

Abstract

The U.S. Nuclear Regulatory Commission (NRC) has considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in 10 CFR Part 51. In the GEIS (and its Addendum 1), the staff identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This Supplemental Environmental Impact Statement (SEIS) has been prepared in response to an application submitted to the NRC by Duke Energy Corporation (Duke) to renew the OLs for Catawba Nuclear Station, Units 1 and 2 (Catawba) for up to an additional 20 years under 10 CFR Part 54 (Duke 2001a). This SEIS includes the NRC staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation regarding the proposed action.

Neither Duke nor the staff has identified information that is both new and significant for any issues for which the GEIS reached generic conclusions and that apply to Catawba Units 1 and 2. The staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the Catawba OLs will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the GEIS conclusion is that the impact is of SMALL^(a) significance (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and from spent fuel, which were not assigned a single significance level).

Each of the remaining issues applicable to Catawba is addressed in this SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental effects of renewal of the OLs is SMALL. The staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

The NRC staff's recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Catawba are not so great that preserving the

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

Abstract

option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Duke; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

Contents

Abstract	iii
Executive Summary	xv
Abbreviations/Acronyms	xxi
1.0 Introduction	1-1
1.1 Report Contents	1-2
1.2 Background	1-3
1.2.1 Generic Environmental Impact Statement	1-3
1.2.2 License Renewal Evaluation Process	1-4
1.3 The Proposed Federal Action	1-7
1.4 The Purpose and Need for the Proposed Action	1-8
1.5 Compliance and Consultations	1-8
1.6 References	1-10
2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment	2-1
2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term	2-1
2.1.1 External Appearance and Setting	2-4
2.1.2 Reactor Systems	2-4
2.1.3 Cooling and Auxiliary Water Systems	2-6
2.1.4 Radioactive Waste Management Systems and Effluent Control Systems	2-7
2.1.4.1 Liquid Waste Processing Systems and Effluent Controls	2-9
2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls	2-10
2.1.4.3 Solid Waste Processing	2-11
2.1.5 Nonradioactive Waste Systems	2-12
2.1.6 Plant Operation and Maintenance	2-13
2.1.7 Power Transmission System	2-13

Contents

2.2	Plant Interaction with the Environment	2-14
2.2.1	Land Use	2-14
2.2.2	Water Use	2-16
2.2.3	Water Quality	2-17
2.2.4	Air Quality	2-18
2.2.5	Aquatic Resources	2-19
2.2.6	Terrestrial Resources	2-23
2.2.7	Radiological Impacts	2-24
2.2.8	Socioeconomic Factors	2-27
2.2.8.1	Housing	2-27
2.2.8.2	Public Services	2-30
2.2.8.3	Offsite Land Use	2-33
2.2.8.4	Visual Aesthetics and Noise	2-36
2.2.8.5	Demography	2-36
2.2.8.6	Economy	2-41
2.2.9	Historic and Archaeological Resources	2-45
2.2.9.1	Cultural Background	2-45
2.2.9.2	Historic and Archaeological Resources at Catawba	2-47
2.2.10	Related Federal Project Activities and Consultations	2-49
2.3	References	2-50
3.0	Environmental Impacts of Refurbishment	3-1
3.1	References	3-4
4.0	Environmental Impacts of Operation	4-1
4.1	Cooling System	4-2
4.1.1	Water-Use Conflicts	4-12
4.1.2	Microbiological Organisms (Public Health)	4-14

4.2	Transmission Lines	4-15
4.2.1	Electromagnetic Fields—Acute Effects	4-18
4.2.2	Electromagnetic Fields—Chronic Effects	4-19
4.3	Radiological Impacts of Normal Operations	4-19
4.4	Socioeconomic Impacts of Plant Operations During the License Renewal Period	4-21
4.4.1	Housing Impacts During Operations	4-22
4.4.2	Public Services: Public Utility Impacts During Operations	4-24
4.4.3	Offsite Land Use During Operations	4-25
4.4.4	Public Services: Transportation Impacts During Operations	4-27
4.4.5	Historic and Archaeological Resources	4-28
4.4.6	Environmental Justice	4-30
4.5	Groundwater Use and Quality	4-34
4.5.1	Groundwater-Use Conflicts (makeup water)	4-35
4.6	Threatened or Endangered Species	4-36
4.6.1	Aquatic Species	4-37
4.6.2	Terrestrial Species	4-37
4.7	Evaluation of Potential New and Significant Information on Impacts of Operations During the Renewal Term	4-38
4.8	Summary of Impacts of Operations During the Renewal Term	4-38
4.9	References	4-39
5.0	Environmental Impacts of Postulated Accidents	5-1
5.1	Postulated Plant Accidents	5-1
5.2	Severe Accident Mitigation Alternatives	5-4
5.2.1	Introduction	5-5
5.2.2	Estimate of Risk for Catawba, Units 1 and 2	5-6

Contents

5.2.2.1	Duke's Risk Estimates	5-6
5.2.2.2	Review of Duke's Risk Estimates	5-9
5.2.3	Potential Design Improvements	5-11
5.2.3.1	Process for Identifying Potential Design Improvements	5-11
5.2.3.2	Staff Evaluation	5-15
5.2.4	Risk Reduction Potential of Design Improvements	5-16
5.2.5	Cost Impacts of Candidate Design Improvements	5-18
5.2.6	Cost-Benefit Comparison	5-20
5.2.6.1	Duke Evaluation	5-20
5.2.6.2	Staff Evaluation	5-24
5.2.7	Conclusions	5-28
5.3	References	5-29
6.0	Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management	6-1
6.1	The Uranium Fuel Cycle	6-2
6.2	References	6-9
7.0	Environmental Impacts of Decommissioning	7-1
7.1	References	7-4
8.0	Environmental Impacts of Alternatives to Operating License Renewal	8-1
8.1	No-Action Alternative	8-1
8.2	Alternative Energy Sources	8-4
8.2.1	Coal-Fired Generation	8-6
8.2.1.1	Closed-Cycle Cooling System	8-7
8.2.1.2	Once-Through Cooling System	8-22

8.2.2	Oil and Natural-Gas-Fired (Combined Cycle)	8-23
8.2.2.1	Closed-Cycle Cooling System	8-24
8.2.2.2	Once-Through Cooling System	8-35
8.2.3	Nuclear Power Generation	8-36
8.2.3.1	Closed-Cycle Cooling System	8-37
8.2.3.2	Once-Through Cooling System	8-44
8.2.4	Purchased Electrical Power	8-45
8.2.5	Other Alternatives	8-46
8.2.5.1	Oil-Fired Generation	8-46
8.2.5.2	Wind Power	8-46
8.2.5.3	Solar Power	8-47
8.2.5.4	Hydropower	8-48
8.2.5.5	Geothermal Energy	8-48
8.2.5.6	Wood Waste	8-48
8.2.5.7	Municipal Solid Waste	8-49
8.2.5.8	Other Biomass-Derived Fuels	8-50
8.2.5.9	Fuel Cells	8-50
8.2.5.10	Delayed Retirement	8-50
8.2.5.11	Utility-Sponsored Conservation	8-51
8.2.6	Combination of Alternatives	8-51
8.3	Summary of Alternatives Considered	8-55
8.4	References	8-56
9.0	Summary and Conclusions	9-1
9.1	Environmental Impacts of the Proposed Action – License Renewal	9-4
9.1.1	Unavoidable Adverse Impacts	9-5
9.1.2	Irreversible or Irrecoverable Resource Commitments	9-6
9.1.3	Short-Term Use Versus Long-Term Productivity	9-6

Contents

9.2	Relative Significance of the Environmental Impacts of License Renewal and Alternatives	9-7
9.3	Staff Conclusions and Recommendations	9-7
9.4	References	9-9
	Appendix A - Comments Received on the Environmental Review	A-1
	Appendix B - Contributors to the Supplement	B-1
	Appendix C - Chronology of NRC Staff Environmental Review Correspondence Related to Duke Energy Corporation's Application for License Renewal of Catawba Nuclear Station, Units 1 and 2	C-1
	Appendix D - Organizations Contacted	D-1
	Appendix E - Catawba Compliance Status and Consultation Correspondence	E-1
	Appendix F - GEIS Environmental Issues Not Applicable to Catawba Nuclear Station, Units 1 and 2	F-1

Figures

2-1	Location of Catawba 80-km (50-mi) Region (Duke 2001a)	2-2	
2-2	Location of Catawba 10-km (6-mi) Region (Duke 2001a)	2-3	
2-3	Catawba Exclusion Area (Duke 2001a)	2-5	
2-4	Catawba Transmission Lines and Rights-of-Way (Duke 2001a)	2-15	
4-1	Geographic Distribution of Minority Populations (shown in shaded areas) Within 80 km (50 mi) of Catawba Based on Census 2000 Block Group Data and Individual Counts	4-32	
4-2	Geographic Distribution of Low-Income Populations (shown in shaded areas) Within 80 km (50 mi) of Catawba Based on Census 1990 Block Group Data and Individual Counts	4-33	

Tables

1-1	Federal, State, and Local Authorizations and Consultations	1-9
2-1	Catawba Transmission Line Rights-of-Way	2-14
2-2	Aquatic Species Listed as Endangered or Threatened by the FWS and Species that are Candidates for FWS Listing as Threatened or Endangered or are Considered Species of Concern by FWS Potentially Occurring in Gaston, Mecklenburg, and Union Counties in North Carolina, and York, Cherokee, Lancaster, and Chester Counties in South Carolina	2-22
2-3	Terrestrial Species Listed as Endangered, Threatened, Candidate, or Federal Species of Concern by the FWS, South Carolina, or North Carolina that Occur or Potentially Occur at Catawba or Its Associated Transmission Line Rights-of-Way	2-25
2-4	Catawba Permanent and Contractor Employee Residency by County	2-27
2-5	Catawba Permanent and Contractor Employee Residency by County and City	2-28
2-6	Total, Occupied, and Vacant (Available) Housing Units by County 1990 and 2000	2-29
2-7	Population Growth in York County, South Carolina, and Mecklenburg and Gaston Counties, North Carolina, 1970 to 2020	2-30
2-8	Major Public Water Supply Systems in York County	2-31
2-9	York County School District Profile	2-32
2-10	Land Use in York County	2-33
2-11	Population Distribution from 2000 to 2040 Within 80 km (50 mi) of Catawba	2-37
2-12	Estimated Age Distribution of Population in 2000	2-38
2-13	Major Employment Sectors in York County, South Carolina in 1999	2-39
2-14	Visitors to Lake Wylie: 1999 and Projected 2050	2-39
2-15	Economic Base for York County by Standard Industrial Classification (SIC) Code	2-42
2-16	Commuting Patterns of York County Workers	2-42
2-17	Catawba Contribution to York County Property Tax Revenues	2-45
3-1	Category 1 Issues for Refurbishment Evaluation	3-2
3-2	Category 2 Issues for Refurbishment Evaluation	3-3
4-1	Category 1 Issues Applicable to the Operation of the Catawba Cooling System During the Renewal Term	4-2
4-2	Category 2 Issues Applicable to the Operation of the Catawba Cooling System During the Renewal Term	4-12

4-3	Category 1 Issues Applicable to the Catawba Transmission Lines During the Renewal Term	4-15
4-4	Chronic Effects of Electromagnetic Fields and Category 2 Issue Applicable to the Catawba Transmission Lines During the Renewal Term	4-18
4-5	Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term	4-20
4-6	Category 1 Issues Applicable to Socioeconomics During the Renewal Term	4-21
4-7	Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the License Renewal Term	4-23
4-8	Category 1 Issue Applicable to Groundwater Use and Quality During the Renewal Term	4-34
4-9	Category 2 Issue Applicable to Groundwater Use and Quality During the Renewal Term	4-35
4-10	Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term	4-36
5-1	Category 1 Issue Applicable to Postulated Accidents During the Renewal Term	5-3
5-2	Category 2 Issue Applicable to Postulated Accidents During the Renewal Term	5-4
5-3	Catawba Core Damage Frequency (Revision 2b of PRA)	5-7
5-4	Breakdown of Population Dose by Containment End-State (Total dose = 0.314 person-Sv [31.4 person-rem] per year)	5-8
5-5	SAMA Cost/Benefit Screening Analysis – SAMAs that Reduce CDF	5-14
5-6	SAMA Cost/Benefit Screening Analysis – SAMAs that Improve Containment Performance	5-15
5-7	Sensitivity Results for Hydrogen Control SAMAs (all benefits based on eliminating early failures only)	5-27
6-1	Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term	6-2
7-1	Category 1 Issues Applicable to Decommissioning of Catawba Following the Renewal Term	7-2
8-1	Summary of Environmental Impacts of the No-Action Alternative	8-2
8-2	Summary of Environmental Impacts of Coal-Fired Generation at Catawba and an Alternate Greenfield Site Using Closed-Cycle Cooling	8-7
8-3	Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Greenfield Site with Once-Through Cooling	8-22

Tables

8-4	Summary of Environmental Impacts of Oil and Natural-Gas-Fired Generation at Catawba and an Alternate Greenfield Site Using a Closed-Cycle Cooling System	8-25
8-5	Summary of Environmental Impacts of Oil and Natural-Gas-Fired Generation at an Alternate Site with a Once-Through Cooling System	8-36
8-6	Summary of Environmental Impacts of New Nuclear Generation at Catawba and at an Alternate Greenfield Site Using Closed-Cycle Cooling	8-38
8-7	Summary of Environmental Impacts of a New Nuclear Power Plant Sited at an Alternate Greenfield Site with Once-Through Cooling	8-45
8-8	Summary of Environmental Impacts for an Assumed Combination of Generating and Acquisition Alternatives	8-52
9-1	Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation	9-8
A-1	Individuals Providing Comments During Scoping Comment Period	A-2
A-2	Comments Received on the Draft SEIS	A-24
E-1	Federal, State, Local, and Regional Licenses, Permits, Consultations, and Other Approvals for Catawba, Units 1 and 2	E-2
F-1	GEIS Environmental Issues Not Applicable to Catawba	F-1

Executive Summary

By letter dated June 13, 2001, Duke Energy Corporation (Duke) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Catawba Nuclear Station, Units 1 and 2 (Catawba) for up to an additional 20-year period. If the OLs are renewed, State regulatory agencies and Duke will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, the plant must be shut down at or before the expiration dates of the current OLs, which are December 6, 2024, for Unit 1, and February 24, 2026, for Unit 2.

Section 102 of the National Environmental Policy Act (NEPA; 42 USC 4321) directs that an environmental impact statement (EIS) be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51, which identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).^(a)

Upon acceptance of the Duke application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the Catawba site in October 2001 and held public scoping meetings on October 23, 2001, in Rock Hill, South Carolina. The staff reviewed the Duke Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1 (*Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*), and considered the public comments received during the scoping process in preparation of this Supplemental Environmental Impact Statement (SEIS) for Catawba. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part I, of this SEIS.

A draft SEIS was published for comment in May 2002. The staff held two public meetings in Rock Hill, South Carolina, on June 27, 2002, to describe the results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on the draft SEIS. All of the comments received on the

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

Executive Summary

| draft SEIS were considered by the staff in developing the final SEIS. These comments are addressed in Appendix A, Part II, of this SEIS.

| This SEIS includes the NRC staff's analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse effects. It also includes the staff's recommendation regarding the proposed action.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

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) decisionmakers.

The goal of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OLS.

| NRC regulations (10 CFR 51.95(c)(2)) contain the following statement regarding the content of SEISs prepared at the license renewal stage:

The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the

scope of the generic determination in § 51.23(a) [“Temporary storage of spent fuel after cessation of reactor operation—generic determination of no significant environmental impact”] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC’s three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS reached the following conclusions:

- (1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).
- (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 not likely to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Executive Summary

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must also be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This SEIS documents the staff's evaluation of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for Catawba) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA), gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from Catawba is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Catawba site or some other unspecified location.

Duke and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Duke nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff has identified any new issue applicable to Catawba that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Catawba.

Duke's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the Duke analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at Catawba. Four Category 2 issues are not discussed in this SEIS, because they are specifically related to refurbishment. Duke has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of Catawba for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement, and therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the NRC's 1983 *Final Environmental Statement Related to the Operation of Catawba Nuclear Station, Units 1 and 2*.

Eleven Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are discussed in this SEIS only in relation to operation during the renewal term. For all 12 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Catawba Units 1 and 2 and the plant improvements already made, the staff concludes that two of the candidate SAMAs are cost beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

If the current Catawba OLs are not renewed and the units cease operation on or before expiration of their OLs, the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Catawba. The impacts may, in fact, be greater in some areas.

The recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Catawba are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by Duke; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments.

Abbreviations/Acronyms

7Q10	the estimated 7-day minimum flow occurring on the average once in 10 years
μCi	microcurie(s)
μCi/mL	microcuries per milliliter
μGy	microgray(s)
μm	micrometer(s)
μSv	microsieverts
AADT	annual average daily traffic (count)
ac	acre(s)
ACC	averted cleanup and decontamination costs
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOSC	averted onsite costs
APE	averted public exposure
APRC	averted power replacement cost
ATWS	anticipated transient without SCRAM
BEA	Bureau of Economic Analysis
Bq	becquerel(s)
Bq/ml	becquerels per milliliter
BMT	basemat melt-through
Btu	British thermal unit(s)
°C	degrees Celsius
Catawba	Catawba Nuclear Station, Units 1 and 2
CCW	component cooling water
CDF	core damage frequency
CEQ	Council on Environmental Quality
CET	containment event tree
CFR	Code of Federal Regulations
CFS	cubic feet per second or ft ³ /s
CHRS	containment heat removal system
Ci	curie(s)
cm	centimeter(s)
COE	cost of enhancement
COPC	chemicals of potential concern
CVCS	chemical and volume control system
CWA	Clean Water Act

Abbreviations/Acronyms

DG	diesel generator
DBA	design-basis accident
DCH	direct containment heating
DOE	U.S. Department of Energy
DPR	demonstration project reactor
DSM	demand-side management
Duke	Duke Energy Corporation
ECCS	emergency core cooling system
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EOP	Emergency Operating Procedure
EPA	U.S. Environmental Protection Agency
EPZ	Emergency Planning Zone
EQ	equipment qualification
ER	Environmental Report
ESA	Endangered Species Act
ESRP	Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Operating License Renewal, NUREG-1555, Supplement 1
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FR	Federal Register
FSAR	Final Safety Analysis Report
ft	foot/feet
ft ³	cubic feet
ft ³ /yr	cubic feet per year
ft ³ /s	cubic feet per second
F-V	Fussell-Vesely (importance measures used in risk analysis)
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act of 1977)
FWS	U.S. Fish and Wildlife Service
gal	gallon
GDC	general design criteria
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437

Abbreviations/Acronyms

GI-LLI	gastrointestinal tract-lower large intestine
gpm	gallons per minute
GSI	generic safety issue
ha	hectare(s)
HHSI	high head safety injection
HLW	high-level waste
hr	hour(s)
Hz	Hertz
in.	inch(es)
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination for External Events
ISFSI	Independent Spent Fuel Storage Installation
ISLOCA	Interfacing Systems Loss of Coolant Accident
kg	kilogram(s)
km ²	square kilometers
km	kilometer(s)
kV	kilovolt(s)
kV/m	kilovolt per meter
kWh	kilowatt hour(s)
L	liter(s)
lb	pound
LNG	liquefied natural gas
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
L/s	liters per second
LWR	light-water reactor
M	million
m	meter(s)
m/s	meter(s) per second
m ²	square meters
m ³	cubic meters
m ³ /d	cubic meters per day
m ³ /s	cubic meter(s) per second
mA	milliampere(s)
MAAP	Modular Accident Analysis Program
MACCS2	MELCOR Accident Consequence Code System 2

Abbreviations/Acronyms

mi	mile(s)
mGy	milligray(s)
MGD	million gallons per day
mL	milliliter(s)
mph	miles per hour
mrad	millirad(s)
mrem	millirem(s)
mSv	millisievert(s)
MT	metric ton(s) (or tonne[s])
MTU	metric ton(s)-uranium
MW	megawatt(s)
MWd/MTU	megawatt-days per metric ton of uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NA	not applicable
NAFTA	North American Free Trade Agreement
NAS	National Academy of Sciences
NCDENR	North Carolina Department of Environmental and Natural Resources
NCI	National Cancer Institute
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
ng/J	nanogram per joule
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NO _x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NWPPC	Northwest Power Planning Council
ODCM	Offsite Dose Calculation Manual
OL(s)	operating license(s)
PAR	passive autocatalytic recombiners
PDS(s)	plant damage state(s)
PM _{2.5}	particulate matter, 2.5 micrometers or less in diameter
PM ₁₀	particulate matter, 10 micrometers or less in diameter
ppt	parts per thousand

Abbreviations/Acronyms

PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSD	prevention of significant deterioration
PSW	plant service water
PWR	pressurized water reactor
PW	present worth
RAB	reactor auxiliary building
RAI	request for additional information
RCP	reactor coolant pump
RCS	Reactor Coolant System
REMP	radiological environmental monitoring program
RWST	Refueling Water Storage Tank
ry	reactor year
s	second(s)
SAG	Severe Accident Guideline
SAMA(s)	Severe Accident Mitigation Alternative(s)
SAMDA	Severe Accident Mitigation Design Alternative
SAMG	Severe Accident Management Guideline
SAR	Safety Analysis Report
SBO	station blackout
SC	South Carolina
SCH	South Carolina Highway
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SGTR	steam generator tube rupture
SHPO	State Historic Preservation Office
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCIAA	South Carolina Institute of Archaeology and Anthropology
SIC	Standard Industrial Classification
SO ₂	sulfur dioxide
SO _x	sulfur oxide(s)
SSS	standby shutdown system
Sv	sieverts
TBq	terabecquerel
UDB	urban development boundary
UFSAR	Updated Final Safety Analysis Report

Abbreviations/Acronyms

U.S.	United States
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UST	upper storage tank
yr	year