

The philosophy of the Nuclear Generation Department is to comply with all environmental laws, regulations and the Corporate Environmental Manual in order to protect the environment. This commitment is embodied in the Environmental Leadership Principles.

These Principles guide Duke Power Company employees as we strive to improve our performance in corporate environmental leadership.

1. CORE VALUE - I care for the environment and realize that its protection is an important part of my job.
2. WASTE REDUCTION - I plan my work to avoid or reduce waste, recycle as much as possible, and safely dispose of that which cannot be re-used.
3. ENERGY EFFICIENCY - I look for ways to produce and use energy more efficiently.
4. QUALITY OF LIFE - I perform my work in a way that seeks to protect the environment and improve the quality of life now and in the future.
5. ENVIRONMENTAL COMPLIANCE - I comply with all applicable environmental laws, regulations, and company environmental policy.
6. EFFECTIVE COMMUNICATIONS - I maintain open, two-way communications on environmental matters.
7. CONTINUOUS IMPROVEMENT - I continually look for ways to improve performance and better protect the environment.

NGD's environmental commitment encompasses environmental processes which are regulated by federal, state, or local laws and regulations as well as non-regulated processes, such as recycling, which can have an impact on the environment. These environmental processes are evaluated and revised by Environmental Management as needed to attain maximum efficiency and consistency among the sites. Guidance and direction for environmental processes shall be provided as follows:

1. The Corporate Environmental Manual (CEM) provides regulatory guidance and corporate interpretations to site Environmental Management.
2. The Nuclear Environmental Process Manual (NEPM) provides consistent responsibilities and guidance to owners of NGD environmental processes. Typically this is Environmental Management, but may include Safety for programs when responsibilities involve both groups.
3. The Environmental Work Practice Manual (EWPM) provides specific guidance to all site workers describing how each environmental process will be executed at the site level.

The responsibility for executing environmental processes outlined in the Environmental Work Practices lies with each person on site. Only with an educated and empowered work force executing each work practice can we hope to achieve 100% environmental compliance and programmatic excellence. The Environmental Management group at each site shall work with each group/individual to assist them in executing environmental processes at the site.

The Site Management Team is the foundation of support which enables Environmental Management and the site groups to develop and execute environmental processes through Environmental Work Practices. Management provides support through commitment, education and resources.

111.3 RESPONSIBILITIES

111.3.1 SITE MANAGEMENT TEAM

Each nuclear site has a management team which provides overall support for environmental processes. The responsibilities of the Site Management Team include:

- Understanding the major environmental impacts to the site.
- Providing broad environmental policy direction for the site.
- Authorizing initiatives to minimize plant impact on the environment.
- Demonstrating environmental commitment by supporting Environmental Work Practices.
- Educating their teammates on environmental issues.
- Ensuring compliance of their teammates with the legal and regulatory aspects of all environmental processes.
- Supporting the site Environmental Support Team.
- Environmental Management shall update the site management team on issues affecting the site through meetings, briefings or written summary as necessary.

111.3.2 SITE ENVIRONMENTAL SUPPORT TEAM

Each site has an Environmental Support Team consisting of representatives from the site groups. The Site Environmental Support Team member responsibilities include:

- Serving as the point contact for the Chemical Control Program within their group.
- Maintaining the Superfund Amendment Reauthorization Act (SARA) chemical inventory for their group.
- Supporting existing environmental work practices.
- Assisting in the development of new work practices as appropriate to ensure the site's compliance with regulatory issues and to support the site's commitment to the environment.
- Serving as the point contact for the dissemination of environmental information within their group.
- Educating their teammates on environmental issues.
- Gathering information from the group(s) they represent for resolving questions and concerns on environmental compliance issues.
- Assisting with periodic environmental audits and assessments for chemical control compliance, waste accumulation, pollution risk, and other environmental areas for their group.
- Reviewing environmental incidents for the site.
- Supporting development and implementation of Stormwater Pollution Prevention, SPCC and Best Management Practices Plans.

The Site Environmental Support Team is generally composed of members from the following groups:

Safety Assurance/Business	ESS
Transportation	Engineering
Operations	Work Control
Safety/OE	Training/Community Relations
QA/Diversified Technology	Chemistry
Radiation Protection	Commodities and Facilities
Maintenance	Security
Business Management	Janitorial/Utility Vendors

Representation from these groups is desired because their day-to-day work is frequently effected by federal and state environmental regulations.

Site Environmental Support Team members are selected based on their technical background or experience within their group and may be technicians, staff, or supervisory personnel.

Environmental Management will determine which site sections should provide support through team membership. Each section needed should select at least one member to serve as a primary contact and a secondary contact to act as an alternate.

The Site Environmental Support Team is chaired by an Environmental Management member and meets as necessary as determined by Environmental Management.

111.3.3 SITE ENVIRONMENTAL MANAGEMENT

The site Environmental Management group is responsible for:

- Providing technical environmental support and direction to site groups/individuals for implementing and maintaining environmental compliance/enhancements within their areas.
- Providing regulatory interpretations to site groups and individuals to enable them to effectively carry out environmental processes.
- Determining if an incident is reportable to local, state, and/or federal agencies.
- Providing technical assistance, if needed, regarding proper containerizing of spill cleanup material, proper labeling of cleanup containers, and storage of containers after cleanup.
- Assessing and managing environmental risks and issues as to their impact on public health and the environment as well as to the health of the corporation.
- Chairing the Site Environmental Support Team.
- Retaining permits, applications, reports, and other documents sent to or received from government environmental agencies, third party assessors, or non-Duke Power interfaces.
- Interfacing with government environmental personnel at the national, state, and local levels as appropriate.
- Developing and maintaining Environmental Work Practices.
- Coordinating site environmental assessments.

111.3.4 SITE MANAGERS AND SUPERVISORS

Each group manager/supervisor is responsible for:

- Assigning environmental contacts for their section to serve on the Site Environmental Support Team.
- Supporting Site Environmental Support Team members reporting through their line organization, including providing adequate time, resources, and accountabilities.
- Ensuring their teammates are in compliance with Environmental Work Practices.
- Ensuring that teammates in their group who are involved in environmental processes receive the necessary training.
- Ensuring that teammates in their group who perform environmental tasks that require a specific license have the appropriate license for the job.
- Ensuring coordination of waste minimization and pollution prevention efforts for their organization in accordance with the Environmental Work Practices.
- Ensuring coordination of cleanup of spills/releases of hazardous materials that were caused by their group from systems or components for which they have responsibility.
- Ensuring hazardous wastes generated by their group are identified and satellite accumulation areas are established and maintained for their hazardous wastes.
- Ensuring Environmental Management is aware of permanent and temporary modifications to the site or equipment that may impact environment regulations, and policies.
- Ensuring coordination with Environmental Management to provide data for spill reporting, hazardous waste quarterly reports, asbestos reports, waste minimization reports, goals tracking, and other environmental information needs.
- Ensuring adequate procedures, tasks, guidelines, etc. exist for implementation of environmental processes within their group when Environmental Work Practices are not the most effective means of communication.
- Ensuring vendors adhere to the Environmental Work Practices.
- Ensuring problems and potential problems related to environmental organization are identified and corrected using the Problem Investigation Process (PIP).

111.3.5 ALL PERSONNEL ON SITE

All personnel on site, regardless if they are permanently or temporarily assigned to the site, or vendor personnel are responsible for;

- Complying with the guidance provided in the site Environmental Work Practices and group procedures.
- Ensuring they have received the necessary environmental training for the tasks they perform.
- Ensuring they have the appropriate environmental license for work requiring one.
- Notifying their management or Environmental Management of any environmental concerns they have.

111.4 ENVIRONMENTAL GUIDANCE

111.4.1 NUCLEAR ENVIRONMENTAL PROCESS MANUAL

The Nuclear Environmental Process Manual (NEPM) contains environmental processes that have been evaluated by Environmental Management and other groups having ownership of an environmental process at all 3 nuclear sites. This evaluation process or mapping ensures the process meets or exceeds federal, state, and local laws and regulations and Duke Power Company policies. The evaluation also includes determining the most efficient and consistent method to implement the process as well as justifications for any site differences.

Since the target audience for the NEPM is the environmental professional, the distribution of this manual is limited to owners of environmental processes.

111.4.2 ENVIRONMENTAL WORK PRACTICES

Environmental Management develops site specific Environmental Work Practices (EWPs) which provide guidance to the site on how environmental processes will be implemented. There may be several Environmental Work Practices for each environmental process.

Environmental Work Practices provide the guidance and direction which should enable the site to comply with federal, state, and local regulations. These work practices are/shall be developed with input from groups which are responsible for the implementation of the work practice. The Environmental Work Practice Manual is maintained current by the site Environmental Management section and is distributed to all groups on site through Document Control and the Duke Intranet. As the technology becomes available, an electronic version of the Environmental Work Practices shall be developed and made available to each site.

111.4.3 GROUP PROCEDURES

Site groups may chose to develop their own procedures when work execution requires more detailed information or procedures are more effective than Environmental Work Practices. In this case, Environmental Management shall be included in the procedure review process to provide technical support and to ensure the procedure guidance meets environmental regulatory requirements.

111.5 ENVIRONMENTAL ASSESSMENTS

Environmental Assessments will be conducted periodically at each site. These assessments include:

111.5.1 GROUP SELF ASSESSMENTS

Each site group performs periodic self-assessments in accordance with NSD 607. It is recommended that environmental processes be included in these assessments to ensure compliance with Environmental Work Practice requirements.

111.5.2 SITE ENVIRONMENTAL ASSESSMENTS

An environmental assessment of the site shall be performed by Environmental Management with the assistance from the Site Environmental Support Team per NSD 607, on a frequency determined by Environmental Management. A report of the results and plans for improvement shall be provided to site management.

111.5.3 CORPORATE ENVIRONMENTAL ASSESSMENTS

Periodically, ESS Environmental Protection will perform site environmental assessments. These assessments will focus on compliance as well as process management. A report will be written and corrective actions taken as described in the Corporate Environmental Manual.