U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1437
Supplement 15
Second Renewal

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 15, Second Renewal

Regarding Subsequent License Renewal of Virgil C. Summer Nuclear Station, Unit 1

Draft Report for Comment

Office of Nuclear Material Safety and Safeguards

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at the NRC's Library at www.nrc.gov/reading-rm.html. Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and Title 10, "Energy," in the *Code of Federal Regulations* may also be purchased from one of these two sources:

1. **The Superintendent of Documents**
   U.S. Government Publishing Office
   Washington, DC 20402-0001
   Internet: https://bookstore.gpo.gov/
   Telephone: (202) 512-1800
   Fax: (202) 512-2104

2. **The National Technical Information Service**
   5301 Shawnee Road
   Alexandria, VA 22312-0002
   Internet: https://www.ntis.gov/
   1-800-553-6847 or, locally, (703) 605-6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:

Address: **U.S. Nuclear Regulatory Commission**
Office of Administration
Digital Communications and Administrative Services Branch
Washington, DC 20555-0001
E-mail: Reproduction.Resource@nrc.gov
Facsimile: (301) 415-2289

Some publications in the NUREG series that are posted at the NRC's Web site address www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—

The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—

American National Standards Institute
11 West 42nd Street
New York, NY 10036-8002
Internet: www.ansi.org
(212) 642-4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licensee, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX),(4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and the Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of the NRC's regulations (NUREG-0750), (6) Knowledge Management prepared by NRC staff or agency contractors (NUREG/KM-XXXX).

United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1437
Supplement 15
Second Renewal

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 15, Second Renewal

Regarding Subsequent License Renewal of Virgil C. Summer Nuclear Station, Unit 1

Draft Report for Comment

Manuscript Completed: November 2024
Date Published: November 2024

Office of Nuclear Material Safety and Safeguards

COMMENTS ON DRAFT REPORT

Proposed Action Issuance of subsequent renewed facility operating license NPF-12 for Virgil C. Summer Nuclear Station, Unit 1, located in Jenkinsville, South Carolina

Type of Statement Draft Supplemental Environmental Impact Statement

Agency Contact Kim Conway
U.S. Nuclear Regulatory Commission (NRC)
Office of Nuclear Material Safety and Safeguards
Mail Stop T-4B72
Washington, DC 20555-0001
Email: kimberly.conway@nrc.gov

Comments:

Any interested party may submit comments on this draft supplemental environmental impact statement (SEIS). Please specify “NUREG-1437, Supplement 15, Second Renewal, draft,” in the subject or title line for your comments. Comments on this draft SEIS should be filed no later than 45 days after the date on which the U.S. Environmental Protection Agency notice, stating that this draft SEIS has been filed with the U.S. Environmental Protection Agency, is published in the *Federal Register*. Comments received after the expiration of the comment period will be considered if it is practical to do so, but assurance of consideration of late comments cannot be given. You may submit comments electronically by searching for Docket ID NRC-2023-0152 at the website: http://www.regulations.gov.

The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC will post all comment submissions into the NRC’s Agencywide Documents Access and Management System. The NRC does not routinely edit comment submissions to remove identifying or contact information.

COVER SHEET

Responsible Agency: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. There are no cooperating agencies involved in the preparation of this document.

Title: Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 15, Second Renewal, Regarding Virgil C. Summer Nuclear Station, Unit 1, Draft Report for Comment (NUREG-1437). Virgil C. Summer Nuclear Station is located in Jenkinsville, South Carolina.

For additional information or copies of this document contact:

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Mailstop T-4 B72
Washington, DC 20555-0001
Email: Kimberly.Conway@nrc.gov

ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) prepared this draft supplemental environmental impact statement in response to an application submitted by Dominion Energy South Carolina, Inc. (Dominion) to renew the operating license for Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer), for an additional 20 years. This supplemental environmental impact statement evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include: (1) natural gas; (2) new nuclear (small modular reactor); (3) natural gas and solar combination; (4) new nuclear and solar combination; and (5) not renewing the operating license (the no-action alternative).

Based on the evaluation of environmental impacts in this draft supplemental environmental impact statement, the NRC staff's preliminary recommendation is that the adverse environmental impacts of subsequent license renewal for V.C. Summer are not so great that preserving the option of subsequent license renewal for energy-planning decision-makers would be unreasonable. The NRC staff based its preliminary recommendation on the following:

- the analysis and findings in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
- the environmental report submitted by the applicant
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received during the scoping process

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Background

By letter dated August 17, 2023, Dominion Energy South Carolina, Inc. (Dominion) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application requesting subsequent license renewal (SLR) for the Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer) operating license (2023-TN10387). The V.C. Summer renewed facility operating license for Unit 1 (NPF-12) expires at midnight on August 6, 2042. In its application, Dominion requested a subsequent renewed operating license for a period of 20 years beyond the current renewed license expiration date, which would extend the expiration date to August 6, 2062.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 51.20(b)(2) (TN10253), the renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) (TN10253) states that, in connection with the renewal of an operating license, the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG-1437, Revision 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Final Report*, dated August 2024 (LR GEIS) (NRC 2024-TN10161).

Dominion submitted an environmental report (ER) of the impacts of continued operations of V.C. Summer during the SLR period (2023-TN10387). The report addressed, on a site-specific basis, each environmental issue, including issues that were previously dispositioned as Category 1 issues in the 2013 LR GEIS (NRC 2013-TN2654). On November 3, 2023, the NRC staff published a notice of its intent to conduct a scoping process and to prepare an EIS for the V.C. Summer SLR (88 FR 75627-TN10388). In preparation for this supplemental environmental impact statement (SEIS) for V.C. Summer, the NRC staff performed the following:

- conducted two public scoping meetings: one held virtually on November 9, 2023, and one held in-person on November 14, 2023, in Blair, South Carolina
- conducted virtual and onsite audits during the weeks of May 14, 2024, and May 21, 2024
- reviewed Dominion's ER (2023-TN10387) and identified site-specific issues that were not analyzed in the LR GEIS
- consulted with Federal, State, Tribal, and local agencies
- conducted an analysis of environmental impacts following the guidance set forth in NUREG-1555, Supplement 1, Revision 2, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Operating License Renewal, Final Report*, dated August 2024 (NRC 2024-TN10251)
- considered public comments received during the scoping comment period

Proposed Federal Action

The proposed Federal action was initiated by Dominion's submittal of an SLR application. The current renewed V.C. Summer operating license is set to expire at midnight on August 6, 2042. The NRC's Federal action is to determine whether to renew the V.C. Summer operating license for an additional 20 years. If the NRC renews the operating license, Dominion would be authorized to operate V.C. Summer until August 6, 2062.

Purpose and Need for Action

The purpose and need for the proposed Federal action (subsequent 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. Such needs may be determined by energy-planning decision-makers, such as State regulators, utility owners, and, where authorized, Federal agencies other than the NRC. This definition of purpose and need reflects the Commission's recognition that, absent findings in the safety review required by the Atomic Energy Act of 1954 (TN663), as amended, or in the environmental review required by the National Environmental Policy Act of 1969 (TN661), as amended, that would lead the NRC to reject a license renewal application, the NRC has no role in the energy-planning decisions of power plant owners, State regulators, system operators, and, in some cases, other Federal agencies as to whether a particular nuclear power plant should continue to operate (61 FR 28467-TN4491).

Environmental Impacts of Subsequent License Renewal

This SEIS evaluates the potential environmental impacts of the proposed action. The environmental impacts of the proposed action are designated as SMALL, MODERATE, or LARGE per definitions in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN10253). The definitions are listed below:

- **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.

Resource-specific effects or impact definitions from applicable environmental laws and executive orders, other than SMALL, MODERATE, and LARGE, are used where appropriate. The LR GEIS evaluates 80 environmental issues related to plant operation and classifies each issue as either a Category 1 issue (generic to all or a distinct subset of nuclear power plants as described below), or a Category 2 issue (specific to individual power plants). Category 1 issues are those that meet all the following criteria:

- 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 characteristic.
- A single significance level has been assigned to the impacts (except for offsite radiological impacts of spent nuclear fuel and high-level waste disposal and offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue is 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.

For Category 1 issues, no additional nuclear plant-specific (i.e., plant-specific) analysis is required in this SEIS unless new and significant information is identified. Category 2 issues are plant-specific issues that do not meet one or more of the criteria for Category 1 issues; therefore, an additional plant-specific review for the non-generic issues is required, and the results are documented in this SEIS. Chapter 3 of this SEIS presents the process for identifying new and significant information.

On August 6, 2024, the NRC published a final rule (89 FR 64166-TN10321) revising its environmental protection regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Specifically, the final rule updated the potential environmental impacts associated with the renewal of an operating license for a nuclear power plant for up to an additional 20 years, which could either be an initial license renewal or a subsequent license renewal. The LR GEIS was also revised (NRC 2024-TN10161) as an update to the 2013 LR GEIS (NRC 2013-TN2654) and provides the technical basis for the final rule. The revised LR GEIS supports the updated list of environmental issues and associated environmental impact findings contained in Table B-1 in Appendix B to Subpart A of the revised 10 CFR Part 51 for both initial license renewals and for one period of SLR.

The final rule became effective 30 days after its publication in the *Federal Register* (i.e., on September 5, 2024), and the NRC staff must now consider the new and modified issues, as applicable, in its license renewal EISs. Accordingly, on October 1, 2024, the NRC staff noticed its intent to prepare a site-specific supplement to the LR GEIS for the V.C. Summer SLR application (89 FR 79975-TN10601). The SEIS will rely on the LR GEIS determinations for Category 1 (generic) issues that apply to all or a distinct subset of nuclear power plants. Plant-specific information will be considered only for Category 2 (plant-specific) issues and will be screened for new and significant information on Category 1 issues.

Neither V.C. Summer nor the NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the LR GEIS. This conclusion is supported by the NRC staff’s review of Dominion’s ER and other documentation relevant to Dominion’s activities, the public scoping process, and the findings from the site audits conducted by the NRC staff. Therefore, the NRC staff relied upon the conclusions in the LR GEIS for all Category 1 issues applicable to V.C. Summer.

Table ES-1 summarizes the Category 2 issues relevant to V.C. Summer and the NRC staff’s findings related to those issues. If the NRC staff determined that there were no Category 2 issues applicable for a particular resource area, the findings in the LR GEIS, as documented in Appendix B to Subpart A of 10 CFR Part 51 (TN10253), are incorporated for that resource area.

Table ES-1 Summary of NRC Conclusions Relating to Plant-Specific Impacts of Subsequent License Renewal at Virgil C. Summer Nuclear Station, Unit 1

Resource Area	Relevant Category 2 Issue	Impact
Surface Water Resources	Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	SMALL
Groundwater Resources	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	SMALL
Groundwater Resources	Groundwater quality degradation (plants with cooling ponds)	SMALL
Groundwater Resources	Radionuclides released to groundwater	SMALL
Terrestrial Resources	Non-cooling system impacts on terrestrial resources	SMALL
Terrestrial Resources	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	SMALL

Table ES-1 Summary of NRC Conclusions Relating to Plant-Specific Impacts of Subsequent License Renewal at Virgil C. Summer Nuclear Station, Unit 1 (Continued)

Resource Area	Relevant Category 2 Issue	Impact
Aquatic Resources	Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL
Aquatic Resources	Effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL
Aquatic Resources	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	SMALL
Federally Protected Ecological Resources	Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction	May affect but is not likely to adversely affect tricolored bat and monarch butterfly
Historic and Cultural Resources	Historic and cultural resources	No adverse effect to historic properties
Human Health	Microbiological hazards to the public	SMALL
Human Health	Electromagnetic fields (EMFs)[(a)]	Uncategorized (Uncertain impact)
Human Health	Electric shock hazards	SMALL
Environmental Justice	Impacts on minority populations, low-income populations, and Indian Tribes	No disproportionate and adverse human health and environmental effects on minority and low-income populations
Greenhouse Gas Emissions and Climate Change	Climate change impacts on environmental resources	See Section 3.15.3 of this SEIS.
Cumulative Effects	Cumulative effects	See Section 3.16 of this SEIS.

DPS = distinct population segment; EMF = electromagnetic field.
(a) This issue was not designated as Category 1 or Category 2 and is discussed in Section 3.11.6.2 of this SEIS.

Alternatives to the Proposed Action

As part of its environmental review, the NRC is required to consider alternatives to SLR and evaluate the environmental impacts associated with each alternative. These alternatives can include other methods of power generation (i.e., replacement power alternatives), as well as not renewing the V.C. Summer operating license (i.e., the no-action alternative).

The NRC staff considered 17 alternatives to the proposed action and eliminated 13 from detailed study due to technical, resource availability, or commercial limitations that are likely to exist when the V.C. Summer operating license expires. Four replacement power alternatives were determined to be commercially viable:

- natural gas
- new nuclear (small modular reactor)
- natural gas and solar combination
- new nuclear and solar combination

These alternatives, along with the no-action alternative, are evaluated in detail in this SEIS.

<u>Preliminary Recommendation</u>

The NRC staff's preliminary recommendation is that the adverse environmental impacts of SLR for V.C. Summer are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. This preliminary recommendation is based on the following:

- the analysis and findings in the LR GEIS
- the ER submitted by the applicant
- the NRC staff’s consultation with Federal, State, Tribal, and local agencies
- the NRC staff’s independent environmental review
- the NRC staff’s consideration of public comments

ABBREVIATIONS AND ACRONYMS

ac	acre(s)
AD	Anno Domini
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
ALARA	as low as reasonably achievable
APE	area of potential effect
AREOR	Annual Radiological Environmental Operating Report
AQCR	air quality control region
BC	Before Christ
bgs	below ground surface
BMP	best management practice
BP	before present
BTA	best technology available
CAA	Clean Air Act of 1970
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic foot/feet per second
CH_4	methane
cm	centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2eq	CO_2 equivalents
COL	combined licenses
CSP	concentrating solar power
CWA	Clean Water Act of 1972, as amended
CWIS	cooling water intake system
dB	decibel(s)
dBA	A-weighted decibel(s)
DBA	design-basis accident
DMR	Discharge Monitoring Report

DOE	U.S. Department of Energy
Dominion	Dominion Energy South Carolina, Inc.
EFH	essential fish habitat
EIA	U.S. Energy Information Administration
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
ESA	Endangered Species Act of 1973, as amended
FERC	Federal Energy Regulatory Commission
fps	feet (foot) per second
ft	foot (feet)
ft^3	cubic foot (feet)
FWS	U.S. Fish and Wildlife Service
GEIS	generic environmental impact statement
GHG	greenhouse gas
gpm	gallon(s) per minute
GWPP	Groundwater Protection Program
ha	hectare(s)
HWC	Hazardous Waste Contingency Plan
Hz	hertz
IM	impingement mortality
IPCC	Intergovernmental Panel on Climate Change
ISFSI	independent spent fuel storage installation
km	kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)

lb	pound(s)
LLRW	low-level radioactive waste
LR	license renewal
LR GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants*
LWPS	liquid waste processing system
m	meter(s)
m^3	cubic meter(s)
m^3/s	cubic meter(s) per second
Ma	million years
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MDCT	mechanical draft cooling tower
MET	meteorological evaluation tower
MGD	million gallons per day
MGM	million gallons per month
MGY	million gallons per year
MHz	megahertz
mi	mile(s)
mi^2	square mile(s)
MSA	Magnuson–Stevens Fishery Conservation and Management Act
MSL	mean sea level
MT	metric ton(s)
MW	megawatt(s)
MWe	megawatt(s) electric
MWh	megawatt-hour
MWt	megawatt(s) thermal
NAAQS	National Ambient Air Quality Standards
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969
NGCC	natural gas-fired combined-cycle
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration

NOV	notice of violation
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ODCM	Offsite Dose Calculation Manual
OSHA	Occupational Safety and Health Administration
OWS	offsite water treatment facility
pCi/L	picocurie(s) per liter
pH	potential of hydrogen
PM	particulate matter
ppb	parts per billion
PV	photovoltaic
RAI	request for additional information
RCP	representative concentration pathway
rem	roentgen equivalent man
REMP	Radiological Environmental Monitoring Program
ROI	region of influence
ROW	right-of-way
SAMA	severe accident mitigation alternatives
SC 176	South Carolina Highway 176
SC 213	South Carolina Highway 213
SC 215	South Carolina Highway 215
SCDAH	South Carolina Department of Archives and History
SCDES	South Carolina Department of Environmental Services
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric and Gas
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SGCN	State species of greatest conservation need
SHPO	State Historic Preservation Officer
SLR	subsequent license renewal

SMR	small modular reactor
SO_2	sulfur dioxide
SPUT	special purpose utility (permit)
SSC	systems, structures, and components
SSP	socioeconomic pathway
SU	standard units
Sv	sieverts
SWAP	State Wildlife Action Plan
SWP	service water pond
SWPPP	Stormwater Pollution Prevention Plan
TEDE	total effective dose equivalent
TMDL	total maximum daily load
TRC	total residual chlorine
TSS	total suspended solid
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
U.S.C.	*United States Code*
USGCRP	United States Global Change Research Program
V.C. Summer	Virgil C. Summer Nuclear Station, Unit 1

1 INTRODUCTION AND GENERAL DISCUSSION

The U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 (TN10253), "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," implement the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* [U.S.C.] 4321 et seq.; TN661). The regulations specified in 10 CFR Part 51 (TN10253) require, in part, that the NRC staff prepare an environmental impact statement (EIS) for issuance or renewal of a nuclear power plant operating license. This EIS is a supplement to the Commission's NUREG-1437, Revision 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Final Report*, dated August 2024 (LR GEIS) (NRC 2024-TN10161).

The Atomic Energy Act of 1954 (AEA), as amended (42 U.S.C. 2011 et seq.-TN663), specifies that licenses for commercial nuclear power reactors can be granted for up to 40 years. The initial licensing period of 40 years was based on economic and antitrust considerations rather than on technical limitations of the nuclear facility. The NRC regulations permit these licenses to be renewed beyond the initial 40-year term for an additional period of time, limited to 20-year increments per renewal. Neither the AEA nor the NRC regulations restrict the number of times a license may be renewed.

The decision to seek a subsequent license renewal (SLR) rests entirely with nuclear power plant owners and, typically, is based on the power plant's economic viability and the investment necessary to continue to meet all safety and environmental requirements. The NRC makes the decision to grant or deny SLR based on whether the applicant has demonstrated reasonable assurance that it can meet the environmental and safety requirements in the agency's regulations during the period of extended operation.

On March 27, 2008, South Carolina Electric & Gas Company submitted an application for 10 CFR Part 52 combined licenses (COLs) for two AP1000 advanced passive pressurized water reactors for the Virgil C. Summer Nuclear Station, Units 2 and 3. Following earlier abandonment and termination of construction activities, on January 29, 2019, both owners of Virgil C. Summer Nuclear Station agreed to terminate the COLs for Units 2 and 3 (Santee Cooper 2019-TN10389) and on March 6, 2019, the COLs were terminated (NRC 2019-TN10390).

1.1 Proposed Federal Action

Dominion Energy South Carolina, Inc. (Dominion) initiated the proposed Federal action by submitting its SLR application to the NRC. The initial renewed Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer) operating license is set to expire at midnight on August 6, 2042 (License No. NPF-12). The NRC's Federal action is to decide whether to renew the license authorizing an additional 20 years of operation.

1.2 Purpose and Need for the Proposed Action

The purpose and need for the proposed action (subsequent 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 energy-planning decision-makers, such as State regulators, utility owners, and, where authorized, Federal agencies other than the NRC. The definition of purpose and need reflects the Commission's recognition that, absent findings in the safety review required by the AEA or in the NEPA environmental analysis that would lead the NRC to reject a license renewal (LR) application, the NRC has no role in the energy planning decisions as to whether a nuclear power plant should continue to operate (61 FR 28467-TN4491).

1.3 Major Environmental Review Milestones

The NRC has established a LR review process that can be completed in a reasonable period of time with clear requirements to ensure safe nuclear power plant operation for up to an additional 20 years, pursuant to 10 CFR Part 54. The safety and environmental reviews are conducted simultaneously. The findings of the safety review are documented in a safety evaluation report (SER) and the findings of the environmental review in a supplemental environmental impact statement (SEIS). The findings in the SER and SEIS are both factors in the NRC's decision to either grant or deny the renewed operating license. The SER and SEIS schedules for the V.C. Summer SLR are provided on the project website: https://publish.nrc.gov/reactors/operating/licensing/renewal/applications/virgil-summer-subsequent.html

By letter dated August 17, 2023, Dominion submitted an SLR application to the NRC for V.C. Summer, which included an environmental report (ER) (2023-TN10387). On October 16, 2023, after reviewing the SLR application and ER for sufficiency, the NRC staff published a notice of acceptance for docketing and opportunity to request a hearing in Volume 88 of the *Federal Register*, page 71384 (88 FR 71384-TN10867). On November 3, 2023, the NRC staff published a notice in the FR 88 FR 75627-TN10388) informing the public of the staff's intent to conduct an environmental scoping process, which began a 30-day scoping comment period, and to prepare an EIS.

The NRC staff held a virtual public scoping meeting on November 9, 2023, followed by an in-person public scoping meeting on November 14, 2023, in Blair, South Carolina. On November 8, 2024, the NRC staff issued a scoping summary report for the V.C. Summer SLR application environmental review (NRC 2024-TN10831), which included the comments received during the scoping process (Appendix A to this SEIS).

To independently verify information provided in the ER, the NRC staff conducted a hybrid environmental site audit related to the V.C. Summer SLR application May 2024. During the audit, the NRC staff held meetings with nuclear power plant personnel and reviewed site-specific documentation and photos. The NRC staff summarized the audit by letter dated July 5, 2024 (NRC 2024-TN10551).

Upon the completion of the scoping period and site audits, the NRC staff compiled its assessments and initial findings in this draft SEIS. This document is made available for public comment for 45 days. During that time, the NRC staff will host public meetings and collect public comments. Based on the information gathered, the NRC staff will amend the draft SEIS findings, as necessary, and publish a final SEIS. Figure 1-1 shows the major milestones of the NRC's LR environmental review process.

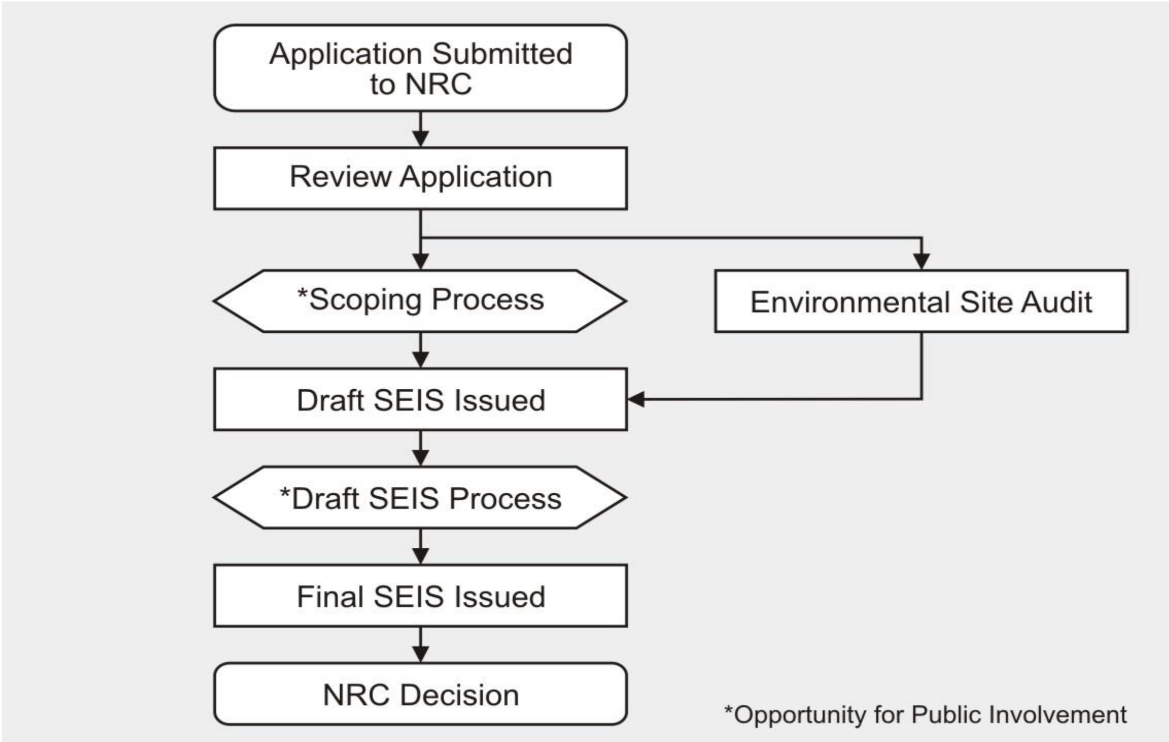


Figure 1-1 Environmental Review Process for Nuclear Power Plants

1.4 Major Environmental Review Milestones

The NRC has established a license renewal (LR) review process that can be completed in a reasonable period of time with clear requirements to ensure safe nuclear power plant operation for up to an additional 20 years, pursuant to 10 CFR Part 54. The safety and environmental reviews are conducted simultaneously. The findings of the safety review are documented in a safety evaluation report (SER) and the findings of the environmental review in a supplemental environmental impact statement (SEIS). The findings in the SER and SEIS are both factors in the NRC's decision to either grant or deny the renewed operating license. The SER and SEIS schedules are provided on the project website: https://publish.nrc.gov/reactors/operating/licensing/renewal/applications/virgil-summer-subsequent.html

1.5 Generic Environmental Impact Statement

To improve the efficiency of its LR review process, the NRC staff performed a generic assessment of the environmental impacts associated with LR. The LR GEIS (NRC 2024-TN10161) documents the results of the NRC's systematic approach to evaluating the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. In the LR GEIS, the staff analyzed in detail and determined the impact of those environmental issues that could be resolved generically.

The LR GEIS establishes separate environmental issues for the NRC staff to independently evaluate in LR environmental reviews. Of these issues, the NRC staff determined that some issues are generic to all plants or a specific subset of plants (Category 1). Other issues do not lend themselves to generic consideration and are nuclear plant-specific (i.e., plant-specific) (Category 2 or uncategorized). The NRC staff evaluates these issues in a supplement to the LR

GEIS. Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 (TN10253) provides a summary of the NRC staff's findings for environmental issues for LR of nuclear power plants that were evaluated in the LR GEIS.

On August 6, 2024, the NRC published a final rule (89 FR 64166-TN10321) revising its environmental protection regulations in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Specifically, the final rule updated the potential environmental impacts associated with the renewal of an operating license for a nuclear power plant for up to an additional 20 years, which could either be an initial LR or SLR. The LR GEIS was revised (NRC 2024-TN10161) as an update to the 2013 LR GEIS (NRC 2013-TN2654) and provides the technical basis for the final rule. The LR GEIS specifically supports the revised list of environmental issues and associated environmental impact findings for LR contained in Table B–1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The LR GEIS and final rule reflect lessons learned, knowledge gained, and experience from LR environmental reviews performed since the development of the 2013 LR GEIS; consider changes to applicable laws and regulations; and factor in new scientific data and methodology with respect to the assessment of potential environmental impacts of a nuclear power plant LR. The LR GEIS and final rule identify 80 environmental issues (i.e., 59 Category 1, 20 Category 2, and 1 issue that remains uncategorized) that may be associated with nuclear power plant operation and refurbishment during the renewal term.

The final rule became effective 30 days after its publication in the *Federal Register* in August 2024, and the NRC staff must now consider the new and modified issues, as applicable, in its LR SEISs. Compliance with the final rule by LR applicants is not required until 1 year from the date of publication in the *Federal Register* (i.e., LR environmental reports submitted later than 1 year after publication must be compliant with the new rule).

For each potential environmental issue addressed in the LR GEIS, the NRC staff:

- describes the activity that affects the environment
- identifies the population or resource that is affected
- assesses the nature and magnitude of the impact on the affected population or resource
- characterizes the significance of the effect for both beneficial and adverse effects
- determines whether the results of the analysis apply to all plants
- considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants

The environmental impacts of the proposed action are designated as SMALL, MODERATE, or LARGE per definitions in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN10253). The definitions of these terms are listed below.

> **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.

These levels are used for describing the environmental impacts of the proposed action as well as for the impacts of a range of reasonable alternatives to the proposed action. Resource-specific effects or impact definitions from applicable environmental laws and executive orders, other than SMALL, MODERATE, and LARGE, are used where appropriate.

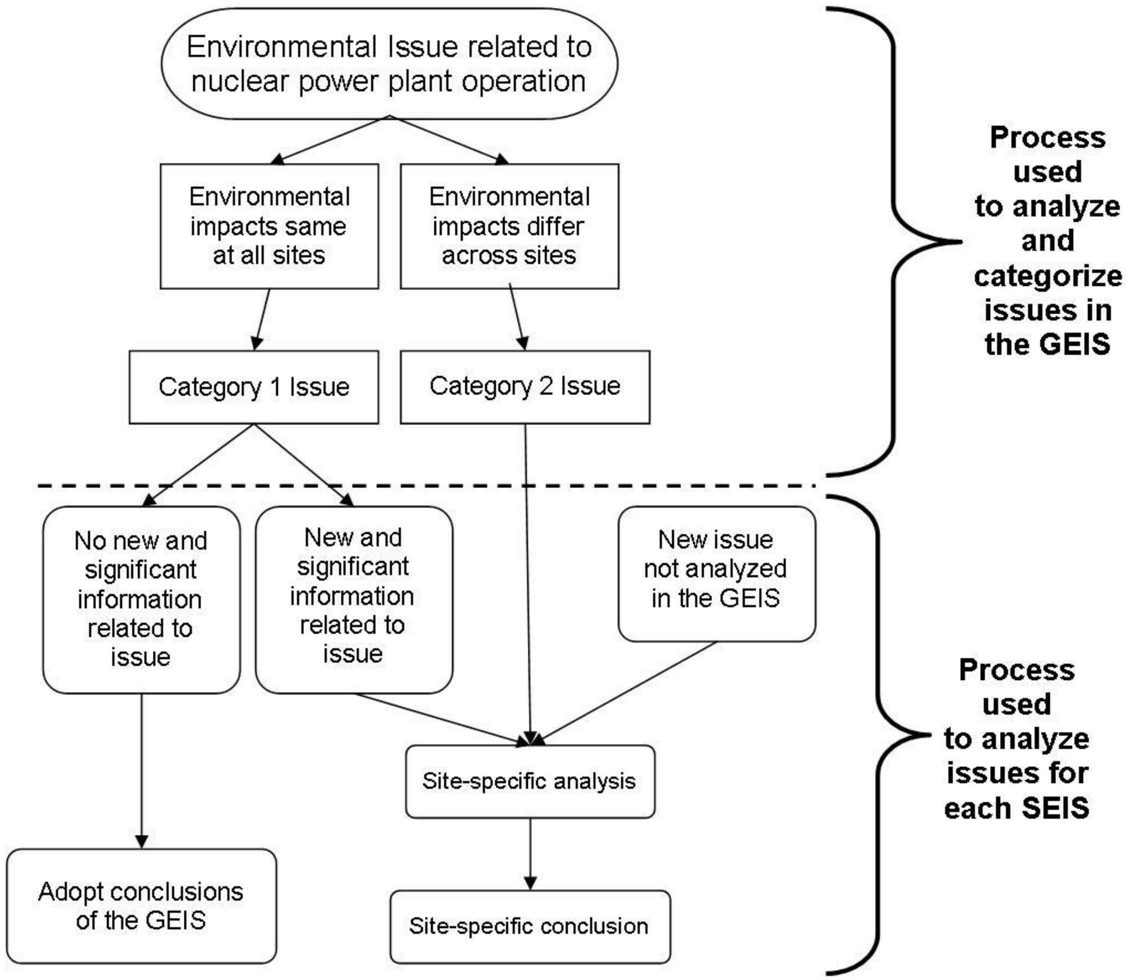
The LR GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted (Figure 1-2). Issues are assigned a Category 1 or Category 2 designation. As set forth in the LR GEIS, Category 1 issues are those that meet the following criteria:

- The environmental impacts associated with the issue have been determined to apply either to all nuclear power plants or, for some issues, to nuclear power plants having a specific type of cooling system or other specified plant or site characteristics.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts of spent nuclear fuel and from the fuel cycle and for high-level waste and spent fuel disposal and offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste).
- 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.

For generic issues (Category 1), no additional plant-specific analysis is required in the SEIS unless new and significant information is identified. The process for identifying new and significant information is presented in Chapter 3 of this SEIS. Plant-specific issues (Category 2) are those that do not meet one or more of the criteria of Category 1 issues; therefore, additional plant-specific review for these issues is required. The results of that plant-specific review are documented in the SEIS.

New information can be identified from many sources, including the applicant, the NRC, other agencies, or public comments. If a new issue is revealed, it is first analyzed to determine whether it is within the scope of the LR environmental evaluation. If the new issue is not addressed in the LR GEIS, the NRC staff would determine the significance of the issue and document the analysis in the SEIS.

New and significant information either identifies a significant environmental issue that was not covered in the LR GEIS, or was not considered in the analysis in the LR GEIS and leads to an impact finding that is different from the finding presented in the LR GEIS.



The LR GEIS evaluated 80 issues. Nuclear plant-specific analysis is required for 20 of those 80 issues.

Figure 1-2 Environmental Issues Evaluated for License Renewal of Nuclear Power Plants

1.6 Supplemental Environmental Impact Statement

This SEIS presents an analysis that considers the environmental effects of the continued operation of V.C. Summer during the SLR term, alternatives to subsequent license renewal, and mitigation measures for minimizing adverse environmental impacts. Chapter 2 of this SEIS includes an analysis of reasonable alternatives. Chapter 3 of this SEIS contains analysis and comparison of the potential environmental impacts from the proposed action and alternatives to the proposed action. Chapter 4 of this SEIS presents the preliminary recommendation of the NRC staff on whether the adverse environmental impacts of SLR for V.C. Summer are so great that preserving the option of SLR would be unreasonable. The final recommendation will be made after consideration of comments received on the draft SEIS during the public comment period.

The NRC staff based its preliminary recommendation on:

- the analysis and findings in the LR GEIS
- the ER submitted by the applicant
- the NRC staff’s consultation with Federal, State, Tribal, and local agencies

- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received from the scoping period

1.7 Decision to Be Supported by the SEIS

The decision to be supported by the SEIS is whether to renew the operating license for V.C. Summer for an additional 20 years. The regulation at 10 CFR 51.103(a)(5) (TN10253) specifies the NRC's decision standard as follows:

> In making a final decision on a license renewal action pursuant to Part 54 of this chapter, the Commission shall 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.

There are many factors that the NRC staff takes into consideration when deciding whether to renew the operating license of a nuclear power plant. The analysis of environmental impacts in this SEIS will provide the NRC's decision-makers (the Commission) with important environmental information for consideration in deciding whether to renew the V.C. Summer operating license.

1.8 Cooperating Agencies

During the scoping process, the NRC staff did not identify any Federal, State, Tribal, or local agencies as cooperating agencies for this SEIS.

1.9 Consultations

Certain Federal environmental statutes require Federal agencies to consult with other agencies, Tribes, and organizations before taking an action that may affect protected environmental resources, such as endangered species, habitat of managed fisheries, and historical and cultural resources. The Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 et seq. [TN1010]); the Magnuson–Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. 1801 et seq. [TN9966]); and the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq. [TN4157]), require Federal agencies to consult with applicable State and Federal agencies and groups before taking an action that may affect endangered species, fisheries, or historic and archaeological resources, respectively. Appendix C to this SEIS contains a list of the agencies and groups with which the NRC staff consulted.

1.10 Correspondence

During the course of the environmental review, the NRC staff corresponded with the applicant, as listed in Appendix D to this SEIS

1.11 Status of Compliance

Dominion is responsible for complying with all NRC regulations and other applicable Federal, State, and local requirements. Appendix F to the LR GEIS, "Laws, Regulations, and Other Requirements," describes some of the major applicable Federal statutes (NRC 2024-TN10161). Numerous permits and licenses are issued by Federal, State, and local authorities for activities at V.C. Summer. Appendix B to this SEIS contains further information regarding Dominion's status of compliance.

1.12 Related State and Federal Activities

The NRC staff reviewed the possibility that activities (projects) of other Federal agencies might impact the renewal of the operating license for V.C. Summer. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparing this SEIS. The NRC staff has determined that there are no Federal projects that would make it necessary for another Federal agency to become a cooperating agency in the preparation of this SEIS (10 CFR 51.10(b)(2) [TN10253]). Projects and actions considered in the cumulative impacts analysis are provided in Section 3.16 of this SEIS.

The NRC is required under Section 102(2)(C) of NEPA (TN661) to consult with and obtain comments from any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EISs. For example, during the preparation of this SEIS, the NRC consulted with the South Carolina Office of Historic Preservation, among others. Appendix C to this SEIS provides a list of key consultation correspondence.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Although the NRC's decision-making authority in SLR is limited to deciding whether to renew a nuclear power plant's operating license, the agency's implementation of NEPA (42 U.S.C. 4321 et seq.-TN661) requires consideration of the environmental impacts of that action, as well as the impacts of reasonable alternatives to renewing a nuclear power plant's operating license. Although the ultimate decision about which alternative (or proposed action) to implement falls on the operator, State, or other non-NRC Federal officials, comparing the impacts of renewing the operating license to the environmental impacts of alternatives allows the NRC to determine whether the environmental impacts of an SLR are so great that preserving the option of an SLR for energy-planning decision-makers would be unreasonable (10 CFR 51.95(c)(4)) (TN10253).

Energy-planning decision-makers and power plant owners ultimately decide whether the nuclear power plant will continue to operate, and economic and environmental considerations play roles in this decision. In general, the NRC's responsibility is to ensure the safe operation of nuclear power facilities, not to formulate energy policy or promote nuclear power, or encourage or discourage the development of alternative power generation. The NRC does not engage in energy-planning decisions, and it makes no judgment as to which replacement power alternatives would be the most likely alternative selected in any given case.

This chapter of the SEIS describes (1) the V.C. Summer site and its operation, (2) the proposed action (subsequent renewal of the V.C. Summer operating license), (3) reasonable alternatives to the proposed action (including the no-action alternative), and (4) alternatives eliminated from detailed study.

2.1 Description of Nuclear Power Plant Facility and Operation

V.C. Summer is located on the southern shore of the Monticello Reservoir in Fairfield County, South Carolina (Figure 2-1). The V.C. Summer site is approximately 3 miles (mi) (4.8 kilometers [km]) northwest of Jenkinsville, the nearest community, and 14 mi (22.5 km) southwest of the county seat of Winnsboro (Figure 2-2). The nearest population center and State capital is Columbia, South Carolina, which is located approximately 26 mi (41.8 km) southeast of V.C. Summer (Figure 2-3). The V.C. Summer site occupies approximately 2,200 acres (ac) (890 hectares [ha]) and includes southern portions of the Monticello Reservoir and the Fairfield Pumped Storage Facility.

The principal structures at V.C. Summer are the nuclear island structures within the protected area fence (i.e., the Reactor Building, Auxiliary Building, Fuel Handling Building, Intermediate Building, Control Building, Service Building, Turbine Building, Diesel Generator Building, independent spent fuel storage installation [ISFSI], Service Water Intake Structure, and Circulating Water Intake Structure) and the potable water supply (e.g., Offsite Water Supply) (Dominion 2023-TN10387).

Figure 2-1 Virgil C. Summer Nuclear Station Plant Layout. Source: Dominion 2023-TN10387.

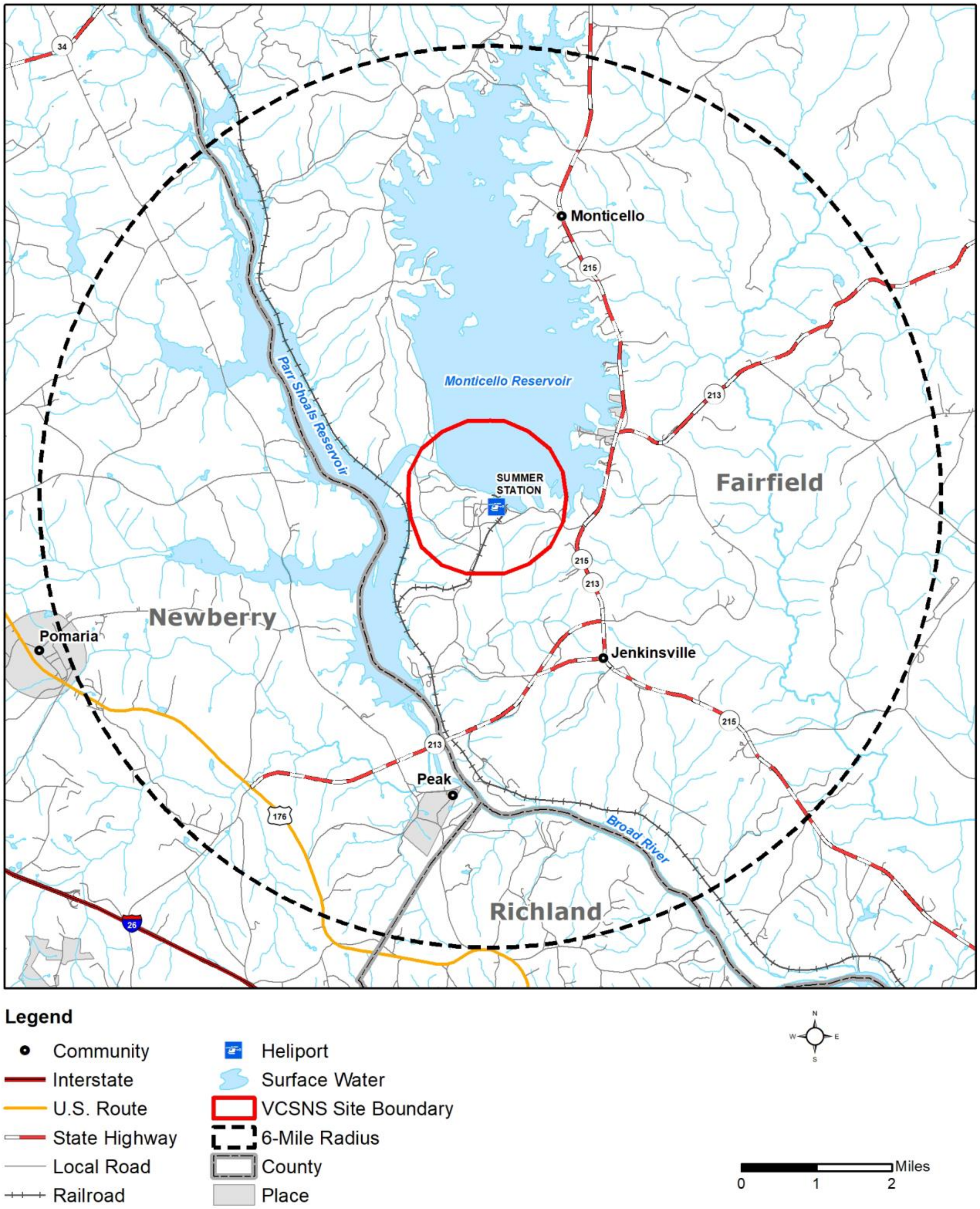


Figure 2-2 Virgil C. Summer Nuclear Station 6 mi (10 km) Radius Map.
Source: Dominion 2023-TN10387.

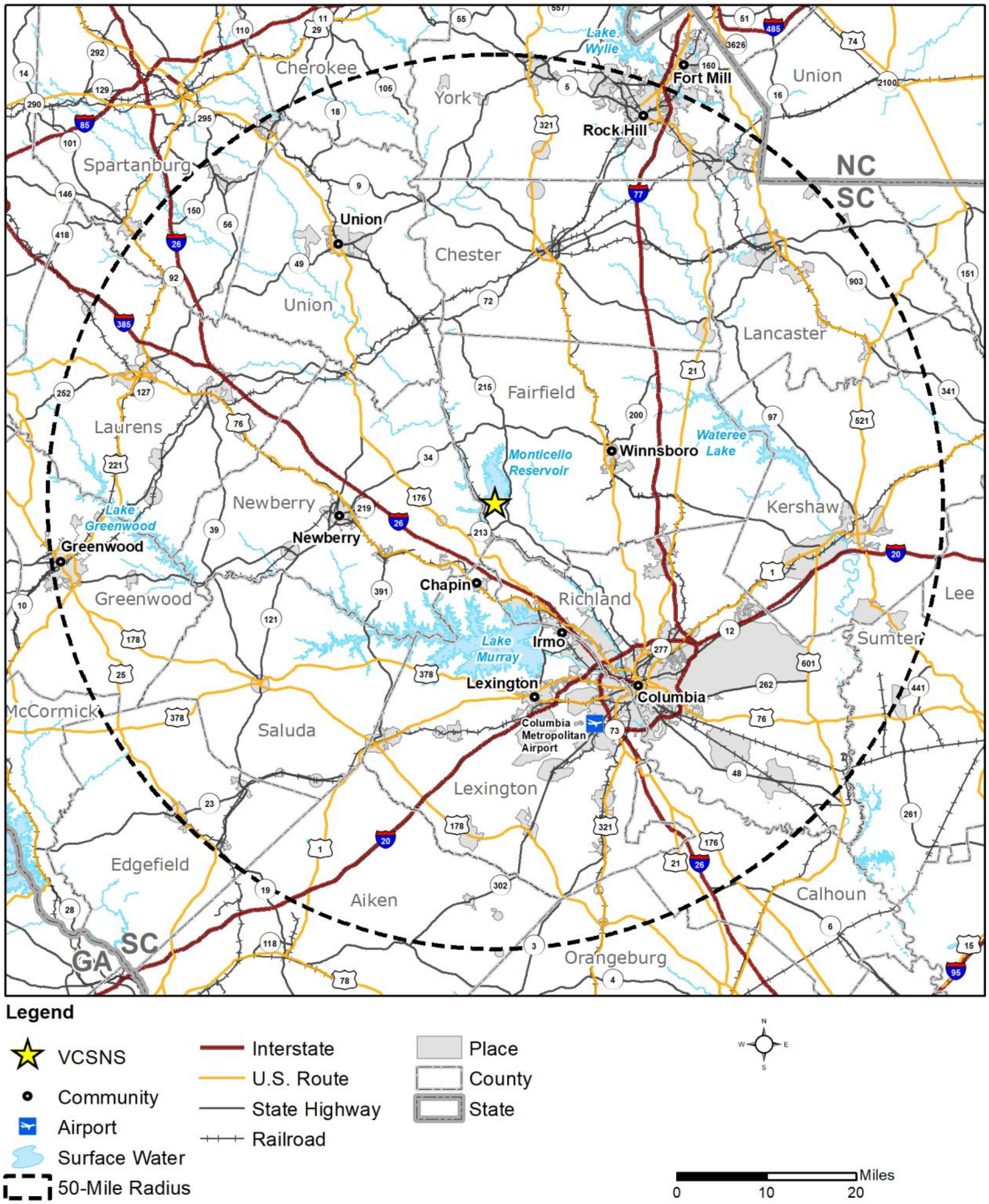


Figure 2-3 Virgil C. Summer Nuclear Station 50 mi (80 km) Radius Map.
Source: Dominion 2023-TN10387.

2.1.1 External Appearance and Setting

The domed reactor building is the tallest structure at V.C. Summer. It is surrounded by the auxiliary buildings, control building, turbine building, and diesel generator building. There are facilities for fuel handling and related support shops, warehouses, and storage. Service water pond dams extend into Monticello Reservoir to the east, as do the discharge bay and canal. The intake structure is located north of the station. A wastewater treatment area and the substation are located to the south. The Fairfield Pumped Storage Facility is about ½ mi (0.8 km) to the west. The entire nuclear station and support facilities are not easily visible from adjacent communities because of the topography and forested cover. The station can be viewed from South Carolina Highway 215 (SC 215) and lands along the eastern shore of Monticello Reservoir.

2.1.2 Reactor and Containment Systems

V.C. Summer is a single-unit plant with a domed concrete containment building. The station includes a pressurized light-water reactor nuclear steam supply system designed and furnished by Westinghouse Electric Company and a turbine generator manufactured by General Electric Corporation. The unit was designed for an output of 2,775 megawatts thermal (MWt) with corresponding net electrical output of approximately 900 megawatts electric (MWe). It achieved initial criticality in October 1982 and began commercial operation in January 1983 (Dominion 2023-TN10387).

In 1996, then-operator South Carolina Electric and Gas (SCE&G) sought approval from the NRC to upgrade performance to a core power output of 2900 MWt with a net electrical output of 945 MWe. In August 1997, instrument changes improving measurement accuracy resulted in a 9 megawatt (MW) increase in indicated electrical power output, to 954 MWe. In the spring of 1999, a more efficient high-pressure turbine rotor increased the net electrical output to 966 MWe (Dominion 2023-TN10387).

2.1.3 Cooling and Auxiliary Water Systems

Section 2.1.3 of NUREG-1437, Supplement 15, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Virgil C. Summer Nuclear Station,* describes the operation of the nuclear power plant’s cooling and auxiliary water systems, including the withdrawal of water from the Monticello Reservoir and the return flow of heated water to the reservoir (NRC 2004-TN7262). Section E2.2.3 of Dominion's ER, submitted as part of its SLR application, provides an expanded description of V.C. Summer’s cooling and auxiliary water systems, including the circulating water system, turbine building closed-cycle cooling water system, service water system and ultimate heat sink, component cooling water system, demineralized water makeup system, condensate storage facilities, and fire protection and domestic water supply systems (Dominion 2023-TN10387). The NRC staff incorporates this information here by reference and summarizes key information in the following subsections (Dominion 2023-TN10387).

V.C. Summer operates as a once-through cooling plant that withdraws from, and discharges to, a cooling pond, Monticello Reservoir. Monticello Reservoir was built to supply cooling water to the station and to provide an upper reservoir for the Fairfield Pumped Storage Facility located on Parr Reservoir.

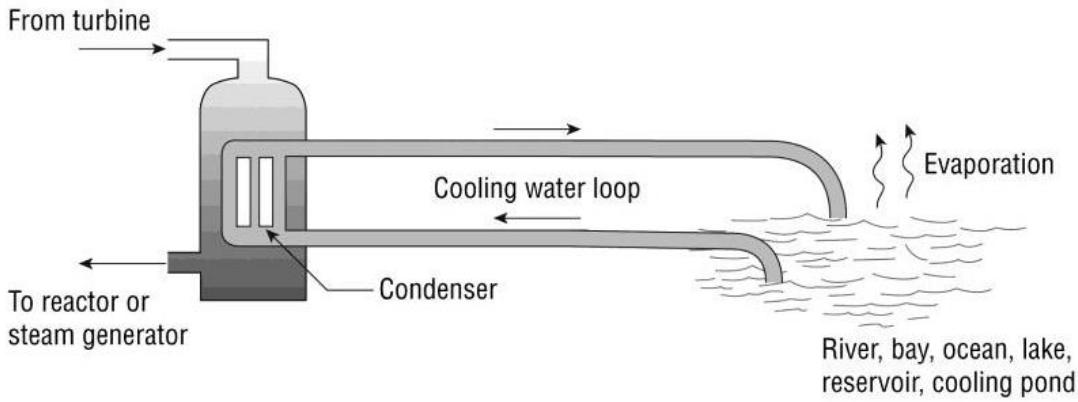


Figure 2-4 Schematic Diagram of Once-Through Cooling Water System with Reservoir Water in a Nuclear Power Plant. Source: LR GEIS (NRC 2024-TN10161).

2.1.3.1 Cooling Water Intake and Discharge

The main cooling system at V.C. Summer is the circulating water system. It is designed to remove 6.67 × 10^9 British thermal units per hour (1.95 x 10^3 MWh) of heat from the main and auxiliary condensers, as well as from the turbine auxiliaries. Cooling water is drawn from the plant's cooling pond, Monticello Reservoir, at a rate of approximately 769 million gallons per day (1,190 cubic feet per second [cfs]), passed through the condensers once, and ultimately returned to Monticello Reservoir. The intake structure, located along the south shoreline of the Reservoir, has three pump bays, each with two entrances. Each entrance is 13 feet wide and 25.5 feet high, extending from the bottom of the Pump House to the bottom of the skimmer wall. The entrances are each equipped with vertical traveling screens (mesh size 0.4 × 3.5 inches) and two sets of trash racks of conventional design (Dominion 2023-TN10387).

2.1.3.2 Turbine Building Closed-Cycle Cooling Water System

The Turbine Building closed-cycle cooling water system provides cooling water to components associated with the steam and power conversion system. The source of water is Monticello Reservoir via the raw water system. System components include a wet surface industrial cooling tower, two 100-percent-capacity tower spray pumps, four cooling tower fans, two 100-percent-capacity closed-cycle cooling pumps, two 100-percent-capacity closed-cycle cooling booster pumps, various equipment coolers, and a head tank. Chemical injection and blowdown are provided to maintain the quality of the spray water. The blowdown is directed to the Monticello Reservoir through the circulating water discharge canal. Under normal operation, one of the two cooling water pumps circulates treated water through the cooling tower coils, transferring the heat removed from the various components to the spray water, and then to the atmosphere by evaporation of the spray water in the air stream produced by cooling tower fans (Dominion 2023-TN10387).

2.1.3.3 Potable and Sanitary Water Systems

V.C. Summer pumps and treats raw water from the Monticello Reservoir at the offsite water treatment facility (OWS), producing both potable water for use at V.C. Summer, and filter process water for Unit 1 which is not connected to a municipal system. The OWS is located on site along the plant's access road. The facility has separate treatment trains for the potable water supply and filter process water but shares the same raw water intake and pumping system and waste stream discharge system. Treatment processes for sanitary water are by flocculation and ultrafiltration. Treatment for the potable water consists of pretreatment by flocculation, followed by ultrafiltration and reverse osmosis membranes, and then remineralization and potential of hydrogen (pH) control treatment. The process water handling and disposal is through gravity in a retention basin with the supernatant discharged to Monticello Reservoir, and the accumulated solids in the basin are sent offsite for disposal, as necessary. Discharges are made back to Monticello Reservoir at the OWS Discharge located approximately 600 feet north of the OWS under National Pollutant Discharge Elimination System (NPDES) General Permit for Water Treatment Plant Dischargers, SCG646000 (Dominion 2023-TN10387).

2.1.3.4 Fire Protection System

The water for portions of V.C. Summer's fire protection system is supplied by an underground yard fire main loop installed around V.C. Summer. The supply source of the water in the system is the Monticello Reservoir. The fire service piping is separate from most domestic and sanitary water service piping so that the fire main loop is independent from these other water services and does not impact, and is not impacted, by these other systems. The 100-percent-capacity electric fire pump, or 100-percent-capacity diesel engine driven fire pump, is designed to provide sufficient flow and pressure to the largest fire protection system demand plus 1,000 gallons per minute (gpm) for hose streams for some areas of V.C. Summer (Dominion 2023-TN10387).

2.1.4 Radioactive Waste Management Systems

The NRC licenses nuclear power plants with the expectation that they will release a limited amount of radioactive material to both the air and water during normal operations.

V.C. Summer uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of nuclear power plant operations. Section E2.2.6 of the Dominion ER, submitted as part of its SLR application, provides an expanded description of V.C. Summer's radioactive waste management systems (2023-TN10387: Appendix E, Section E2.2.6, E-2-15 to E-2-22). The NRC staff discusses the radioactive waste management systems in Section 3.13.1 of this SEIS.

2.1.5 Nonradioactive Waste Management Systems

V.C. Summer generates nonradioactive waste as a result of nuclear power plant maintenance, cleaning, and operational processes. V.C. Summer manages nonradioactive wastes in accordance with applicable Federal and State regulations, as implemented through its corporate procedures. Section E2.2.7 of the Dominion ER, submitted as part of its SLR application, provides an expanded description of V.C. Summer's nonradioactive waste management systems (2023-TN10387: Appendix E, Section E2.2.7, p. E-2-22). The NRC staff discusses the nonradioactive waste management systems in Section 3.13.2 of this SEIS.

2.1.6 Utility and Transportation Infrastructure

The utility and transportation infrastructure at nuclear power plants typically interfaces with public infrastructure systems available in the region. Such infrastructure includes utilities, such as suppliers of electricity, fuel, and water, as well as roads and railroads that provide access to the site. The following sections briefly describe the existing utility and transportation infrastructure at V.C. Summer. Plant-specific information in this section is primarily derived from Dominion's ER (2023-TN10387), unless otherwise cited.

2.1.6.1 Electricity

Nuclear power plants generate electricity for other users; however, they also use electricity to operate. Offsite power sources provide power to engineered safety features and emergency equipment in the event of a malfunction or interruption of power generation at the nuclear power plant. Planned independent backup power sources provide power, if power from both the nuclear power plant itself and offsite power sources is interrupted.

2.1.6.2 Fuel

V.C. Summer utilizes low-enriched uranium dioxide fuel with enrichments below 5 percent by weight of uranium-235, with peak fuel-rod burn-up levels less than 62,000 megawatt-days per metric ton of uranium. The reactor is refueled on an 18-month cycle with approximately 30 percent of the fuel being replaced during each refueling outage. V.C. Summer stores spent fuel in the spent fuel pool located in the reactor building, or in dry cask storage containers at the onsite ISFSI (Dominion 2023-TN10387).

2.1.6.3 Water

Surface water withdrawn from Monticello Reservoir is the sole source of water for V.C. Summer operations. In this SEIS, Section 2.1.3 describes the V.C. Summer industrial water systems.

2.1.6.4 Transportation Systems

Nuclear power plants are served by controlled access roads that are connected to U.S. highways and Interstate highways. In addition to roads, many nuclear power plants also have railroad connections for moving heavy equipment and other materials. Nuclear power plants located on navigable waters may have facilities to receive and ship loads on barges. Section 3.10.6 of this SEIS describes the V.C. Summer transportation systems.

2.1.6.5 Power Transmission Systems

For LR actions, the NRC staff evaluates, as part of the proposed action, the continued operation of those power transmission lines that connect to the substation where it feeds electricity into the regional power distribution system. The transmission lines that are in scope for the V.C. Summer SLR environmental review include the lines from the Turbine Building to the 230 kilovolt (kV) switchyard, as well as a 115 kV line that extends to the Parr Generating Complex. The area between the Turbine Building and the 230 kV switchyard is within the site's exclusion area, as shown in Figure E2.2-1 of the ER (Dominion 2023-TN10387 and Dominion 2024-TN10391), and is therefore, not publicly accessible. The Parr 115 kV transmission corridor continues past the site boundary of the V.C. Summer plant site. This transmission corridor access is controlled by Dominion, so although it is outside the site boundary, it is not accessible to the public (Dominion 2024-TN10391). The NRC staff also considers, as part of the proposed action, environmental impacts from the continued operation of the transmission lines that supply outside power to the nuclear plant from the grid. Section 3.11.4 of this SEIS describes these transmission lines.

2.1.7 Nuclear Power Plant Operations and Maintenance

Maintenance activities conducted at V.C. Summer include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements (Dominion 2023-TN10387). These activities include in-service inspections of safety-related structures, systems, and components; quality assurance and fire protection programs; and radioactive and nonradioactive water chemistry monitoring.

Dominion implements additional programs to meet technical specification surveillance requirements and in response to NRC generic communications. Such additional programs include various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components. Certain program activities are performed during the operation of the units, whereas others are performed during scheduled refueling outages (Dominion 2023-TN10387).

2.2 Proposed Action

As stated in Section 1.1 of this SEIS, the NRC's Federal action is to determine whether to renew the V.C. Summer operating license for an additional 20 years. Section 2.2.1 of this SEIS describes normal nuclear power plant operations during the SLR term.

2.2.1 Nuclear Power Plant Operations during the Subsequent License Renewal Term

Nuclear power plant operation activities during the SLR term would be the same as, or similar to, those occurring during the current license term. Section 2.1 of this SEIS describes the general types of activities carried out during nuclear power plant operations. These include the following:

- reactor operation
- waste management
- cooling water intake and discharge
- nuclear fuel receipt and storage
- spent fuel storage security
- office and clerical work; possible laboratory analysis
- surveillance, monitoring, and maintenance
- refueling and other outages

As part of its SLR application, Dominion submitted an ER stating that V.C. Summer will continue to operate during the SLR term in the same manner as it would during the current license term except for additional aging management programs, as necessary (2023-TN10387). Such programs would address structure and component aging in accordance with 10 CFR Part 54 (TN4878), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

2.2.2 Refurbishment and Other Activities Associated with Subsequent License Renewal

Refurbishment activities include replacement and repair of major structures, systems, and components. Most major refurbishment activities are actions that would typically take place only once in the life of a nuclear power plant, if at all. Refurbishment activities may have an impact on the environment beyond those that occur during normal operations and may require evaluation, depending on the type of action and the nuclear power plant-specific design.

In preparation for its SLR application, Dominion evaluated major structures, systems, and components in accordance with 10 CFR 54.21 (TN4878), “Contents of Application—Technical Information,” to identify major refurbishment activities necessary for the continued operation of V.C. Summer during the proposed 20-year period of extended operation (2023-TN10387). Dominion did not identify any major refurbishment or replacement activities necessary for the continued operation of V.C. Summer beyond the end of the current renewed operating license period (2023-TN10387).

2.2.3 Termination of Nuclear Power Plant Operations and Decommissioning after the License Renewal Term

NUREG-0586, Supplement 1, Volumes 1 and 2, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors* (the decommissioning GEIS) (NRC 2002-TN665), describes the environmental impacts of decommissioning. The majority of nuclear power plant operation activities would cease with reactor shutdown. Some activities (e.g., security and oversight of spent nuclear fuel) would remain unchanged, whereas others (e.g., waste management, administrative work, laboratory analysis, surveillance, monitoring, and maintenance) would continue at reduced or altered levels. Systems dedicated to reactor operations would cease. However, if these systems are not removed from the site after reactor shutdown, their physical presence may continue to impact the environment. Impacts associated with dedicated systems that remain in place, or with shared systems that continue to operate at normal capacities, could remain unchanged.

Decommissioning will occur whether V.C. Summer is shut down at the end of its current renewed operating license or at the end of a SLR period of extended operation 20 years later.

2.3 Alternatives

As stated above, NEPA requires the NRC to consider reasonable alternatives to the proposed action of renewing the V.C. Summer operating license. For a replacement power alternative to be considered reasonable, it must be either (1) commercially viable on a utility scale and operational before the reactor’s operating license expires, or (2) expected to become commercially viable on a utility scale and operational before the reactor’s operating license expires.

The first alternative to the proposed action of renewing the V.C. Summer operating license is for the NRC to not renew the license. This is called the no-action alternative and is described in Section 2.3.1 of this SEIS. In addition to the no-action alternative, this section identifies four reasonable replacement power alternatives for detailed study. As described in Section 2.3.2 of this SEIS, these alternatives would seek to replace V.C. Summer’s generating capacity by meeting the region’s energy needs through other means or sources.

2.3.1 No-Action Alternative

At some point, all operating nuclear power plants will permanently cease operations and undergo decommissioning. Under the no-action alternative, the NRC would not renew the V.C. Summer operating license, and the reactor unit would be shut down on or before the expiration of the current renewed license. The LR GEIS (NRC 2024-TN10161) describes the environmental impacts that arise directly from permanent plant shutdown. The NRC staff expects the impacts to be relatively similar, whether they occur at the end of the current renewed license term (i.e., after 60 years of operation) or at the end of a subsequent renewed license term (i.e., after 80 or more years of operation).

After permanent reactor shutdown, nuclear power plant operators will initiate decommissioning in accordance with 10 CFR 50.82, “Termination of License” (TN249). The decommissioning GEIS (NUREG-0586) (NRC 2002-TN665) describes the environmental impacts from decommissioning a nuclear power plant and related activities. The analysis in the decommissioning GEIS bounds the environmental impacts of decommissioning when Dominion terminates reactor operations at V.C. Summer. A licensee in decommissioning must assess in its post-shutdown decommissioning activities report submitted to the NRC, whether there are planned decommissioning activities with reasonably foreseeable environmental impacts that are not bounded in previous EISs. Section 2.2.3 of this SEIS describes the incremental environmental impacts of SLR on decommissioning activities.

Termination of reactor operations would result in the total cessation of electrical power production at V.C. Summer. Unlike the replacement power alternatives described in Section 2.3.2 of this SEIS, the no-action alternative does not meet the purpose and need of the proposed action, as described in Section 2.3.1, because the no-action alternative does not provide a means of delivering baseload power to meet future electric system needs. Assuming that a need currently exists for the electrical power generated by V.C. Summer, the no-action alternative would likely create a need for replacement power.

2.3.2 Replacement Power Alternatives

The following sections describe replacement power alternatives. The potential environmental impacts of these alternatives are described in Chapter 3 of this SEIS. Although the NRC’s authority only extends to deciding whether to renew the V.C. Summer operating license, replacement power alternatives represent possible options that energy-planning decision-makers may need to consider if the V.C. Summer operating license is not renewed.

In evaluating alternatives, the NRC considered energy-generating technologies in commercial operation, as well as technologies likely to be commercially available by the time the current V.C. Summer renewed operating license expires. Because energy-generating technologies continually evolve in capability and cost, and because regulatory structures change to either promote or impede the development of certain technologies, this evaluation considered which replacement power alternatives would be available and commercially viable when the V.C. Summer current renewed operating license expires.

The Dominion ER describes possible replacement power alternatives. In addition, information from the following sources were considered in the replacement power analysis:

- U.S. Department of Energy (DOE), U.S. Energy Information Administration (EIA)
- other DOE offices
- U.S. Environmental Protection Agency (EPA)
- other Federal agency and national laboratory publications
- industry sources and publications

In total, the NRC staff considered 17 replacement power alternatives to the proposed agency action and eliminated 13 of these from the detailed study, leaving four replacement power alternatives. The four replacement power alternatives and 13 eliminated alternatives include the following:

- Alternatives to the proposed agency action:
  - natural gas
  - new nuclear (small modular reactor)
  - natural gas and solar combination
  - new nuclear and solar combination
- Alternatives eliminated from detailed study:
  - solar power
  - wind power
  - biomass power
  - hydroelectric power
  - geothermal power
  - ocean wave, current, and tide energy
  - municipal solid waste-fired power
  - petroleum-fired power
  - coal-fired power
  - fuel cells
  - purchased power
  - delayed retirement of other power-producing facilities
  - demand-side management/energy conservation/energy efficiency

Section 2.4 briefly describes the 13 alternatives eliminated from detailed study and provides the basis for each elimination. Section 2.5 of this SEIS summarizes the key characteristics of the replacement power alternatives. The NRC assigns a significance level of SMALL, MODERATE, or LARGE for most plant-specific issues. For ecological resources subject to the ESA (16 U.S.C. 1531 et seq.-TN1010) and the Magnuson–Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. 1801 et seq.-TN9966), and for historic and cultural resources subject to the National Historic Preservation Action of 1966, as amended (NHPA) (54 U.S.C. 300101 et seq.-TN4157), the impact significance determination language is specific to the authorizing legislation. The order in which this SEIS presents the different alternatives does not imply increasing or decreasing level of impact, nor does the order imply that an energy planning decision-maker would be more (or less) likely to select any given alternative.

2.3.2.1 Natural Gas

The proposed natural gas alternative would involve the construction and operation of a standalone natural gas-fired combined-cycle (NGCC) power plant, comprised of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. A design capacity of 1,110 MWe (gross) of electricity generation would be needed to replace the 966 MWe of power currently generated by V.C. Summer, based on a natural gas capacity factor of 87 percent (EIA 2022-TN10537). The standalone NGCC power plant would have closed-cycle cooling using mechanical draft cooling tower (MDCTs).

The NGCC plant would require approximately 50 ac (20 ha) at the abandoned V.C. Summer Units 2 and 3 project site. Existing transmission infrastructure would be used, including an existing onsite natural gas transmission pipeline.

2.3.2.2 New Nuclear Alternative (Small Modular Reactor)

The applicant proposed a new nuclear alternative that would involve the installation and operation of two multiunit NuScale small modular reactor (SMR) designs yielding up to 1,768 MWe. Because each NuScale SMR generates approximately 884 MWe, two SMRs would be needed to replace the 966 MWe of power currently generated by V.C. Summer. The SMR plants would have closed-cycle cooling using MDCTs.

The SMRs would require approximately 130 ac (50 ha) at the abandoned V.C. Summer Units 2 and 3 project site. Existing transmission infrastructure would be used.

2.3.2.3 Natural Gas and Solar Combination Alternative

The applicant proposed natural gas and solar combination alternative would involve the construction and operation of all the following structures:

- a 700 MWe (gross) NGCC plant at the abandoned V.C. Summer Units 2 and 3 project site
- 60 megawatt (MW) solar installation with battery storage at V.C. Summer Units 2 and 3 project site
- Three 100-MW solar installations with battery storage located offsite in South Carolina

The NGCC power plant would require approximately 50 ac (20 ha) and the onsite solar installation would require over 500 ac (approximately 200 ha) at the abandoned V.C. Summer Units 2 and 3 project site. Existing transmission infrastructure would be used, including an existing onsite natural gas transmission pipeline.

Offsite solar installations would require approximately 3,200 ac (1,300 ha), and up to 25 mi (40 km) of new 345 kV transmission lines would be needed to support each offsite solar installation, impacting approximately 1,400 ac (600 ha) of land.

2.3.2.4 New Nuclear and Solar Combination Alternative

The new nuclear and solar combination proposed alternative would involve the installation and operation of a single multiunit NuScale SMR design yielding up to 884 MWe, requiring less than the approximately 130 ac (50 ha) needed for the standalone SMR alternative at the abandoned V.C. Summer Units 2 and 3 project site. The SMR plant would have closed-cycle cooling system using MDCTs. In addition, an 82-MW solar installation with battery storage would require approximately 700 ac (280 ha) at the V.C. Summer Units 2 and 3 site.

2.4 Alternatives Considered but Eliminated from Detailed Review

The NRC staff eliminated 13 alternatives from detailed study due to resource availability and commercial or regulatory limitations. Many of these limitations will likely still exist when the current renewed V.C. Summer operating license expires. This section briefly describes these 13 alternatives as well as the reasons why they were eliminated from detailed study.

2.4.1 Solar Power

Solar power, including photovoltaic and concentrating solar power technologies, generates power from sunlight. Solar photovoltaic components convert sunlight directly into electricity using solar cells made from silicon or cadmium telluride. Concentrating solar power uses heat from the sun to boil water and produce steam. Steam drives a turbine connected to a generator to produce electricity (NREL Undated-TN10852).

Solar generators are considered an intermittent electrical power resource because their availability depends on exposure to the sun, also known as solar insolation. Further, to be viable, a utility-scale solar power alternative must replace the amount of electrical power that V.C. Summer currently provides. Assuming a capacity factor of 25 percent (DOE/EIA 2023-TN8821), approximately 3,864 MW of additional solar energy capacity would be needed to replace the 966 MW of electricity generated by V.C. Summer. Approximately 34,000 ac (13,759 ha) of land may be needed to house solar power installations using Dominion's estimate of 8.9 ac (3.6 ha) of land per megawatt.

It is unlikely that V.C. Summer's generating capacity could be replaced by a single type of intermittent electricity generation, including a non-baseload resource such as utility-scale solar. However, a combination of energy sources, including sources analyzed in Section 2.3.2 of this SEIS, could complement each other and reduce issues such as the intermittency of utility-scale solar.

Alternatives that include utility-scale solar power in combination with other energy generating technologies are described in Sections 2.3.2 of this SEIS and analyzed in detail in Chapter 3. The types of impacts of a standalone solar energy alternative would be similar to the combination alternative, although the magnitude of such impacts may differ based on the amount of solar energy capacity to be constructed. A standalone baseload solar power alternative was considered but eliminated from detailed analysis because of the intermittency of solar power and its inability to provide reliable baseload power. However, a limited amount of solar power generation, in combination with other energy generating technologies, could be a reasonable alternative to V.C. Summer's SLR, as explained in Section 2.3.2 of this SEIS.

2.4.2 Wind Power

As is the case with other renewable energy sources, the feasibility of wind energy providing baseload power depends on the location (relative to electricity users), value, accessibility, and constancy of the resource. Wind energy must be converted to electricity at or near the point where it is used, and there are limited energy storage opportunities available to overcome the intermittency and variability of wind resources.

The American Clean Power Association reports a total of more than 122,000 MW of installed wind energy capacity nationwide as of December 31, 2020 (NREL Undated-TN10853). To be considered a reasonable replacement power alternative to V.C. Summer's SLR, a wind power alternative must replace the amount of electrical power that V.C. Summer provides. Assuming a capacity factor of 41.4 percent for onshore wind facilities (DOE 2021-TN9562), land-based wind energy facilities would need to generate approximately 2,333 MW of electricity to replace 966 MWe of V.C. Summer's generating capacity. Using DOE metrics of 0.74 ac/MW for permanent structures, 2.47 ac/MW for construction footprint, and 85 ac/MW for wind farm boundaries, onshore wind farms could require over 200,000 ac (80,937 ha) of land (DOE 2015-TN8757). Additionally, because wind is an intermittent energy source, energy storage would be needed, increasing land requirements.

Furthermore, South Carolina does not have substantial onshore wind energy resources. While offshore wind potential exists, no installed utility-scale wind generating capacity currently exists (DOE/EIA 2024-TN10525), nor is it reasonably foreseeable that any such wind resources will be installed. A wind energy alternative is not a reasonable alternative to V.C. Summer's SLR, and was eliminated from detailed analysis both as a standalone baseload power alternative and as part of a combination alternative because it is an intermittent energy source and because there is no current or reasonably foreseeable future capacity for wind to generate baseload power.

2.4.3 Biomass Power

Biomass resources used for biomass fuel-fired power generation include agricultural residues, animal manure, wood wastes from forestry and industry, residues from food and paper industries, municipal green wastes, dedicated energy crops, and methane from landfills (IEA 2007-TN8436). Using biomass fuel-fired generation for baseload power depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources. For this analysis, biomass fuel would be combusted for power generation in the electricity sector.

As of 2022, biomass in South Carolina powered approximately 2 percent of total State electricity, most of that from wood and wood waste (DOE/EIA 2024-TN10525). For utility-scale biomass fuel-fired electricity generation, technologies used for biomass energy conversion would be similar to the technology used in fossil fuel-fired power plants, including the direct combustion of biomass fuel in a boiler to produce steam (NRC 2024-TN10161). Accordingly, biomass generation is considered a carbon-emitting technology.

Biomass energy generation is generally more cost-effective when co-located with coal-fired power plants (IEA 2007-TN8436). However, most biomass fuel-fired power plants generally only reach capacities of 50 MWe, which means that replacing V.C. Summer’s generating capacity, using only biomass fuel, would require the construction of 19 new power plants, which is unlikely to occur in the foreseeable future.

Biomass fuel-fired generation is not a reasonable alternative to V.C. Summer SLR because there is no current or reasonably foreseeable future capacity for biomass fuel to generate baseload power.

2.4.4 Hydroelectric Power

As of 2020, there were approximately 2,300 operating hydroelectric facilities operate in the United States (DOE Undated-TN7701). Hydropower technologies capture the energy of flowing water and direct it to turbines and generators to produce electricity (NRC 2024-TN10161). There are three variants of hydroelectric power generation: (1) run of the river (diversion) facilities that redirect the natural flow of a river, stream, or canal through a hydroelectric power facility; (2) store and release facilities that block the flow of the river by using dams that cause water to accumulate in an upstream reservoir; and (3) pumped storage facilities that use electricity from other power sources to pump water to higher elevations during off-peak hours to be released during peak load periods to generate additional electricity (DOE Undated-TN10854).

Although the EIA projects that hydropower will remain a leading source of renewable power generation in the United States through 2040, there is little expected growth in large-scale hydropower capacity (DOE/EIA 2013-TN2590). The potential construction of large new hydropower facilities has diminished because of public concern over flooding, habitat alteration and loss, and the impact on natural rivers (NRC 2024-TN10161).

Given the projected lack of growth in hydroelectric power, the competing demands for water resources, and public opposition to the environmental impacts from the construction of large hydroelectric power facilities, hydroelectric power is not a reasonable alternative to V.C. Summer SLR.

2.4.5 Geothermal Power

Geothermal energy generating technologies extract heat from geologic formations to produce steam to drive steam turbine generators. Electricity production from geothermal energy has demonstrated 95 percent or greater capacity factors, making geothermal energy a potential source of baseload electric power. However, the feasibility of geothermal power generation to provide baseload power depends on the regional quality and accessibility of geothermal resources. Utility-scale power generation requires geothermal reservoirs with a temperature above 200°F (93°C). Such utility-scale geothermal resources are concentrated in the western United States, specifically in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, and most assessments of geothermal power generation resources have been conducted in these States (DOE Undated-TN7698; USGS 2008-TN7697). There is currently no utility-scale geothermal power production in the V.C. Summer region. Given its low potential, geothermal power generation is not a reasonable alternative to V.C. Summer SLR.

2.4.6 Wave and Ocean Energy

Ocean waves, currents, and tides are generally predictable and reliable, making them attractive candidates for potential renewable energy generation. Four major technologies can be used to harness wave energy: (1) terminator devices that range from 500 kilowatts (kW) to 2 MW, (2) attenuators, (3) point absorbers, and (4) overtopping devices (BOEM Undated-TN7696). Point absorbers and attenuators use floating buoys to convert wave motion into mechanical energy, driving generators to produce electricity. Overtopping devices trap a portion of a wave at a higher elevation than the sea surface; waves enter a tube and compress air that is then used to drive a generator producing electricity (NRC 2024-TN10161). Some of these technologies are undergoing demonstration testing at commercial scales, but none are currently used to provide baseload power (BOEM Undated-TN7696). In the United States, there are currently several projects licensed or seeking permits, the largest of which is 20 MW (Duke Energy 2021-TN8897).

While South Carolina borders the Atlantic Ocean, application of wave energy technologies would likely not be viable, as wave and ocean energy-generation technologies are still in their infancy and currently lack commercial application (EPRI 2011-TN8442). Therefore, wave and ocean energy power generation is not a reasonable alternative to V.C. Summer SLR, either as a stand-alone alternative or as part of a combination alternative.

2.4.7 Municipal Solid Waste-Fired Power

Energy recovery from municipal solid waste converts nonrecyclable waste materials into usable heat, electricity, or fuel through combustion. The three types of municipal solid waste combustion technologies are: (1) mass burning, (2) modular systems, and (3) refuse derived fuel systems. Mass burning is the method used most frequently in the United States. The heat released from combustion is used to convert water to steam, which is then used to drive turbine generators to produce electricity. Ash is then collected and taken to a landfill, and particulates are captured through a filtering system (EPA 2023-TN8443).

Currently, 75 waste-to-energy power plants are in operation in 21 states, processing approximately 29 million tons (26,308 kg) of waste per year. These waste-to-energy power plants have an aggregate capacity of 2,725 MWe (Michaels and Krishnan 2019-TN7700). Although some power plants have expanded to handle additional waste a to produce more energy, only one new municipal solid waste combustion power plant has been built in the United States since 1995 (Maize 2019-TN7699). The average waste-to-energy power plant produces about 50 MWe, which is a very small fraction of the energy produced by V.C. Summer.

The decision to burn municipal solid waste to generate electricity is usually driven by the need for a waste disposal alternative to landfills, rather than a need to generate energy. Stable supplies of municipal solid waste would be needed to support new waste-to-energy power plants in the region; such supplies are not currently available. Based on this information, municipal solid waste-fired power is not a reasonable alternative to V.C. Summer SLR.

2.4.8 Petroleum-Fired Power

The variable costs and environmental impacts of petroleum-fired electrical power generation tend to be greater than those of natural gas-fired generation. The historically higher cost of oil has also resulted in a steady decline in its use for electricity generation, and the EIA forecasts no growth in capacity using petroleum-fired power plants through 2040 (DOE/EIA 2015-TN4585). Based on this information, petroleum-fired electricity generation is not a reasonable alternative to V.C. Summer SLR.

2.4.9 Coal-Fired Power

Although coal has historically been the largest source of electricity in the United States, both natural gas generation and nuclear energy generation surpassed coal generation at the national level in 2020. Coal-fired electricity generation in the United States has decreased and is expected to continue to decrease as coal-fired units retire or are converted to use other fuels as the remaining units are used less often (DOE/EIA 2021-TN7718).

Baseload coal-fired power units have proven their reliability and can routinely sustain capacity factors as high as 85 percent. Among the available technologies, pulverized-coal boilers producing supercritical steam (supercritical pulverized-coal boilers) have become increasingly common, given their generally high thermal efficiencies and overall reliability.

Supercritical pulverized-coal facilities are more expensive to build than subcritical coal-fired power plants but consume less fuel per unit output. Integrated gasification combined cycle combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is cleaner than conventional pulverized-coal plants because some of the major pollutants are removed before combustion. Although several smaller, integrated gasification combined-cycle power plants have been in operation since the mid-1990s, large scale projects have experienced setbacks, and public opposition has hindered it from being fully integrated into the energy market.

On average, siting and constructing a 1,000 MW coal plant may require 500 ac (202.3 ha) of land cover, with potentially substantial short- and long-term ecological and cultural impacts. Construction activities associated with a coal facility can result in considerable dust emissions along with sedimentation and erosion. During operation, coal facilities emit higher amounts of nitrogen oxides (NO_x), carbon dioxide (CO_2), sulfur dioxide (SO_2), heavy metals, and particulate matter (PM) than do other fuel sources, leading to public health risks such as chronic obstructive pulmonary disease, asthma, lung cancer, and respiratory infection. The mining of the coal itself requires large amounts of land, as does the disposal of solid waste, especially fly ash and scrubber sludge (NRC 2024-TN10848). Based on these considerations, coal-fired power is not a reasonable alternative to V.C. Summer SLR.

2.4.10 Fuel Cells

Fuel cells oxidize fuels without combustion and, therefore, without the environmental side effects of combustion. Fuel cells use a fuel (e.g., hydrogen) and oxygen to create electricity through an electrochemical process. The only byproducts are heat, water, and CO_2 (depending on the hydrogen fuel type) (DOE Undated-TN7695). Hydrogen fuel can come from a variety of hydrocarbon resources, including natural gas. As of October 2020, the United States had only 250 MW of fuel cell power generation capacity (CEA 2022-TN10547).

Currently, fuel cells are not economically or technologically competitive with other electricity generating alternatives. The EIA estimates that fuel cells may cost $6,639 per installed kilowatt (total overnight capital costs in 2021 dollars), which is high compared to other replacement power alternatives (DOE/EIA 2022-TN7694). In June 2021, DOE launched an initiative to reduce the cost of hydrogen production to spur fuel cell and energy storage development over the next decade (DOE 2021-TN7693). However, it is unclear whether or to what degree this initiative will lead to increased future development and deployment of fuel cell technologies.

More importantly, fuel cell units used for power production are likely to be small (approximately 10 MW). The world's largest industrial hydrogen fuel cell power plant is a 50 MWe plant in South Korea (Larson 2020-TN8401). Using fuel cells to replace the power that V.C. Summer provides would require the construction of approximately 97 units. Given the limited deployment and high cost of fuel cell technology, fuel cells are not a reasonable alternative to V.C. Summer SLR.

2.4.11 Purchased Power

Power may be purchased and imported from outside the region. Although purchased power would have no new impact, environmental impacts could be occurring where electricity is generated, depending on the technology used to generate the power.

Importing power can be economically adverse, because the cost of electric power generation is generally less than the cost of purchasing power from a third-party supplier (NRC 2024-TN10161). Purchased power agreements carry the inherent risk that a supplier may not be able to deliver all of the contracted power. Purchased power is not a reasonable alternative to V.C. Summer SLR, therefore, due to its higher cost and lower reliability.

2.4.12 Delayed Retirement of Other Generating Facilities

Delaying the retirement of a power generating facility provides for the continued supply of electricity. Due to new regulations requiring significant reductions in power plant emissions, some power generating facility owners may opt to retire their older, less efficient units rather than incur the cost for compliance. Retirements also may be driven by low competing commodity prices (such as low natural gas prices), slow growth in electricity demand, and EPA Mercury and Air Toxics Standards for fossil-fueled power plants (DOE/EIA 2015-TN4585; EPA 2020-TN8379), making delayed retirements less likely to be realized. Because of these conditions, delayed retirement of older power generating units is not a reasonable alternative to V.C. Summer SLR.

2.4.13 Demand-Side Management

Demand-side management refers to energy conservation and efficiency programs that do not require the addition of new generating capacity. Demand-side management programs can include reducing energy demand through consumer behavioral changes or through altering the characteristics of the electrical load. These programs can be initiated by a utility, transmission operators, the State, or other load serving entities. In general, residential electricity consumers have been responsible for the majority of peak load reductions, and participation in most demand-side management programs is voluntary (NRC 2024-TN10161).

The existence of a demand-side management program does not guarantee that reductions in electricity demand will occur. The LR GEIS concludes that, although the energy conservation or energy efficiency potential in the United States is substantial, there have been no cases in which an energy efficiency or conservation program alone has been implemented expressly to replace or offset a large baseload generation station (NRC 2024-TN10161); generally, the NRC staff has concluded that the analysis of a need for a new generating facility has already accounted for any savings from demand-side management programs (NRC 2024-TN10848). Therefore, baseload demand-side management programs alone are not a reasonable alternative to V.C. Summer SLR. However, in combination with other power generating technologies, demand-side management could be a reasonable alternative to V.C. Summer's SLR. While the replacement power alternatives discussed in Section 2.3.2 do not explicitly include consideration of demand-side management, such programs could help to reduce the size and/or capacity of the energy sources considered in these alternatives. However, without being able to quantify the size of demand-side management programs, the impacts of such programs can only be addressed qualitatively; as such, demand-side management is not further discussed in the replacement power alternatives carried forward for detailed analysis.

2.5 Comparison of Alternatives

This section presents a comparison of the environmental impacts of the following five alternatives to the proposed action (V.C. Summer SLR): (1) the no-action alternative; (2) natural gas; (3) new nuclear (small modular reactor); (4) natural gas and solar combination; and (5) new nuclear and solar combination. Chapter 3 describes the environmental impacts of the proposed action and the alternatives. Table 2-1 summarizes the environmental impacts of the proposed action (V.C. Summer SLR), and the alternatives to SLR considered in this SEIS.

The environmental impacts of the proposed action (i.e., V.C. Summer SLR) would be SMALL for all impact categories. In comparison, the four replacement power alternatives have 10 identified environmental impacts that are greater than the impacts from the proposed action. In addition, replacement power alternatives would result in construction impacts. If the NRC does not renew the V.C. Summer operating license (i.e., the no-action alternative), energy-planning decision-makers would have to choose a replacement power alternative similar to the ones evaluated in this SEIS. Based on the review of the reasonable replacement power alternatives, the no-action alternative, and the proposed action, the NRC staff concludes that the environmentally preferred alternative is the proposed SLR action. Therefore, the NRC staff's preliminary recommendation is that the V.C. Summer operating license be renewed for the SLR period of extended operation.

1 **Table 2-1 Summary of Environmental Impacts of the Proposed Action and Alternatives**

Impact Area (Resource)	V.C. Summer Subsequent License Renewal (Proposed Action)	No-Action Alternative	Natural Gas Alternative	New Nuclear (Small Modular Reactor) Alternative	Natural Gas and Solar Combination Alternative	New Nuclear and Solar Combination Alternative
Land Use	SMALL	SMALL	SMALL	SMALL	MODERATE TO LARGE	SMALL TO MODERATE
Visual Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL TO MODERATE
Air Quality	SMALL	SMALL	MODERATE	SMALL	SMALL TO MODERATE	SMALL
Noise	SMALL	SMALL	SMALL	SMALL	SMALL TO MODERATE	SMALL
Geologic Environment	SMALL	SMALL	SMALL	SMALL TO MODERATE	SMALL	SMALL TO MODERATE
Surface Water Resources	SMALL	SMALL	SMALL	SMALL TO MODERATE	SMALL	SMALL
Groundwater Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Terrestrial Resources	SMALL	SMALL	SMALL	SMALL	MODERATE TO LARGE	SMALL TO MODERATE
Aquatic Resources	SMALL	SMALL	SMALL	SMALL TO MODERATE	SMALL TO MODERATE	SMALL TO MODERATE
Federally Protected Ecological Resources	SEE NOTE[(a)]	SEE NOTE[(b)]	SEE NOTE[(c)]	SEE NOTE[(c)]	SEE NOTE[(c)]	SEE NOTE[(c)]
Historic and Cultural Resources	SEE NOTE[(d)]	SEE NOTE[(e)]	SEE NOTE[(f)]	SEE NOTE[(f)]	SEE NOTE[(f)]	SEE NOTE[(f)]
Socioeconomics	SMALL	MODERATE TO LARGE	SMALL TO LARGE	SMALL TO LARGE	SMALL TO MODERATE	SMALL TO LARGE
Transportation	SMALL	SMALL	SMALL TO LARGE	SMALL TO LARGE	SMALL TO MODERATE	SMALL TO LARGE
Human Health	SMALL[(g)]	SMALL[(g)]	SMALL[(g)]	SMALL[(g)]	SMALL[(g)]	SMALL[(g)]
Environmental Justice	SEE NOTE[(h)]	SEE NOTE[(h)]	SEE NOTE[(h)]	SEE NOTE[(h)]	SEE NOTE[(h)]	SEE NOTE[(h)]
Waste Management and Pollution Prevention	SMALL[(i)]	SMALL[(i)]	SMALL	SMALL	SMALL	SMALL

Table 2-1 Summary of Environmental Impacts of the Proposed Action and Alternatives (Continued)

Impact Area (Resource)	V.C. Summer Subsequent License Renewal (Proposed Action)	No-Action Alternative	Natural Gas Alternative	New Nuclear (Small Modular Reactor) Alternative	Natural Gas and Solar Combination Alternative	New Nuclear and Solar Combination Alternative

(a) May affect, but is not likely to adversely affect, tricolored bat and monarch butterfly. No effect on essential fish habitat. No effect on sanctuary resources of National Marine Sanctuaries.

(b) Overall, the effects on federally listed species, critical habitat, and essential fish habitat (EFH) would likely be smaller under the no-action alternative than the effects under continued operation, but that would depend on the specific shutdown activities as well as the listed species, critical habitats, and designated EFH present when the no-action alternative is implemented.

(c) The types and magnitudes of adverse impacts to species listed in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; TN1010), designated critical habitat, and EFH would depend on the proposed alternative site, nuclear power plant design and operation, as well as listed species and habitats present when the alternative is implemented. Therefore, the NRC staff cannot forecast a level of impact for this alternative.

(d) Based on the location of historic properties within and near the area of potential effect, Tribal input, Dominion's administrative procedures, a site-specific cultural resource management plan, and no planned physical changes or ground-disturbing activities, the proposed action (SLR) would not adversely affect historic properties.

(e) Until the post-shutdown decommissioning activities report is submitted, the NRC staff cannot determine whether historic properties would be affected outside the existing industrial site boundary after the nuclear power plant is shut down.

(f) Impacts of this alternative would be dependent on the specific site location, plant design, layout of buildings, and vertical and horizontal depth of planned ground disturbance activities. The South Carolina Department of Archives and History (SCDAH) would need to be consulted prior to any activities to determine the presence or absence of historic properties. If historic properties are determined to be present, impacts would be assessed and, if applicable, mitigated with the Advisory Council on Historic Preservation, the SCDAH, and consulting Tribes through the Section 106 process.

(g) The chronic effects of electromagnetic fields on human health associated with operating nuclear power and other electricity generating plants are uncertain.

(h) With the exception of the no-action alternative, there would be no disproportionate and adverse impacts to minority and low-income populations. For the no-action alternative, the loss of jobs and income could have an immediate socioeconomic impact. This could disproportionately affect minority and low-income populations that may have become dependent on these services.

(i) NUREG-2157, *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel* (NRC 2014-TN4117), discusses the environmental impacts of spent fuel storage for the timeframe beyond the licensed life for reactor operations.

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATING ACTIONS

3.1 Introduction

In conducting its environmental review of the V.C. Summer SLR, the NRC staff defines and describes the environment that could be affected by the proposed action (i.e., issuing a subsequent renewed license authorizing an additional 20 years of operation). The NRC staff then evaluates the environmental consequences of the proposed action as well as alternatives to the proposed action.

In this chapter, the NRC staff first defines the affected environment as the environment that currently exists at and around the V.C. Summer site. Because existing conditions are at least partially the result of past construction and nuclear power plant operations, this chapter considers the nature and impacts of past and ongoing operations and evaluates how, together, these actions have shaped the current environment. This chapter also describes reasonably foreseeable environmental trends. The effects of ongoing reactor operations at the site have become well established as environmental conditions have adjusted to the presence of the facility.[1] It is this existing environment that composes the environmental baseline against which potential environmental effects (or impacts) of license renewal are evaluated.

Sections 3.2 through 3.13 of this SEIS describe the affected environment for each resource area, followed by the NRC staff's evaluation of the environmental consequences of the proposed action and alternatives to the proposed action. The NRC staff compares the environmental impacts of SLR with those of the no-action alternative and replacement power alternatives in order to determine whether the adverse environmental impacts of SLR are so great that it would be unreasonable to preserve the option for energy-planning decision-makers.

The NRC staff's evaluation of environmental consequences includes the following:

- impacts associated with continued operations of V.C. Summer during the period of extended operation
- impacts of the reasonable power replacement alternatives to the proposed action and the no-action alternative (i.e., not issuing renewed license)
- impacts common to all alternatives: (1) fuel cycle, including uranium fuel cycle, (2) terminating V.C. Summer operations and decommissioning, and (3) greenhouse gas (GHG) emissions and climate change
- impacts of postulated accidents (i.e., design-basis accidents and severe accidents)
- cumulative effects of the proposed action
- resource commitments associated with the proposed action, including unavoidable adverse impacts, the relationship between short-term use and long-term productivity, and irreversible and irretrievable commitment of resources
- new and potentially significant information about environmental issues related to the impacts of continued operations during the period of extended operation

---

[1] Where appropriate, the NRC staff has summarized reference information (incorporated information by reference) in this SEIS. This allows the staff to focus on new and potentially significant information identified since the previous EIS for V.C. Summer.

As stated in Sections 1.5 and 1.6, this SEIS documents the NRC staff's environmental review of the V.C. Summer SLR application and supplements the information provided in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (LR GEIS) (NRC 2024-TN10161). The LR GEIS identifies 80 issues (59 Category 1 [generic], 20 Category 2 [plant-specific] issues, and 1 uncategorized issue) to be evaluated for the proposed action. Section 1.5 of this SEIS explains the criteria for Category 1 issues and Category 2 issues, as well as the definitions of SMALL, MODERATE, and LARGE impact significance.

For the evaluation of Category 1 issues in this SEIS, the NRC staff relies on the analysis in the LR GEIS, unless otherwise noted. Table 3-1 lists the applicable Category 1 issues that apply to V.C. Summer during the proposed subsequent license renewal period. For these issues, the NRC staff did not identify any new or significant information that would change the conclusions of the LR GEIS. Therefore, there are no impacts related to issues beyond those discussed in the LR GEIS (Table 3-1 and Table 3-2, below), as cited in Sections 3.2 to 3.13 of this SEIS below. Section 3.14 of this SEIS describes the NRC staff's process for evaluating new and significant information.

The NRC staff analyzed the Category 2 (plant-specific) issues applicable to V.C. Summer during the proposed SLR period and assigned impacts for these issues as shown in Table 3-2.

Table 3-1 Applicable Category 1 (Generic) Issues for Virgil C. Summer Nuclear Station Subsequent License Renewal

Issue	LR GEIS Section	Impact
Land Use – Onsite land use	4.2.1.1	SMALL
Land Use – Offsite land use	4.2.1.1	SMALL
Land Use – Offsite land use in transmission line right-of-ways (ROWs)	4.2.1.1	SMALL
Visual Resources – Aesthetic impacts	4.2.1.2	SMALL
Air Quality – Air quality impacts	4.3.1.1	SMALL
Air Quality – Air quality effects of transmission lines	4.3.1.1	SMALL
Noise – Noise impacts	4.3.1.2	SMALL
Geologic Environment – Geology and soils	4.4.1.1	SMALL
Surface Water Resources – Surface water use and quality (non-cooling system impacts)	4.5.1.1	SMALL
Surface Water Resources – Altered current patterns at intake and discharge structures	4.5.1.1	SMALL
Surface Water Resources – Altered thermal stratification of lakes	4.5.1.1	SMALL
Surface Water Resources – Scouring caused by discharged cooling water	4.5.1.1	SMALL
Surface Water Resources – Discharge of metals in cooling system effluent	4.5.1.1	SMALL
Surface Water Resources – Discharge of biocides, sanitary wastes, and minor chemical spills	4.5.1.1	SMALL
Surface Water Resources – Surface water use conflicts (plants with once-through cooling systems)	4.5.1.1	SMALL
Surface Water Resources – Effects of dredging on surface water quality	4.5.1.1	SMALL
Surface Water Resources – Temperature effects on sediment transport capacity	4.5.1.1	SMALL
Groundwater Resources – Groundwater contamination and use (non-cooling system impacts)	4.5.1.2	SMALL

Table 3-1 Applicable Category 1 (Generic) Issues for Virgil C. Summer Nuclear Station Subsequent License Renewal (Continued)

Issue	LR GEIS Section	Impact
Groundwater Resources – Groundwater use conflicts (plants that withdraw less than 100 gallons per minute [gpm])	4.5.1.2	SMALL
Terrestrial Resources – Exposure of terrestrial organisms to radionuclides	4.6.1.1	SMALL
Terrestrial Resources – Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	4.6.1.1	SMALL
Terrestrial Resources – Cooling tower impacts on terrestrial plants	4.6.1.1	SMALL
Terrestrial Resources – Bird collisions with plant structures and transmission lines	4.6.1.1	SMALL
Terrestrial Resources – Transmission line right-of-way (ROW) management impacts on terrestrial resources	4.6.1.1	SMALL
Terrestrial Resources – Electromagnetic field effects on terrestrial plants and animals	4.6.1.1	SMALL
Aquatic Resources – Entrainment of phytoplankton and zooplankton (all plants)	4.6.1.2	SMALL
Aquatic Resources – Infrequently reported effects of thermal effluents	4.6.1.2	SMALL
Aquatic Resources – Effects of non-radiological contaminants on aquatic organisms	4.6.1.2	SMALL
Aquatic Resources – Exposure of aquatic organisms to radionuclides	4.6.1.2	SMALL
Aquatic Resources – Effects of dredging on aquatic resources	4.6.1.2	SMALL
Aquatic Resources – Non-cooling system impacts on aquatic resources	4.6.1.2	SMALL
Aquatic Resources – Impacts of transmission line right-of-way (ROW) management on aquatic resources	4.6.1.2	SMALL
Socioeconomics – Employment and income, recreation and tourism	4.8.1.1	SMALL
Socioeconomics – Tax revenue	4.8.1.2	SMALL
Socioeconomics – Community services and education	4.8.1.3	SMALL
Socioeconomics – Population and housing	4.8.1.4	SMALL
Socioeconomics – Transportation	4.8.1.5	SMALL
Human Health – Radiation exposures to plant workers	4.9.1.1.1	SMALL
Human Health – Radiation exposures to the public	4.9.1.1.1	SMALL
Human Health – Chemical hazards	4.9.1.1.2	SMALL
Human Health – Microbiological hazards to plant workers	4.9.1.1.3	SMALL
Human Health – Physical occupational hazards	4.9.4.1.5	SMALL
Postulated Accidents – Design-basis accidents	4.9.1.2.1	SMALL
Postulated Accidents – Severe accidents	4.9.1.2.1	SMALL
Waste Management – Low-level waste storage and disposal	4.11.1.1	SMALL
Waste Management – Onsite storage of spent nuclear fuel	4.11.1.2	SMALL
Waste Management – Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	4.11.1.3	[(a)]
Waste Management – Mixed waste storage and disposal	4.11.1.4	SMALL
Waste Management – Nonradioactive waste storage and disposal	4.11.1.5	SMALL

Table 3-1 Applicable Category 1 (Generic) Issues for Virgil C. Summer Nuclear Station Subsequent License Renewal (Continued)

Issue	LR GEIS Section	Impact
Greenhouse Gas Emissions and Climate Change – Greenhouse gas impacts on climate change	4.12.1	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste	4.14.1.5	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste	4.14.1.5	(b)
Uranium Fuel Cycle – Non-radiological impacts of the uranium fuel cycle	4.14.1.5	SMALL
Uranium Fuel Cycle – Transportation	4.14.1.5	SMALL
Termination of Plant Operations and Decommissioning	4.14.2.1	SMALL

gpm = gallon(s) per minute; LR GEIS = *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants*; ROW = right-of-way.

(a) The ultimate disposal of spent fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this review. Per 10 CFR Part 51 (TN10253) Subpart A, Appendix B, the Commission concludes that the impacts presented in NUREG-2157 (NRC 2014-TN4117) would not be sufficiently large to require the NEPA conclusion, for any nuclear power plant, that the option of extended operation under 10 CFR Part 54 (TN4878) should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants.

(b) There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits and standards. As stated in the 2024 LR GEIS, "The Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated." (10 CFR Part 54; TN4878)

Sources: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN10253; NRC 2024-TN10161.

The NRC staff analyzed the applicable Category 2 (plant-specific) issues for V.C. Summer and assigned a significance level for each issue as shown in Table 3-2.

Table 3-2 Applicable Category 2 (Plant-Specific) Issues for Virgil C. Summer Nuclear Station Subsequent License Renewal

Issue	LR GEIS Section	Impact[a]
Surface Water Resources – Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	4.5.1.1	SMALL
Groundwater Resources – Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	4.5.1.2.4	SMALL
Groundwater Resources – Groundwater quality degradation (plants with cooling ponds)	4.5.1.2.6	SMALL
Groundwater Resources – Radionuclides released to groundwater	4.5.1.2.7	SMALL
Terrestrial Resources – Non-cooling system impacts on terrestrial resources	4.6.1.1	SMALL
Terrestrial Resources –water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	4.6.1.1	SMALL

Table 3-2 Applicable Category 2 (Plant-Specific) Issues for Virgil C. Summer Nuclear Station Subsequent License Renewal (Continued)

Issue	LR GEIS Section	Impact[a]
Aquatic Resources – Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Aquatic Resources – Effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Aquatic Resources – Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	4.6.1.2	SMALL
Federally Protected Ecological Resources – Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction	4.6.1.3.1	May affect but is not likely to adversely affect tricolored bat and monarch butterfly
Historic and Cultural Resources – Historic and cultural resources	4.7.1	No adverse effect to historic properties
Human Health – Microbiological hazards to the public	4.9.1.1.3	SMALL
Human Health – Electromagnetic fields (EMFs)[b]	4.9.1.1.4	Uncategorized (Uncertain impact)
Human Health – Electric shock hazards	4.9.1.1.5	SMALL
Environmental Justice – Impacts on minority populations, low-income populations, and Indian Tribes	4.10.1.1	No disproportionate and adverse human health and environmental effects on minority and low-income populations
Greenhouse Gas Emissions and Climate Change – Climate change impacts on environmental resources	4.12.2	See Section 3.15.3 of this SEIS
Cumulative Effects – Cumulative effects	4.13	See Section 3.16 of this SEIS

LR GEIS = *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants*; SEIS = supplemental environmental impact statement.

"-" denotes no data in table cell.

(a) Impact determinations for Category 2 issues based on findings described in Sections 3.2 through 3.13 of this SEIS, as applicable, for the proposed action.

(b) This issue was not designated as Category 1 or Category 2 and is discussed in Section 3.11.4 of this SEIS.

Sources: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN10253; NRC 2024-TN10161.

3.2 Land Use and Visual Resources

This section describes land use and visual resources in the vicinity of the V.C. Summer site as well as the potential impacts from the proposed action of SLR and alternatives to the proposed action. Section E3.2 of Dominion's ER describes current V.C. Summer onsite and offsite land use conditions as well as visual resources (Dominion 2023-TN10387).

3.2.1 Land Use

V.C. Summer is located on an approximately 2,200 ac (890 ha) site on the southern shore of the Monticello Reservoir in Fairfield County, South Carolina. The nearest town is Jenkinsville, which is approximately 3 mi (4.8 km) southeast of the site. Columbia is the largest population center in the region, approximately 26 mi (42 km) southeast of the site.

The sections below describe onsite and offsite land use within a 6 mi (10 km) radius.

3.2.1.1 Onsite Land Use

V.C. Summer plant and ancillary facilities occupy 370 ac (150 ha; or 17 percent) of the site. The remainder of the site is comprised of the Monticello Reservoir, forested areas, transmission right-of-ways (ROWs), and other developed areas, including the abandoned Unit 2 and Unit 3 construction site. As shown in Table 3-3, the predominant land cover at the V.C. Summer site is open water (38 percent), evergreen forest (19 percent), high intensity development (10 percent), and scrub/shrub (7 percent).

Table 3-3 Land Cover, Virgil C. Summer Nuclear Station Site

Category	Acres	Percentage
Open Water	835.1	37.7
Developed, Open Space	76.9	3.5
Developed, Low Intensity	91.0	4.1
Developed, Medium Intensity	152.6	6.9
Developed, High Intensity	209.3	9.5
Barren Land (Rock/Sand/Clay)	29.8	1.4
Deciduous Forest	58.0	2.6
Evergreen Forest	421.2	19.0
Mixed Forest	54.0	2.4
Shrub/Scrub	153.0	6.9
Grassland/Herbaceous	73.8	3.3
Pasture/Hay	54.5	2.5
Woody Wetlands	1.8	0.1
Emergent Herbaceous Wetlands	2.4	0.1
TOTAL	**2,213.5**	**100.0**

Source: Dominion 2023-TN10387.

Fairfield County has zoned V.C. Summer as an Industrial District (I-1) per its zoning map that was adopted in 2012 (Fairfield County 2011-TN10392). Access to the plant is from South Carolina Highways 215 and 213, and Bradham Boulevard. There is rail access via a Norfolk Southern rail line spur located southwest of the site. Duke Energy maintains two 230 kV transmission lines in a ROW to the west of the site.

3.2.1.2 Offsite Land Use

The 6 mi (10 km) vicinity surrounding V.C. Summer includes portions of Fairfield, Newberry, Lexington, and Richland counties. As shown in Table 3-4, the largest land use/land cover in the vicinity is evergreen forest (41 percent), followed by mixed forests (15 percent), open water (13 percent), and deciduous forest (8 percent).

Table 3-4 Land Use/Land Cover, 6 mi (10 km) Radius of the Virgil C. Summer Nuclear Station Site

Category	Acres	Percentage
Open Water	9,647.5	13.3
Developed, Open Space	2,103.0	2.9
Developed, Low Intensity	712.8	1.0
Developed, Medium Intensity	462.4	0.6
Developed, High Intensity	459.7	0.6
Barren Land (Rock/Sand/Clay)	132.5	0.2
Deciduous Forest	5,491.4	7.6
Evergreen Forest	29,402.4	40.6
Mixed Forest	11,092.8	15.3
Shrub/Scrub	4,576.0	6.3
Grassland/Herbaceous	3,013.9	4.2
Pasture/Hay	2,448.6	3.4
Cultivated Crops	390.7	0.5
Woody Wetlands	2,288.7	3.2
Emergent Herbaceous Wetlands	215.5	0.3
TOTAL	**72,437.7**	**100.0**

Source: Dominion 2023-TN10387.

Fairfield County is approximately 439,218 ac (177,745 ha), of which 73,082 ac (29,575 ha) (17 percent) are farmland. Newberry County is approximately 403,228 ac (163,181 ha), of which 94,810 ac (38,368 ha) (24 percent) are farmland. Lexington County is approximately 447,398 ac (181,056 ha), of which 102,585 ac (41,515 ha) (23 percent) are farmland. Richland County is approximately 484,572 ac (196,099 ha), of which 52,401 ac (21,206 ha) (11 percent) are farmland. Major crops in these counties include forage, soybeans, cotton, peanuts, wheat, and corn. Livestock includes cattle, poultry, hogs and pigs, and sheep and lambs.

Each of the above counties has issued a comprehensive plan in accordance with Section 6-29-720 of the South Carolina code, which requires that zoning and development regulations be made in accordance with the comprehensive plan (Fairfield County 2024-TN10393; Lexington County 2022-TN10394; Newberry County 2024-TN10395; and Richland County 2015-TN10396).

3.2.2 Visual Resources

As discussed above, V.C. Summer is located to the south of the Monticello Reservoir in Fairfield County, South Carolina. Predominant visual features include the reactor containment building (the tallest building on site at 166 ft [51 m]), auxiliary buildings, control building, turbine building, diesel generator building, and transmission corridors. Areas surrounding the site are generally forested, with interspersed farmland and residences. The site can be seen from the Monticello Reservoir from portions of SC 215, and from lands on the east of the Monticello Reservoir.

3.2.3 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for generic issues related to land use and visual resources, the impacts of a nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on land use and visual resources would be SMALL. There are no plant-specific (Category 2) air quality issues applicable to V.C. Summer.

3.2.3.1 Onsite Land Use

Operational activities during the SLR term would be similar to those already occurring at V.C. Summer. Additional spent fuel and low-level radioactive waste generated during the SLR term could result in the need for additional onsite storage; such actions would be addressed in separate reviews by the NRC. The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS; the impact of continued nuclear power plant operations on onsite land use during the V.C. Summer SLR term would be SMALL.

3.2.3.2 *Offsite Land Use*

License renewal and subsequent license renewal activities have little to no effect on offsite land use in communities near nuclear power plants. Operational activities during the SLR term, including periodic nuclear refueling outages requiring temporary staff, would be similar to those already occurring at the plant and would not affect offsite land use beyond what has already been affected. The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS; the impact of continued nuclear power plant operations on offsite land use, including within offsite transmission line ROWs, during the V.C. Summer SLR term would be SMALL.

3.2.3.3 Visual Resources

The visual appearance of the V.C. Summer nuclear power plant structures and associated transmission lines has become well established over the plant's operating history and is not likely to change during the SLR term. The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS. The NRC staff concludes that the visual impact of continued nuclear power plant operations at V.C. Summer during the SLR term would be SMALL because the visual appearance of nuclear power plant structures, transmission lines, and vapor plume from the cooling towers will not change appreciably.

3.2.4 No-Action Alternative

3.2.4.1 Land Use

Under the no-action alternative, the NRC would not issue a renewed V.C. Summer operating license, and reactor power generating operations would cease on or before the expiration of the current renewed license. However, maintenance activities (e.g., maintaining, inspecting, and testing plant equipment) would continue before and after the expiration of the license. Decommissioning activities would begin after the expiration of the license. Under this alternative, onsite land use would remain similar to onsite land use under the proposed SLR. Plant structures and other facilities would remain in place until decommissioning. Transmission lines and ROWs would remain in place after the cessation of reactor operations.

Shutdown of V.C. Summer would not affect land use. Based on this information, the NRC staff concludes that land use impacts under the no-action alternative would be SMALL.

3.2.4.2 Visual Resources

Termination of reactor operations because the operating license is not renewed under the no-action alternative would not immediately change the visual appearance of the V.C. Summer site. The most visible structures are the reactor containment and other buildings, and they would likely remain in place for some time during decommissioning until they are eventually dismantled. There would be no further operational impacts such as the vapor plumes associated with the cooling towers. As a result, the NRC staff concludes that the visual impacts from the no-action alternative would be SMALL.

3.2.5 Replacement Power Alternatives: Common Impacts

3.2.5.1 Land Use

Land use impacts are determined by the change in use and the amount of land affected by the construction and operation of a replacement power generating facility, infrastructure, and other installations. Table 3-5 below summarizes land use impacts of replacement power alternatives.

3.2.5.2 Visual Resources

Visual impacts are determined by the degree of contrast between the replacement power generating facility and the surrounding landscape and the visibility of the new power plant.

<u>Construction</u>

Installation of power generating facilities and support structures at existing power plant sites would be consistent with visual character of the industrial site. Land for any replacement power generating facility would require clearing, excavation, and the use of construction equipment. Temporary visual impacts may occur during construction because of the use of cranes and other construction equipment. If most of the components of this alternative are constructed at the abandoned V.C. Summer Units 2 and 3 project site, new visual impacts may be minimal. However, construction of new offsite solar at greenfield sites could result in new visual impacts. As such, the NRC staff concludes that construction and installation of the natural gas, new nuclear, and new nuclear and solar combination alternatives would have a SMALL visual impact, and the natural gas and solar combination alternative, which involves the construction of new solar and associated transmission offsite, would have a SMALL to MODERATE visual impact.

Table 3-5 Land Use Impacts of Replacement Power Alternatives for Virgil C. Summer Nuclear Station

Alternative	Resource Requirements	Impacts	Discussion
Natural Gas	48 ac at the abandoned V.C. Summer Units 2 and 3 project site	SMALL	All construction and operations would occur on the already disturbed abandoned V.C. Summer Units 2 and 3 project site.
New Nuclear (SMR)	130 ac at the abandoned V.C. Summer Units 2 and 3 project site	SMALL	All construction and operations would occur on the already disturbed abandoned V.C. Summer Units 2 and 3 project site.
Natural Gas and Solar Combination Alternative	NGCC: 48 ac at the abandoned V.C. Summer Units 2 and 3 project site Solar: over 500 ac at the abandoned V.C. Summer project site; approximately 3,200 ac offsite, with approximately 1,400 ac of new transmission lines	MODERATE TO LARGE	Construction and operations of the NGCC and one of the solar installations would occur on the already disturbed abandoned V.C. Summer Units 2 and 3 project site. The offsite aspects of this alternative would require three separate solar installations and associated new transmission lines.
New Nuclear and Solar Combination Alternative	SMR: 130 ac at the abandoned V.C. Summer Units 2 and 3 project site Solar: approximately 700 ac at the abandoned V.C. Summer Units 2 and 3 project site	SMALL TO MODERATE	All construction and operations would occur on the already disturbed abandoned V.C. Summer Units 2 and 3 project site; these impacts would be larger than the standalone NGCC and SMR alternatives.

ac = acre(s); NGCC = natural gas-fired combined-cycle; SMR = small modular reactor.
Source: Resource requirements based on Dominion 2023 (TN10387).

Operations

Visual impacts during power plant operations of any of the replacement power alternatives would be similar in type and magnitude. Combustion turbines and SMRs would be tall enough, and solar panels could be seen offsite from a distance, depending on screening vegetation and landscape. Transmission lines would be visible, unless screened. Vapor plumes associated with mechanical draft cooling towers would be the most noticeable visual impact and would likely be visible farther from the site than other buildings and infrastructure. Aircraft warning lights on power plant stacks or towers would be visible at night. After completing construction and installation, the NRC staff concludes that power plant operations for each of the replacement power alternatives would have a SMALL visual impact.

3.3 Meteorology, Air Quality, and Noise

3.3.1 Meteorology

South Carolina’s climate is humid subtropical characterized by hot and humid summers and mild winters. The Bermuda High, a semipermanent high-pressure system in the North Atlantic Ocean, provides a flow of warm, moist air from the Atlantic Ocean (Runkle et al. 2022-TN7161). The Appalachian Mountains block cold air masses moving in from the northwest, which leads to the mild winters. Annual average temperature varies from the mid-50s °F in the mountains to the mid-60s °F along the coast. Annual precipitation varies, with the northwest part of the State averaging 80 in. (2.0 m), and the Midlands averaging 39 in. (1.0 m). Extreme weather threats for South Carolina include hurricanes (in the summer and fall) and severe thunderstorms (in late winter and spring) which can produce tornadoes.

Dominion maintains a meteorological monitoring system that comprises one onsite meteorological tower. The meteorological tower measures temperature, wind speed, wind direction, and precipitation. In its ER, Dominion provided meteorological observations (temperature measurements and wind conditions) from the meteorological system for the 1992–2021 period (2023-TN10387). While the meteorological tower has the capability to measure precipitation, Dominion does not maintain precipitation data from the onsite meteorological tower; therefore, the data was not available for the 1992–2021 period of record (2024-TN10391). The NRC staff obtained climatological data from the Columbia Metropolitan Airport (KCAE) weather station (NCEI 2024-TN10570). The station is approximately 38 mi (61 km) from the V.C. Summer site and was used to characterize the region's climate because of its relative location and long period of record.

The mean annual temperature from the Columbia weather station for the period of record (1945–2022) is 63.9°F (17.7°C), with a mean monthly temperature ranging from a low of 45.2°F (7.3°C) in January to a high of 81.9°F (27.7°C) in July (NCEI 2024-TN10570). The mean annual temperature from V.C. Summer's onsite meteorological tower is 65.2°F (18.4°C) with a mean monthly temperature ranging from a low of 45.1°F (7.3°C) in January to a high of 82.9°F (28.3°C) in July (Dominion 2023-TN10387). The mean annual precipitation from the Columbia weather station for the period of record (1945–2022) is 47 in. (1.2 centimeters [cm]), with a mean monthly precipitation ranging from a low of 2.70 in. (6.9 cm) in November to a high of 5.45 in. (13.8 cm) in July and August (NCEI 2024-TN10570). The mean annual wind speed from the Columbia weather station for the period of record (1984–2022) is 6.1 miles per hour (mph) (9.8 kilometers per hour [kph]), with a prevailing wind direction from the west–southwest (NCEI 2024-TN10570). The mean annual wind speed from V.C. Summer's onsite meteorological tower is 6.8 mph (10.9 kph), with a prevailing wind direction from the southwest (Dominion 2023-TN10387).

The following numbers of severe weather events have been reported in Fairfield County from January 1950 through May 2024 (NOAA 2024-TN10526):

- tornadoes: 30 events
- hail: 89 events
- flash flood: 5 events
- thunderstorm wind: 284 events

3.3.2 Air Quality

The EPA has set primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards" [TN1089]) for six common criteria pollutants to protect sensitive populations and the environment. The NAAQS criteria pollutants include carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, SO_2, and PM. PM is further categorized by size—PM_{10} (diameter of 10 micrometers or less) and $PM_{2.5}$ (diameter of 2.5 micrometers or less).

The EPA designates areas of attainment and nonattainment with respect to meeting NAAQS. Areas for which there are insufficient data to determine attainment or nonattainment are designated as unclassifiable. Areas that were once in nonattainment, but are now in attainment, are called maintenance areas; these areas are under a 10-year monitoring plan to maintain their attainment designation status. States have primary responsibility for ensuring attainment and maintenance of the NAAQS. Under the Clean Air Act of 1970 (CAA) Section 110 (42 U.S.C. 7410) (Clean Air Act-TN1141) and related provisions, States are to submit, for EPA approval, State implementation plans that provide for the timely attainment and maintenance of the NAAQS.

In South Carolina, air quality designations are made at the county level. For the purpose of planning and maintaining ambient air quality with respect to the NAAQS, the EPA has developed air quality control regions (AQCRs). AQCRs are intrastate or interstate areas that share a common airshed. V.C. Summer is located in Fairfield County, which is part of the Columbia Intrastate AQCR (40 CFR Part 81-TN7226). With respect to NAAQS, the EPA designated Fairfield County and all the counties in the Columbia Intrastate AQCR in attainment for all NAAQS (EPA 2024-TN10527).

The South Carolina Department of Health and Environmental Control (SCDHEC) issues and enforces air permits under the authority of the CAA. Sources of air emissions at V.C. Summer include multiple emergency diesel generators, mechanical draft cooling towers equipped with drift eliminators, storage tanks, and a paint booth (Dominion 2023-TN10387, Dominion 2024-TN10391). Additionally, during outages, a rented auxiliary boiler is used (Dominion 2024-TN10391). South Carolina's regulations exempt various sources from permitting requirements, including the following (SCDHEC 2015-TN10528: Sections 48-1-10 et seq. of the 1976 South Carolina Code of Laws):

- Emergency power generators with a capacity less than or equal to 150 kW.
- Emergency power generators of greater than 150 kW rated capacity operated for a total of 500 hours per year or less for testing and maintenance.
- Sources with a total uncontrolled potential to emit less than 5 tons/year of particulates, SO_2, NO_x, and carbon monoxide, and a total of less than 1,000 pounds (lb)/month of volatile organic compounds.

In 2012, Dominion received an exemption from the requirements to obtain an air permit for V.C. Summer, and, as such, there are no annual reporting requirements with respect to air emission sources at V.C. Summer (2023-TN10387).

Small amounts of ozone and substantially smaller amounts of NO_x are produced during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface of transmission lines. During corona, ozone is approximately 90 percent of the oxidants generated, and NO_x are approximately 10 percent (BLM 2010-TN9626). Dominion has not conducted field tests of ozone or nitrogen oxide emissions generated by V.C. Summer's 115 kV and 230 kV in-scope transmission lines (2024-TN10391). However, field studies have shown that high voltage lines up to 765 kV do not generate emissions above ambient measurements (Lee et al. 1989-TN7481; TVA 2013-TN7899; NRC 2015-TN5842).

The EPA promulgated the Regional Haze Rule to improve and protect visibility in national parks and wilderness areas from haze, which is caused by numerous, diverse air pollutant sources located across a broad region (40 CFR 51.308–309-TN1090). Specifically, 40 CFR Part 81, Subpart D, "Identification of Mandatory Class I Federal Areas Where Visibility Is an Important Value," lists mandatory Federal areas where visibility is an important value. The Regional Haze

Rule requires states to develop State implementation plans to reduce visibility impairment at Class I Federal Areas. There are no Class I Federal Areas in South Carolina. The nearest Class I Federal Area from V.C. Summer (i.e., Great Smoky Mountains National Park) is over 100 mi (160 km) away.

3.3.3 Noise

Noise is unwanted sound and can be generated by many sources. Sound intensity is measured in logarithmic units called decibels (dB). A dB is the ratio of the measured sound pressure level to a reference level equal to a normal person's threshold of hearing. Most people barely notice a difference of 3 dB or less. Another characteristic of sound is frequency or pitch. Noise may be composed of many frequencies, but the human ear does not hear very low or very high frequencies. To represent noise as closely as possible to the noise levels people experience, sounds are measured using a frequency-weighting scheme known as the A-scale. Sound levels measured on this A-scale are given in units of A-weighted decibels (dBA). Levels can become annoying at 80 dBA and very annoying at 90 dBA. To the human ear, each increase of 10 dBA sounds twice as loud (EPA 1981-TN7412).

Several different terms are commonly used to describe sounds that vary in intensity over time. The equivalent sound intensity level (Leq) represents the average sound intensity level over a specified interval, often 1 hour. The day–night sound intensity level is a single value calculated from hourly Leq during a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. This addition accounts for the greater sensitivity of most people to nighttime noise. The statistical sound level (Ln) is the sound level that is exceeded n percent of the time during a given period. For example, L90, is the sound level exceeded 90 percent of the time and is considered the background level.

V.C. Summer is located in a largely rural area, with forests and small farms composing the dominant land use. The nearest resident is approximately 1.0 mi (1.6 km) east–southeast of the reactor building (Dominion 2023-TN10387). Fairfield County has a noise ordinance that stipulates maximum sound levels in residential and nonresidential areas (measured at the property line). In a nonresidential area, maximum sound levels should not exceed 70 dBA between the hours of 6 a.m. and 10:00 p.m. or 65 dBA between the hours of 10:00 p.m. and 6:00 a.m. (Fairfield County 2019-TN10529: Section 16-65 of Code of Ordinances Fairfield County). Primary offsite (i.e., beyond the site boundary) noise sources in the immediate vicinity of V.C. Summer include traffic, rifle range, and railroad operations (SCDHEC 2015-TN10528; Dominion 2024-TN10391). Primary noise sources at V.C. Summer include pumps, turbine, generators, switchyard equipment, transformers, cooling tower, and loudspeakers (Dominion 2023-TN10387). Dominion has not conducted offsite noise surveys (2024-TN10391). Between 2018–2023, Dominion did not receive noise complaints related to operation of V.C. Summer (2023-TN10387, 2024-TN10391).

3.3.4 Proposed Action

3.3.4.1 Air Quality

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for generic issues related to air quality, the impacts of a nuclear power plant SLR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on air quality would be SMALL. There are no plant-specific (Category 2) air quality issues applicable to V.C. Summer.

3.3.4.2 Noise

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for the generic issue related to noise, the impacts of a nuclear power plant SLR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. V.C. Summer does not anticipate future upgrades or replacement activities during the SLR term to support plant operation that could introduce new noise sources or increase in sound levels. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on noise would be SMALL. There are no plant-specific (Category 2) noise issues applicable to V.C. Summer.

3.3.5 No-Action Alternative

3.3.5.1 Air Quality

Under the no-action alternative, the permanent cessation of V.C. Summer operations would reduce overall air emissions (e.g., from boiler, diesel generators, and vehicle traffic). Therefore, the NRC staff concludes that if emissions decrease, the impact on air quality from the shutdown of V.C. Summer would be SMALL.

3.3.5.2 Noise

The permanent cessation of V.C. Summer operations would result in a reduction in noise from the pumps, turbine, generators, switchyard equipment, transformers, cooling tower, loudspeakers, and worker vehicles. As site activities are reduced, the NRC staff expects the impact on ambient noise levels to be less than current plant operations; therefore, the NRC staff concludes that impacts on noise levels from the no-action alternative would be SMALL.

3.3.6 Replacement Power Alternatives: Common Impacts

3.3.6.1 Air Quality

Construction of a replacement power alternative would result in temporary impacts on local air quality. Air emissions include criteria air pollutants (e.g., PM, NO_x, carbon monoxide, and SO_2), volatile organic compounds, hazardous air pollutants, and GHGs. Air emissions would be intermittent and would vary based on the level and duration of specific activities throughout the construction phase. During the construction phase, the primary sources of air emissions would consist of engine exhaust and fugitive dust emissions. Engine exhaust emissions would be from heavy construction equipment and commuter, delivery, and support vehicular traffic traveling to and from the facility as well as within the site. Fugitive dust emissions would be from soil disturbances by heavy construction equipment (e.g., earthmoving, excavating, and bulldozing), vehicle traffic on unpaved surfaces, concrete batch plant operations, and, to a lesser extent, wind erosion. Various mitigation techniques and best management practices (e.g., watering disturbed areas, reducing equipment idle times, and using ultra-low sulfur diesel fuel) could be used to minimize air emissions and to reduce fugitive dust.

The impacts on air quality from operation of a facility for a replacement power alternative would depend on the energy technology (e.g., nuclear or renewable). Worker vehicles, auxiliary power equipment, and mechanical cooling towers would result in air emissions.

3.3.6.2 Noise

Construction of a replacement power facility would be similar to the construction of any industrial facility in that they all involve many noise-generating activities. In general, noise emissions would vary during each phase of construction, depending on the level of activity, types of equipment and machinery used, and site-specific conditions. Typical construction equipment, such as dump trucks, loaders, bulldozers, graders, scrapers, air compressors, generators, and mobile cranes, would be used, and pile-driving and blasting activities could take place. Other noise sources include construction worker vehicle and truck delivery traffic. However, noise from vehicular traffic would be intermittent.

Noise generated during operations could include noise from transformers, mechanical draft cooling towers, turbines, equipment, speakers, as well as offsite sources, such as employee and delivery vehicular traffic. Noise from vehicles would be intermittent.

3.3.7 Natural Gas Alternative

3.3.7.1 Air Quality

For the natural gas alternative, air emissions and sources for construction would include those identified as common to all replacement power alternatives in Section 3.3.6.1 of this SEIS. The natural gas alternative would be located at the abandoned V.C. Summer Units 2 and 3 project site. Use of the existing infrastructure would be maximized, including use of the existing transmission lines and corridors, as well as natural gas transmission pipeline. A relatively small land requirement would be needed for construction of the natural gas alternative. Therefore, fugitive dust emissions would not be significant. Overall, air emissions from construction of the natural gas alternative would be intermittent, short-term, and temporary.

Operation of a natural gas alternative would result in emissions of criteria pollutants and GHGs. The NRC staff estimated air emissions for the natural gas alternative using emission factors developed by the DOE's National Energy Technology Laboratory (NETL 2022-TN10530). The NRC staff estimates the following annual air emissions would result from operation of a natural gas alternative with a design capacity of 1,110 MWe:

- CO—58 tons (52 metric tons [MT])
- NO_x—107 tons (97 MT)
- SO_2—29 tons (26 MT)
- PM—58 tons (53 MT)
- CO_2 equivalents—3.6 million tons (3.3 million MT)

Operation of mechanical draft cooling towers and worker vehicles would result in additional air emissions. A new natural gas alternative would need to secure a permit from the SCDHEC for air pollutants associated with its operation. The natural gas alternative would emit more than 100 tons/year of NO_x and would thus qualify as a major emitting industrial facility. As such, the new natural gas plant would be subject to Prevention of Significant Deterioration and Title V air permitting requirements under the Clean Air Act of 1970, as amended (42 U.S.C. 7661 et seq.), to ensure that air emissions are minimized and that the local air quality is not degraded substantially.

Nitrogen oxide emissions from operation of natural gas plant could be significant. Therefore, the NRC staff concludes that the overall air quality impacts associated with operation of a natural gas alternative would be MODERATE.

3.3.7.2 Noise

Noise generated during the construction and operation of a natural gas plant would be similar to noise for all replacement power alternatives as discussed in Section 3.3.6.2 of this SEIS. Noise impacts during construction would be limited to the immediate vicinity of the site. The nearest resident is located approximately 1.0 mi (1.6 km) from the site (NRC 2011-TN10532, NRC 2011-TN10533). Noise generated as a result of construction of a natural gas alternative at the V.C. Summer Units 2 and 3 site would not be noticeable given the existing industrial setting, distance of noise-sensitive receptors from the site, and consideration of noise attenuation from the construction site.

During operations, noise sources from a natural gas alternative would include those discussed in Section 3.3.6.2 of this SEIS, as well as offsite mechanical noise from compressor stations and pipeline blowdowns. Most of the noise-producing equipment (e.g., turbines, pumps, and mechanical draft cooling towers) would be located inside the power block. Since the natural gas alternative would be located at the abandoned V.C. Summer Units 2 and 3 site, the NRC staff does not anticipate noise levels at noise-sensitive receptors to be significantly greater than currently or previously experienced from operation of V.C. Summer. The Federal Energy Regulatory Commission requires that any new compressor station, compression added to an existing station, or any modification, upgrade, or update of an existing station must not exceed day–night sound intensity level of 55 dBA at any pre-existing noise-sensitive area (18 CFR 157.206(b)(5)(i)-TN7483). Day–night sound intensity level of 55 dBA was designated by the EPA as a noise level that is adequate to protect against outdoor activities (EPA 1974-TN3941). Additionally, noise from pipeline blowdowns would not constitute a new noise source at the V.C. Summer Units 2 and 3 site given the existing natural gas pipeline. Therefore, the NRC staff concludes that the noise impacts from operation of a natural gas alternative would be SMALL.

3.3.8 New Nuclear (Small Modular Reactor) Alternative

3.3.8.1 Air Quality

Air emissions and sources associated with construction of the new nuclear alternative located at the abandoned V.C. Summer Units 2 and 3 site would include those identified as common to all replacement power alternatives as described in Section 3.3.6.1 of this SEIS. Air emissions from construction of the new nuclear alternative would be intermittent, short term, and temporary (NRC 2019-TN6136).

Operation of the new nuclear alternative would result in air emissions similar in magnitude to air emissions from the operation of V.C. Summer. Sources of air emissions would include stationary combustion sources (e.g., diesel generators, auxiliary boilers, and gas turbines), mechanical draft cooling towers, and mobile sources (e.g., worker vehicles, onsite heavy equipment, and support vehicles). The mechanical draft cooling towers could contribute to impacts associated with the formation of visible plumes, fogging, and subsequent icing downwind of the towers.

In general, most stationary combustion sources at a nuclear power plant would operate only for limited periods, often during periodic maintenance testing. A new nuclear power plant may need to secure a permit from the SCDHEC for air emission sources associated operations. As such, the NRC staff expects the air emissions for combustion sources from a new nuclear power plant to be similar to those currently being emitted from V.C. Summer (see Section 3.3.6.1 of this SEIS). Therefore, the NRC staff expects that the air quality impact of emissions from onsite sources would be minor.

Given that the new nuclear alternative would result in air emissions similar in magnitude to air emissions from the operation of V.C. Summer and given the designated in attainment status for all NAAQS of Fairfield County, the NRC staff does not expect air emissions from operation of a new nuclear alternative to contribute to NAAQS violations. The NRC staff concludes that the impacts of operation of a new nuclear alternative on air quality would be SMALL.

3.3.8.2 Noise

Noise generated during the construction and operation of a new nuclear power plant would be similar to noise for all replacement power alternatives, as discussed in Section 3.3.6.2 of this SEIS. Noise impacts during construction would be limited to the immediate vicinity of the site. The nearest resident is located approximately 1.0 mi (1.6 km) from the site (NRC 2011-TN10532, NRC 2011-TN10533). Based on the temporary nature of construction activities, the distance of noise-sensitive receptors from the site, and consideration of noise attenuation from the construction site, the NRC staff concludes that the potential noise impacts of construction activities from a new nuclear alternative would not be noticeable.

Sources of noise during nuclear power plant operations would include industrial equipment, machinery, vehicles, and communications. Given that the site for the new nuclear alternative would be the abandoned V.C. Summer Units 2 and 3 site, the NRC staff does not anticipate noise levels at noise-sensitive receptors to be significantly greater than currently or previously experienced from operation of V.C. Summer. Therefore, noise from operations of a new nuclear alternative would not be noticeable to noise-sensitive receptors. The NRC staff concludes that the noise impacts from construction and operation of a new nuclear alternative would be SMALL.

3.3.9 Natural Gas and Solar Combination Alternative

3.3.9.1 Air Quality

Air emissions associated with construction of the natural gas portion of the combination alternative would be similar to those associated with the natural gas alternative discussed in Section 3.3.7.1 of this SEIS, given that the natural gas portion would be located in the abandoned V.C. Summer Units 2 and 3 site and the existing transmission infrastructure and natural gas transmission pipeline on site would be used. Air emissions and sources for construction of the renewable portion of this alternative would include those identified as common to all replacement power alternatives in Section 3.3.6.1 of this SEIS. Solar panels with battery storage would not have power block buildings. Accordingly, the amount of heavy equipment and workforce, level of activities, and construction duration would be lower, and, consequently, fewer air emissions would be generated at the site location. However, solar installations located in South Carolina (but not in the abandoned V.C. Summer Units 2 and 3 site) would require construction of new transmission lines.

Air emissions associated with operation of the natural gas portion of the combination alternative would be similar, but less than, those associated with the natural gas alternative discussed in Section 3.3.7.1 of this SEIS, since it would consist of one 700 MWe natural gas plant at the abandoned V.C. Summer Units 2 and 3 site. The NRC staff estimated air emissions for the natural gas portion of this combination alternative using emission factors developed by the DOE’s National Energy Technology Laboratory (NETL 2022-TN10530). The NRC staff estimates the following annual air emissions would result from operation of a natural gas portion of this combination alternative:

- CO—37 tons (33 MT)
- NO_x—67 tons (61 MT)
- SO_2—18 tons (16 MT)
- PM—67 tons (61 MT)
- carbon dioxide equivalents—2.3 million tons (2.1 million MT)

Operation of mechanical draft cooling towers and worker vehicles would result in additional air emissions. A new natural gas alternative would need to secure a permit from the SCDHEC for air pollutants associated with its operation. Emissions would be less than those for the natural gas alternative, but still noticeable.

Direct air emissions associated with operation of the solar with battery storage of this alternative are negligible because no fossil fuels are burned to generate electricity. Emissions would include fugitive dust and engine exhaust from worker vehicles and heavy equipment associated with site inspections, maintenance activities, and wind erosion from cleared lands and access roads. Emissions would be localized and intermittent.

Given that emissions from the natural gas portion of this combination alternative can be noticeable, the NRC staff concludes that the overall air quality impacts associated with construction and operation of the natural gas and solar combination alternative would be SMALL to MODERATE.

3.3.9.2 Noise

Construction-related noise sources for the natural gas portion of the combination alternative would be similar to the natural gas alternative discussed in Section 3.3.7.2 of this SEIS. The solar with battery portion of this alternative would have no power block buildings requiring construction. The amount of heavy equipment and workforce, level of activities, and construction duration would be lower than those for other alternatives. Noise levels generated by construction activities of a solar facility can range from 70 to 80 dBA at 50 feet (ft) (15 m) (BLM 2019-TN8386). The nearest resident to the V.C. Summer Units 2 and 3 site is approximately 1.0 mi (1.6 m). The nearest resident or noise-sensitive receptors for the solar panel with battery offsite location (located in South Carolina, but not in the abandoned V.C. Summer Units 2 and 3 site) is unknown. Additionally, construction of transmission lines would be needed, and noise levels may be noticeable to nearby noise-sensitive receptors along transmission corridors during construction. Therefore, noise levels during construction to nearby noise-sensitive receptors may be noticeable.

Operation-related noise sources for the natural gas portion of the combination alternative would be similar to the natural gas alternative discussed in Section 3.3.7.2 of this SEIS. The solar portion with battery storage of this alternative would have no power block or cooling towers, and a minimal number of noise sources, such as transformers and vehicular traffic, would be associated with maintenance and inspection activities.

Given that noise associated with construction of the offsite solar panel with battery storage of the combination alternative can be noticeable to noise-sensitive receptors, the NRC staff concludes that the noise impacts associated with the natural gas and solar combination alternative would be SMALL to MODERATE.

3.3.10 New Nuclear and Solar Combination Alternative

3.3.10.1 Air Quality

Air emissions associated with construction of the new nuclear portion of the combination alternative would be similar to those associated with the new nuclear alternative discussed in Section 3.3.8.1 of this SEIS., given that the new nuclear portion would be located in the abandoned V.C. Summer Units 2 and 3 site and the existing infrastructure would be used. Air emissions and sources for construction of the solar portion of this alternative would include those identified as common to all replacement power alternatives as described in Section 3.3.6.1 of this SEIS. Solar panels with battery storage would not have power block buildings. Accordingly, the amount of heavy equipment and workforce, level of activities, and construction duration would be lower, and, consequently, fewer air emissions would be generated at the site location. The solar with battery storage would be located at the V.C. Summer Units 2 and 3 site, and the existing transmission line infrastructure would also be used.

Air emissions associated with operation of the new nuclear portion of the combination alternative would be similar to those associated with the new nuclear alternative discussed in Section 3.3.8.1 of this SEIS. Direct air emissions associated with operation of solar with battery storage of this alternative are negligible because no fossil fuels are burned to generate electricity. Emissions would include fugitive dust and engine exhaust from worker vehicles and heavy equipment associated with site inspections, maintenance activities, and wind erosion from cleared lands and access roads. Emissions would be localized and intermittent.

The NRC staff concludes that the overall air quality impacts associated with construction and operation of the new nuclear and solar combination alternative would be SMALL.

3.3.10.2 Noise

Construction-related noise sources and impacts for the new nuclear portion of the combination alternative would be similar to the new nuclear alternative discussed in Section 3.3.8.2 of this SEIS. The solar with battery portion of this alternative would have no power block buildings requiring construction. The amount of heavy equipment and workforce, level of activities, and construction duration would be lower than those for other alternatives. Construction-related noise would be limited to immediate vicinity of the abandoned V.C. Summer Units 2 and 3 site since the existing transmission infrastructure would be used. Noise levels generated by construction activities of a solar facility can range from 70 to 80 dBA at 50 ft (15 m) (BLM 2019-TN8386). The nearest resident to the V.C. Summer Units 2 and 3 site is approximately 1.0 mi (1.6 km). At a 0.5 mi (0.8 km) distance from construction equipment, 70–80 dBA noise levels can drop to 35–45 dBA. Based on the temporary nature of construction activities, the distance of noise-sensitive receptors from the site, and consideration of noise attenuation from the construction site, the NRC staff concludes that the potential noise impacts of construction activities from a new nuclear and solar combination alternative would not be noticeable.

Operation-related noise sources and impacts for the new nuclear portion of the combination alternative would be similar to the new nuclear alternative discussed in Section 3.3.8.2 of this SEIS. The solar with battery storage portion of this alternative would have no power block or cooling towers. A minimal number of noise sources, such as transformers and vehicular traffic, would be associated with maintenance and inspection activities. The NRC staff does not anticipate noise levels at noise-sensitive receptors from operation of a new nuclear and solar combination alternative at the V.C. Summer Units 2 and 3 site to be significantly greater than currently or previously experienced from operation of V.C. Summer. The NRC staff concludes that the noise impacts associated with the combination alternative would be SMALL.

3.4 Geologic Environment

This section of the SEIS summarizes the descriptive information about the geologic environment of the V.C. Summer site and site vicinity as provided in the Section E3.5 of the applicant's ER (Dominion 2023-TN10387). The descriptive information addresses regional geology and physiography, site geology, soils, and seismic history. The analysis by the NRC staff regarding potential environmental impacts on geology and soils from the proposed SLR action and alternatives to the proposed action follows the information summary.

3.4.1 Physiography and Regional Geology

From northwest to southeast, the region within 200 mi (321.8 km) of the V.C. Summer site includes portions of five physiographic provinces: the Appalachian Plateau, Valley and Ridge, Blue Ridge, Piedmont, and Coastal Plain (Dominion 2023-TN10409). The V.C. Summer site is located within the Piedmont physiographic province (Dominion 2023-TN10387: Figure E3.5-1), which is characterized by gently to steeply rolling hills underlain by crystalline metamorphic and plutonic igneous intrusive rocks. These rock units comprise the competent, tectonically deformed bedrock at the site and in the site vicinity. The base grade elevation of the V.C. Summer site is approximately 335 ft (102 m) mean sea level (MSL) within the competent bedrock (Dominion 2023-TN10387), which is 100 ft (30.5 m) above the graded ground surface of 435 ft (133 m) MSL.

3.4.2 Site Geology

Topography of the V.C. Summer site area is characterized by relatively gentle hills, typical of the Piedmont and well-drained mature valleys. Maximum topographic relief is approximately 250 ft (76 m) (Dominion 2023-TN10409). The site specifically overlies the Winnsboro plutonic complex with three major rock categories identified. The first and most prevalent rock category consists of granodiorite and quartz diorite intrusive igneous masses associated with the Winnsboro plutonic complex that are dated at about 300 million years (Ma) in age (Dominion 2023-TN10409). The second rock category consists of amphibolite grade metamorphic rocks comprising biotite and hornblende gneiss and amphibolite schist. The third rock category consists of migmatite associated with the contact margins between the intrusive igneous and metamorphic units (Dominion 2023-TN10409). Saprolite, which is produced by in-place chemical weathering of indurated rock units, and residual soils range from several feet to several tens of feet (approximately 1 to 20 m) in thickness. Alluvium occurs locally along the Broad River, in Frees Creek, and in the flatter segments of smaller drainages and gullies (Dominion 2023-TN10387). Geologic cross sections A-A' (Figure 3-8 in this SEIS) and B-B' in the ER (Dominion 2023-TN10387: Figures E3.5-3b and E3.5-3c, pp. E-3-70 and E-3-71) show that unconsolidated materials, including engineered fill and saprolite, occur from 0 to 89 ft (0 to 27.1 m) below ground surface at the site. Those cross sections indicate that the underlying competent bedrock elevation surface is variable due to the development of saprolite, which ranges in thickness from 0 to 40 ft (0 to 12.2 m) beneath the fill.

3.4.3 Geologic Resources

Geologic resources in the V.C. Summer region include intrusive igneous granitic rock bodies; whole, crushed, or broken stone; and clay, sand, and gravel (USGS 2023-TN10591). Multiple inactive stone quarries are located within 5 mi (8 km) of the site, the nearest of which is approximatley 2 mi (3.3 km) south of the site. Fairfield County produces construction grade sand, gravel, and crushed stone (USGS 2019-TN9149), and also produced gold from the Kennecott Ridgeway mine until 1999 (USGS 2024-TN10855; Wachob et al. 2009-TN9029).

3.4.4 Soils

Natural soils and rock materials across the V.C. Summer site were graded and disturbed during nuclear power plant construction. Where soils are present and undisturbed within the V.C. Summer plant boundary, mapping by the U.S. Department of Agriculture Natural Resources Conservation Service shows that the soils consist mainly of various types of loam, including: Hiwassee sandy clay loam (15.6 percent of site area), Pacolet sand loam (15.5 percent of site area), and Wilkes sand loam (15.4 percent of site area) (USDA 2024-TN10398). The majority of the undisturbed soils of the site area (excluding soil units mapped within the Monticello Reservoir) are not classed as prime farmland. The Hiwassee (except HwC2 and HsB), Iredell, and Cecil soil groups are classifed as farmland of statewide importance. An area of Chewacla soil in the southwest portion of the site is classified as prime farmland if drained and either protected from flooding or not frequently flooded during the growing season. An area of Goccoa soil on the western boundary of the site is designated as prime farmland if protected from flooding or not frequently flooded during the growing season.

The Natural Resources Conservation Service rates all soils on the site as either somewhat limited or very limited for shallow excavations (USDA 2024-TN10398). The Wilkes sandy loam (ranging from 6–40 percent slopes), Wateree-Rion complex, and Pacolet sandy loam soil groups that are present predominantly within the disturbed areas of the plant and in the western portion of the site boundary are rated severe for erosion potential, indicating significant erosion is expected without mitigating measures. Areas of the site composed of sandy clay loams, such as the Madison sandy clay loam (ranging from 6–25 percent slopes), Hiwassee sandy clay loam, and Cecil sandy clay loam are rated slight to moderate for expected erosion. These soils are predominantly present in the eastern portion of the site area. Stabilization measures to prevent erosion and sedimentation impacts to the site and surrounding area have been in place at the V.C. Summer site since operations began in the early 1970s (Dominion 2023-TN10387). Dominion maintains a Stormwater Pollution Prevention Plan (SWPPP) for the plant site that identifies best management practices (BMPs) to reduce pollutants in stormwater discharges and inlcudes a sediment and erosion control program. Measures include graveled surfaces in industrial areas to reduce sediment transport, as well as vegetated filters in specific locations to provide sediment and erosion control. The SWPPP includes the provision for adding new BMPs if new areas of concern are identified (Dominion 2023-TN10387). The SWPPP is associated with the general industrial NDPES permit (SCR000000) that is maintained by Dominion for the site.

3.4.5 Seismic History

The V.C. Summer site is located within the Piedmont physiographic province, 25 mi (40 km) northwest from the boundary with the Coastal Plain physiographic province (Nystrom 1996-TN10399). Approximately 70 percent of the earthquakes that occur in South Carolina are located in the Coastal Plain with the single densest cluster in the area around Charleston, which experienced an earthquake in 1886 with a Modified Mercalli intensity of X—the highest intensity value on the Modified Mercalli scale and indicative of extreme ground shaking. The closest known regional fault is a normal fault in the Lake Murray area that is about 13 mi (21 km) south of the V.C. Summer site. Evidence indicates that this fault has been inactive for at least about 200 million years (Dominion 2023-TN10409; SCE&G 2010-TN2024). The Eastern Tennessee Seismic Zone, one of the most seismically active areas in the eastern United States, is located approximately 175 mi (282 km) northwest of the site. No historical earthquakes in the Eastern Tennessee Seismic Zone have occurred at magnitudes great enough to be damaging. Figure 3-1 shows the locations of historic seismic events of magnitude greater than or equal to Richter magntiude 3 within 200 mi (322 km) of the V.C. Summer site from January 1970 through August 26, 2024.

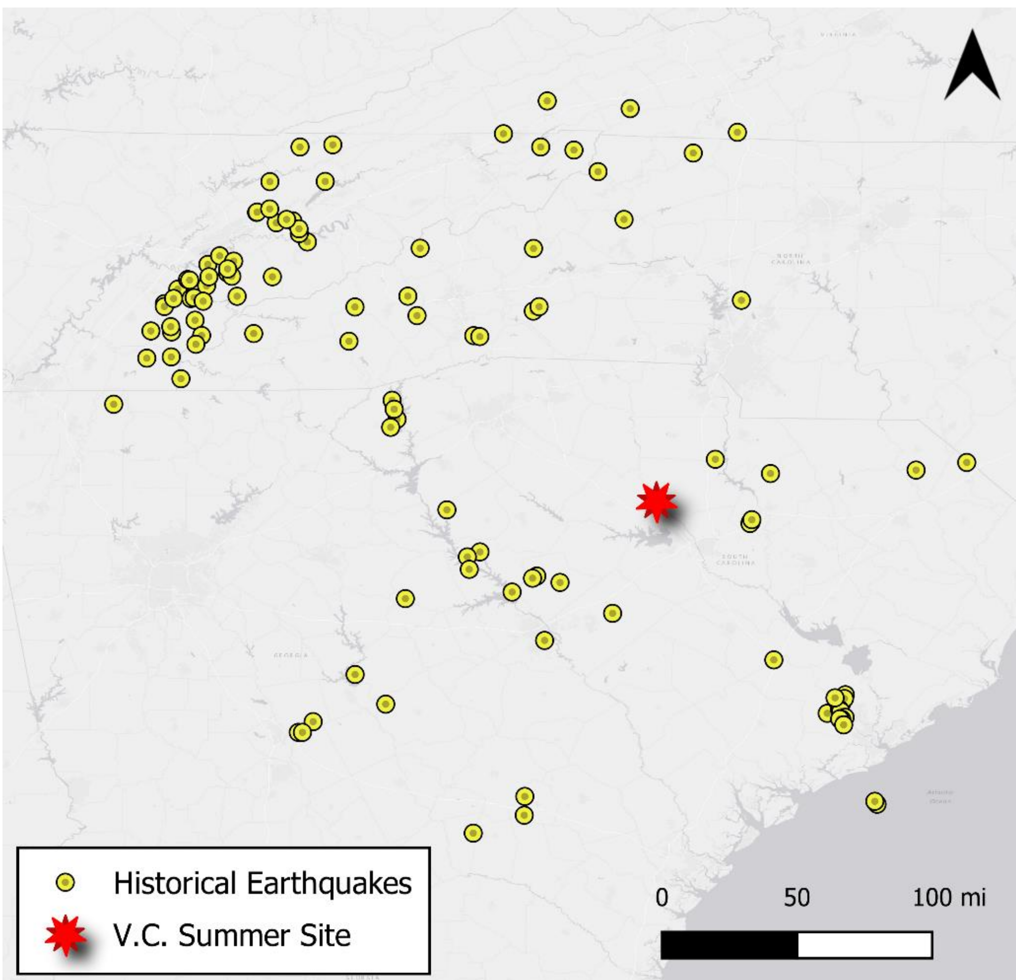


Figure 3-1 Historical Earthquakes of Magnitude Greater Than or Equal to Richter Magnitude 3 within 200 mi (322 km) of the Virgil C. Summer Nuclear Station (January 1970–August 26, 2024). Source: USGS 2024-TN10534.

Following the initial filling of the Monticello Reservoir, thousands of small reservoir-induced earthquakes occurred for several years in the vicinity of the V.C. Summer site. Occasional small-magnitude earthquakes still originate at the reservoir. The majority of the reservoir-induced seismic events are less than Richter magnitude 3 and are generally too small to be felt (SCEMD Undated-TN10400).

In 2023, the U.S. Geological Survey published updated seismic hazard maps that included the region encompassing the V.C. Summer site (Petersen et al. 2024-TN9940). Seismic hazard (i.e., peak ground acceleration) for a specific location due to shaking induced by an earthquake is expressed as a percentage of *g*, the gravitational acceleration near the Earth's surface, to assess the potential impact of the earthquake on engineered structures. Several factors, including the properties of rock and sedimentary materials through which the earthquake waves travel as well as earthquake magnitude and location, control the level of ground shaking that can occur. Based on the 2023 seismic hazard maps, the V.C. Summer site is in an area with a predicted peak horizontal ground acceleration between 0.36 and 0.60 *g* with a 2 percent probability of exceedance in 50 years, corresponding to a return period of about 2,500 years. This acceleration corresponds to a Modified Mercalli Intensity of VII for a 2 percent probability of exceedance in 50 years, indicating a moderate risk for damaging ground shaking of intensity V or greater in the next 50 years. Previous peak horizontal acceleration estimates and intensity levels for the site were 0.28 to 0.4 *g,* and VII, respectively (Petersen et al. 2020-TN7281).

The impacts of natural phenomena associated with geologic and seismic hazards on nuclear power plant systems, structures, and components are outside the scope of the NRC staff's LR environmental review. V.C. Summer was originally sited, designed, and licensed with due consideration for applicable geologic and seismic criteria. Seismic issues at operating nuclear power plants are assessed as part of the NRC's ongoing regulatory oversight. Furthermore, the NRC requires all licensees to consider seismic activity to maintain safe operating conditions at all nuclear power plants. When new seismic hazard information becomes available, the NRC staff evaluates that information to determine whether any changes are necessary at existing nuclear power plants. This Reactor Oversight Process, which considers seismic safety, is separate and distinct from the SLR environmental review performed by the NRC staff.

3.4.6 Proposed Action

As documented in the 2024 LR GEIS (NRC 2024-TN10161) for the generic Category 1 geology and soils issue, the impact of SLR and continued operations for V.C. Summer would be SMALL. The finding in 10 CFR Part 51 (TN10253), Subpart A, Appendix B, Table B-1 related to geology and soils indicates that this generic Category 1 issue would result in a SMALL impact for all nuclear power plants.

The NRC staff independently reviewed applicable information for geology and soils in the applicant's ER (Dominion 2023-TN10387) and associated references therein, considered information discussed during site audits and the scoping process, and evaluated other sources of available information (e.g., USGS 2024-TN10855 for geologic resources and Petersen et al. 2024-TN9940 for seismic hazard maps). The NRC staff did not identify any new and significant information related to geology and soils that would change the environmental impact determination stated in the 2024 LR GEIS (NRC 2024-TN10161) for this Category 1 generic issue. No significant impacts on geology and soils are anticipated during the SLR term to implement the proposed action that would be different from those occurring during the current license term. Thus, as documented in the LR GEIS and 10 CFR Part 51, the NRC staff concludes that impacts of subsequent license renewal related to the geology and soils issue would be SMALL for V.C. Summer. There are no applicable Category 2 issues related to geology and soils that require consideration for the V.C. Summer SLR.

3.4.7 No-Action Alternative

The no-action alternative would involve not renewing the existing operating license. With the subsequent cessation of operations, there would be little or no additional impact on geology and soils. Any contamination of onsite geology or soils would be assessed during decommissioning, whether at the end of the current licensing period or at the end of the SLR period. A license termination plan would describe any necessary actions needed for site-specific cleanup before release of the V.C. Summer site. Consequently, the NRC staff concludes that the impact of the no-action alternative on geology and soils would be SMALL.

3.4.8 Replacement Power Alternatives: Common Impacts

Construction

Construction activities associated with replacement power alternatives might result in temporary impacts on geology and soils if excavations for facility foundations or slope stabilization are necessary. Potential impacts would vary based on depth of excavations for impacts on geology and acreage of the area disturbed for impacts on soils. The NRC staff assumes that aggregate materials (e.g., crushed stone, riprap, sand, and gravel) needed to construct buildings, foundations, roads, parking lots, pad sites, transmission lines, and other supporting infrastructure would be obtained from local suppliers. The NRC staff expects that any impacts from construction of replacement alternatives on geology and soils would be localized and of short duration. Potential impacts would be prevented or mitigated by implementation of BMPs and Federal, State, and local permitting requirements.

Operation

Consumption of aggregate materials or topsoil for maintenance purposes during operations would be negligible. The NRC staff expects that operation activities associated with replacement power alternatives would not result in any detrimental impacts on geology and soils because there would be no disruptions affecting geology and soils during normal operation of those alternatives.

3.4.9 Natural Gas Alternative

The natural gas alternative would require construction of multiple combustion turbines, a heat recovery generator, and a steam turbine generator. Construction and operation of the plant would occur over 48 ac (19.4 ha) of the already disturbed V.C. Summer site, including abandoned Units 2 and 3. The impacts on geologic and soil resources from the NGCC plant alternative would likely be similar to, but of lesser intensity than, those described and assumed to be common to all alternatives in Section 3.4.8 of this SEIS. Existing transmission infrastructure and corridors could be used, in addition to an existing natural gas transmission pipeline currently located on site (with a minimal extension). Therefore, the NRC staff concludes that the impacts on geology and soil resources from the natural gas combined cycle alternative would be SMALL.

3.4.10 New Nuclear (Small Modular Reactor) Alternative

The new nuclear alternative would involve installation and operation of two 12-unit SMRs, which would utilize the abandoned V.C. Summer Units 2 and 3 site. The cooling system for the units would have mechanical draft cooling towers using makeup water from the existing Monticello Reservoir, and the existing transmission corridors/infrastructure could be used. Using the existing infrastructure at the V.C. Summer site to the maximum extent possible reduces potential construction impacts and other related impacts on site geology and soils, as well as consumption of geologic resources. Disturbance of geologic strata and soil erosion and loss under this alternative would generally be localized at the construction sites, and any necessary offsite soil erosion impacts would be mitigated by using BMPs. However, excavation work for the nuclear power block associated with the SMR modules could extend to a depth of approximately 140 ft (43 m) below grade (NRC 2019-TN6136) involving an additional 40 ft (12.2 m) below the existing site excavation depth. This increased depth would require excavation of additional rock material and the application of methods (e.g., grouting and dewatering) to stabilize the deep excavation during construction. The current V.C. Summer site utilizes a non-safety related dewatering system to prevent water intrusion to plant structures, and additional capacity provided by additional wells might be required. Because this alternative would require deep excavations for the two SMRs and substantial soil disturbance, the NRC staff concludes that the overall impacts on geology and soil resources from the new nuclear alternative would be SMALL to MODERATE.

3.4.11 Natural Gas and Solar Combination Alternative

The natural gas and solar combination alternative involves the construction and operation of an NGCC plant (as described in Section 3.4.9 of this SEIS) as well as the construction and operation of three solar installations with battery storage at the existing V.C. Summer site. Three additional solar installations would be constructed offsite in South Carolina. The impacts on geologic and soil resources from this alternative would likely be similar to but of greater intensity from those described and assumed to be common to all alternatives in Section 3.4.8 of this SEIS and to the natural gas alternative in Section 3.4.9 of this SEIS. The impacts would be due to the additional land requirements to support the offsite solar installations and associated transmission corridors. Disturbance of geologic strata, soil erosion, and loss under this alternative would generally be shallow and localized to the construction sites. Offsite soil erosion impacts would be mitigated by using BMPs. Based on these considerations, the NRC staff concludes that the potential impacts on geology and soil resources from the natural gas and solar combination alternative would be SMALL.

3.4.12 New Nuclear and Solar Combination Alternative

The new nuclear and solar combination alternative involves the installation and operation of one 12-unit SMR and one solar installation with battery storage at the V.C. Summer Units 2 and 3 site. Additional land disturbance outside the existing site would be required to support the battery storage of the solar installation, but existing transmission infrastructure and corridors could be used. The impacts on geologic and soil resources from this alternative would likely be similar to but of lesser intensity than the standalone new nuclear alternative described in Section 3.4.10 of this SEIS. Because this alternative would require a deep excavation for the SMR and substantial soil disturbance, the NRC staff concludes that the overall impacts on geology and soil resources from the new nuclear and solar combination alternative would be SMALL to MODERATE.

3.5 Water Resources

This section of the SEIS describes surface water and groundwater resources at and around the V.C. Summer site. The description of the resources is followed by the staff's analysis of the potential impacts on surface water and groundwater resources from the proposed action (SLR) and alternatives to the proposed action.

3.5.1 Surface Water Resources

Surface water encompasses all water bodies that occur above the ground surface, including rivers, streams, lakes, ponds, and manmade reservoirs or impoundments.

3.5.1.1 Surface Water Hydrology

Local and Regional Hydrology

V.C. Summer is located in Fairfield County, South Carolina. Nearby cities include Winnsboro and Columbia. V.C. Summer is located in the Piedmont physiographic province, characterized by hilly terrain with broad stream valleys. The surrounding area has numerous small streams, and the Broad River is the major river near V.C. Summer, located approximately 1 mi (1.5 km) west of the plant site (Figure 3-2). The Broad River is a major river in South Carolina and its watershed covers approximately 12 percent (3,800 square miles [mi^2], 9,842 square kilometers [km^2]) of the State (BRBC 2024-TN10402). The majority of the Broad River watershed is either forested or agricultural land (BRBC 2024-TN10402).

The V.C. Summer site is located topographically above the Broad River along the southwestern shore of Monticello Reservoir. The Monticello Reservoir was created by damming the outlet of the small 17 mi^2 (44 km^2) Frees Creek Valley watershed, a small tributary of the Broad River. Monticello Reservoir is also hydraulically connected to a small 300 ac (121 ha) water body called the Monticello Sub-impoundment that is used for recreational boating and fishing (Dominion 2023-TN10387). The Broad River to the west of the site is dammed, and the dammed section of the river is called Parr Shoals Reservoir (hereafter referred to as Parr Reservoir). Together, the Parr Reservoir and Monticello Reservoir are operated as the lower and upper portions of the Fairfield Pumped Storage Facility.

The Parr Reservoir was constructed in 1914, decades before the creation of the Monticello Reservoir, to provide water to the 15 MW downstream Parr Hydroelectric Plant. The Fairfield Pumped Storage Facility was constructed in 1977, which involved expanding the capacity of Parr Reservoir and building the Monticello Reservoir. The Monticello Reservoir has a surface area of 6,800 ac (2,751 ha) and storage capacity of 431,000 ac-ft (531.6 million cubic meter [million m^3]) (Dominion 2023-TN10387). The Monticello Reservoir serves the dual purpose of supplying cooling water for V.C. Summer and also serving as the upper water storage reservoir for the Fairfield Pumped Storage Project. The pumped storage project generates hydroelectric power during peak power demand periods by releasing water from Monticello Reservoir. Storage for Monticello Reservoir is replenished by pumping water from Parr Reservoir during non-peak power demand periods. Daily releases and pumping can transfer up to 29,000 ac-ft (35.8 million m^3) of water between the two reservoirs, with the magnitude of daily releases varying seasonally and depending on power needs. Pumped storage operations occur year-round.

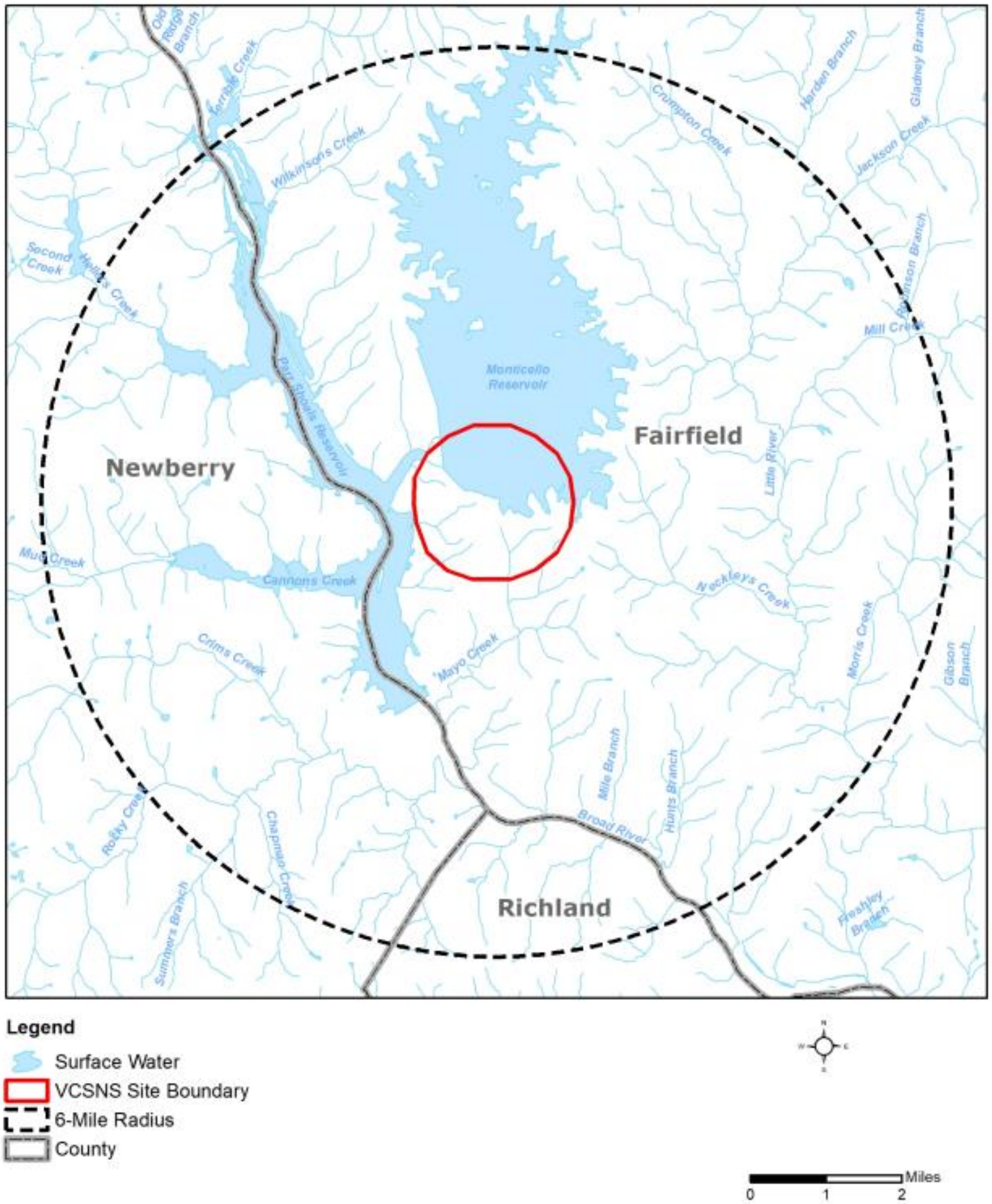


Figure 3-2 Major Surface Water Features in the Vicinity of the Virgil C. Summer Nuclear Station Site. Source: Dominion 2023-TN10387.

The Broad River near the V.C. Summer site is approximately 2,000 ft (610 m) wide with depths of up to 15 ft (4.6 m). While local runoff from the Frees Creek Valley can be stored by the Monticello Reservoir, the operation of the pumped storage project is the primary source of water to maintain storage. Reliable flow from the Broad River is therefore essential to providing water supply to the Monticello Reservoir. Over the last 43 years (i.e., from 1980 to 2023), the lowest recorded flow on the Broad River 1.2 mi (1.9 km) downstream of Parr Reservoir was 48.3 cfs or approximately 25.9 million gallons per day (MGD) (1.37 cubic meter per second [m^3/s]) on September 12, 2002 (USGS 2024-TN10403, USGS 2024-TN10828), and the lowest monthly mean flow was 546 cfs or approximately 293.8 MGD (15.5 m^3/s) in August 2002 (USGS 2024-

TN10404). Water levels in Monticello Reservoir are continuously monitored by V.C. Summer. Releases from Monticello Reservoir and pumping from Parr Reservoir maintain relatively constant water levels in Monticello Reservoir. An alarm system is triggered if water levels exceed 427 ft (130.1 m) MSL or fall below 419 ft (127.7 m) MSL.

V.C. Summer uses a once-through cooling system. Monticello Reservoir is the source of cooling water for V.C. Summer, and after being passed through the condensers, cooling water is discharged back into the Monticello Reservoir. There is a single circulating water intake structure comprising of three pump bays located along the south shoreline of Monticello Reservoir. Cooling water is discharged into the cooling water discharge canal to the southeast of the V.C. Summer intake structure.

Flooding

Flooding at the V.C. Summer site from the Broad River/Parr Reservoir is unlikely because the river and reservoir are topographically separated from the site. The V.C. Summer site is located in Federal Emergency Management flood hazard Zone X (minimal flood hazard) (Figure 3-3). The Monticello and Parr Reservoirs are mapped as Zone A, indicating that they are in the 1 percent chance floodplain. The V.C. Summer plant grade (435 ft [132.6 m] MSL) is approximately 10 ft (3 m) above the maximum operating level of Monticello Reservoir (425 ft [129.5 m] MSL). Additionally, the location and design of safety-related structures, exterior access, equipment, and systems relative to the shoreline of Monticello Reservoir reduce the possible hazard of flooding from storm-generated waves to these key features.

Stream gauge data for the Broad River in the vicinity of V.C. Summer are available at three USGS locations: Carlisle station 02156500 (24.6 mi [39.6 km] upstream of Parr Dam), Alston station 02161000 (1.2 mi [1.9 km] downstream of Parr Dam), and Richtex station 02161500 (10.2 mi [16.4 km] downstream of Parr Dam). Historical flow data show two flood seasons that occur between January and April and between July to October, with the latter flood season having larger high flow events associated with hurricanes. Based on available peak streamflow data for the three stations, the maximum peak flows at Carlisle, Alston, and Richtex stations were 123,000 cfs (3,483 m^3/s) on October 10, 1976; 140,000 cfs (3,964 m^3/s) on June 7, 1903; and 228,000 cfs (6,456 m^3/s) on October 3, 1929, respectively (USGS 2024-TN10405, USGS 2024-TN10406, USGS 2024-TN10407).

V.C. Summer has engineered and natural drainage systems to remove stormwater runoff from the site. However, the storm drain system for V.C. Summer is not credited to prevent flooding during a local intense precipitation event (Dominion 2023-TN10409). If the storm drain system became blocked or was not capable of fully discharging surface runoff, runoff would accumulate on the surface of the V.C. Summer site and flow toward topographic low points. Excess runoff from the power block area would flow toward the service water pond (SWP). Following the Fukushima accident, the NRC mandated additional reevaluation of the local intense precipitation flood hazards (NRC 2020-TN10401). Following the assessment, permanent modifications to enhance the protection of key plant structures, systems, and components were made. The assessment also evaluated flooding due to the combined storm surge and wind-induced wave run-up in Monticello Reservoir, and determined that key structures, systems, and components were not at risk from flooding from Monticello Reservoir (Dominion 2023-TN10387).

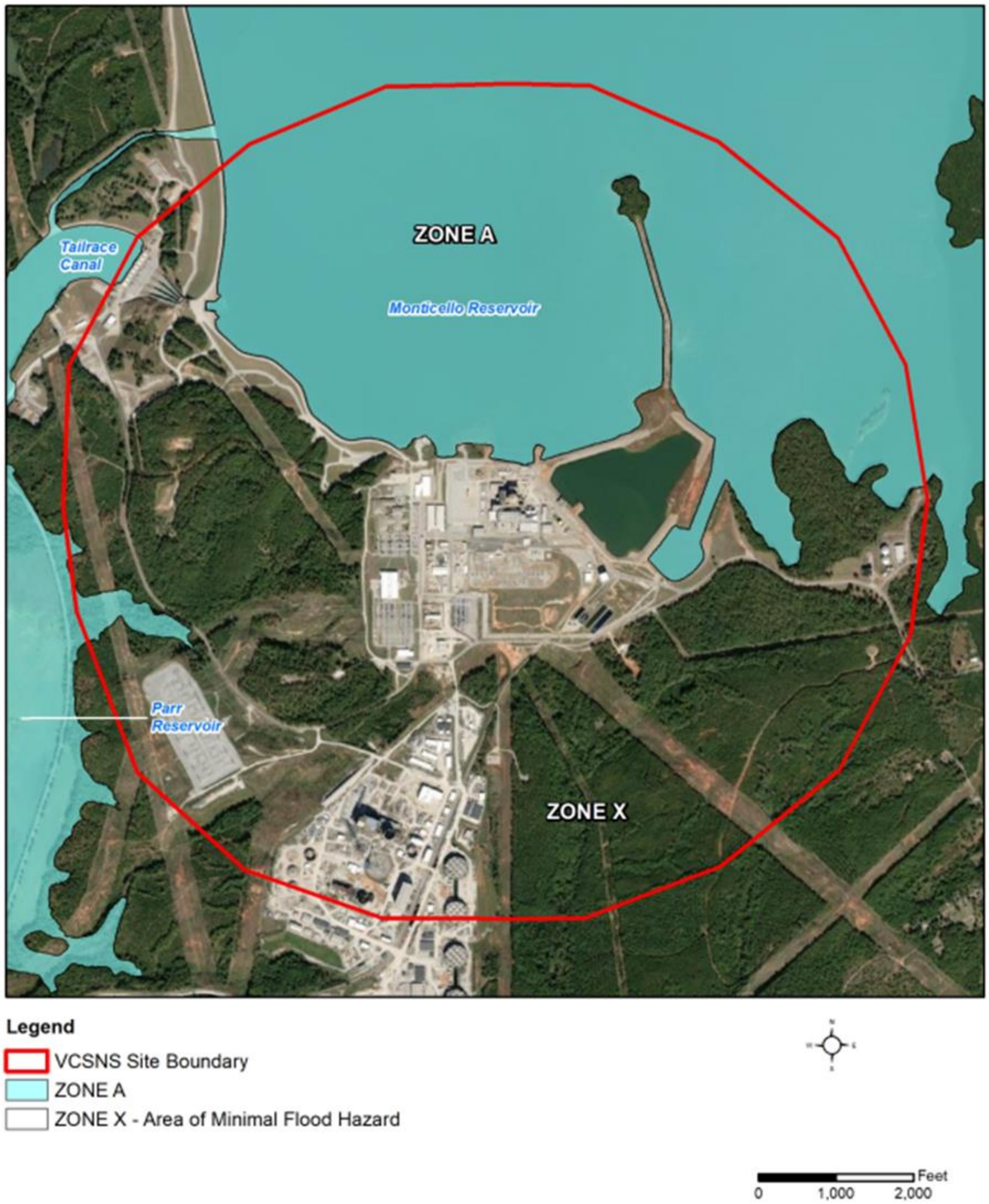


Figure 3-3 Federal Emergency Management Agency Flood Hazard Designation for the Virgil C. Summer Nuclear Station Site. Source: Dominion 2023-TN10387.

The NRC staff evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations through its Reactor Oversight Process. If new information about changing environmental conditions becomes available, the NRC staff will evaluate the new information to determine whether any safety-related changes are needed.

3.5.1.2 Surface Water Use Last 5 Years

Surface water withdrawals for V.C. Summer are permitted under Surface Water Withdrawal Permit No. 20PN001. The permit allows V.C. Summer to withdraw a maximum of 26,243.86 million gallons of surface water per month (MGM) (99.3 million m^3 per month) from Monticello Reservoir via the circulating water intake structure and the OWS. The majority of withdrawn water is used for condenser cooling. A small fraction of the withdrawals is used for the service water system, potable water, Turbine Building cooling tower makeup water, and fire protection. Recent surface water withdrawals for V.C. Summer are summarized in Table 3-6. Over the 2019–2023 period, V.C. Summer withdrew an annual average of 249,835 million gallons per year (MGY) or 684 MGD (946 million m^3 per year), with a maximum of 269,816 MGY or 739 MGD (1,021 million m^3 per year) in 2019 and a minimum of 229,011 MGY or 630 MGD (867 million m^3 per year) in 2021. Over the same 5-year period, monthly maximum and minimum withdrawals were 22,918 MGM or 764 MGD (86.8 million m^3 per month) and 4,752 MGM or 158 MGD (18 million m^3 per month), respectively.

Table 3-6 Surface Water Withdrawals for Virgil C. Summer Nuclear Station from the Monticello Reservoir

Year	Monthly Average (MGM)	Monthly Minimum (MGM)	Monthly Maximum (MGM)	Yearly Total (MGY)
2019	22,485	20,699	22,918	269,816
2020	19,785	8,202	22,915	237,424
2021	19,084	4,752	22,916	229,011
2022	22,122	19,496	22,917	265,465
2023	20,622	5,382	22,910	247,459

MGM = million gallon(s) per month; MGY = million gallon(s) per year.
All reported values are rounded.
Source: Dominion 2023-TN10387, Dominion 2024-TN10391.

Surface water is used downstream of Fairfield Pumped Storage Facility (the combined operation of Parr and Monticello Reservoirs) for municipal and industrial supply. The largest downstream user of surface water in the vicinity of V.C. Summer is the City of Columbia, using an estimated 23 MGD (87,100 m^3 per day) from the Broad River (Dominion 2023-TN10387). The V.C. Summer withdrawals are from Monticello Reservoir, with makeup water obtained from Parr Reservoir. Due to the operations of the Fairfield Pumped Storage Facility, the Parr Reservoir has a daily average water level change of approximately 4 ft (1.2 m), and the Monticello Reservoir could change up to 4.5 ft (1.4 m) daily (Dominion 2023-TN10387). Average natural evaporation from Monticello Reservoir is estimated at 65 ac-ft per day (21.3 MGD), and an additional average loss of 44 ac-ft per day (14.3 MGD) is estimated from evaporation of condenser water (Dominion 2023-TN10387). Based on the reported evaporative loss estimate of 14.3 MGD (54,100 m^3 per day) and average withdrawals of 684 MGD (2.6 million m^3 per day), V.C. Summer consumes approximately 2 percent of the withdrawn water. Annual average precipitation offsets a majority of the combined annual evaporative losses from Monticello Reservoir (Dominion 2023-TN10387).

The SWP is a safety-class impoundment within a small arm of the Monticello Reservoir (Dominion 2023-TN10387). The SWP is created by three earthen dams and the west site embankment (Dominion 2023-TN10409). It supplies service water under normal and emergency conditions. The service water system intake provides water from the SWP or the Monticello Reservoir using an interconnecting pipe and an isolation valve (Dominion 2023-TN10409). Under normal operating conditions, the water levels in Monticello Reservoir and the SWP vary between 420.5 and 426 ft (128.2 and 129.8 m) MSL. At a water level of 425 ft (129.5 m) MSL, the SWP contains 1,408 ac-ft (1.74 million m^3) of water with a surface area of 41 ac (16.6 ha) (Dominion 2023-TN10387).

3.5.1.3 Surface Water Quality and Effluents

<u>Water Quality Assessment and Regulation</u>

In accordance with Section 303(c) of the Federal Water Pollution Control Act (i.e., Clean Water Act of 1972, as amended [CWA; 33 U.S.C. 1251-1387-TN662]), States have the primary responsibility for establishing, reviewing, and revising water quality standards for the Nation's navigable waters. Such standards include the designated uses of a water body or water body segment, the water quality criteria necessary to protect those designated uses, and an anti-degradation policy with respect to ambient water quality. As established under Section 101(a) of the CWA, water quality standards are intended to restore and maintain the chemical, physical, and biological integrity of the Nation's waters and to attain a level of water quality that provides for designated uses. The EPA reviews each State's water quality standards to ensure that they meet the goals of the CWA and Federal water quality standards regulations (40 CFR Part 131-TN4814: Water Quality Standards).

Section 303(d) of the CWA requires States to identify all "impaired" waters for which effluent limitations and pollution control activities are not sufficient to attain water quality standards in such waters. Similarly, CWA Section 305(b) requires States to assess and report on the overall quality of waters in their state. States prepare a CWA Section 303(d) list that identifies the water quality limited water bodies that require the development of total maximum daily loads (TMDLs) to assure future compliance with water quality standards. The list also identifies the pollutant or stressor causing the impairment and establishes a priority for developing a control plan to address the impairment. The TMDLs specify the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Once established, TMDLs are often implemented through watershed-based programs administered by the State, primarily through permits issued under the NPDES permit program, pursuant to Section 402 of the CWA, and associated point and nonpoint source water quality improvement plans and associated BMPs. States are required to update and resubmit their impaired waters list every 2 years, which assures that impaired waters continue to be monitored and assessed by the State until applicable water quality standards are met.

Under CWA Sections 305(b) and 303(d), South Carolina compiles an integrated report of surface water quality (SCDES 2024-TN10408).[2] South Carolina's 2022 assessment of surface water quality was partially approved by the EPA on December 28, 2022 (EPA 2022-TN10535). The Clean Water Act (CWA) Section 305(b) requires each State to report the condition of its surface water quality to the EPA every 2 years and Section 303(d) requires each State to report on its impaired water bodies (i.e., those not meeting water quality standards). A review of the 2022 SCDHEC 303(d) list of impaired waters identified the following impaired waters in the vicinity of V.C. Summer:

- Broad River downstream of Parr Reservoir: copper
- Broad River upstream of Parr Reservoir: turbidity
- Parr Reservoir: *E. coli*, phosphorus at multiple locations
- Monticello Reservoir: pH at multiple locations

[2] On July 1, 2024, the South Carolina Department of Health and Environmental Control (SCDHEC) was split into two agencies—the South Carolina Department of Environmental Services (SCDES) and the South Carolina Department of Public Health. The State's 303(d) list is now maintained and updated by SCDES' Bureau of Water.

The 2024 draft 303(d) list is currently available for public comment (SCDES 2024-TN10408). The impaired waters listed above are also listed on the 2024 draft 303(d) list. The only TMDL established in the vicinity of V.C. Summer is for fecal coliform at some Broad River locations. TMDLs for pH and total phosphorus are currently being developed for Monticello and Parr Reservoirs.

Currently, South Carolina's list of water quality impairment constituents does not include radionuclides (SCDES 2024-TN10408). A review of Annual Radiological Environmental Operating Reports (AREORs) from 2020 through 2024 for V.C Summer shows that all surface water samples collected for Monticello Reservoir were below the applicable lower limits of detection for tritium and gamma-emitting isotopes (Dominion 2020-TN10416, Dominion 2021-TN10417, Dominion 2022-TN10418, Dominion 2023-TN10419, and Dominion 2024-TN10420).

National Pollutant Discharge Eliminating System Permitting Status and Plant Effluents

To operate a nuclear power plant, NRC licensees must comply with the CWA, including associated requirements imposed by the EPA or the State, as part of the NPDES permitting system under Section 402 of the CWA. The Federal NPDES permit program addresses water pollution by regulating point sources (i.e., pipes, ditches) that discharge pollutants to waters of the United States. NRC licensees must also meet State water quality certification requirements under Section 401 of the CWA. The EPA or the States, not the NRC, sets the limits for effluents and operational parameters in plant specific NPDES permits. Nuclear power plants cannot operate without a valid NPDES permit and a current Section 401 Water Quality Certification.

Since June 10, 1975, the State of South Carolina has had the authority to administer the NPDES program (EPA 2024-TN10085). The State's regulations for administering the NPDES program are contained in the South Carolina Code of Regulations, specifically within SC Regulation 61-9 (SCDHEC 2019-TN9121). NPDES permits are typically issued on a 5-year renewal cycle. V.C. Summer operates under the current NPDES wastewater permit No. SC0030856. The current NPDES permit was issued on August 9, 2022, by the SCDHEC, and has a listed expiration of August 31, 2027 (Dominion 2023-TN10387). V.C. Summer's OWS operates under a general permit for water treatment plant discharges, Permit No. SCG646000, which has an expiration date of July 31, 2027 (Dominion 2023-TN10387).

V.C. Summer's current NPDES Permit No. SC0030856 authorizes monitored discharges from nine outfalls, including three external (Outfalls 001, 003, and 014) and six internal (Outfalls 004, 005, 06A, 06B, 007, and 008), see Figure 3-4. External outfalls discharge directly to a surface water body or feature that connects directly to a water body, while internal outfalls are associated with flow from waste streams that are eventually discharged into an external outfall. External Outfalls 001 and 014 comprise the majority of external outfall discharge, with an estimated 24,955 MGM (94.5 million m^3 per month), while Outfall 003 is estimated to discharge 0.16 MGM (Dominion 2023-TN10387). The six internal outfalls are related to non-cooling water discharges to the Monticello Reservoir and Broad River. The three external outfalls are related to non-contact cooling water, low volume waste, and non-chemical metal cleaning waste. The current NPDES permit for the OWS (currently Permit No. SCG646000, formerly Permit No. SCG646072 Version 3.2) authorizes effluent limitations for discharges to the Monticello Reservoir at Outfalls 01A, 01B, 01C, 02A, 02B, 02C, 03A, 03B, 03C, 04A, 04B, 04C, 05A, 05B, 05C, 06A, 06B, 07A, 08A, 08B, and 09A (Dominion 2023-TN10387).

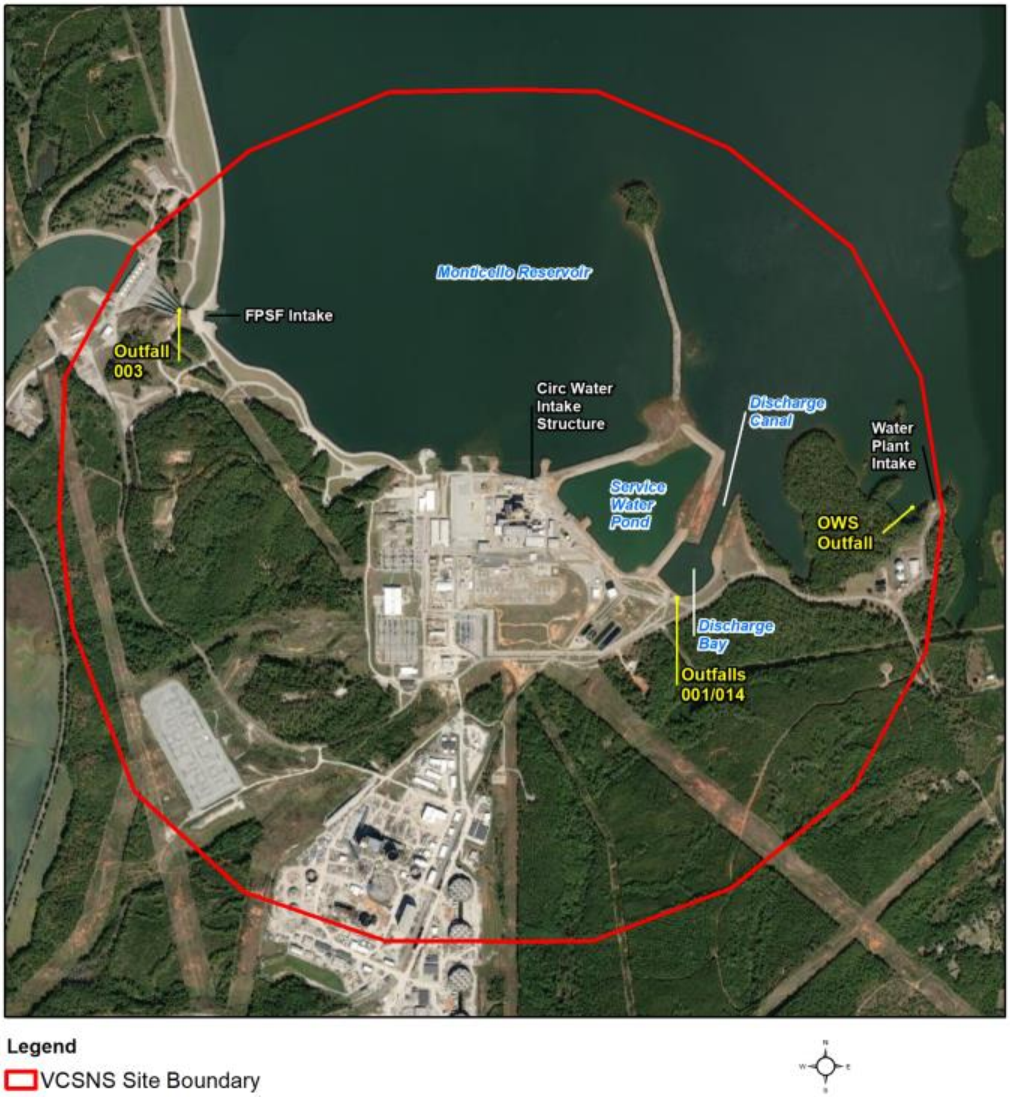


Figure 3-4 Virgil C. Summer Nuclear Station Site National Pollutant Discharge Elimination System Permitted Outfalls. Source: Dominion 2023-TN10387.

The NPDES permits specific pollutant-specific effluent limits and outlines sampling requirements for outfall effluents in order to ensure that discharges from V.C. Summer comply with applicable water quality standards. Monitoring requirements for each outfall associated with Permit No. SC0030856 are summarized in Table E3.6-2 of Dominion's ER (Dominion 2023-TN10387). Monitoring requirements for Permit No. SCG646000 are listed in the copy of the NPDES permit provided in Appendix A to the ER associated with the V.C. Summer SLR (Dominion 2023-TN10387). Parameters monitored under the NPDES permits (SC0030856 and SCG646000) include outfall flow rates; intake and discharge temperatures; pH; total suspended solids; oil and grease; *Ceriodaphnia dubia* toxicity; biochemical oxygen demand; *E. coli*; iron; copper; total residual chlorine; and other constituents. Monitoring requirements and effluent limits vary by outfall. Descriptions of the plant processes that contribute to each outfall along with outfall-specific permit requirements are provided in Dominion's ER Section E3.6.1.2.1 and Table E3.6-2 (Dominion 2023-TN10387). V.C. Summer's significant outfalls are described below.

External Outfall 001 discharges non-contact cooling water and low volume waste from Internal Outfalls 004 and 007. Effluent from Outfall 001 is discharged into the Monticello Reservoir via the discharge canal (Figure 3-4). The discharge elevation is approximately 10 ft (3 m) below the maximum water level in Monticello Reservoir of 425 feet (129.5 m) MSL. There are no discharge rate limits for Outfall 001, but there are limits on pH (between 6.0 and 8.5 standard units [SU]) and temperature (daily maximum less than 113°F [45°C]). Numerical modeling studies of the thermal plume created by cooling water discharge were conducted as part of the 2012 NPDES wastewater permit renewal application (No. SC0030856), and additional modeling was performed in 2014 at the request of the SCDHEC (Dominion 2023-TN10387). The modeling evaluated whether the maximum permitted cooling water discharge temperature of 113°F (45°C) could adversely impact the thermal conditions of Monticello Reservoir. The modeling results supported maintaining the 113°F (45°C) discharge water temperature limit, which applies to the current 2022 NPDES permit (Dominion 2023-TN10387). There are no limits on the intake water temperature or the maximum difference between intake and discharge water temperatures. Figure 3-5 presents monthly average intake water temperatures from 2006 to 2023 from Monticello Reservoir. There is no apparent trend over the 18-year period for monthly average intake water temperatures.

Discharge from External Outfall 003 consists of low volume metal cleaning waste. The receiving water body for Outfall 003 is the Broad River/Parr Reservoir. Outfall 003 is located 0.5 mi (0.8 km) from the northwest corner of the plant, where discharge is released into the penstocks of the Fairfield Pumped Storage Facility (Figure 3-4).

External Outfall 014 discharges the combined flows from Internal Outfalls 005, 06A, 06B, and 008. Outfall 014 is collocated with Outfall 001 and, like Outfall 001, discharges to Monticello Reservoir via the discharge canal (Figure 3-4). There is no effluent limit for discharge rate from Outfall 014, but pH must be between 6.0–8.5 and there are monitoring and reporting requirements for whole effluent toxicity testing using *Ceriodaphnia dubia.*

For all monitored effluents, V.C. Summer submits discharge monitoring reports to the SCDHEC in accordance with the reporting schedule specified in the NPDES permits. The following exceedances and violations are those incidents that occurred over the 5 year reporting period between 2019 and 2023, and are associated with V.C. Summer wastewater discharges (Dominion 2023-TN10387, 2024-TN10391):

- An SCDHEC warning letter dated September 3, 2019, noted a missing mercury measurement for the 2019 Discharge Monitoring Report (DMR) associated with NPDES Permit No. SCG646072 (OWS system). V.C. Summer submitted a corrected DMR to SCDHEC on September 11, 2019.

- The SCDHEC issued a notice of violation (NOV) on May 25, 2021, for NPDES Permit No. SCG646072 (OWS system) for exceedances of daily maximum total suspended solids and missing reported total manganese monthly average and daily maximum. The SCDHES did not require further action because explanations of the violations were provided by V.C. Summer.

- On May 24, 2021, SCDHEC issued violations for lapses of required periodic underground storage tank testing. V.C. Summer performed tests in October 2021 and February 2022 to satisfy the specified corrective actions. An email from SCDHEC on February 16, 2022, confirmed that V.C. Summer achieved compliance.

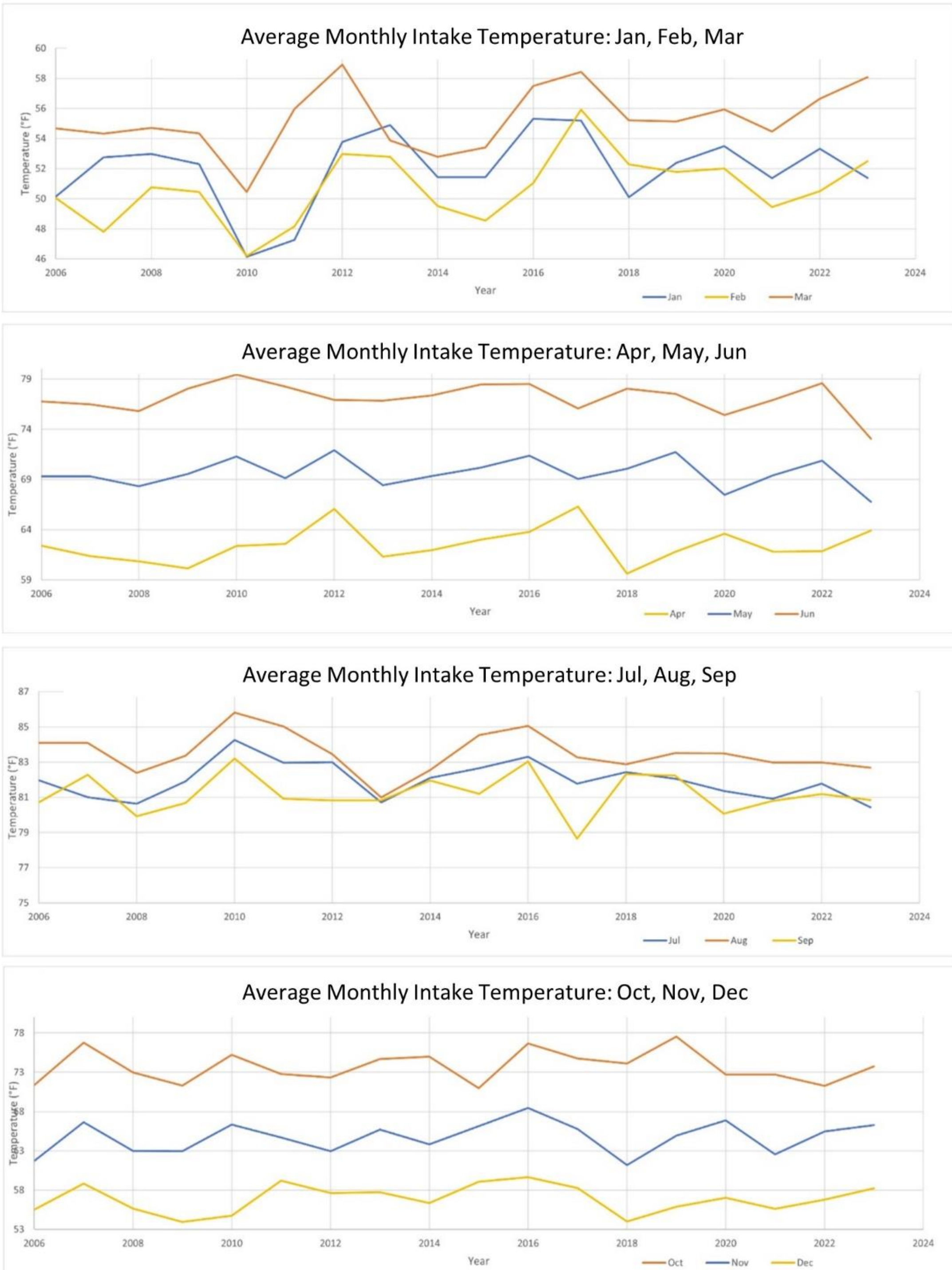


Figure 3-5 Monthly Average Intake Water Temperatures from Monticello Reservoir for Virgil C. Summer Nuclear Station, 2006–2023. Adapted from Request For Additional Information Response: Dominion 2024-TN10391.

- An NOV was issued by SCDHEC for NPDES Permit No. SCG646072 because reported total residual chlorine (TRC) analysis in DMRs over the June 2018 to July 2021 period was not conducted by a certified South Carolina laboratory. As a result, SCDHEC issued Consent Order 22-024-W on April 21, 2022. SCDHEC closed the consent order on May 5, 2022, and a letter from the SCDHEC on May 12, 2022, stated that the consent order requirements had been satisfied. Additionally, SCDHEC approved the laboratory certification application for TRC analysis on September 16, 2022.
- In December 2021, there was a reported exceedance of the maximum pH value for Outfall 014 associated with Permit No. SC0030856. The measured value was 8.8 SU, while the permitted range is 6.0–8.5 SU. V.C. Summer reported that the exceedance was due to cross-contamination from a sampling container and resampled the same day. The remeasured sample had a pH of 8.39 SU. Because this was the first reported pH exceedance in a 12-month period, SCDHEC did not issue an NOV.
- On April 6, 2022, SCDHEC issued V.C. Summer an NOV related to TRC for NPDES Permit No. SCG646072 (OWS system). The TRC exceedances occurred for Outfall 08A and included exceedances of the daily maximum and monthly average in January 2022. V.C. Summer provided a written response to the NOV on April 20, 2022. The response stated that the January exceedance was likely due to interference from oxidized manganese. To reduce the possibility of TRC exceedance, V.C. Summer implemented the following protocols: running aerators multiple days before discharging to lower residual chlorine concentrations and adding dechlorination tablets to the continuous chlorine monitoring system. In their response, V.C. Summer also noted that the basins had been sampled in January 2022 prior to releasing discharge via Outfall 08A and that neither sample exceeded the SCDHEC Practical Quantitation Limit of 0.05 mg/L for TRC. No releases occurred in February or March of 2022, and TRC in the April 2022 release was not detected.
- In March 2022, an exceedance associated with NPDES Permit No. SCG646072 (OWS system) for monthly average total suspended solid (TSS) at Outfall 06A was reported. The monthly limit of 30 mg/L was exceeded due to only a single measured value of 32.6 mg/L during the month. The daily maximum of 98 mg/L for TSS was not exceeded. V.C. Summer did not have any further correspondence from SCDHEC for this permit exceedance (Dominion 2024-TN10391).
- A monthly sample at the offsite water treatment facility was not collected in February 2023, resulting in a violation of NPDES Permit No. SCG646072 (Dominion 2024-TN10391). The parameters not sampled included effluent TRC, temperature, pH, TSS, total phosphorus, total iron, and total manganese. Following the discovery of the violation, grab samples were collected to verify that no abnormal indicators were present in the wastewater discharge. This violation was documented in V.C. Summer’s corrective action program, but the violation was not reportable.

Other Surface Water Resources Permits and Approvals

As stated earlier, NRC licensees must meet State water quality certification requirements under Section 401 of the CWA. Under the CWA, the NRC cannot issue a Federal permit or license unless the CWA Section 401 water quality certification has been issued or the water quality certification requirement has been waived by a State or another authorized agency. In preparation for the SLR application for Unit 1, Dominion requested a Section 401 waiver from SCDHEC in a June 22, 2022, letter. The SCDHEC approved the Section 401 waiver request in an August 4, 2022, letter (Dominion 2023-TN10387). Based on the staff’s review of this correspondence and applicable regulatory requirements in effect at the time, the SCDHEC rendered its CWA Section 401 determination, and the staff has determined that no further action is required by the NRC as the responsible Federal licensing or permitting agency as related to the CWA Section 401 certification process.

Stormwater runoff from the V.C. Summer site is covered by the NPDES general stormwater permit for industrial activities (SCR000000, coverage No. SCR004134). Stormwater runoff from the site area covered by the general stormwater permit is collected by seven storm drain systems that discharge to small, unnamed tributaries of the Broad River and Mayo Creek, which subsequently drains into the Broad River. To mitigate contamination, stormwater runoff generated from plant areas with the highest potential of runoff contamination is routed to and treated at the waste treatment facility. The waste treatment facility operates under current NPDES Permit No. SC0030856. OWS outfalls that feed into retention ponds that discharge into Monticello Reservoir are authorized by current NPDES Permit No. SCG646000 (formerly Permit No. SCG646072 Version 3.2). The outfalls associated with the general stormwater permit are SW12, SW13, and SWSW. These permitted outfalls have no effluent limits. Dominion has implemented an SWPPP for these outfalls under the general industrial stormwater permit. The SWPPP identifies potential sources of pollution that would be reasonably expected to impact water quality of runoff and manages these with BMPs that prevent or reduce pollutants in stormwater discharge. V.C. Summer annually evaluates its stormwater management plan to: (1) inspect for potential pollutant sources, (2) identify stormwater and non-stormwater discharges previously not identified in the SWPPP, (3) identify potential pollutant hot spots, and (4) review the CWA 303(d) list of impaired waters and TMDLs (Dominion 2024-TN10391). V.C. Summer annually certifies its compliance with the NPDES general stormwater permit.

No dredging has occurred or is planned for the intake or discharge structures at V.C. Summer. Therefore, V.C. Summer does not have a CWA Section 404 permit. If dredging is required in the future, V.C. Summer must obtain the necessary permits.

V.C. Summer generates hazardous and non-hazardous waste and is classified as a large-quantity hazardous waste generator (Dominion 2023-TN10387). V.C. Summer maintains an SWPPP, a spill prevention control and countermeasures plan, and a hazardous waste contingency (HWC) Plan. The HWC Plan is reviewed and updated annually (Dominion 2024-TN10391). The HWC Plan was last revised in February 2024 and is scheduled for review in December 2024. The plan is immediately implemented if a threat to human health or the environment is likely from an unplanned release of hazardous materials or hazardous waste. If hazardous materials or hazardous waste from a spill migrate to the stormwater drainage system, a downstream location is identified where the stormwater flow could be blocked using dams, absorbents, or other impermeable material. The SCDES Bureau of Land and Waste Management Emergency Response Section is notified of reportable quantity releases to air, land, or water. The NRC is notified if the spill threatens human health or the environment outside the plant or if the spill containing Comprehensive Environmental Response, Compensation, and Liability Act substances reaches navigable waters. After a release event, recovered waste is treated, stored, or disposed of appropriately. The event is investigated to determine the cause, then corrective actions are taken, and the HWC Plan is amended, if necessary. No reportable spills occurred in the 2017–2021 period (Dominion 2023-TN10387) or between January 2022 and April 2024 (Dominion 2024-TN10391).

3.5.2 Groundwater Resources

This SEIS section describes the groundwater flow systems (aquifers) and groundwater quality in and around the V.C. Summer site. Aquifers are a geologic formation, a group of formations, or part of a formation that contain sufficient saturated, permeable material to yield significant quantities of water to wells and springs.

3.5.2.1 Local and Regional Groundwater Resources

Sections E3.5.2 and E3.6.2 of the applicant’s ER describe the regional geology and groundwater resources, respectively, in the vicinity of the V.C. Summer site (Dominion 2023-TN10387). The NRC staff also evaluated information related to groundwater resources during the site audit, scoping process, and review of other available information cited in this SEIS.

The site is located in the Piedmont physiographic province of South Carolina. Crystalline bedrock underlies the site and is weathered in-place to form an overburden of clayey, silty, sandy soils, referred to as saprolite. A transition zone of partially weathered bedrock is often present near the top of the bedrock, as shown in Figure 3-6 below (LeGrand 2004-TN9017; Harned and Daniel 1992-TN9019). Regolith is generally defined as the composition of surface soils, saprolite, and stream deposits overlying the fractured bedrock. The regolith and fractured bedrock together form the aquifer, with the higher porosity regolith providing most of the water storage which also transmits water to the underlying fractures in the low-porosity bedrock. Recharge to the saprolite and bedrock is predominantly by precipitation infiltrating the ground along ridges/upland areas. Groundwater is generally unconfined, and the water table (i.e., the upper surface of saturation) is typically a subdued representation of the ground surface topography.

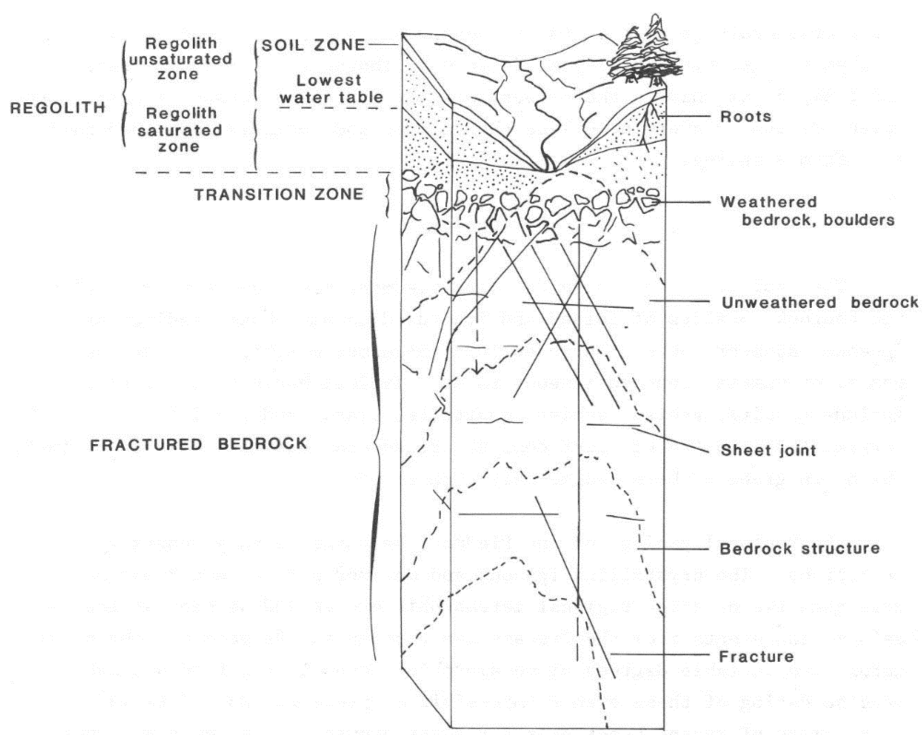


Figure 3-6 Conceptual Components of the Piedmont and Mountains Groundwater System. Source: Harned and Daniel (1992-TN9019).

At the V.C. Summer site, groundwater has been characterized within two zones—shallow groundwater that exists in the surface soils, fill, and saprolite, and deep groundwater that exists in the fractured crystalline bedrock (see Section 3.4.2 of this SEIS for a description of site geology). The two zones are hydraulically connected, and groundwater is typically encountered between 20 and 90 ft below ground surface (bgs) (6.1–27.4 m bgs) within the saprolite or fill materials (Dominion 2023-TN10387). The presence of discontinuous sand and gravel lenses is indicated by instances of perched groundwater at the site (Dominion 2024-TN10391).

Prior to construction of the Monticello Reservoir in 1978, groundwater flow from the site area was northeast toward Frees Creek and the Broad River (Dominion 2023-TN10409). Once the reservoir was constructed and filled, groundwater levels in the surrounding area increased, and the flow direction reversed. Flow paths in the shallow groundwater unaltered by site structures and the passive drainage system are now toward the south and southwest. Groundwater discharges to small tributaries of the Broad River, such as Mayo Creek (Dominion 2023-TN10387). Prior to the installation of the full dewatering system, the site calculated the linear horizontal groundwater velocity of the Zone I and II fill (0.07 ft/day [0.02 m/day]), Zone III fill (1.3 ft/day [0.40 m/day]), and saprolite (0.33 ft/day [0.10 m/day]).

Local post-construction groundwater conditions have been altered by the presence of a dewatering system within the V.C. Summer site footprint. Groundwater flow reversal and groundwater elevation rise following the impoundment of the reservoir resulted in persistent groundwater intrusion into some plant buildings at elevations below the water table (Dominion 2023-TN10409). Following the completion of hydrogeologic investigations in the early 2000s, a non-safety dewatering system was installed in 2008 near the plant buildings subject to water intrusion issues. The dewatering system is comprised of 16 wells installed at elevations between 85 and 180 ft below ground surface and mainly surrounds the main reactor buildings (e.g., Unit 1, Turbine Building, Fuel Handling Building). Figure 3-7 displays the dewatering wells, current monitoring wells, and groundwater elevation data from August 2022 (Dominion 2023-TN10387). Figure 3-8 is a hydrogeological cross-section, oriented west to east, across the main plant area, which depicts four dewatering wells in red.

The rate of dewatering is controlled by pre-determined water elevation set points within the wells using submersible pumps, level transmitters, and controllers. Groundwater elevation in the dewatering wells is maintained between 402 to 372 ft (122.5 to 113.4 m) MSL, and the rate of dewatering is estimated to be approximately 70,000 gallons per day (gpd; 264,979 liters per day [lpd]) during steady-state flow. The dewatering system ultimately discharges to two stormwater outfalls; specifically, water from well DW-3 is discharged to IGP Outfall SW13, and water from the remaining wells is discharged to IGP Outfall SW12 (Dominion 2024-TN10391).

The NRC staff reviewed groundwater contour maps pre- and post-dewatering system implementation at the plant (Dominion 2024-TN10391). Although the exact rate of discharge from the system is unknown, the radius of influence of the dewatering system is likely to be within the plant boundaries based on groundwater elevation contour data. The dewatering system creates a local groundwater flow divide between groundwater captured by the underdrain system and groundwater that is not influenced by the underdrain system. Investigations at the site in 2009, following the installation of the system, found groundwater flow capture in all directions: south from Monticello Reservoir, west from the service water pond, and north and east from two areas of groundwater mounding (seen in Figure 3-7 as the areas surrounding wells B-36 and B-22). The areas of groundwater mounding anomalies at B-36 and B-22 are likely the result of perched groundwater, clogged screens, and/or underground springs (Dominion 2024-TN10391).

The EPA has not designated any sole source aquifers in the State of South Carolina or adjoining the V.C. Summer site (EPA 2019-TN9022).

Figure 3-7 Groundwater Contours, Dewatering Wells, and Monitoring Wells at the Virgil C. Summer Nuclear Station Site, August 2022. Source: Dominion 2023-TN10387.

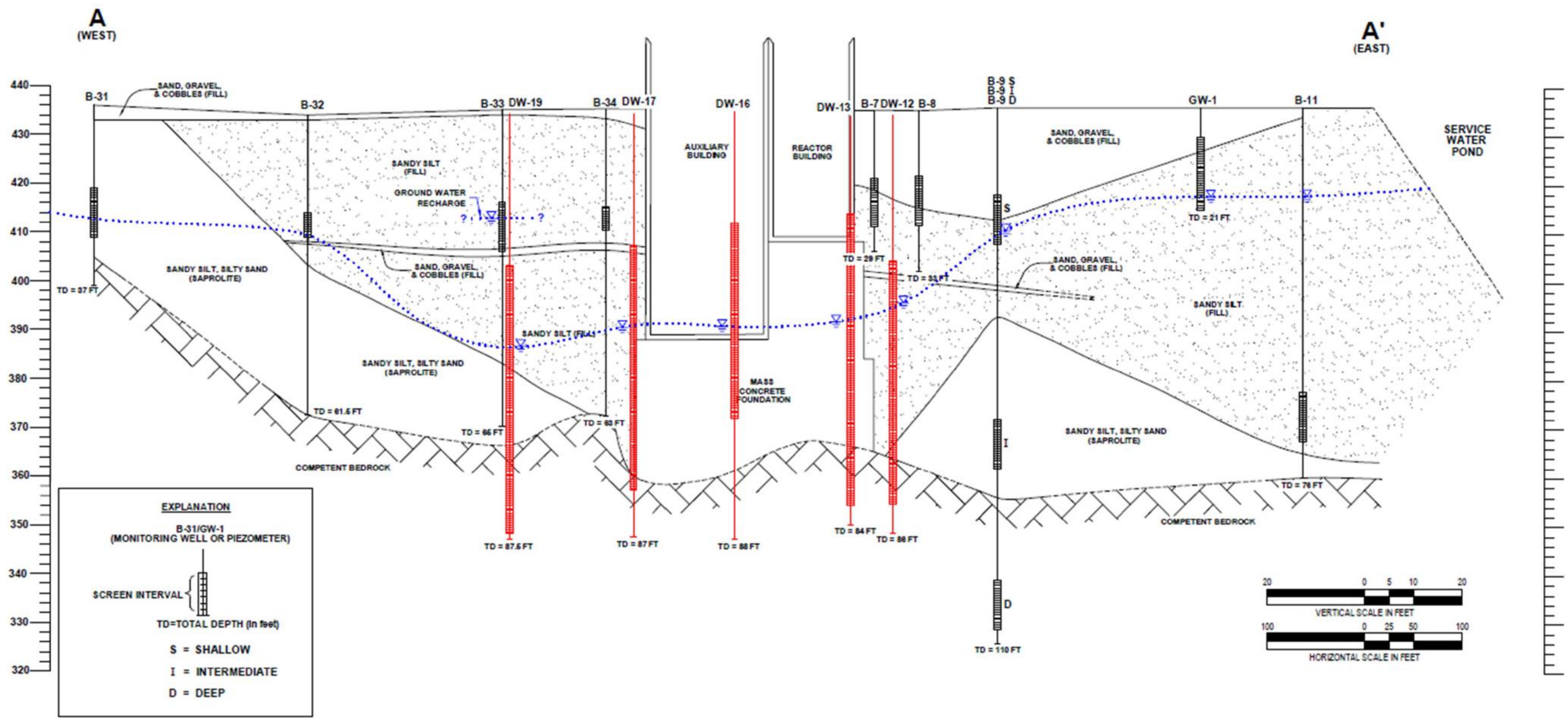


Figure 3-8 Hydrogeological Cross Section of Virgil C. Summer Nuclear Station Site. Source: Dominion 2023-TN10387.

3.5.2.2 Local and Regional Water Consumption

Counties within the Piedmont province in South Carolina largely rely on surface water for public supply, industry, agriculture, and power production. Not including power production, which is the largest user of surface water in the county, Fairfield County used approximately 1,200 million gallons of surface water and approximately 62 million gallons of groundwater in 2022 (SCDHEC 2023-TN10410). Public groundwater supply was the primary use of groundwater in Fairfield County in 2022.

There are 41 domestic supply wells within a 2 mi (3.2 km) radius of the center point of the V.C. Summer site (Dominion 2023-TN10387). Most of the wells are located to the east of the plant, and reported well depths ranged from 65 to 365 ft (19.8–111.3 m). The Jenkinsville Water Supply Company Inc. sources drinking water from nine wells, three of which are located approximately 2 mi (3.2 km) northeast of the site center (SCE&G 2010-TN2024).

There is no onsite use of groundwater at the V.C. Summer plant. As discussed in Section 3.5.2.1 of this SEIS, there is an onsite dewatering system that became fully operational in 2008 to prevent water intrusion into building foundations. The system maintains groundwater elevations at a range within the design specifications, and it is estimated the system discharges a maximum of 70,000 gpd (264,979 lpd) to the stormwater system.

3.5.2.3 Groundwater Quality

Groundwater quality in the Piedmont region is generally good and within drinking water standards for most constituents (USGS 1990-TN6648). Groundwater constituents vary based on the dominant aquifer rock type in the Broad River subbasin in which Fairfield County is located. Total dissolved solids in the subbasin range from 8–658 milligrams per liter (mg/L), and pH ranges from 5.1 to 9.1. Radionuclides above drinking water standards have been detected in wells in Jenkinsville, which is located approximately 2.5 mi (4.0 km) southeast of the site (Wachob et al. 2009-TN9029).

<u>Historical Radiological Spills and Tritium in Groundwater</u>

Groundwater Protection Program

Based on the Industry Groundwater Protection Initiative (NEI 2019-TN6775), a groundwater protection program (GWPP) was implemented at the V.C. Summer site in 2009. The GWPP was recently reviewed to align with the Electric Power Research Institute (EPRI) Guideline for Implementing a Groundwater Protection Program at Nuclear Power Plants (Dominion 2023-TN10387; EPRI 2008-TN1961). Alignment included the addition of new groundwater monitoring wells. There are 21 onsite monitoring wells included as part of the GWPP (Dominion 2023-TN10387). The purpose of the GWPP is to ensure timely and effective management of inadvertent releases of licensed material to groundwater.

Monitoring wells under the GWPP target nine systems, structures, and components (SSCs). Table 3-7 lists the groundwater monitoring wells on site at V.C. Summer and the associated monitored location of SSCs. Monitoring wells are depicted in Figure 3-7.

Table 3-7 Monitoring Wells, Sites, and Associated Locations with Systems, Structures, and Components of the Virgil C. Summer Nuclear Station

Monitoring Well/Site ID	Description of Monitored Location/SSCs
B-6	Upgradient / background
B-2S, B-36	SSC-1 • Liquid radioactive waste • Discharge line between auxiliary building and penstock • Manhole 35
DW-7	SSC-2 • Condensate storage tank
DW-2, DW-18, DW-19	SSC-3 • Spent fuel
GW-15A, GW-8A, GW-9, GW-12, GW-13A	SSC-4 • Waste treatment facility settling ponds • Required monitoring as part of NPDES Permit No. SC0030856
DW-13, DW-14, DW-15, DW-16, DW-17, DW-18	SSC-5 • Fuel transfer tube joint penetration SSC-6 • Spent fuel pool liner
Environmental Sites #27 and #122	SSC-7* • Steam generator blow down
B-22, B-23, B-26	SSC-8 • Turbine Building sump and discharge line to waste treatment facility SSC-9 • Condensate backwash receiver tank discharge to waste treatment facility

SSC = system, structure, and component.
*The steam generator blow down (SSC-7) is not directly monitored by a groundwater monitoring well. Two surveillance monitoring sites (i.e., environmental sites #27 and #122) monitor this SSC by proximity (Dominion 2024-TN10391).

The GWPP includes quarterly monitoring for tritium and gamma isotopes. If gamma and tritium activity is detected above lower limits of detection and above the maximum contaminant level (MCL) (20,000 picocuries per liter [pCi/L]), respectively, analysis for hard to detect radionuclides is also performed. Reporting levels provided in the Offsite Dose Calculation Manual (ODCM) are used as notification criteria for environmental samples (Dominion 2024-TN10391). The reporting level for tritium in water samples is 20,000 pCi/L.

In addition to the GWPP, V.C. Summer implements a Radiological Environmental Surveillance Program and a Supplemental Radiological Environmental Surveillance Program. The supplemental program is used to evaluate and modify the ODCM as needed. Six additional wells (namely, DW-3, GW-16, P2, P5, environmental lab garden, old nuclear training center) are not included in the GWPP but are monitored quarterly for gamma isotopic and tritium analysis.

Dewatering System Groundwater Discharge

The onsite dewatering system is described in Section 3.5.2 of this SEIS, and dewatering well locations are shown in Figure 3-7. The dewatering system discharges to the local stormwater drainage system via Outfalls SW12 and SW13. Potential releases from SSCs within the power block area will be captured by the dewatering system. Water samples are collected from

Outfalls SW12 and SW13 daily. A monthly composite sample is analyzed for gamma isotopes, and a quarterly composite sample is analyzed for tritium as part of the Supplemental Radiological Environmental Monitoring Program. The results of this sampling are summarized in the AREORs and are reported as locations 72 (SW12) and 73 (SW13). The analytical results are voluntarily included in the “Radiological Environmental Monitoring Program Summary” table for surface water. Tritium and gamma results between January 2018 and December 2023 for locations 72 and 73 were all below lower limits of detection (Dominion 2024-TN10391). Plant-specific procedures secure the dewatering pumps if groundwater contamination is detected (Dominion 2023-TN10409).

Radiological Releases

Annual Radiological Effluent Release Reports are submitted to the NRC (as required by 10 CFR 50.36a TN249) in order to report the quantities of radionuclides released from liquid and gaseous effluents as well as the results of groundwater monitoring under the GWPP (2020–2024 Annual Radiological Effluent Release Reports: Dominion 2020-TN10411, Dominion 2021-TN10412, Dominion 2022-TN10413, Dominion 2023-TN10414, and Dominion 2024-TN10415). The NRC staff reviewed 5 years of available radiological release reports (2019–2023 monitoring results), in addition to radiological environmental monitoring program results, including supplemental data, provided in AREORs (2020–2024 AREORs: Dominion 2020-TN10416, Dominion 2021-TN10417, Dominion 2022-TN10418, Dominion 2023-TN10419, and Dominion 2024-TN10420). Table 3-8 below summarizes recent detections of radiological contamination in groundwater. Where multi-year trends of contamination were identified, the applicable AREORs were reviewed to capture the entirety of a detection event (i.e., 2018 and 2019 AREORs: SCE&G 2018-TN10421, SCE&G 2019-TN10422).

Table 3-8 Recent Radiological Contamination from Virgil C. Summer Nuclear Station Identified in Onsite Groundwater

Date of Detection	Location	Description of Contamination Detected	Potential Source
Quarterly samples from 2017–2023	GW-16 (NPDES well) near sanitary and wastewater treatment facility	Tritium concentrations detected between 805 pCi/L (2022) and 2,800 pCi/L (2020) (Dominion 2021-TN10417, Dominion 2023-TN10419)	Historical leak from the Turbine Building sump (Dominion 2023-TN10387)
One quarterly sample in 2019	GW-13A (NPDES well) near sanitary and wastewater treatment facility	Tritium detected at 341 pCi/L (Dominion 2020-TN10416)	Historical leak from the Turbine Building sump (Dominion 2023-TN10387)
Quarterly samples between 2018–2019	DW-14, DW-15, DW-16 (dewatering wells) in the north power block area	Tritium detected in DW-15 in May 2018 at 6,230 pCi/L. Tritium detected in nearby wells DW-14 and DW-16 in 2018 at concentrations of 1,330 pCi/L and 1,290 pCi/L, respectively. (SCE&G 2019-TN10422). Last tritium detection among the three dewatering wells occurred in 2019 at a maximum concentration of 3,140 pCi/L (DW-15). (Dominion 2020-TN10416)	No specific source identified, though a potential source is a backflow event from the radioactive waste pad trench located north of the Fuel Handling Building following contamination of the trench from use of a hose that was stored near a tritiated source

NPDES = National Pollutant Discharge Elimination System.

None of the tritium detections described in Table 3-8 resulted in an exceedance of the MCL for tritium in drinking water (i.e., 20,000 pCi/L), nor did they exceed site reporting requirements. The ongoing tritium detections in GW-16 and GW-13A do not indicate an increasing trend but are likely due to low level radioactivity contained in the Turbine Building sump, which discharges to the sanitary waste collection sump. Groundwater in this area and pond water that infiltrates into groundwater will likely flow south toward Mayo Creek, based on groundwater elevation and flow path data, as described in Section 3.5.2.1 of this SEIS. Groundwater is not used as a source of drinking water in this area, and any release of tritium to surface water will be further diluted below the MCL.

In 2018 and 2019, tritium detected in dewatering wells DW-14, DW-15, and DW-16 discharged to the stormwater drainage system. All monthly composite samples collected from the stormwater drainage system from 2018–2019 measured below the limit of detection for tritium (SCE&G 2019-TN10422 and Dominion 2020-TN10416).

In 2019 and 2020, tritium was detected in an offsite monitoring location. Columbia Water Works (Radiological Environmental Monitoring Program [REMP] sample location 17) detected tritium in three samples at a maximum concentration of 935 pCi/L in 2020 (Dominion 2020-TN10416, Dominion 2021-TN10417). Although a source of the tritium was not reported, the concentration is much less than the MCL for tritium in drinking water (20,000 pCi/L), and the anticipated dose for the maximum recorded concentration is within permitted values per 10 CFR Part 20-TN283, as described Section 3.13 of this SEIS.

Dominion did not report any unplanned or inadvertent releases of radioactive material from January 2017–April 2024 (Dominion 2023-TN10387, Dominion 2024-TN10391).

Nonradiological Spills

In addition to radiological monitoring programs, groundwater monitoring is also required in the area of the auxiliary boiler fuel oil storage tank due to a release of No. 2 fuel oil in 1978 (Dominion 2023-TN10387). Dominion reports that the historical spill has resulted in ongoing contamination in wells GW-3 and GW-4. Free-phase product has been consistently measured in GW-3, so groundwater sampling efforts are concentrated on GW-2 (downgradient of the source) and GW-4 (upgradient of the source). Sampled constituents (i.e., benzene, toluene, ethylbenzene, xylenes, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(K)fluoranthene, chrysene, and dibenzo(a,h)anthracene) have not been detected above respective MCLs in downgradient well GW-2. The extent of the impacted groundwater is likely contained within the GW-3 and GW-4 based on the lack of contamination in down-gradient wells (Dominion 2023-TN10387).

In addition to the historical release in the auxiliary boiler fuel oil storage tank area, there have been three inadvertent releases of nonradioactive materials from January 2019–April 2024 (Dominion 2023-TN10387, Dominion 2024-TN10391). Only one of the releases resulted in an exceedance of reporting criteria. On November 16, 2021, mineral oil mixed with a large amount of water from a main transformer suppression system surpassed the capacity of the plant's oil/water separator. The separator sump ultimately discharged to NPDES Outfall 014, which released approximately 50 gallons of mineral oil into Monticello Reservoir. Dominion reports that the oil was contained with booms and remediated (Dominion 2023-TN10387).

There are no ongoing remediation activities associated with nonradiological releases at the V.C. Summer site. The site utilizes several site-specific procedures and BMPs to minimize the potential for a chemical release to the environment, including a spill prevention control and countermeasures plan, hazardous waste contingency plan, hazardous waste management plan, and chemical control procedure (Dominion 2023-TN10387).

3.5.3 Proposed Action

3.5.3.1 Surface Water Resources

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and cited in Table 3-1 for generic surface water resources issues, the impacts of nuclear power plant SLR and continued operations would be SMALL for Category 1 issues applicable to V.C. Summer. The NRC staff's review did not identify any new and significant information that would change the conclusion in the 2024 LR GEIS. This includes a review of the exceedances and violations related to V.C. Summer's NPDES permit. The NRC staff does not consider the impact of these exceedances and violations to be significant because they were resolved to the satisfaction of SCDHEC upon appropriate actions taken by V.C. Summer. Thus, as concluded in the 2024 LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on surface water resources would be SMALL.

The 2024 LR GEIS lists one Category 2 issue for surface water resources—surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) (NRC 2024-TN10161). V.C. Summer uses the Monticello Reservoir as its cooling pond, and the makeup water for the cooling pond is obtained from Broad River/Parr Reservoir (Dominion 2023-TN10387). Because of the operation of the Fairfield Pumped Storage Facility that uses the Parr Reservoir as the lower water storage reservoir and uses the Monticello Reservoir as the upper water storage reservoir, daily water levels in Monticello Reservoir can change as much as 4.5 ft (1.4 m) (Dominion 2023-TN10387). The daily average fluctuation in Parr Reservoir's water level is approximately 4 ft (1.2 m), with daily fluctuations reaching up to 10 ft (3 m). Total evaporation from Monticello Reservoir is estimated as 55 cfs (1.6 m^3/s), with 33 cfs (0.9 m^3/s) of natural evaporation during normal operations of V.C. Summer, and an additional 22 cfs (0.6 m^3/s) of induced evaporation from the discharged condenser water (Dominion 2023-TN10387). Evaporative losses from the Monticello Reservoir are made up by precipitation and water pumped from the Parr Reservoir/Broad River.

Based on streamflow measurement from 1938–2023, the discharge at Carlisle station, which is located 24.6 mi (39.6 km) upstream of Parr Dam, has a mean monthly discharge of 2,738 cfs (77.5 m^3/s) during periods of typically lower flow (i.e., June–November) (USGS 2024-TN10425). During the rest of the year, the mean monthly discharge is 4,752 cfs (134.6 m^3/s) (USGS 2024-TN10425). For the same period of record, the minimum mean daily discharge at Carlisle station was 44 cfs (1.2 m^3/s) for the months of June through November, and 192 cfs (5.4 m^3/s) during the remaining months (USGS 2024-TN10426). The corresponding minimum and 5th percentile flows are 302 cfs (8.6 m^3/s) and 778 cfs (22 m^3/s), respectively (USGS 2024-TN10427). These data indicate that while very low-flow days are possible on Broad River, the streamflow quickly recovers. The estimated total evaporation of 55 cfs (1.6 m^3/s) from the Monticello Reservoir is approximately 2 percent of mean monthly available flow during June through November, and 1.2 percent of mean monthly flow during the rest of the year. These calculated percent-of-low values are conservative, as they neglect direct precipitation onto Monticello Reservoir which, on a mean annual basis, offsets a majority of the combined annual evaporative losses from the reservoir (Dominion 2023-TN10387). As part of its relicensing in 2020, the Federal Energy Regulatory Commission (FERC) requires the Parr Hydroelectric Project be operated, including minimum flow, in accordance with an Adaptive Management Plan (FERC 2020-TN10536).

Based on the above analysis, the NRC staff concluded that the impacts of continued operation of V.C. Summer during the SLR term on regional surface water use conflicts would be SMALL.

3.5.3.2 Groundwater Resources

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and cited in Table 3-1 for generic groundwater resources issues, the impacts of nuclear power plant SLR and continued operations would be SMALL for Category 1 issues applicable to V.C. Summer. These issues are:

- groundwater contamination and use (non-cooling system impacts)
- groundwater use conflicts (plants that withdraw less than 100 gpm)

These applicable Category 1 issues were determined to result in a SMALL impact in 10 CFR Part 51 (10 CFR Part 51-TN10253), Subpart A, Appendix B, Table B-1. No significant groundwater impacts with respect to Category 1 (generic) issues are anticipated during the SLR term that would be different from those occurring during the current license term. As discussed in Section 3.5.2 of this SEIS, the NRC staff performed a review of groundwater use and quality. This review, including the independent review of the ER, the scoping process, the audit, and evaluation of available information, did not identify any new and significant information that would change the conclusion reached in the LR GEIS. The NRC staff concluded the following:

- No discharges to groundwater requiring permits by regulatory agencies are expected during the renewal period. There are currently no regulated discharges to groundwater, and none were identified by the applicant to likely occur during the renewal period.

- There are no foreseeable conditions during the renewal term under which onsite groundwater withdrawals increase to near or above the 100 gpm limit included in the LR GEIS conclusion.

As a result, and as concluded in the LR GEIS (NRC 2024-TN10161) for these Category 1 (generic) issues that are reported in Table 3-1, the impacts on groundwater resources of continued operation of V.C. Summer would be SMALL.

Staff concluded groundwater quality degradation resulting from water withdrawals, a Category 1 issue documented in the 2024 LE GEIS (NRC 2024-TN10161), is not applicable to V.C. Summer. Groundwater is not currently used for operations at V.C. Summer, and dewatering rates, coupled with the hydraulic setting of the plant, would not result in the type of groundwater degradation discussed in the LR GEIS.

As shown in Table 3-2, the NRC staff identified three plant-specific Category 2 issues related to groundwater resources applicable to V.C. Summer during the SLR term. These Category 2 issues are analyzed below.

<u>Groundwater Use Conflicts (Plants with Closed-Cycle Cooling Systems That Withdraw Makeup Water from a River)</u>

As described in Section 2.1.3 of this SEIS, V.C. Summer uses once-through cooling that withdraws from, and discharges to, a cooling pond, the Monticello Reservoir. This is a case where a plant uses a cooling pond that functions as a closed-cycle system, as described in the LR GEIS (NRC 2024-TN10161). The Parr Reservoir (an impoundment of the Broad River) is the source of makeup water for the Monticello Reservoir (to replace evaporative losses from the use of the reservoir for plant cooling). Consumptive use of water from the Broad River (for makeup), if significant enough to lower river water levels and affect water levels in the adjacent aquifer, could result in groundwater use conflicts, especially during low-flow conditions. The 2024 LR GEIS (NRC 2024-TN10161) determined that the significance of impacts would depend on makeup water requirements, water availability, and competing water demands, and therefore the impact could be SMALL, MODERATE, or potentially LARGE during the SLR term.

Section 3.5.3.1 of this SEIS describes the evaporative loss of the Monticello Reservoir due to plant operations and the flow conditions of the Broad River entering the Parr Reservoir. The estimated induced evaporation of 22 cfs (0.6 m^3/s) from the Monticello Reservoir is approximately 0.8 percent of mean monthly flow from the Broad River during the low-flow months of June through November, and 0.5 percent of mean monthly flow available during the rest of the year. Because the plant's makeup water use is a small fraction of the average flow in the Broad River, the effect on river levels is likely to be negligible. Groundwater use in the vicinity of the plant is not expected to increase significantly during the SLR term, and it is unlikely that makeup water taken from the Parr Reservoir or Broad River would impact offsite groundwater users. Therefore, the NRC staff conclude that the impacts of continued operation of V.C. Summer during the SLR term on groundwater use conflicts would be SMALL.

<u>Groundwater Degradation (Plants with Cooling Ponds)</u>

According the LR GEIS (NRC 2024-TN10161), this issue combines two issues from the 2013 LR GEIS (NRC 2013-TN4007) which both considered the possibility of groundwater quality becoming degraded as a result of the migration of contaminants discharged to cooling ponds. As described in Section 3.5.1.3, V.C. Summer discharges heated cooling water effluent and small volumes of wastewater (which are monitored according to the site's NPDES permit) back to Monticello Reservoir. Water quality of the reservoir is controlled and assessed by multiple programs, including Sections 303(b) and 303(d) of the CWA, NPDES (Permit No. SC00305856), and the REMP. In 2020 and 2022, Monticello Reservoir was classified as "impaired" by SCDHEC for pH only. Additionally, tritium and gamma-emitting isotopes have not been detected above lower limits of detection in the past 5 years. V.C. Summer implements site-specific procedures for reducing the potential for onsite spills to impact offsite resources (e.g., SWPP, spill prevention control and countermeasures plan) and utilizes BMPs to prevent or reduce pollutant discharges. NRC staff therefore concludes that the impacts of continued operation of V.C. Summer during the SLR term on groundwater degradation from cooling pond operation would be SMALL.

<u>Radionuclides Released to Groundwater</u>

This issue was added for consideration as part of the groundwater review for LR in the LR GEIS, Revision 1 (NRC 2013-TN2654) and retained in Revision 2 (NRC 2024-TN10161) because of the accidental releases of liquids containing radioactive material into the groundwater at power reactor sites. The types of inadvertent releases reported have included, but have not been limited to, leakage from spent fuel pools, storage tanks, buried piping, failed pressure relief valves on an effluent discharge line, and other nuclear power plant equipment. In 2006, the NRC released a report titled, "Liquid Radioactive Release Lessons Learned Task Force Report," documenting lessons learned from a review of these incidents that ultimately concluded that these instances had not adversely affected public health and safety (NRC 2006-TN1000). This report concluded, in general, that groundwater affected by radionuclide releases is expected to remain onsite, but instances of offsite migration have occurred. The LR GEIS (NRC 2024-TN10161) determined that impacts on groundwater quality from the release of radionuclides could be SMALL or MODERATE during the SLR term, depending on the magnitude of the leak, the radionuclides involved and concentrations, hydrogeologic factors, distance to receptors, and the response time of plant personnel to identify and stop the leak in a timely fashion. As a result, this is a Category 2 issue requiring a plant-specific evaluation that is discussed below.

This issue was discussed in Sections E3.6.4.2 and E3.6.4.2.1 of Dominion's ER (Dominion 2023-TN10387). V.C. Summer monitors groundwater for inadvertent releases as part of its GWPP, which was implemented under Nuclear Energy Institute (NEI) 07-07 (NEI 2007-TN1913) to satisfy requirements of 10 CFR 20.1501 (TN283) and is aligned with EPRI guidance. The site additionally implements a Radiological Environmental Surveillance Program and a Supplemental Radiological Surveillance Program. Tritium is the only radionuclide that has been historically detected in onsite groundwater above the minimum detectable limits but below the MCL of 20,000 pCi/L. Potential releases of radiological effluent within the groundwater divide created by the onsite dewatering system would be monitored and detected by onsite groundwater wells and by two stormwater drainage outfalls. From 2019–2023, tritium has not been detected in the composite stormwater drainage outfall samples. Outside of the influence of the dewatering system, potential releases of radiological effluent would likely flow to the south toward Mayo Creek and Broad River. Onsite detections of tritium near the sanitary and wastewater treatment facility are below the MCL (20,000 pCi/L) and do not indicate an increasing trend in concentration.

While tritium has been detected in onsite groundwater, levels do not exceed the EPA's MCL for tritium, and groundwater is not used as a source of drinking water at V.C. Summer. The site has implemented a groundwater protection program to identify and monitor leaks through the installed monitoring well network. With the robust sampling strategy at V.C. Summer, potential future releases of tritium into the groundwater would be readily detected. Therefore, the NRC staff concludes that the impacts on groundwater use and quality related to the inadvertent release of radionuclides to groundwater during the SLR term would be SMALL.

3.5.4 No-Action Alternative

3.5.4.1 Surface Water Resources

Under the no-action alternative, the NRC would not issue a subsequent renewed operating license for V.C. Summer, and reactor power generating operations would cease at the end of the current license term. With the cessation of operations, there would be a large reduction in the amount of water withdrawn from Monticello Reservoir. Wastewater discharges would also greatly decrease. Stormwater runoff would continue to be discharged from the site. As a result, V.C. Summer shutdown would reduce the overall impacts on surface water use and quality. Therefore, the NRC staff concludes that the impact of the no-action alternative on surface water resources would be SMALL.

3.5.4.2 Groundwater Resources

With the cessation of operations, there would be little or no additional impact on groundwater quality. Contamination in onsite soil and groundwater, including tritium, would be assessed during decommissioning, whether the plant is decommissioned at the end of the current licensing period or at the end of the SLR period. A license termination plan will describe actions needed for site remediation to meet the NRC criteria for radiologic dose and site-specific cleanup criteria to be met before release of the V.C. Summer site. Consequently, the NRC staff concludes that the impact of the no-action alternative on groundwater resources would be SMALL.

3.5.5 Replacement Power Alternatives: Common Impacts

3.5.5.1 Surface Water Resources

<u>Construction</u>

Construction activities associated with replacement power alternatives may cause temporary impacts on surface water quality by increasing sediment loading to water bodies and waterways. Construction of intake and discharge structures, if needed, could result in within-water activities including dredge-and-fill, underwater construction, and tunneling. Construction activities might also affect surface water quality through pollutants in stormwater runoff from disturbed areas and excavations, spills, and leaks from construction equipment, and from sediment and other pollutants disturbed due to associated dredge-and-fill activities. These pollutants could be detrimental to downstream surface water quality, where applicable, and to ambient water quality in waterways near work sites.

Facility construction activities might alter surface water drainage features within the construction footprints of replacement power facilities, including any wetland areas. Impervious areas may increase, resulting in a potential for greater and quicker surface runoff. Potential hydrologic impacts would vary depending on the nature and acreage of the land area disturbed and the intensity of excavation work. Changes in stormwater runoff volume, timing, and quality are usually controlled and managed with applicable Federal, State, and local permits and implementation of BMPs.

The NRC staff assumes that construction contractors would implement BMPs for soil erosion and sediment control to minimize water quality impacts in accordance with applicable Federal, State, and local permitting requirements. These measures would include spill prevention and response procedures, such as measures to avoid and respond to spills and leaks of fuels and other materials from construction equipment and activities. Surface water use during construction is generally related to concrete preparation, dust suppression, and potable and sanitary water for the workforce and is limited to the construction duration. These water needs are usually small compared to cooling water needs during thermoelectric plant operation.

<u>Operation</u>

Thermoelectric generation, a component of all four replacement power alternatives considered, may require varying amounts of surface water for the cooling of plant components depending on the selected cooling technology and, therefore, may require new water use permits from and agreements with State and local agencies. Potable and sanitary water use for the plant would depend on the workforce size and, therefore, may also require new potable water use permits from and sanitary water disposal agreements with local agencies or municipalities.

Discharge of wastewater including cooling system discharges would require permits from Federal, State, and local agencies, including a certification that the discharges are consistent with State water quality standards. Wastewater discharges would be subject to treatment and monitoring and the reporting requirements of relevant permitting agencies. The NRC staff assumes that plant operations would follow the requirements of any applicable Federal, State, and local permits.

3.5.5.2 Groundwater Resources

Construction

Excavation dewatering for foundations and substructures during construction of power generation facilities, as applicable, may be required to stabilize slopes and permit placement of foundations and substructures below the water table. Groundwater levels in the immediate area surrounding an excavation may be temporarily affected, depending on the duration of dewatering and the methods (e.g., cofferdams, sheet piling, sumps, and dewatering wells) used for dewatering. The NRC staff expects that any impacts on groundwater flow and quality caused by dewatering would be highly localized and short in duration and would cause no effects on other groundwater users. Discharges resulting from dewatering operations would be released in accordance with applicable State and local permits.

Although foundations, substructures, and backfill may alter onsite groundwater flow patterns, local and regional trends would remain unaffected. Construction of power generating facilities may contribute to onsite changes in groundwater infiltration and quality due to the removal of vegetation and construction of buildings, parking lots, and other impervious surfaces. The potential impacts of increased runoff and subsurface pollutant infiltration or discharge to nearby water bodies would be prevented or mitigated through implementation of BMPs and an SWPPP.

In addition to construction dewatering, onsite groundwater could be used to support construction activities (e.g., dust abatement, soil compaction, and water for concrete batch plants). Groundwater withdrawal during construction could have a temporary impact on local water tables or groundwater flow, and these withdrawals and resulting discharges would be subject to applicable permitting requirements.

Operation

Dewatering for building foundations and substructures may be required during the operational life of the power facility. Operational dewatering rates, if required, are assumed to be similar to the current dewatering rate for V.C. Summer of less than 100 gpm and can be managed subject to applicable permitting requirements. Dewatering discharges and treatment would be properly managed in accordance with applicable NPDES permitting requirements. The NRC staff expects that any impacts on groundwater flow and quality affected by dewatering at a rate of less than 100 gpm would be localized, and that there would be no effects on other groundwater users due to their distance from the site location.

Effluent discharges (e.g., cooling water, sanitary wastewater, and stormwater) from a facility are subject to applicable Federal, State, and other permits specifying discharge standards and monitoring requirements. Adherence by power facility operators to proper procedures during all material, chemical, and waste handling and conveyance activities would reduce the potential for any releases to the environment, including releases to the subsurface and groundwater.

For power alternatives, groundwater use during operation is assumed to be similar to current nuclear power plant use, where a groundwater dewatering system discharges less than 100 gpm. Onsite groundwater withdrawals would be subject to applicable State water appropriation, permitting, and registration requirements. Site groundwater use was determined by the NRC staff to have minimal impact on surrounding groundwater use or quality, as described in Section 3.5.3.2 of this document.

3.5.6 Natural Gas Alternative

3.5.6.1 Surface Water Resources

This alternative includes a new, natural gas combustion turbine plant constructed on the abandoned Units 2 and 3 site to replace the current generating capacity of the current Unit 1 V.C. Summer plant, approximately 966 MWe (net) (Dominion 2023-TN10387). The hydrologic and water quality assumptions for construction and operation described in Section 3.5.5.1 of this SEIS as common impacts to all replacement power alternatives also apply to this alternative. The water demand of the proposed natural gas combustion turbine units along with new MDCTs would have withdrawal and consumptive water demands that are far less than current demands for V.C. Summer Unit 1. Using factors of 4 gpm/MWe (withdrawal) and 3.1 gpm/MWe (consumption) for a 966 MWe NGCC plant (NETL 2022-TN8820: Exhibit 5-94), estimated withdrawal and consumptive demands are approximately 2,000 MGY and 1,600 MGY, respectively, compared to recent withdrawals of over 200,000 MGY and consumption of over 5,000 MGY (Dominion 2023-TN10387). NGCC water use would be primarily associated with cooling water makeup. The use of surface water for cooling tower makeup and blowdown as well as plant discharge would be required to comply with appropriate NPDES permits.

Some water quality impacts could result from erosion and runoff associated with construction and operations that would be controlled by implementation of BMPs and compliance with stormwater permits along with applicable regulations. Based on this analysis, the NRC staff concludes that the overall impacts on surface water resources from construction and operation under the NGCC alternative would be SMALL.

3.5.6.2 Groundwater Resources

The new NGCC plant required for this alternative would be constructed on the abandoned Units 2 and 3 site to replace the current generating capacity of the V.C. Summer plant. The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5 of this SEIS as being common to all replacement power alternatives also apply to this alternative. Although water withdrawal and consumptive demands will likely be less than what is required by the current site, it is unlikely groundwater use would occur due to the low yields of the onsite aquifer system. Therefore, the NRC staff concludes that the impacts on groundwater resources from construction and operation under the natural gas alternative would be SMALL.

3.5.7 New Nuclear (Small Modular Reactor) Alternative

3.5.7.1 Surface Water Resources

This alternative proposes the installation of two, 12-unit SMRs at the abandoned Units 2 and 3 site. The modular reactors will have a closed-cycle cooling system that uses MDCTs with makeup water from the Monticello Reservoir. As with the NGCC alternative, the primary operations-related water use would be for cooling water. Based on water demand factors for SMR technologies (NRC 2019-TN6136), annual water withdrawals for the 1,768 MWe SMR alternative would be significantly less (<10 percent) than current amounts, but consumptive use would be expected to increase by around 180 percent (from 22 cfs to 63 cfs [from 0.6 m^3/s to 1.8 m^3/s]).

The NRC staff assumes that the SMR plant would operate in compliance with a State issued NPDES permit, any applicable industrial stormwater permit, State and local surface withdrawal requirements, and would have spill prevention and response procedures in place to minimize impacts on surface water quality. Some water quality impacts could result from erosion and runoff associated with construction and operations that would be controlled by implementation of BMPs and compliance with stormwater permits along with applicable regulations.

Based on the above analysis, because the consumptive water use is noticeably increased but potential water quality impacts would be controlled and managed, the NRC staff concludes that the overall impacts on surface water resources from construction and operation under the new nuclear alternative would likely be SMALL to MODERATE.

3.5.7.2 Groundwater Resources

The hydrologic and water quality assumptions as well as implications for construction and operations described in Section 3.5.5.2 of this SEIS as being common to all replacement power alternatives would also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Although consumptive water use would increase with the operation of two, 12-unit SMRs (as described in Section 3.5.7.1 of this SEIS), it is considered unlikely new groundwater use at the site would be utilized (due to low well yields [Dominion 2023-TN10387]). Therefore, the NRC staff concludes that the impacts on groundwater resources from installation and operation of two, 12-unit SMRs at the abandoned Units 2 and 3 site would be SMALL.

3.5.8 Natural Gas and Solar Combination Alternative

3.5.8.1 Surface Water Resources

This alternative includes a proposed 700 MWe NGCC located at the abandoned Units 2 and 3 site, a 60 MW solar installation with battery storage at the Units 2 and 3 site, and three offsite 100 MW solar installations with battery storage located offsite in South Carolina.

The surface water use and quality impacts for the combination NGCC plant would be less than those described for the NGCC alternative discussed in Section 3.5.6.1 of this SEIS due to its smaller generating capacity. The construction of the solar installations and new transmission lines would require water for dust suppression, equipment washing, and sanitary systems. Operational water requirements for the solar portion are dependent on whether the solar technology is photovoltaic (PV) or concentrating solar power (CSP). No water is required for operation of PV solar installations beyond a small amount for periodic washing of the panels. However, CSP would require water for mirror washing, makeup, and cooling water. A 360 MWe CSP plant would require between 2,300 MGY and 2,700 MGY (NRC 2024-TN10161); for CSP, it is assumed that withdrawal and consumption are identical (NRC 2024-TN10161).

Water demands during construction of the NGCC plant and the onsite portion of the solar installations would be sourced from V.C. Summer’s water treatment plant and water supply. For offsite installations, water would either be trucked in or sourced from local surface and groundwater (Dominion 2023-TN10387). The NGCC plus CSP alternative would require much lower total withdrawals (around 4,000 MGY) than current withdrawals (over 200,000 MGY), and total consumption would be slightly lower (3,400 to 3,800 MGY) than current consumptive use (around 5,000 MGY). The 360 MWe of CSP would be installed at multiple locations, and water use impacts would depend on water availability at those locations. The NGCC plus PV alternative would have much less withdrawal and consumptive use with approximately 1,400 MGY of withdrawals and 1,140 MGY of consumption. The NRC staff assumes that appropriate water withdrawal permits and authorizations would be obtained for any offsite CSP plants and for the proposed NGCC plant at the abandoned Units 2 and 3 site.

Based on the above analysis, the NRC staff concludes that the overall impacts on surface water resources from construction and operations of the NGCC and solar combination alternative would likely be SMALL.

3.5.8.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 of this SEIS as being common to all replacement power alternatives also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Therefore, the NRC staff concludes that the impacts on groundwater resources from construction and operations under the natural gas and solar combination alternative would be SMALL.

3.5.9 New Nuclear and Solar Combination Alternative

3.5.9.1 Surface Water Resources

This alternative proposes the installation and operation of a single 12-unit SMR at the abandoned Units 2 and 3 site. The modular reactors will have a closed-cycle cooling system that uses MDCTs with makeup water from the Monticello Reservoir. The SMR capacity for this combined alternative is estimated at 884 MWe, with 82 MWe of solar making up the remaining capacity to replace the 966 MWe of Unit 1. Based on water demand factors for SMR technologies (NRC 2019-TN6136), annual water withdrawals for the 884 MWe SMR alternative would be significantly less (<5 percent) than current amounts, but consumptive use would be expected to increase by around 40 percent (from 22 cfs to 31 cfs [from 0.62 m^3/s to 0.9 m^3/s]). As for the NGCC plus solar alternative, the water demand for the solar portion of this alternative depends on whether the technology is PV or CSP. An 82 MWe CSP plant would require around 2.5 cfs for withdrawal and consumption. However, the additional withdrawal and consumptive demand of a CSP solar option versus PV is small relative to the demand of the 884 MWe SMR portion. Overall, the SMR plus solar alternatives, whether solar is PV or CSP, would require much less annual withdrawals but would increase consumptive use by approximately 50 percent.

Surface water use and water quality impacts associated with the installation and operation for an onsite SMR and solar installation alternatives are discussed in Section 3.5.7.1 and Section 3.5.8.1 of this SEIS, respectively. Surface water use and water quality impacts associated with the installation and operation for an onsite SMR and solar installation alternatives are discussed in Section 3.5.7.1 and Section 3.5.8.1 of this SEIS, respectively. Based on this analysis, the NRC staff concludes that the overall impacts on surface water resources from construction and operation for the new nuclear and solar combination alternative would likely be SMALL.

3.5.9.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 of this SEIS as being common to all replacement power alternatives also apply to this alternative. The NRC staff did not identify any impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. The annual water withdrawal rate for a single 12-unit SMR is expected to be much less than the current withdrawal rate, and no water is required for operation of the solar installations beyond a small amount for periodic washing of the panels. Therefore, utilization of new groundwater use at the site is unlikely (Dominion 2023-TN10387). The NRC staff concludes that the impacts on groundwater resources from construction and operation for the new nuclear and solar combination alternative would likely be SMALL.

3.6 Terrestrial Resources

This section describes the terrestrial resources of the V.C. Summer site and the surrounding landscape. Following the description, the NRC staff analyzes the potential impacts on terrestrial resources from the proposed action of SLR and alternatives to the proposed action. Information here is based on the NRC's initial V.C. Summer license renewal SEIS (NRC 2004-TN7262), the applicant's ER (Dominion 2023-TN10387), and other publicly available information.

3.6.1 Ecoregion

The V.C. Summer site lies within the Piedmont Ecoregion (Dominion 2023-TN10387: Section E3.7.2.1). The EPA (Griffith et al. 2002-TN10428) characterizes this ecoregion (Level III Ecoregion 45) as a transitional area between the mountainous Appalachians to the northwest and the relatively flat coastal plains to the southeast. Topography consists of irregular plains with some hills as the ecoregion covers the non-mountainous portion of the old Appalachian Highland. Land covers consist of urban and suburban areas with a mosaic of oak-hickory-pine forest and pastures. Two Level IV ecoregions occur within 6 mi (10 km) of V.C. Summer site: (1) Southern Outer Piedmont, and (2) Carolina Slate Belt. Primary pre-settlement vegetation of Southern Outer Piedmont consists of pine (loblolly and shortleaf) within old field sites and pine plantations, and mixed oak forest. For the Carolina Slate Belt, pre-settlement vegetation was oak-hickory-pine forest dominated by white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), and hickory (*Carya* spp.), with shortleaf pine (*Pinus echinata*), and loblolly pine (*Pinus taeda*) (Griffith et al. 2002-TN10429).

The U.S. Army Corps of Engineers (USACE) defines wetlands as areas either inundated or saturated by surface or groundwater at a frequency and duration sufficient to support (and that under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions. In its ER, Dominion (Dominion 2023-TN10387) characterizes the National Wetlands Inventory features in the 6 mi (9.65 km) vicinity surrounding the V.C. Summer site as follows:

- freshwater emergent wetlands 186 ac (75.27 ha)
- freshwater forested/shrub wetlands 1,695 ac (685.94 ha)
- freshwater ponds 183 ac (74.06 ha)
- lakes 9,513 ac (3,849.78 ha)
- riverine waters 875 ac (354.1 ha)

3.6.2 V.C. Summer Site

The V.C. Summer site consists of about 2,200 ac (890 ha) of land along the southern shores of the Monticello Reservoir in Fairfield County, South Carolina (Dominion 2023-TN10387: Section E3.1). The V.C. Summer site lies within the Southern Outer Piedmont (Level IV Ecoregion 45b). This ecoregion is dominated by irregular plains and loblolly pine plantations (Griffith et al. 2002-TN10428).

Within the approximately 2,200 ac (890 ha) site, the V.C. Summer plant and supporting facilities are located on about a 370 ac (149.7 ha) of industrial area along the southern shores of the Monticello Reservoir. Because these facilities are mostly located on previously cultivated areas, existing vegetation in the industrial area around the plant is mainly early successional grasses and forbs.

About 24 percent of the 2,200 ac (890 ha) V.C. Summer site consists of developed land cover types, 37.7 percent is open water, and the remaining 38.3 percent of the site is vegetated (Dominion 2023-TN10387: Table 3.2-1). Forests and shrub/scrub are the dominant vegetation types, covering about 24 percent and 6.9 percent of the site, respectively. Most of the forest is evergreen forest (19 percent). Minor forest types are deciduous (2.6 percent) and mixed forests (2.4 percent). Other minor vegetation types (less than 5 percent) are grassland/herbaceous (3.3 percent), pasture/hay (2.5 percent), barren land (rocks/sand/clay) (1.4 percent), woody wetlands (0.1 percent), and emergent herbaceous wetlands (0.1 percent).

The descriptions, presented in Dominion's ER (2023-TN10387: Section E3.7.2.2), characterize the terrestrial habitats within the site boundary. Habitat descriptions of the associated tree, shrub, and herbaceous strata are incorporated here by reference:

- upland pine
- mesic forest
- rock outcrops
- river bottoms
- Piedmont small stream forest
- cove forest
- depressions
- upland mixed forest
- grassland and early successional habitats

V.C. Summer site boundaries contain a total of 837 ac (338.72 ha) of wetlands, lakes, ponds, and riverine waters (Table 3-9 below) (Dominion 2023-TN10387: Section E3.7.2.4). Table 3-9 summarizes the area and percentage of wetlands and surface water features on the V.C. Summer site as documented in the National Wetlands Inventory. Figure 3-9 shows the location of National Wetlands Inventory wetlands on a map of the V.C. Summer site.

Table 3-9 Wetlands and Surface Water Features on the Virgil C. Summer Nuclear Station Site as Mapped in the National Wetlands Inventory

Wetland or Water Feature	Area	Percent of Onsite Wetland Habitat
Freshwater Forested/Shrub Wetlands	4.0 ac	0.48
Riverine Waters	11.4 ac	1.36
Freshwater Ponds	3.35 ac	0.40
Lakes	818.5 ac	97.76
Total	**837.25 ac**	**100.00**

Source: Dominion 2023-TN10387.

Figure 3-9 Wetlands Located Within the Virgil C. Summer Nuclear Station Site as Mapped in National Wetlands Inventory. Source: Dominion 2023-TN10387: Figure 3.7-2.

Wildlife species occurring on the V.C. Summer site consist of those species typically found in South Carolina forests, croplands, developed areas, and riparian areas. Table E3.7-3 in the applicant's ER presents a list of the terrestrial wildlife species likely to occur in Fairfield, Richland, and Newberry counties; this list includes 31 mammals, 277 birds, 64 amphibians, and 67 reptiles. Common mammals include toads (Fowler's toad [*Anaxyrus fowleri*]), lizards (Carolina anole [*Anolis carolinensis*], fence lizard [*Sceloporus undulatus*], various skinks), snakes (black racer [*Coluber constrictor*], rat snake, ringneck snake [*Diadophis punctatus*]), songbirds (cardinal, bluejay, towhee, various warblers), birds of prey (red-tailed hawk [*Buteo jamaicensis*], red-shouldered hawk [*Buteo lineatus*]), and many small mammals (gray squirrel [*Sciurus carolinensis*], eastern cottontail [*Sylvilagus floridanus*], raccoon, white-tailed deer [*Odocoileus virginianus*]).

Birds on the V.C. Summer site include a mix of resident bird species that may breed or overwinter, be onsite seasonal residents, or species that stop briefly during migration. The V.C. Summer site is located within the Atlantic flyway, an important bird migration route which extends from South America to Canada. Migrant birds often fly at night, landing to rest early in the morning. Suitable habitats that allow migratory birds to feed, rest, and avoid predators are called stopovers. Large natural barriers may create crowded stopover locations because flights over the barriers mean long stretches without opportunities to rest or feed. Along the Atlantic flyway, mountains, deserts, or large bodies of water are major barriers. Many species of migratory birds likely use the V.C. Summer site and vicinity during the spring and fall migrations.

3.6.3 Important Species and Habitats

Important terrestrial species and habitats discussed in this section include those protected by State and Federal laws, invasive species, and those that are culturally important. In particular, bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) are known to nest on the V.C. Summer site on the eastern edge of the boundary near the offsite water supply facility and the meteorological evaluation tower (MET), respectively (Dominion 2023-TN10387, Dominion 2024-TN10391). Section 3.6.3.3 of this SEIS discusses bald eagles in more detail.

3.6.3.1 Federally Listed Species

For a discussion of terrestrial species and habitats that are federally protected under the Endangered Species Act of 1973, as amended, see Section 3.8 of this SEIS.

3.6.3.2 State-Listed Species

Dominion (2023-TN10387: Table E3.7-4) provided a list of species that the State of South Carolina has listed as threatened or endangered and that are known to occur or potentially occur in Fairfield, Richland, and Newberry counties. Of these State-listed species, three are also federally listed by the U.S. Fish and Wildlife Service as endangered, threatened, or candidates for Federal listing, and one is an aquatic species. The NRC staff addresses all federally listed species in Section 3.8 of this SEIS and State-listed aquatic species in Section 3.7 of this SEIS. Table 3-10 below summarizes the six terrestrial species that are State-listed as threatened or endangered (but not also federally listed) and are known to occur in Fairfield, Richland, and Newberry counties.

Table 3-10 State-Listed Species (That Are Not Also Federally Listed) for Fairfield, Richland, and Newberry Counties, Potentially Occurring in the Vicinity of Virgil C. Summer Nuclear Station

Common Name	Scientific Name	Class	State Legal Status
Bald Eagle[a,b]	*Haliaeetus leucocephalus*	Bird	Threatened
Spotted Turtle[b]	*Clemmys guttata*	Reptile	Threatened
Southern hognosed snake[b]	*Heterodon simus*	Reptile	Threatened
Pine barrens treefrog[b]	*Dryophytes andersonii*	Amphibian	Threatened
Carolina gopher frog[b]	*Lithobates capito*	Amphibian	Endangered
Rafinesque's big-eared bat[b]	*Corynorhinus rafinesquii*	Mammal	Endangered

(a) Species with potential habitat on the V.C. Summer site.
(b) Species known within 6 mi (9.66 km) of the V.C. Summer site (Dominion 2023-TN10387: Section E3.7.8.2).

For all species in Table 3-10, Dominion's ER contains full species descriptions and occurrence information (Dominion 2023-TN10387: Sections E3.7.8.2 and E4.6.23.4.2), which the NRC incorporates here by reference. Of the six State-listed terrestrial species that are not also federally listed (Table 3-10), one is a bird, one is a mammal, two are reptiles, and two are amphibians.

Of the six State-listed terrestrial species (Table 3-10), only bald eagles are known to occur on the V.C. Summer site. Bald eagles are discussed below in Section 3.6.3.3 of this SEIS.

In addition, potential habitat for the spotted turtle occurs on the V.C. Summer site. According to Dominion's ER (Dominion 2023-TN10387), the spotted turtle was recorded within the past 5 years within 6 mi (9.7 km) of the V.C. Summer site. However, the species is not known to occur on the V.C. Summer site. Spotted turtles inhabit a variety of wetland types including ponds, small streams, swamps, flooded forests, and other shallow bodies of water. Potential habitat occurs within the emergent wetlands onsite; however, these wetlands are separated from other areas of potential habitat, i.e., shallow bodies of water and wetlands, offsite.

3.6.3.3 Species Protected under the Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d-TN1447) extends regulatory protections to the bald eagle and golden eagle. The Act prohibits anyone without a permit from the U.S. Secretary of the Interior from "taking" bald eagles or golden eagles, including their parts, nests, or eggs.

Dominion summarizes eagle occurrences and nesting on the V.C. Summer site and in the vicinity (2023-TN10387: Section E3.7.8.2.2 and Section E3.7.8.3). Bald eagles are known to nest on the V.C. Summer site and in the vicinity at the adjoining Parr/Fairfield FERC project boundary. In addition, the ER (2023-TN10387) stated that by the 1990s six bald eagle nesting sites occurred within a 5 mi (8 km) radius of the station. Although golden eagles are known to winter within the coastal plains of South Carolina (Vukovich et al. 2015-TN10430; National Audubon Society 2024-TN10431), they are not known to nest within the State. Furthermore, the U.S. Fish and Wildlife Service (FWS) did not list golden eagles as a species of concern for the site within the Information for Planning and Consultation report (FWS 2024-TN10473).

Dominion maintains a corporate avian protection plan and migratory bird special purpose utility permit (SPUT), which authorizes the collection, transport, and temporary possession of migratory birds found on the property, structures, and associated transmission lines for avian morality monitoring. The SPUT permit is currently being renewed, and while the renewal is being processed, Dominion is adhering to the previous permit conditions (2023-TN10387: Section E3.7.8.2.2, 2024-TN10391). In addition, Dominion currently has a Migratory Bird Permit from South Carolina Department of Natural Resources (SCDNR) (#MB-03-24) (2024-TN10391).

Dominion's corporate Avian Protection Plan and its Migratory Bird and Eagle Protection document summarize the requirements, explain how these requirements apply to Dominion's sites and activities, and detail protocols and reporting procedures that Dominion personnel and contractors must follow regarding eagles and eagle nests on site. These documents state that unless there is a site-specific determination that disturbance can be closer due to time of year, disturbances must not occur within 660 feet of an active bald eagle nest and must ensure that large nest protocol is followed with any nest equal to or greater than 2 ft (0.61 meters [m]) in diameter, which is assumed to be a bald eagle nest until a biologist confirms otherwise (Dominion 2024-TN10391). From 2013–2023, Dominion reported 32 bird incidents (2024-TN10391). There were no incidents involving the in-scope transmission lines and bald eagles.

In addition to the avian protection policies and permits, physical avian safety features are in place onsite as approximately 10 percent of the in-scope transmission lines have avian safety features installed which include cones on the poles and triangles on the arms that hold the static wires. No plastic coils are installed on in-scope lines (Dominion 2024-TN10391).

3.6.3.4 Species Protected under the Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale any migratory bird or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued under Federal regulations. Dominion has a FWS SPUT permit and a corporate avian protection plan to address migratory birds that may be present, injured, or killed on Dominion property (Dominion 2023-TN10387: Section E4.6.23.4.2). This permit can only be issued to utility companies to collect, transport, and temporarily possess migratory birds found dead on utility properties, structures, and rights-of-way (FWS Undated-TN9282). In emergency circumstances, permit holders may relocate or destroy active nests.

In its ER, Dominion lists 277 bird species that are likely to be observed in Fairfield, Newberry, and Richland counties (Dominion 2023-TN10387: Section E3.7.8.4). Of these 277 bird species, 265 species are protected by the MBTA (50 CFR Part 10-TN5490). In addition, 14 of these migratory birds are Birds of Conservation Concern, a FWS designation for species of highest conservation priority that are not already federally listed as threatened or endangered (FWS 2021-TN8740): American kestrel (*Falco sparverius paulus*), bald eagle, black-billed cuckoo (*Coccyzus erythropthalmus*), Cerulean warbler (*Dendroica cerulea*), eastern whip-poor-will (*Antrostomus vociferus*), Henslow's sparrow (*Ammodramus henslowii*), Kentucky warbler (*Oporornis formosus*), lesser yellowlegs (*Tringa flavipes*), Prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), red-headed woodpecker (*Melanerpes erythrocephalus*), rusty blackbird (*Euphagus carolinus*), swallow-tailed kite (*Elanoides forficatus*), and wood thrush (*Hylocichla mustelina*).

FWS (2024-TN10473) provided a list of seven migratory birds that could occur within the V.C. Summer site. These birds are of particular concern for the project because they are an eagle or are a Bird of Conservation Concern: bald eagle, chimney swift (*Chaetura pelagica*), eastern whip-poor-will, Kentucky warbler, prothonotary warbler, red-headed woodpecker, and wood thrush.

In 2021, an osprey (*Pandion haliaetus*) nest was observed on the MET (Dominion 2023-TN10387: Section E3.7.8.4). The osprey nest remains active on the MET and Dominion has modified the lighting schedule onsite to accommodate the nest until it is unoccupied (2024-TN10391). Ospreys and other migratory birds are handled according to the avian protection plan and the requirements listed in the South Carolina Department of Natural Resources and SPUT permits.

In 2015, South Carolina revised their comprehensive State Wildlife Action Plan (SWAP), which addresses the species with greatest conservation need within the State (SCDNR 2020-TN10432). The SWAP is required to list distribution and abundance of species, location and relative condition of key habitats, problems that affect species, conservation actions, plans for monitoring and adaptive management, and coordination with other entities (i.e., Federal, State, Tribal, and local agencies). Within the past 20 years, Richland counties had six MBTA species that were ranked high or highest priority within SWAP. Within the past 5–10 years, records of the painting bunting (*Passerina ciris*), ranked highest priority, occurred within Richland County (SC Heritage Trust 2023-TN10435). Records of high ranked species such as the black and white warbler (*Mniotilta varia*), prairie warbler, and wood thrush occurred within Richland County in the past 5–10 years (SC Heritage Trust 2023-TN10435). Within 10–20 years, sightings of high ranked Swainson’s warbler (*Limnothlypis swainsonii*) and Baltimore oriole (*Icterus galbula*) occurred within Richland County (SC Heritage Trust 2023-TN10435). Newburry and Fairfield counties did not have any MBTA species ranked high or highest priority within the SWAP.

3.6.3.5 Invasive Species

Invasive species are identified as nonnative organisms whose introduction causes or is likely to cause economic or environmental harm or to cause harm to human, animal, or plant health (EO 13751, 81 FR 88609-TN8375). Executive Order (EO) 13112 (64 FR 6183-TN4477) directs Federal agencies to not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species unless they determine that the benefits of the action clearly outweigh the harm from invasive species and that all feasible and prudent measures to minimize risk of harm are taken (EO 13112: Section 2).

Dominion noted important invasive species in the vicinity of the V.C. Summer site (Dominion 2023-TN10387: Section E3.7.5). Of these, three are terrestrial animals that have potential habitat onsite: Asian rock pool mosquito (*Aedes japonicus*), Japanese beetle (*Popillia japonica*), and imported red fire ant (*Solenopsis invicta*). Newberry and Richland counties are considered to be infested with Japanese beetles. The aquatic plants, alligatorweed, Brazilian waterweed, brittleleaf naiad, Eurasian watermilfoil, European water chestnut, hydrilla, and water primrose, are addressed in Section 3.7.1 of this SEIS. The remaining invasive plant species (Dominion 2023-TN10387: Section E3.7.5.3) have the potential to occur within the site and are addressed here as terrestrial species, with full species biology and occurrence information incorporated by reference from Dominion’s ER. The following invasive terrestrial species are reported to occur within 6 mi (9.65 km) of the site, as documented in records from iNaturalist and EDD Maps (iNaturalist 2024-TN10433 and University of Georgia 2024-TN10434).

Within the cleared transmission corridor, on the edges of the forest, and roadsides, autumn olive (*Elaeagnus umbellata*), Chinese bushclover (*Lespedeza cuneata*), Japanese wisteria (*Wisteria floribunda*), and Japanese honeysuckle (*Lonicera japonica*) have the potential to occur onsite (Smith 2008-TN10436; Gucker 2010-TN10437; NC Cooperative Extension Undated-TN10438; and Swearingen et al. 2010-TN10439). Records of these species occur approximately 2–3 mi (3.22 km–4.83 km) from the V.C. Summer site and the seeds of these species can be distributed widely by wildlife and human disturbances. In addition, water can spread the Japanese wisteria seed, and occurrences have been noted on the shores of Lake Monticello (Swearingen et al. 2010-TN10439).

Within the shady forested areas onsite, great periwinkle (*Vinca major*) may occur. Records of the invasive plant occur approximately 3 mi (4.83 km) from the V.C. Summer site by the Broad River, and can spread by nodes and through water pathways (NC Cooperative Extension Undated-TN10440).

From the floodplains of Lake Monticello and streams onsite to the buildings and forests, Asian rock pool mosquito and red imported fire ant have potential to occur. Asian rock pool mosquitos are known within South Carolina. Larvae tend to be found more frequently in wooded and rural areas within rock pools or artificial containers like tires or containers made of concrete (Kaufman and Fonseca 2014-TN10441). Occurrence of red imported fire ants were noted approximately 1.5 mi (2.41 km) north of the V.C. Summer site, within islands in Lake Monticello, as well as 3 mi (4.83 km) from a transmission corridor. Fire ants can form rafts to survive flooding conditions and could potentially migrate to the site by raft or through infected soil or equipment associated with soil movement (Clemson 2024-TN10442 and iNaturalist 2024-TN10443).

Within the wetlands onsite, the pond slider (*Trachemys scripta*) may occur. The slider is a ubiquitous invasive turtle that prefers freshwater wetland systems within low elevations (SCPARC 2020-TN10444). This turtle outcompetes, hybridizes with, and potentially transmits diseases to native turtle species. Several records occur within 2 to 6 mi (3.22 km to 9.65 km) of the V.C. Summer site, the closest of which occurs within Parr Reservoir.

3.6.3.6 Important Habitats

Important habitats include any wildlife sanctuaries, refuges, preserves, or habitats identified by State or Federal agencies as unique, rare, prioritized for protection, wetlands and floodplains, and land areas identified as critical habitat for species listed by the FWS as threatened or endangered. Important habitats on and around the V.C. Summer site include the wetlands discussed above in Sections 3.6.1 and 3.6.2 of this SEIS. No critical habitat for federally protected species occurs within the V.C. Summer site (Section 3.8).

In addition, nearby Federal lands provide important terrestrial habitats (Dominion 2023-TN10387: Sections E3.7.4). Sumter National Forest-Enoree Ranger District provides special areas managed for waterfowl and other areas are maintained in an open state for habitat diversity. State lands such as Parr Reservoir Waterfowl Management Area and leased land such as the Monticello Reservoir Waterfowl Management Area also provide important habitats. The Parr Reservoir Waterfowl Management Area and the Monticello Reservoir Waterfowl Management Area are designated as a Category II Waterfowl Areas, which means they consist of generally lower quality habitat, and are less intensively managed.

3.6.3.7 Culturally Important Species

No culturally important species were identified onsite or within 6 mi (9.65 km) of the V.C. Summer site during the NRC staff's cultural consultations discussed in Section 3.9 of this SEIS.

3.6.4 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and cited in Table 3-1 of this SEIS, the impacts of all Category 1 (generic) terrestrial resources would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS. Thus, consistent with the conclusions in the LR GEIS for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on terrestrial resources would be SMALL. Table 3-2 identifies two Category 2 issues that require site-specific analysis for V.C. Summer SLR to determine whether impacts would be SMALL, MODERATE, or LARGE. These issues are (1) non-cooling impacts, and (2) water use conflicts with terrestrial resources (plants with once-through cooling systems or cooling ponds using makeup water from a river). The sections below analyze these issues in detail.

The following sections address the plant-specific environmental impacts of the V.C. Summer SLR on the environmental issues related to terrestrial resources.

3.6.4.1 Non-cooling system Impacts on Terrestrial Resources

According to the 2024 LR GEIS (NRC 2024-TN10161), non-cooling system impacts on terrestrial resources can include impacts that result from site and landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that would occur during the SLR period on and near a plant site. The NRC staff based its analysis in this section on information derived from Dominion's ER (2023-TN10387), unless otherwise cited. Dominion has not identified any refurbishment activities during the proposed relicensing term (Dominion 2023-TN10387: Section E2.3). Therefore, no further analysis of potential impacts from refurbishment activities is necessary.

In its ER (2023-TN10387: Sections E2.2.2 and E4.6.1.3), Dominion states that it will conduct ongoing operational and maintenance activities at V.C. Summer throughout the SLR term, including landscape maintenance activities, stormwater management, and building expansion and removal. Based on the description of these activities outlined in Dominion's ER (2023-TN10387), the NRC staff expects that physical disturbances would be limited to paved or disturbed areas or to areas of mowed grass or early successional vegetation and should not encroach into wetlands or into the remaining areas of forest and scrub/shrub habitat. Dominion maintains a special use permit from FWS and has procedures to protect nests and nesting birds on the V.C. Summer site. As such, the NRC staff concludes that the anticipated activities would have only minimal effects on terrestrial resources, based on information presented in the ER and the staff's independent analysis.

Dominion (2023-TN10387: Section E4.12.4.5.1) states that it has administrative controls in place at V.C. Summer to ensure that it reviews operational changes or construction activities and minimizes environmental impacts through BMPs, permit modifications, or new permits, as needed. Dominion (2023-TN10387: Section E4.12.4.5.1) further states that regulatory programs for issues like stormwater management, spill prevention, dredging, and herbicides further minimize impacts on terrestrial resources. In addition, adherence to regulatory and permit requirements and administrative controls regarding responses to avian collisions with transmission lines minimizes and avoids impacts to Federal and State-listed species (2023-TN10387: Section E4.12.4.5.1). Based on this information, the NRC staff concludes that continued adherence to environmental management practices and BMPs already established for V.C. Summer would continue to protect terrestrial resources during the SLR operational period.

Operational noise from the V.C. Summer site facilities extends into the remaining natural areas on the site. However, V.C. Summer has exposed these habitats to similar operational noise levels since it began operation in 1982. The NRC staff therefore expects that extending the same level of operational noise levels during the 20-year SLR period is therefore unlikely to noticeably change the patterns of wildlife movement and habitat use.

Based on its independent review of the information provided by Dominion in its ER, the NRC staff concludes that the landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that Dominion might undertake during the SLR term would primarily be confined to already disturbed areas of the V.C. Summer site. These activities would neither have noticeable effects on terrestrial resources, nor would they destabilize any important attribute of the terrestrial resources on or in the vicinity of the site. The NRC staff expects that Dominion would continue to comply with the applicable requirements of Federal and State regulatory programs and obtain any required permits. Accordingly, the NRC staff concludes that non-cooling system impacts on terrestrial resources during the SLR term would be SMALL.

3.6.4.2 Water Use Conflicts with Terrestrial Resources (Plants with Cooling Ponds or Cooling Towers using Makeup Water from a River)

Water use conflicts occur when the amount of water needed to support riparian communities is diminished as a result of demand for agricultural, municipal, or industrial use or decreased water availability due to droughts, or a combination of these factors. The NRC staff describes how this issue has been addressed historically, and then provides a plant-specific evaluation for the V.C. Summer SLR term.

In the 1996 LR GEIS (NRC 1996-TN288), the NRC evaluated water use conflicts as a surface water quality issue and included all ecological impacts within this surface water quality issue. The NRC rated water use conflicts as SMALL. The 2013 LR GEIS (NRC 2013-TN2654) separated surface water quality issues from ecological water use conflicts. For terrestrial resources, the NRC created a new issue of water use conflicts for nuclear power plants with cooling ponds or cooling towers using makeup water from a river, reasoning that riparian communities could be impacted by reduced flows if the makeup water is from a river. For the Wolf Creek Generating Station in Coffey County, Kansas, which withdraws makeup water from a small river with especially low flow during drought conditions, the NRC staff concluded that the water use conflict impacts on terrestrial resources were SMALL to MODERATE. For other nuclear power plants, the NRC staff concluded that the impact of water use conflicts with riparian communities is a plant-specific issue and that the range of impacts at plants with cooling ponds or cooling towers using make up water from a river could not be determined generically. The 2024 LR GEIS (NRC 2024-TN10161) determined that water use conflicts with terrestrial resources would be SMALL at most nuclear power plants with cooling ponds or cooling towers that withdraw makeup from a river, but may be MODERATE at some plants, therefore requiring a site-specific review.

In the 2004 V.C. Summer LR SEIS (NRC 2004-TN7262), the NRC staff reviewed the available information, including the rate of evaporative water loss associated with the plant's operations, maintenance of minimum flow conditions of the Broad River, and past operation information, and concluded that the impacts were SMALL for V.C. Summer initial LR. In this SEIS, the NRC staff analyzes surface water resource use conflicts in Section 3.5.3 and water use conflicts regarding aquatic resources in Section 3.7.3.3. Below, the NRC staff analyzes this plant-specific issue for the SLR term.

V.C. Summer's cooling water intake system operates as an open-cycle (i.e., once-through cooling plant) that withdraws from and discharges to a cooling pond, Monticello Reservoir (Dominion 2023-TN10387: Section E2.2.3). Terrestrial riparian communities that could be impacted by diminished water availability are the terrestrial resources associated with the wetlands and surface water habitats on the V.C. Summer site (Table 3-10, Figure 3-9). These riparian habitats total about 837.25 ac (338.8 ha) and consist mostly of lake (97.75 percent of onsite wetland habitats) and riverine waters (1.36 percent of onsite wetland habitats).

In Section 3.5.3.1 of this SEIS, the NRC staff concluded that surface water use conflicts would be SMALL because the Broad River quickly recovers to exceed the FERC-mandated minimum releases below the Parr Dam. Accounting for the FERC-mandated minimum release from the Parr Dam, the estimated total evaporation of 55 cfs (1.6 m^3/s) from the Monticello Reservoir is approximately 1.4 percent of mean monthly flow during March, April, and May, and 1.7 percent of mean monthly flow during the rest of the year. As part of relicensing of the Parr Hydroelectric Project, FERC mandated minimum instream flows of 150 cfs (4.2 m^3/s) during most of the year and 1,000 cfs (28.3 m^3/s) during the March, April, and May striped bass spawning period (Dominion 2023-TN10387; NRC 2004-TN7262). FERC did not express any concerns with the operations of V.C. Summer and its impacts on minimum flow in the Broad River (NRC 2004-TN7262).

The proposed SLR for V.C. Summer would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR on terrestrial resources would be similar. For the reasons explained above, water use conflicts with terrestrial resources from SLR either would not occur or would be so minor that the effects on terrestrial resources would be undetectable. The NRC staff concludes that water use conflicts with terrestrial resources during the V.C. Summer SLR term would be SMALL.

3.6.5 No-Action Alternative

Under the no-action alternative, the NRC would not issue a renewed license, and V.C. Summer would shut down on or before the expiration of the current operating license. Much of the operational noise and human activity at V.C. Summer would cease, thereby reducing disturbances to wildlife in forest cover and other natural vegetation on and near the site. However, some continued maintenance of V.C. Summer would still be necessary. Human activity, noise, and herbicide application would continue at the site with possible impacts resembling, but perhaps of a lower magnitude than, those described for the proposed action of SLR. Shutdown itself is unlikely to noticeably alter terrestrial resources. Reducing human activity and frequency of operational noise may constitute minor beneficial effects on wildlife inhabiting nearby natural habitats. The NRC staff therefore concludes that the impacts of the no-action alternative on terrestrial resources during the proposed SLR term would be SMALL.

3.6.6 Replacement Power Alternatives: Common Impacts

Under all the replacement power alternatives that the NRC staff considered, additional land would likely be temporarily disturbed for construction and laydown areas. If not already previously disturbed, the licensee could mitigate the impact by later revegetating temporarily disturbed land. All replacement power alternatives would also involve construction on developed or undeveloped lands outside the vicinity of the V.C. Summer site with indeterminate loss of offsite forest, grasslands, desert, or wetlands.

Loss of habitat and increased noise generation during construction and operation of the new facilities could cause terrestrial wildlife to move into other habitats in the surrounding landscape, increasing demands on those habitats and competing with other wildlife. Erosion and sedimentation from clearing, leveling, and excavating land could affect adjacent riparian and wetland habitats. However, implementation of appropriate BMPs and the revegetation of temporarily disturbed lands would minimize impacts. Natural gas and nuclear facilities would require cooling towers, which may impact surrounding vegetation via drift or could impact riparian resources through water withdrawals. The operator of the new facilities would develop and adhere to environmental management practices and BMPs protect terrestrial resources for the generation facilities, cooling towers, other plant infrastructure or equipment, and associated transmission corridors.

All the power replacement alternatives assume the construction and maintenance of new transmission line corridors. Loss of habitat, habitat fragmentation, and increased noise generation during construction and operation of the new transmission line corridor could cause terrestrial wildlife to move into other habitats in the surrounding landscape, increasing demands on those habitats and competing with other wildlife. As the corridor revegetates and routine maintenance occurs, species favoring differing habitats could avoid or prefer the open habitat of the corridor. Invasive plants may also colonize the newly created corridors. In a review of bird mortality literature, Loss et al. (2014-TN9396) estimated that the median annual collision mortality for birds is 23.2–29.6 birds/km of powerline. Biological, environmental, location, and design factors influence the likelihood of collisions (APLIC 2012-TN6779; Bevanger 1994-TN9619).

The MBTA makes it illegal to take any migratory bird (or parts, nests, or eggs), except under a valid permit issued under Federal regulations. The utility may need to commission avian impact studies and obtain a Federal migratory bird special purpose utility permit for take of MBTA protected bird species, in order to collect, transport, and temporarily possess migratory birds found on utility property or to handle active nest (FWS Undated-TN9282).

3.6.7 Natural Gas Alternative

This alternative would involve construction of a 1,110 MWe natural gas plant facility on approximately 48 ac (19.4 ha) within the existing footprint of the V.C. Summer Units 2 and 3 site. A short extension of the existing natural gas pipeline on the V.C. Summer site would be required to connect the new gas natural facility. Although some infrastructure upgrades like new MDCTs may be required, the existing transmission line and transportation infrastructure at the V.C. Summer would be adequate to support the alternative (Dominion 2023-TN10387).

The 2024 LR GEIS (NRC 2024-TN10161: p. 2-35) concludes that many of the impacts on terrestrial resources from the operation of fossil-fuel energy alternatives would be essentially similar to those from the continued operation of a nuclear power plant. These similar impacts include cooling tower drift, noise, bird collisions with plant structures and transmission lines, the impacts connected with herbicide application and landscape management, and the potential water use conflicts connected with cooling water withdrawals. However, some impacts particular to a natural gas plant would be from air emissions of GHGs such as nitrogen oxide, CO_2, and methane. Such GHGs can lead to consequences like climate change.

Because the natural gas facility would use existing V.C. Summer transmission lines, the NRC staff expects no increased potential in wildlife injury from transmission lines. However, this alternative will require adding new, tall structures to the landscape. The addition of these tall structures might result in increased bird or bat mortality or injury from collisions.

Based on the above, the NRC staff concludes that the impacts on terrestrial resources from construction and operation of a natural gas alternative would be SMALL.

3.6.8 New Nuclear (Small Modular Reactor) Alternative

This alternative would involve the installation and operation of two, 12-unit SMRs on approximately 130 ac (53 ha) of V.C. Summer Units 2 and 3 site. Although some infrastructure upgrades like new MDCTs may be required, the existing transmission line and transportation infrastructure at the V.C. Summer site would be adequate to support the alternative (Dominion 2023-TN10387).

Because the SMR facility would use existing V.C. Summer transmission lines and transportation, the NRC staff expects no increased potential in wildlife injury. However, the alternative will require adding new, tall structures to the landscape. The addition of these tall structures might result in increased bird or bat mortality or injury from collisions.

Based on the above, the NRC staff concludes that the impacts on terrestrial resources from construction and operation of a new nuclear alternative would be SMALL.

3.6.9 Natural Gas and Solar Combination Alternative

This alternative would involve the construction of a 700 MWe natural gas facility, a 60 MW solar PV installation with battery storage, and three 100 MW solar PV installations with battery storage.

<u>Natural Gas Facility</u>

Effects of the natural gas portion of this alternative would be similar to the natural gas only alternative, because the natural gas facility would be sited at the same location (V.C. Summer Units 2 and 3 site) and would use the same infrastructure. However, because the new natural gas facility in this alternative would have less generation capacity (700 MWe vs. 1,110 MWe) and require less land (<19.4 ac [7.85 ha] vs. <48 ac [19.42 ha]) than the natural gas only alternative, the NRC assumes that the impacts of this portion of the alternative would be less than that of the natural gas only alternative. Therefore, the NRC staff concludes that the impacts on terrestrial resources from construction and operation of a natural gas facility would be SMALL.

<u>Solar Facilities</u>

Impacts on terrestrial habitats and biota from the construction and operation of solar PV plants depend largely on the amount of land required and the location of the land. If the land chosen for the solar plants were previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the lands were forest, grasslands, wetlands, or desert containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats, but some species would return at the end of construction when temporarily disturbed land is restored. This portion of the alternative requires approximately 5,100 ac (2,064 ha).

Four solar PV facilities with a total generation capacity of 360 MW would be constructed. A 60 MW facility with battery storage would be co-located on the V.C. Summer Units 2 and 3 with the natural gas facility. In addition, three 100 MW solar PV facilities with battery storage would be constructed offsite in South Carolina. Total land requirement for the solar facility portion of this alternative is approximately 3,700 ac (1,497 ha). Although the 60 MW solar facility on the V.C. Summer Units 2 and 3 site would require no additional transmission corridors, the NRC estimates that the three offsite solar PV facilities would require new transmission corridors totaling approximately 1,400 ac (567 ha).

Once in operation, solar plants pose special hazards to birds through collisions with PV equipment and transmission lines, electrocution by substation and distribution lines, and predation when injured and stunned on the ground after collision (Hathcock 2019-TN8470). Another less understood cause of bird collisions is known as the lake effect theory. Birds, especially migrating waterfowl and shorebirds, perceive the horizontally polarized light of PV solar panels as bodies of water and are injured or killed when they attempt to land on the panels as if they were water (Horvath et al. 2009-TN897). Water-seeking insects can also collide with the panels for the same reasons. In large enough numbers, such insect deaths may affect food webs. The Multiagency Avian-Solar Collaborative Working Group is a collection of Federal and State agencies identifying information needs and best practices for reducing the impacts of solar energy on avian populations. Collaboration with government agencies on best practices in the construction and siting of the solar installations can mitigate their impacts on birds.

The NRC staff concludes that the construction and operational impacts on terrestrial resources from the solar portion of this alternative would be MODERATE to LARGE based on the significant loss of wildlife habitats and vegetation from the large amount of land required for facilities and transmission corridors, as well as from the increased mortality risk to birds from collisions with solar PVs and new transmission lines.

<u>Alternative Conclusion</u>

Based on the above discussion of natural gas and solar facilities, the NRC staff concludes that the overall impacts on terrestrial resources from this alternative range from MODERATE to LARGE, mainly because of the large area of land, types of land that could be used for the solar portion of the alternative, as well as the operational impacts of solar PV on birds and bats.

3.6.10 New Nuclear and Solar Combination Alternative

Under this alternative, one 12-unit SMR (884 MWe) would be installed and operated on the V.C. Summer Units 2 and 3 site, as would one 82 MW solar PV installation with battery storage. Existing transmission and transportation infrastructure would be used. Total land area required is less than 830 ac (336 ha).

Small Modular Reactor

Because the proposed location and design of the SMR are the same as the two-unit SMR alternative, the NRC staff concludes that the impacts of this portion are similar. Because only one SMR facility would be constructed instead of two, less land would be required. In addition, less cooling water would be required, resulting in fewer impacts on the riparian environment and fewer potential drift impacts to surrounding vegetation. Therefore, the NRC staff finds that the impacts of construction and operation of the SMR portion of this alternative on terrestrial resources would be SMALL.

Solar Facilities

Solar construction impacts for this alternative are less than the natural gas and solar combination alternative. Although more of the V.C. Summer Units 2 and 3 site would be developed under this alternative, no offsite lands would be developed for solar installations, nor would any new transmission corridors be required. Solar panels would still remain a collision risk for birds, but the reduced generation capacity reduces the probability of collisions. Therefore, the NRC staff concludes that the construction and operational impacts of the solar portion of this alternative are SMALL to MODERATE.

Alternative Conclusion

The NRC staff concludes that the overall impacts on terrestrial resources for the New Nuclear and Renewables (solar) combination alternative would range from SMALL to MODERATE. The NRC staff's conclusion is based primarily on the area of land required for the facilities, the fact that the proposed site was already developed, and the increased likelihood of bird mortality from collisions with the new solar PV.

3.7 Aquatic Resources

This section describes the aquatic resources of the affected environment, which are associated with the Monticello Reservoir on Frees Creek and with the Parr Reservoir on the Broad River. Both are within the Broad River Basin. The NRC staff previously characterized these resources in Section 2.2.5 of the 2004 V.C. Summer LR SEIS, which analyzed the environmental impacts of initial license renewal (NRC 2004-TN7262). Section E3.7.1 of Dominion's 2023 ER also contains a description of the aquatic environment (Dominion 2023-TN10387). Key, new, and updated information are summarized in the sections below. Following the description of the aquatic environment, the NRC staff analyzes the potential impacts on these resources that would occur from the proposed action (SLR) and alternatives.

3.7.1 Monticello Reservoir on Frees Creek

SCE&G constructed the Monticello Reservoir, also called Lake Monticello, in 1977 to supply cooling water to V.C. Summer and to serve as the upper storage reservoir for the Fairfield Pumped Storage hydroelectric facility. The reservoir is approximately 6 mi (10 km) in length with a surface area covering 6,800 ac (2752 ha), which holds a volume of 431,000 ac-ft, and has a watershed area of 17.4 mi^2 (45 km^2) in the Frees Creek Valley, a tributary of the Broad River (Dominion 2023-TN10387 and SCE&G 2019-TN10445: Figure 1). The average reservoir depth is 59 ft (18 m) with a maximum depth of around 126 ft (38.5 m). During periods of high electrical demand, generating turbines direct water from the Monticello Reservoir to the Parr Reservoir, generating power as it flows. In contrast, when electricity needs are low, a portion of the power generated at V.C. Summer is used to pump water back into the Monticello Reservoir (SCDNR

2013-TN10446). Pumped storage activities cause daily fluctuations in water levels, with surface elevation in the Monticello Reservoir varying by up to 5 ft (1.5 m). There is little natural surface water flow, and water movement is largely controlled by the V.C. Summer intake and the hydroelectric turbines.

The SCDHEC monitors water quality at two permanent monitoring stations (B-327 and B-328), and monitors fish tissue at two stations within the publicly accessible portions of the Monticello Reservoir. SCDHEC checks fish tissue for mercury and PCBs. Currently, there are no fish consumption advisories within the reservoir (SCDHEC Undated-TN10447). Surface water temperatures range from approximately 48°F (9°C) during the winter to 86°F (30°C) during the summer, with spring and summer temperatures at depth up to 12°F (6.7°C) cooler than the surface (SCDHEC 2020-TN10521). Maximum observed temperatures have not exceeded the South Carolina's water classifications and standards at R.61-68 criteria of 90°F (32.2°C) for freshwaters (Dominion 2023-TN10387). The reservoir is listed on SCDHEC's 303(d) list of impaired waterbodies for aquatic life use because of pH (EPA 2022-TN10448; SCDHEC Undated-TN10450). In the 2007 Broad River Basin Watershed Water Quality Assessment, samples taken from four stations in the Monticello Reservoir, with 12 to 58 samples at each station, ranged from 8.56 to 9.03 in pH (SCDHEC 2007-TN10449). That report also described levels of dissolved oxygen, turbidity, total phosphorus, total nitrogen, fecal coliform bacteria, cadmium, chromium, copper, lead, mercury, nickel, and zinc; none of which violated the appropriate State standards. More recent water quality assessment data, which can be accessed in the South Carolina's Watershed Atlas, show the same compliance with State standards as the 2007 published report (SCDHEC Undated-TN10450).

3.7.2 Parr Reservoir on the Broad River

The Broad River originates in the Blue Ridge Mountains in North Carolina and flows southeast into South Carolina. In 1914, a dam was built just west of Jenkinsville, South Carolina to create the Parr Reservoir for hydroelectric power. In 1976, the dam was raised 9 ft (2.7 m) higher to 37 ft (11 m), in conjunction with the creation of the Monticello Reservoir. Today the Parr Reservoir, also called Parr Shoals, provides makeup water from evaporative loss to the Monticello Reservoir. When full, the Parr Reservoir is 13 mi (21 km) long, covering 4,400 ac (1,780 ha) and has a storage capacity of 32,000 ac-ft (8,960 million gallons [Mgal]) (Dominion 2023-TN10387: Figure E2-1). Pumped storage activities cause daily fluctuations in water levels, with surface elevation in the Parr Reservoir varying by up to 10 ft (3 m). The Broad River continues southeast for 26 mi (42 km) where it combines with the Saluda River to form the Congaree River in Columbia, South Carolina. Average annual flow of the Broad River ranges from about 1,500 cfs (42.5 m/s^3) near the North Carolina border to more than 6,000 cfs (170 m/s^3) at the confluence with the Saluda River at Columbia (SCDNR 2013-TN10446).

The SCDHEC monitors water quality at two stations within the Parr Reservoir (B-345 and B-346). At these stations, water temperatures are as low as 51°F (10.5°C) at the water's surface in January to a peak of 86°F (30°C) in the summer (SCDHEC 2020-TN10521). Until 2019, USGS also maintained monitoring stations. The recorded temperatures in 2019 at these stations ranged from 49°F (9.5°C) in January to 84.6°F (29.2°C) in July, with corresponding dissolved oxygen concentrations of 10.87 mg/L and 5.96 mg/L (USGS 2024-TN10522), respectively. From 1999 through 2013, SCDHEC's water quality data showed that dissolved oxygen concentrations in the Parr Reservoir varied from a low of approximately 4.5 mg/L to a high of about 13.0 mg/L (Kleinschmidt 2014-TN10523).

3.7.2.1 Biological Communities

The trophic structure of the Monticello and Parr Reservoirs, which are connected by the generating intake and pump-back intakes at the Fairfield Pumped Storage hydroelectric facility, includes primary producers (plankton, macrophytes, and periphyton), primary consumers (zooplankton and benthic macroinvertebrates), and bottom feeding, planktivorous, and piscivorous fish that serve as secondary and tertiary consumers. Primary producers are organisms that capture solar energy and synthesize organic compounds from inorganic chemicals. They form the trophic structure's foundation by producing the organic nutrients and energy used by consumers. Primary producers in lake systems include phytoplankton, aquatic macrophytes, and periphyton. Of the three, phytoplankton are the major producers in all but very shallow lakes. Figure 3-10 below illustrates the trophic structure of the interconnected reservoirs.

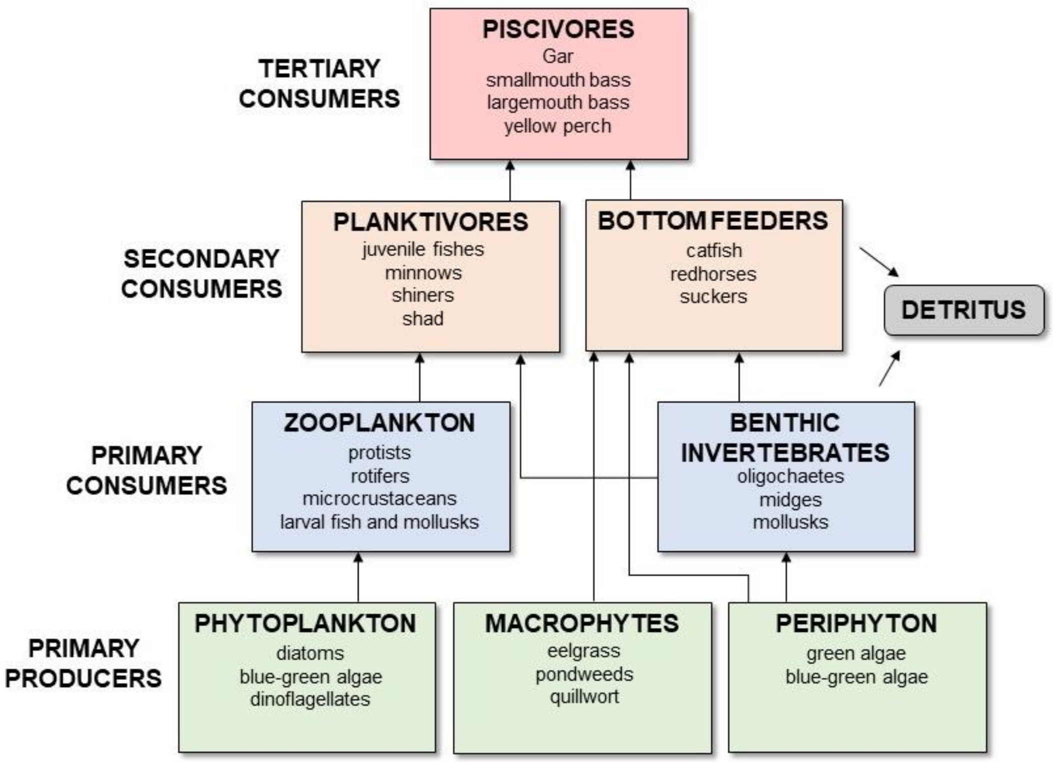


Figure 3-10 Trophic Structure of the Monticello and Parr Reservoirs

<u>Plankton</u>

Plankton are small and often microscopic organisms that drift or float in the water column. Phytoplankton are single-celled plant plankton and include diatoms (single-celled, yellow algae) and dinoflagellates (a single-celled organism with two flagella). Phytoplankton live suspended in the water column and occur in the limnetic (open water) zone of a lake.

Zooplankton are animals that either spend their entire lives as plankton (e.g., holoplankton) or exist as plankton for a short time during development (e.g., meroplankton). Zooplankton include rotifers, isopods, protozoans, marine gastropods, polychaetes, small crustaceans, and the eggs and larval stages of insects and other aquatic animals.

Macrophytes and Periphyton

Aquatic macrophytes are large plants, both emergent and submerged, that inhabit shallow water areas. Periphyton consist of single-celled or filamentous species of algae that attach to benthic or macrophytic surfaces. Macrophytes and periphyton occur in the littoral (nearshore and shallow) zone. They tend to be highly productive because they have more access to nutrients through their roots compared to phytoplankton.

Benthic Invertebrates

Benthic invertebrates inhabit the bottom of rivers and mainly consume periphyton. They include certain zooplankton and macroinvertebrates such as insects, mussels, crayfish, snails, clams, and polychaetes. Benthic invertebrates are primary consumers and are an important indicator of the health of an aquatic system. The SCDNR's 2007 freshwater mussel surveys, which included sites in the Parr Reservoir, identified four species across multiple size and age classes (Table 3-11 below) (Price 2010-TN10451). Two of the species are State species of greatest conservation need, but none are federally listed. Dominion's 2015 freshwater mussel surveys in the Monticello Reservoir identified six species across multiple size and age classes (Three Oaks Engineering 2016-TN10452). Three of the species are State species of greatest conservation need, but none are federally listed. The Carolina creekshell occurrence in the Monticello Reservoir may have been misidentified, as this species had never been seen in the reservoir before, and it is unlikely to be found outside of a stream habitat (Price 2010-TN10451).

Table 3-11 Freshwater Mussel Species Observed during Surveys Conducted at the Monticello and Parr Reservoirs in 2007 and 2015

Common Name	Species	SGCN Priority (2015)	Monticello Reservoir	Parr Reservoir (2007)
common elliptio	*Elliptio complanate*	Moderate	-	Present
Carolina lance	*Elliptio angustata*	Moderate	Present	-
yellow lance	*Elliptio lanceolate*	None	-	Present
eastern floater	*Pyganadon catacta*	None	Present	-
Florida pondhorn	*Uniomerus carolinianus*	None	Present	Present
paper pondshell	*Utterbackia imbecillis*	None	Present	
eastern creekshell	*Villosa delumbis*	Moderate	Present	Present
Carolina creekshell	*Villosa vaughaniana*	Highest	Present	-

SGCN = State species of greatest conservation need.
"-" denotes no entry in the table cell.
Adapted from FERC 2020-TN10457.

Ichthyoplankton

Ichthyoplankton are the eggs and larvae of fish. SCDHEC sampled ichthyoplankton from three stations in the Monticello Reservoir from October 1983 to September 1984 as part of a CWA Section 316(b) technology demonstration (Dominion 2024-TN10391: Enclosure 3). Researchers identified 17 different species of larval fish from six families overall. SCDHEC used a towed plankton net, with clupeid (primarily gizzard shad, 83 percent) being most abundant, followed distantly by smaller numbers of yellow perch (7.5 percent), white bass, crappie, sunfish, minnows, and suckers.

Normandeau Associates, Inc. collected ichthyoplankton samples for Dominion from 2008 to 2009 near the existing intake at V.C. Summer on the Monticello Reservoir using towed bongo nets (Dominion 2024-TN10391: Enclosure 4). Dominion did not collect any fish eggs, likely because the species present have eggs that remain on the bottom of the reservoir. Dominion collected fish larvae only from March through August, with a peak in May. Threadfin shad were the most abundant, making up 71 percent of the total, followed by white perch (13 percent), Clupeidae (undetermined either threadfin shad or gizzard shad, 12 percent), and gizzard shad (2 percent). Black crappie, darter, yellow perch, suckers, Cyprinidae (minnow and carp), and *Lepomis* sp. (sunfish) made up the remaining 2 percent.

In 2016, researchers from Normandeau Associates, Inc. again sampled ichthyoplankton near the intake at V.C. Summer using towed bongo nets (Dominion 2024-TN10391: Enclosure 5). These collections, occurring from March to August, found the same seven families of fish as the 2009 study, which was one more (Ictaluridae e.g., bullhead, catfish) than the original sampling in 1985. Clupeids (e.g., threadfin and gizzard shad) again dominated samples (86 percent), followed by sunfish (10 percent), Cyprinidae (2 percent), and suckers, catfish, bass, and perch making up the remaining 2 percent.

The dominant fish species, both threadfin shad and gizzard shad, are important prey species. Although threadfin shad is a nonnative species introduced by fishery managers to supplement forage fish populations, it is a valuable prey species due to its small size. The threadfin shad is a semi-tropical species that would tend to die off during cold winters, but the warm effluents from V.C. Summer allow the shad to establish a stable community (Kleinschmidt 2013-TN10455).

Juvenile and Adult Fish

In 1983 and 1984, shortly after the plant began operating, SCE&G used gill nets and electrofishing to conduct a comprehensive survey of the fish community in the Monticello Reservoir to support of the station's CWA Section 316(a) demonstration. Biologists collected 32 different species of fish which were dominated by sunfish (Centrarchids, 55 percent) and Clupeids (28 percent) (Dominion 2024-TN10391: Enclosure 3). They also found smaller numbers of catfish (Ictalurids, 7 percent), suckers (Catastomids, 5 percent), and perch (Percids, 3 percent). These abundances were similar to pre-operational fish surveys conducted by SCE&G in 1978.

From 1987 to 1989, SCDNR conducted cove rotenone sampling in the Monticello Reservoir (Nash et al. 1990-TN10456). They blocked off three coves with 0.4 in. (9.5 mm) mesh netting, collecting 24 different species of fish and estimated a standing stock of 183 lb (83 kg) of fish per acre. The most dominant fish were bluegill, channel catfish, gizzard shad, and white catfish (Table 3-12). The abundance data indicated prey is available for all size groups of predators in the reservoir with major prey species including bluegill, threadfin shad, and yellow perch. Predator species include largemouth bass, black crappie, larger catfish, and white bass (Nash et al. 1990-TN10456).

Dominion conducted fish sampling, using electrofishing and gill nets, from 2007 to 2009 in both the Monticello and Parr Reservoirs, and again in 2012 for only the Parr Reservoir as part of the application for the Parr hydropower license (FERC 2020-TN10457). Dominion documented 24 warmwater species of fish in Monticello Reservoir and 30 species of warmwater fish in Parr Reservoir (Table 3-12). Similar abundances were reported in both reservoirs with the exception of channel catfish being more abundant in the Parr Reservoir.

SCDNR also conducts yearly spring electrofishing sampling that targets black bass species. In 2014, SCDNR only collected largemouth bass across three sites within the Monticello

Reservoir. In 2015, researchers collected largemouth bass and smallmouth bass, although smallmouth bass comprised less than 5 percent of individuals collected. Since 2020, in addition to smallmouth and largemouth bass, SCDNR has also collected small numbers of Alabama bass, Bartram's bass, and hybrids, identified using genetic samples (SCDNR 2024-TN10524).

Table 3-12 Fish Species and Abundance in the Monticello and Parr Reservoirs during Sampling by South Carolina Department of Natural Resources (1987–1989) and Dominion (2007–2009, and 2012)

Species	Scientific Name	Monticello	Parr	Average Abundance (percent) SCDNR 1987–1989	Impingement Abundance (percent) SCE&G 2005–2006
bluegill	*Lepomis macrochirus*	Present	Present	24	-
channel catfish	*Ictalurus punctatus*	Present	Present	21	11.8
gizzard shad	*Dorosoma cepedianum*	Present	Present	18	-
white catfish	*Ameiurus catus*	Present	Present	14	
threadfin shad	*Dorosoma petenense*	Present	Present	5	50.2
yellow perch	*Perca flavescens*	Present	Present	5	6.1
silver redhorse	*Moxostoma anisurum*	Present	-	2	-
river carpsucker	*Carpiodes carpio*	Present	-	2	-
largemouth bass	*Micropterus salmoides*	Present	Present	2	-
pumpkinseed	*Lepomis gibbosus*	Present	Present	2	-
black crappie	*Pomoxis nigromaculatus*	Present	Present	2	-
redear sunfish	*Lepomis microlophus*	Present	Present	1	-
blue catfish	*Ictalurus furcatus*	Present	Present	0.8	12.2
warmouth	*Lepomis gulosus*	Present	Present	0.4	-
shorthead redhorse	*Moxostoma macrolepidotum*	Present	-	0.3	-
white bass	*Morone chrysops*	Present	Present	0.3	-
whitefin shiner	*Cyprinella nivea*	Present	Present	0.2	-
white crappie	*Pomoxis annularis*	Present	-	0.1	-
golden shiner	*Notemigonus crysoleucas*	Present	Present	0.06	-
silvery minnow	*Hybognathus amarus*	Present	-	0.03	-
flat bullhead	*Ameiurus platycephalus*	Present	Present	0.03	-
redbreast sunfish	*Lepomis auritus*	Present	Present	0.03	-
longnose gar	*Lepisosteus osseus*	Present	Present	Trace	-
snail bullhead	*Ameiurus brunneus*	Present	-	Trace	-
gambusia	*Gambusia affinis*	Present	-	Trace	-
tessellated darter	*Etheostoma olmstedi*	Present	-	Trace	-
white perch	*Morone americana*	Present	Present	0	9.4
sandbar shiner	*Notropis scepticus*	-	Present	-	-

Table 3-12 Fish Species and Abundance in the Monticello and Parr Reservoirs during Sampling by South Carolina Department of Natural Resources (1987–1989) and Dominion (2007–2009, and 2012) (Continued)

Species	Scientific Name	Monticello	Parr	Average Abundance (percent) SCDNR 1987–1989	Impingement Abundance (percent) SCE&G 2005–2006
spottail shiner	*Notropis hudsonius*	Present	Present	-	-
highfin carpsucker	*Carpiodes velifer*	-	Present	-	-
northern hogsucker	*Hypentelium nigricans*	Present	Present	-	-
notchlip redhorse	*Moxostoma collapsum*	Present	Present	-	-
quillback	*Carpiodes cyprinus*	Present	Present	-	-
robust redhorse	*Moxostoma robustum*	Present	Present	-	-
shorthead redhorse	*Moxostoma macrolepidotum*	Present	Present	-	-
flathead catfish	*Pylodictis olivaris*	-	Present	-	-
yellow bullhead	*Ameiurus natalis*	Present	Present	-	-
smallmouth bass	*Micropterus dolomieu*	Present	Present	-	-
Alabama bass	*Micropterus henshalli*	Present	-	-	-
Bartram's bass	*Micropterus sp. cf. cataractae*	Present	-	-	-

SCDNR = South Carolina Department of Natural Resources; SCE&G = South Carolina Electric and Gas.
"-" denotes no data in table cell.
Sources: Nash et al. 1990-TN10456 and FERC 2020-TN10457.

3.7.2.2 Important Species and Habitats

This section summarizes important Monticello Reservoir fisheries, as well as State-protected and other special status species.

Commercially Important Fisheries

There are no commercial fisheries in the Monticello or Parr Reservoirs (SCDNR 2014-TN10458).

Recreationally Important Fisheries

The Monticello Reservoir is managed by SCDNR for recreational fishing activities and bass tournaments are held there throughout the year. Popular sport fish on the Monticello Reservoir include catfish species such as blues, channels, whites, yellows, and flat bullhead catfish. Other popular game fish include largemouth bass, black and white crappies, white bass, and bream species such as bluegill, redear, and redbreast (SCDNR 2014-TN10459).

SCDNR collected data from the winter of 1987 through the spring of 1990 to assess the annual fishing effort on the Monticello Reservoir, also called Lake Monticello (Nash et al. 1990-TN10456). The average estimated annual fishing effort for the reservoir is 45,818 fishing hours or 6.7 hours per acre. Fishing varied by season with fishing effort being highest in the spring at 2.5 hours per acre, slightly lower in spring and fall at 1.5 to 1.6 hours per acre, and lowest in the winter at just 1.1 hours per acre. Most of the fishing effort in the reservoir is spent fishing for catfish (36 percent) or largemouth bass (34 percent) with a smaller amount spent on crappie (24 percent), bluegill (3 percent), and white bass (2 percent). The fish that recreational fishers target changes by season depending on specific species traits. Annual catch per unit effort (CPUE) estimates for the Monticello Reservoir are 0.65 fish per hour or 0.44 lb per hour. At the time of this survey there was no length limit on largemouth bass although now the bass limit is for fish larger than 14 in. (36 cm) in total length (SCDNR 2014-TN10458).

The Broad River is broken up by numerous shoals which limits boating access to fishing and, as a result, most fishing is done by kayak, canoe, or flat bottom boat. Freshwater game fish include: bream: bluegill, flier (*Centrarchus macropterus*), green sunfish (*Lepomis cyanellus*), pumpkinseed, redbreast, redear (shellcracker), spotted sunfish (*Lepomis punctatus*), warmouth; black bass: largemouth bass, smallmouth bass, redeye bass (Bartrams) and any other species of the genus Micropterus; striped bass or rockfish; white bass; hybrid striped bass; white crappie; black crappie; trout: rainbow (*Oncorhynchus mykiss*), brown (*Salmo trutta*), brook (*Salvelinus fontinalis*) and their hybrids; chain pickerel (jackfish, *Esox niger*); redfin pickerel (*Esox americanus*); sauger (*Sander canadensis*), walleye (Sander vitreus), and yellow perch (SC eRegs 2024-TN10829).

<u>State-Protected and Other Special Status Species</u>

The SCDNR has regulatory authority for fish and wildlife in South Carolina under South Carolina Code of Laws, Title 50. The SCDNR also has the authority to implement rules to protect species that it deems as endangered at the State level (SC Code of Law § 50-TN10460). Under these rules, “endangered” means any species or subspecies of wildlife whose prospects of survival or recruitment within the State are in jeopardy or are likely within the foreseeable future to become so. The Carolina pygmy sunfish (*Elassoma boehlkei*) is a State-listed species of conservation concern (SCDNR 2015-TN10461) with only a few populations known to exist in South Carolina. There is one population in Big Pine Tree Creek, part of the Santee River Basin, and a few populations in the Waccamaw River in Horry County and Georgetown, South Carolina. The Carolina pygmy sunfish are abundant where they are found; however, there have been no reported Carolina pygmy sunfish in the Monticello or Parr Reservoirs, or the Broad River Basin (SCDNR 2015-TN10461).

The shortnose sturgeon (*Acipenser brevirostrum*), a federally and State-listed endangered species, inhabits major rivers along the Atlantic coast from Georgia to Canada. While this species is anadromous and moves between fresh and salt water for reproduction, they appear to rarely leave the river in which they were spawned (SCDNR 2020-TN10462). In South Carolina, shortnose sturgeon populations have been observed in various rivers including the Savannah River, one or more of the rivers flowing into St. Helena Sound (Ashepoo, Combahee, and Edisto Rivers), the Cooper River, the Santee River, and one or more Winyah Bay rivers (Pee Dee, Waccamaw, and Black). There may also be a landlocked (“damlocked”) population in the Santee-Cooper Lake System. There have been no reported shortnose sturgeon in the Broad River Basin (SCDNR 2020-TN10462).

3.7.2.3 Invasive and Nuisance Species

Nonnative species are those species that are present only because of introduction and that would not naturally occur either currently or historically in an ecosystem. Invasive species are nonnative organisms whose introduction causes, or is likely to cause, economic or environmental harm or harm to human, animal, or plant health (81 FR 88609-TN8375). For purposes of this discussion, nuisance species are nonnative species that alter the environment but that do not rise to the level of invasive.

The primary invasive species concern related to V.C. Summer operations is biofouling of the cooling water intake system by invasive bivalves, such as Asian clams (*Corbicula fluminea*), which were first identified in the Monticello and Parr Reservoirs in 1979 (Counts 1985-TN10463). Dominion uses chemical additives approved by the SCDHEC to control pH, scale, and corrosion in the circulating water system, and to control biofouling of nuclear power plant equipment (Dominion 2023-TN10387).

In 2020 and 2021, during broodstock collections of smallmouth bass, SCDNR conducted genetic analysis. The results of the genetic analysis indicated, for the first time, the presence of Alabama bass and Bartram's bass genes in smallmouth bass hybrids (Sammons et al. 2023-TN10471). Both the Alabama bass and Bartram's bass are nonnative species to the Broad River watershed, although both have been spread to reservoirs, lakes, and rivers across the south and southeast, especially Alabama bass due to the popularity of bass fishing. Data collected from reservoirs across the southeast suggest that Alabama bass can outcompete largemouth bass and will hybridize with non-largemouth bass, black bass species (Sammons et al. 2023-TN10471).

3.7.3 Proposed Action

As described in the 2024 LR GEIS (NRC 2024-TN10161) and cited in Table 3-1 of this SEIS, the impacts of all Category 1 (generic) aquatic resources would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, consistent with the conclusions in the LR GEIS for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on aquatic resources would be SMALL. Table 3-2 of this SEIS identifies two Category 2 issues that require site-specific analysis for each proposed LR to determine whether impacts would be SMALL, MODERATE, or LARGE. These issues are (1) impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) and (2) effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds). The sections below analyze these issues in detail.

3.7.3.1 Impingement Mortality and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

For plants with once-through cooling systems or cooling ponds such as V.C. Summer, the NRC staff determined in the 2024 LR GEIS that impingement and entrainment of aquatic organisms is a Category 2 issue that requires plant-specific evaluation (NRC 2024-TN10161).

Impingement occurs when organisms are trapped against the outer part of an intake structure's screening device (79 FR 48300-TN4488). The force of the intake water traps the organisms against the screen, and individuals are unable to escape. Impingement can kill organisms immediately or cause exhaustion, suffocation, injury, and other physical stresses that contribute to mortality later. The potential for injury or death is generally related to the amount of time an organism is impinged, its fragility (susceptibility to injury), and the physical characteristics of the screen wash and fish return systems of the intake structure. The EPA has found that impingement mortality (IM) is typically less than 100 percent if the cooling water intake system includes fish return or backwash systems (79 FR 48300-TN4488). Because impingeable organisms are typically fish with fully formed scales and skeletal structures and well-developed survival traits, such as behavioral responses to avoid danger, many impinged organisms can survive under proper conditions (79 FR 48300-TN4488).

Entrainment occurs when organisms pass through the screening device and travel through the entire cooling system, including the pumps, condenser or heat exchanger tubes, and discharge pipes (79 FR 48300-TN4488). Organisms susceptible to entrainment are of smaller size, such as ichthyoplankton, larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. During travel through the cooling system, entrained organisms experience physical trauma and stress, pressure changes, excess heat, and exposure to chemicals (Mayhew et al. 2000-TN8458). Because organisms that get entrained generally possess fragile life stages (e.g., eggs, which exhibit poor survival after interaction with cooling water intake structure; or early larvae, which lack a skeletal structure and swimming ability), the EPA has concluded that for purposes of assessing the impacts of a cooling water intake system on the aquatic environment, all entrained organisms are assumed to die (79 FR 48300-TN4488).

Entrainment susceptibility is highly dependent on life history characteristics. For example, broadcast spawners with non-adhesive, free-floating eggs that drift with the water current may become entrained in a cooling water intake system. Nest building species or species with adhesive, demersal eggs are less likely to be entrained in early life stages. Susceptibility of larval life stages to entrainment depends on body morphology and swimming ability.

A species can be susceptible to both impingement and entrainment if several life stages of the species occupy the same source water. For instance, adults and juveniles of a given species of fish may be impinged against the intake screens, while larvae and eggs may pass through the screening device and be entrained through the cooling system. The susceptibility to either impingement or entrainment relates to the size of the individual relative to the size of the mesh on the screening device. The EPA considers aquatic organisms that can be collected or retained on a sieve with 0.56 in. (1.4 cm) diagonal openings to be susceptible to impingement (79 FR 48300-TN4488). This equates to screen device mesh openings of 0.5 in. × 0.25 in. (1.3 cm × 0.635 cm), which is slightly larger than the openings on the typical 0.375 in. (0.95 cm) square mesh found at many nuclear power plants. Organisms smaller than the 0.56 in. (1.4 cm) mesh are considered susceptible to entrainment.

The magnitude of the impact that impingement and entrainment create on the aquatic environment depends on the plant-specific characteristics of the cooling system as well as the local aquatic community. Relevant nuclear power plant-based characteristics include location of the cooling water intake structure, intake velocities, withdrawal volumes, screening device technologies, and the presence or absence of a fish return system. Relevant characteristics of the aquatic community include species present in the environment, life history characteristics, population abundances and distributions, special species statuses and designations, and regional management objectives.

V.C. Summer Cooling Water Intake System

The V.C. Summer cooling water intake system impinges and entrains aquatic organisms as it withdraws water from the Monticello Reservoir. Section 2.1.3 of this SEIS describes the V.C. Summer cooling and auxiliary water systems in detail. Features relevant to the impingement and entrainment analysis are summarized below.

Monticello Reservoir water is drawn into the cooling water intake structure at one of three pump bays, each with two entrances. Each entrance is 4 m (13 ft) wide and 8 m (25.5 ft) high, extending from the bottom of the pump house to the bottom of the skimmer wall. The entrances are equipped with vertical traveling screens (mesh size 1.0 × 0.89 cm [0.4 × 0.35 in.]) and two sets of trash racks of conventional design (NRC 1981-TN10472). Intake velocity is 1.31 feet per second (fps) (0.4 m/s) through the traveling screens (Dominion 2023-TN10387). Organisms that are too large to pass through the traveling screen mesh, such as juvenile and adult fish not able to swim away as well as shellfish, could become impinged on the screens. V.C. Summer does not have a fish return system, so all impinged organisms are either collected at the trash racks or on the traveling screens and are disposed of as solid waste along with other debris.

Organisms small enough to pass through the traveling screen mesh, such as fish eggs, larvae, and other zooplankton, are entrained into the cooling water system and pass through the entire system. After leaving the condensers, circulating water moves via a 3.7 m (12 ft) diameter pipe from the plant to a semi-enclosed discharge basin. From the basin, the heated effluent moves through a 305 m (1,000 ft) long discharge canal to the Monticello Reservoir. The discharge canal directs the discharge flow (heated effluent) to the northeast. A 790 m (2,600 ft) long jetty prevents the recirculation of the heated water. During this process, entrained organisms are subject to mechanical, thermal, and toxic stresses.

<u>Clean Water Act Section 316(b) Requirements for Existing Facilities</u>

Section 316(b) of the CWA addresses the adverse environmental impacts caused by the intake of cooling water from waters of the United States. This section of the CWA grants the EPA the authority to regulate cooling water intake structures to minimize adverse impacts on the aquatic environment. Under CWA Section 316(b), the EPA has issued regulations for existing facilities, such as V.C. Summer, at 40 CFR Part 122 (TN2769) and 40 CFR Part 125 (TN254), Subpart J. Existing facilities include power generation and manufacturing facilities that are not new facilities as defined at 40 CFR 125.83 (TN254) and that withdraw more than 2 MGD (7.6 million liters per day) of water from waters of the United States and use at least 25 percent of the water they withdraw exclusively for cooling purposes.

Under the CWA Section 316(b) regulations, the location, design, construction, and capacity of cooling water intake structures of regulated facilities must reflect the best technology available (BTA) for minimizing impingement mortality and entrainment. The EPA, or authorized States and Tribes, impose BTA requirements through NPDES permitting programs. In South Carolina, the SCDHEC administers the NPDES program and issues NPDES permits to regulated facilities.

With respect to IM, the BTA standard requires that existing facilities comply with one of the following seven alternatives (40 CFR 125.94(c) [TN254]):

1. operate a closed-cycle recirculating system, as defined at 40 CFR 125.92(c) (herein referred to as “IM Option 1”)
2. operate a cooling water intake structure that has a maximum through-screen design intake velocity of 0.5 fps (0.15 m/s)
3. operate a cooling water intake structure that has a maximum actual through-screen intake velocity of 0.5 fps (0.15 m/s)
4. operate an offshore velocity cap, as defined at 40 CFR 125.92(v), that was installed on or before October 14, 2014

5. operate a modified traveling screen that the NPDES Permit Director determines meets the definition at 40 CFR 125.92(s), and that the NPDES Permit Director determines is the BTA for impingement reduction at the site

6. operate any other combination of technologies, management practices, and operational measures that the NPDES Permit Director determines is the BTA for impingement reduction (herein referred to as “IM Option 6”)

7. achieve a 12-month IM performance standard of all life stages of fish and shellfish of no more than 24 percent mortality, including latent mortality, for all non-fragile species

Options (1), (2), and (4) above are essentially preapproved technologies requiring either no demonstration or only a minimal demonstration that the flow reduction and control measures are functioning as the EPA envisioned. Options (3), (5), and (6) require more detailed information to be submitted to the permitting authority before the permitting authority may specify it as BTA for a given facility. Under Option (7), the permitting authority may also review site-specific data and conclude that a de minimis rate of impingement exists; and, therefore, no additional controls are warranted to meet the BTA IM standard.

With respect to entrainment, the CWA Section 316(b) regulations do not prescribe a single nationally applicable entrainment performance standard, because the EPA did not identify a technology for reducing entrainment that is effective, widely available, feasible, and does not lead to unacceptable non-water-quality impacts (79 FR 48300-TN4488). Instead, the permitting authority must establish the BTA entrainment requirement for each facility on a site-specific basis. In establishing site-specific requirements, the regulations direct the permitting authority to consider the following factors (40 CFR Part 125-TN254):

- numbers and types of organisms entrained, including, specifically, the numbers and species (or lowest taxonomic classification possible) of federally listed, threatened and endangered species, and designated critical habitat (e.g., prey base)
- impact of changes in particulate emissions or other pollutants associated with entrainment technologies
- land availability inasmuch as it relates to the feasibility of entrainment technology
- remaining useful plant life
- quantified and qualitative social benefits and costs of available entrainment technologies when information on both benefits and costs is of sufficient rigor to make a decision

In support of entrainment BTA determinations, facilities must conduct site-specific studies and provide data to the permitting authority to aid in its determination of whether site-specific controls would be required to reduce entrainment and which controls, if any, would be necessary.

<u>Analysis Approach</u>

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to the impacts of impingement and entrainment. Therefore, if the NPDES permitting authority has made BTA determinations for a facility pursuant to CWA Section 316(b) in accordance with the current regulations specified in 40 CFR Part 122 (TN2769) and 40 CFR Part 125 (TN254), which were promulgated in 2014 (79 FR 48300-TN4488), and the facility has implemented any associated requirements or those requirements would be implemented before the proposed SLR period, then the NRC staff assumes that adverse impacts on the aquatic environment will be minimized. In such cases, the NRC staff concludes that the impacts of either impingement, entrainment, or both would be SMALL for the proposed SLR term.

In cases in which the NPDES permitting authority has not made BTA determinations, the NRC staff analyzes the potential impacts of impingement, entrainment, or both using a weight of evidence approach. In this approach, the staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the NRC staff might consider characteristics of the cooling water intake system design, the results of impingement and entrainment studies performed at the facility, and trends in fish and shellfish population abundance indices. The NRC staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience during the proposed SLR term.

Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the aquatic community of the Monticello Reservoir as it occurs today, which is described in Section 3.7.1 of this SEIS. All fish and benthic invertebrate populations are self-sustaining. Electrofishing, gill netting, and seining sampling indicate no major upward or downward trends in juvenile or adult fish populations (Dominion 2024-TN10391: Enclosure 3; Nash et al. 1990-TN10456; FERC 2020-TN10457). While species richness, evenness, and diversity within the community may change or shift between now and when the proposed SLR period would begin, the NRC staff finds the present aquatic community to be a reasonable surrogate in the absence of fishery and species-specific projections.

3.7.3.1.1 Impingement

Impingement Mortality BTA

In the 2022 NPDES permit, SCDHEC, in consultation with EPA, determined that V.C. Summer meets the administrative criteria of a closed-cycle recirculating system consistent with the definition in 40 CFR 125.92(c)(2) (Dominion 2023-TN10387: Appendix A). Under the regulatory definition, a closed-cycle recirculating system is one that passes cooling water through the condenser and other components of the cooling system and reuses the water for cooling multiple times. Such a system can include impoundments of waters of the United States where the impoundment was constructed before October 1, 2014, and was created for the purposed of serving as part of the cooling water system.

Monticello Reservoir was built in 1977 to supply cooling water to V.C. Summer and to serve as the upper storage reservoir for the Fairfield Pumped Storage hydroelectric facility. Accordingly, V.C. Summer is eligible to meet the IM reduction standard through Compliance Alternative 1 (40 CFR 125.94(c)(1) [TN254]) described previously in this section. In the current NPDES permit, SCDHEC confirmed that V.C. Summer meets the BTA standard for IM (Dominion 2023-TN10387: Appendix A).

Impingement Studies

1983–1984 Impingement Study

Shortly after V.C. Summer began operation on January 1, 1983, SCE&G conducted IM studies from October 1983 to September 1984 (Dominion 2024-TN10391: Enclosure 3). Researchers collected samples at the intake structure and recorded data on the species, number, length, and weight of fish impinged on the traveling screens twice monthly. Researchers collected a total of

5,140 fish, weighing 68 lb (31 kg). Impingement rates were highest from January through March, likely due to colder winter temperatures.

The fish collected included 17 different species from six families. The most abundant was the Clupeidae family with gizzard shad making up 83 percent and threadfin shad making up 1 percent of the sample. Second most abundant was the Percidae family, which made up 7.6 percent of the sample, all of which were yellow perch. There were eight species of sunfish (Centrarchidae), which made up only 4.6 percent of the sample. Most of the impinged fish were young of the year or first year fish.

Researchers estimated 85,000 fish per year are impinged, or 1,135 lb (515 kg) of fish per year, which is 0.47 percent of the estimated fish in the Monticello Reservoir.

2005–2006 Impingement Study

From June 2005 to June 2006, Geosyntec Consultants conducted an impingement study at the Monticello Reservoir in connection with the V.C. Summer CWA Section 316(b) requirements (Dominion 2024-TN10391: Enclosure 6). The purpose of this study was to conduct an IM characterization study by characterizing existing fish impingement at the V.C. Summer cooling water intake system (CWIS) based on bi-weekly sampling from July 12, 2005 through June 27, 2006, and to develop a preliminary estimate of annual IM.

Researchers gathered impingement samples using a modified debris collection basket with ⅜ in. (1 cm) wire mesh to match the traveling screens. They collected samples over 24-hour periods and divided them into 12-hour day and night sub-samples. In total, 52 impingement samples yielded 13 fish species (e.g., shad, catfish, bullheads, white and yellow perch, bass, and sunfish), crayfish, and freshwater grass shrimp. The fish species included two types of shad, five types of catfish or bullheads, white perch, yellow perch, and three types of bass and sunfish. Threadfin shad were the most numerous, making up 50.2 percent of the total fish count. Other common species included blue catfish, channel catfish, white perch, and yellow perch. White perch account for the largest biomass at 36.6 percent of the total catch. No rare, threatened, or endangered species were impinged during the yearlong study.

Most of the impinged fish were sub-adult or young of the year fish under 6.7 in. (17 cm) in total length. Threadfin shad, the most commonly impinged fish, ranged in size from less than 1.5 to 4.7 in. (3.8 to 12 cm) total length. Impingement rates were highest from late December through February, a period dominated by threadfin shad. Higher impingement rates occurred at night in 19 out of 26 sampling events.

Researchers used Monte Carlo simulation techniques to establish a baseline estimate for annual IM. After adjusting for the actual plant operations observed during the study, they determined that the 95 percent upper confidence limit for the estimated annual IM was 9,154 organisms weighing a total of 272 lb (123 kg). This baseline reflects the once-through cooling system at V.C. Summer without any additional EPA required structural or operational measures specifically designed to mitigate IM and to meet BTA requirements.

Impingement Conclusion

Because Compliance IM Option 1 is a preapproved alternative under CWA Section 316(b) regulations, and because the EPA and SCDHEC have confirmed that V.C. Summer meets the criteria for a closed-cycle recirculating system for purposes of CWA Section 316(b) compliance, the NRC staff finds that the adverse impacts on the aquatic environment associated with impingement are minimized. This indicates that impingement is unlikely to cause noticeable or detectable impacts on Monticello Reservoir's aquatic populations. Accordingly, the NRC staff finds that the impacts of impingement during the proposed SLR term would neither destabilize nor noticeably alter any important attribute of the aquatic environment and would, therefore, result in SMALL impacts on aquatic resources.

3.7.3.1.2 Entrainment

<u>Entrainment BTA</u>

The CWA Section 316(b) regulations direct the permitting authority to establish BTA entrainment requirements for each facility on a site-specific basis. The 2022 NPDES permit, issued by SCDHEC, in consultation with EPA, determined that V.C. Summer meets BTA for entrainment by employing a closed-cycle recirculating cooling system per 40 CFR 125.92(c)(2) (Dominion 2023-TN10387: Appendix A).

SCE&G completed entrainment studies at V.C. Summer in 1983 and 1984 for the original CWA Section 316(b) study, in 2008 and 2009 and again in 2016. Threadfin shad, gizzard shad, and white perch are the most susceptible species and planktonic fish larvae is the most susceptible life stage to entrainment. These species are in abundance in the Monticello Reservoir and are very fertile. There are no threatened or endangered aquatic species or designated critical habitat present.

<u>Entrainment Studies</u>

Entrainment Study, 1983–1984

SCE&G conducted an ichthyoplankton study in the Monticello Reservoir from October 1983 to September 1984, as part of the original CWA Section 316(b) determination for V.C. Summer (Dominion 2024-TN10391: Enclosure 3). Ichthyoplankton were collected monthly at three stations in the Monticello Reservoir at the surface and middle of the water column, no samples were taken inside the V.C. Summer intake screens. Only the samples at the station closest to the V.C. Summer intake are discussed in this summary as they are the most relevant.

Researchers found a total larval density of 54 larvae per 100 m^3 (per 3531.5 cubic feet [ft^3]) at the surface and 11.8 larvae per 100 m^3 (larvae per 3531.5 [ft^3]) in the middle of the water column near the CWIS. Gizzard shad (Clupeidae) dominated, representing 94 percent of the sample, while white bass was a distant second in abundance at 5 percent. Other fish collected include minnows, suckers, sunfish, and perch. Larval fish were found in samples from February to August, and density was greatest in May. The species most susceptible to entrainment were the gizzard and threadfin shad in May and June.

Entrainment Study, 2008–2009

Normandeau Associates, Inc. conducted an ichthyoplankton study from September 2008 to August 2009 in the Monticello Reservoir (Dominion 2024-TN10391: Enclosure 4). The purpose of this study was to provide estimates of entrainment of ichthyoplankton at the proposed V.C. Summer raw water intake structure. Samples were collected using 1.6 ft (0.5 m) diameter, 0.012 in. (0.300 mm) mesh bongo nets in parallel transects near the proposed intake. Each tow was about 820 ft (250 m) long, with each side of the bongo net filtering at least 1,765 ft^3 (50 m^3). Field composited samples ranged from 3,708 to 6,745 ft^3 (105 to 191 m^3) in volume and were preserved in formalin. Samples were collected monthly from September to February, twice monthly from March through July, and once in August for a total of 17 sampling events. Ichythyoplankton were identified by species and life stage.

Researchers found fish larvae present only from March to August and no fish eggs, likely because the resident species lay adhesive eggs on the lake bottom (Dominion 2024-TN10391: Enclosure 4). Fish larvae density peaked in May with 125 organisms per 100 m^3 (per 3531.5 ft^3) and rapidly decreased to less than 1 per 100 m^3 (per 3531.5 ft^3) by August. Threadfin shad dominated in March, April, and May with some white perch, yellow perch, darters, and black crappie also present. In June, clupeids were the dominant species, but the total density of fish larvae was only 25 percent of what it was the previous month. In July and August, the few remaining larvae were clupeids and sunfish. Based on the densities of larvae found in this study, researchers estimated 15.3 million larvae would be entrained annually under the typical water withdrawal rate, and 24.9 million under the maximum water withdrawal rate.

Entrainment Study, 2016

In the spring and summer of 2016, Normandeau Associates, Inc. conducted another ichthyoplankton study (Dominion 2024-TN10391: Enclosure 5). The purpose of the study was to collect ichthyoplankton density data from the Monticello Reservoir in the area of hydraulic influence of the V.C. Summer CWIS and then to estimate the number of ichthyoplankton potentially entrained by actual CWIS withdrawals during the fish spawning season. The CWIS area of hydraulic influence extends approximately 550 ft (168 m) out into the reservoir with a width of 250 ft (76 m) and includes any areas with a measurable flow toward the intake. Sampling was conducted using the same methods as the 2009 study with the addition of night sampling. Day sampling occurred at least 2 hours after sunrise and 2 hours before sunset, and night sampling occurred at least 2 hours after sunset and 2 hours before sunrise.

Researchers collected larval fish from May through August, with over half of all the fish collected in June. Clupeids comprised 86 percent of the fish collected, followed by Centrarchidae (9.6 percent), Cyprinidae (1.6 percent), and less than 1 percent each of Catostomidae, Ictaluridae, Moronidae, and Percidae. They found that mean ichthyoplankton density was typically higher at night than during the day. Researchers estimated that V.C. Summer entrained 78.1 million ichthyoplankton during the night and 27.3 million ichthyoplankton during the day. The researchers estimated the yearly larval fish entrainment during this study at 105.4 million, with the highest entrainment abundance in June attributed to shad larvae.

<u>Entrainment Conclusion</u>

Because water withdrawals, and the associated risk of entrainment, would remain the same under the proposed action as under the current license, the NRC staff anticipates similar (i.e., nondetectable) effects during the proposed SLR period. Further, the SDHEC determined that V.C. Summer meets BTA for entrainment as part of issuing the 2022 NPDES permit.

For the reasons described above, the NRC staff finds that the impacts of entrainment of aquatic organisms resulting from the proposed SLR of V.C. Summer would be SMALL.

<u>Impingement and Entrainment Conclusion</u>

Based on the discussion summarized under “Impingement Conclusion” and “Entrainment Conclusion,” the NRC staff concludes that the impacts of impingement and entrainment on aquatic organisms resulting from the proposed V.C. Summer SLR term would be SMALL.

3.7.3.2 Effects of Thermal Effluents on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

For plants with once-through cooling systems or cooling ponds such as V.C. Summer, the NRC staff determined in the LR GEIS that thermal impacts on aquatic organisms is a Category 2 issue that requires plant-specific evaluation (NRC 2024-TN10161).

The primary form of thermal impact of concern at V.C. Summer is heat shock. Heat shock occurs when water temperature meets or exceeds the thermal tolerance of an aquatic species for some duration of the exposure (NRC 2024-TN10161). In most situations, fish can avoid areas that exceed their thermal tolerance limits, although some aquatic species or life stages lack such mobility. Heat shock is typically observable only for fish because fish tend to float when dead. In addition to heat shock, thermal plumes resulting from thermal effluent can create barriers to fish passage, which is of particular concern for migratory species. Thermal plumes can also reduce the available aquatic habitat or alter habitat characteristics in a manner that results in cascading effects on the local aquatic community.

<u>V.C. Summer Effluent Discharge</u>

As described in Section 3.5.1.3 of this SEIS, V.C. Summer's NPDES permit establishes thermal limits for heated effluent discharges into Monticello Reservoir (Dominion 2023-TN10387: Appendix A). V.C. Summer discharges heated effluent through a 120 ft (3.7 m) diameter pipe from the nuclear power plant to a semi-enclosed discharge bay. From the bay, the heated effluent moves through a 1,000 ft (305 m) long discharge canal to Monticello Reservoir. The discharge canal directs the discharge flow (heated effluent) to the northeast and a 2,600 ft (793 m) long jetty to the west prevents the recirculation of the heated water (Dominion 2023-TN10387). The sections below summarize thermal plume studies.

<u>Clean Water Act Section 316(a) Requirements for Point Source Discharges</u>

The CWA Section 316(a) addresses the adverse environmental impacts associated with thermal discharges into waters of the United States. This section of the CWA grants the EPA the authority to impose alternative, less-stringent, facility-specific effluent limits (called "variances") on the thermal component of point source discharges. To be eligible, facilities must demonstrate, to the satisfaction of the NPDES permitting authority, that facility-specific effluent limitations will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water. CWA Section 316(a) variances are valid for the term of the NPDES permit (i.e., 5 years). Facilities must reapply for variances with each NPDES permit renewal application. The EPA issued regulations under CWA Section 316(a) at 40 CFR 125, Subpart H (TN254).

<u>Analysis Approach</u>

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to thermal impacts on aquatic organisms. Therefore, if the NPDES permitting authority has made a determination under CWA Section 316(a) that thermal effluent limits are sufficiently stringent to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water, and that facility has implemented any associated requirements; then, the NRC staff assumes that adverse impacts on the aquatic environment will be minimized. In such cases, the NRC staff concludes that thermal impacts on aquatic organisms would be SMALL for the proposed SLR term.

In cases in which the NPDES permitting authority has not granted a CWA Section 316(a) variance, the NRC staff analyzes the potential impacts of thermal discharges on aquatic organisms using a weight-of-evidence approach. In this approach, the NRC staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the NRC staff might consider characteristics of the cooling water discharge system design, the results of thermal studies performed at the facility, and trends in fish and shellfish population abundance indices. The NRC staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience over the course of the proposed SLR term.

Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the Monticello Reservoir aquatic community as it occurs today, which is described in Section 3.7.1 of this SEIS. While species richness, evenness, and diversity within the community may change or shift between now and when the proposed SLR period would begin, the NRC staff finds the aquatic community as it occurs today to be a reasonable surrogate in the absence of fishery and species-specific projections.

Clean Water Act Section 316(a) Thermal Variance

The SCDHEC regulates thermal discharge temperatures at V.C. Summer through the NPDES permit (Dominion 2023-TN10387: Appendix A). In accordance with South Carolina Regulation 61-68, Section E.12.c, the weekly average water temperature of all freshwater lakes shall not be increased by more than 5°F (2.8°C) above natural conditions and shall not exceed 90°F (32.2°C) from thermal discharges unless a different site-specific temperature standard has been established, a mixing zone has been established, or a Section 316(a) determination has been made under the CWA. Additionally, the 2022 NPDES permit limits the daily maximum discharge temperature to 113°F (45°C) with continuous monitoring required.

In 2012, Dominion conducted a thermal mixing zone evaluation as part of the NPDES wastewater permit renewal application with additional modeling completed in 2014 after SCDHEC requested additional information. This study is detailed in Section E3.6.1.2.6 of the V.C. Summer SLR ER (Dominion 2023-TN10387). In all modeled scenarios the thermal plumes due to the cooling water discharge remained entirely or predominantly to the east of the jetty that seperates the V.C. Summer cooling water intake structure from the discharge and the largest thermal plume was less than 6 percent of the reservoir’s surface area (Dominion 2023-TN10387). The thermal plumes also did not approach the Fairfield Pumped Storage Facility intake, the V.C. Summer cooling water intake structure, or the northern reach of the Monticello Reservoir (Dominion 2023-TN10387).

From the information gathered during the environmental site audit, the NRC staff understands that there have been no fish kills observed in the V.C. Summer discharge bay or adjacent areas in the last 10 years and that no further dredging of the discharge bay is anticipated during the SLR term (Dominion 2024-TN10391: Enclosure 1).

Thermal Impacts Conclusion

Because SCDHEC has granted Dominion multiple, sequential NPDES permits with temperature limits that are designed to be protective of aquatic life under CWA Section 316(a) and South Carolina regulations, the NRC staff finds that the adverse impacts on the aquatic environment associated with thermal effluents are minimized. Because characteristics of the thermal effluent would remain the same under the proposed action, the NRC staff anticipates similar effects during the proposed SLR period. Further, SCDHEC will continue to review the CWA Section 316(a) variance with each successive NPDES permit renewal and may require additional mitigation or monitoring in a future renewed NPDES permit if it deems such actions to be appropriate to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the Monticello Reservoir. The NRC staff assumes that any additional requirements that SCDHEC imposes would further reduce the impacts of the V.C. Summer thermal effluent over the course of the proposed SLR term. For these reasons, the NRC staff finds that thermal impacts during the proposed SLR period would neither destabilize nor noticeably alter any important attribute of the aquatic environment and would, therefore, result in SMALL impacts on aquatic organisms.

3.7.3.3 Water Use Conflicts with Aquatic Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

Water use conflicts occur when the amount of water needed to support aquatic resources is diminished as a result of demand for agricultural, municipal, or industrial use or decreased water availability due to droughts, or a combination of these factors.

In the 2004 V.C. Summer LR SEIS (NRC 2004-TN7262), the NRC staff evaluated “water use conflicts (plants with cooling towers and cooling ponds using make-up water from a small river with low flow)” as a surface water quantity issue and included impacts on ecological resources, including aquatic communities. The NRC staff determined that impacts of water use conflicts would be SMALL during the initial license renewal term (i.e., 2022–2042). In 2013, the NRC issued Revision 1 of the LR GEIS (NRC 2013-TN2654) and separated out ecological impacts from surface water, expanded the issue to include cooling towers, and titled the issue “water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river).” The separation of these issues was continued in the 2024 Revision 2 of the LR GEIS (NRC 2024-TN10161). This section of the SEIS evaluates water use conflicts as they apply to continued operation of V.C. Summer during the proposed SLR term (i.e., 2042–2062).

Section 3.5.3.1 of this SEIS describes surface water use conflicts that also apply to aquatic resources. In summary, surface water flow in the Broad River as a result of the Parr Hydroelectric Project is mandated by the FERC. It mandated minimum instream flows of 150 cfs (4.2 m^3/s) during most of the year and 1,000 cfs (28.3 m^3/s) during the March, April, and May striped bass spawning period (Dominion 2023-TN10387; NRC 2004-TN7262). FERC did not express any concerns with the operations of V.C. Summer and its impacts on minimum flow in the Broad River (FERC 2020-TN10457). The NRC staff also analyzed surface water conflicts in Section 3.5.3.1 of this SEIS. The NRC staff did this by evaluating streamflow measurements from 1938 to 2023 and estimated that the total evaporation from the Monticello Reservoir was between 1.2 and 2 percent of mean monthly flow in the Broad River. The NRC staff concluded that the impacts of continued operation of V.C. Summer during the SLR term on regional surface water use conflicts would be SMALL because V.C. Summer operations only permanently remove a small portion of Broad River flows during an average year (2 percent or less). Thus, a high percentage (over 98 percent) of Broad River flows would remain in the river which would preserve aquatic habitats and aquatic resources.

The proposed SLR would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR on this resource category would be similar. For the reasons explained in this section, water use conflicts with aquatic resources would either not occur from SLR, or would be so minor that the effects on aquatic resources would be undetectable. The NRC staff concludes that water use conflicts with aquatic resources during the V.C. Summer SLR term would be SMALL.

3.7.4 No-Action Alternative

If V.C. Summer were to cease operating, impacts on the aquatic environment would decrease or stop following reactor shutdown. Some withdrawal of water from the Monticello Reservoir would continue during the shutdown period to provide cooling to spent fuel in the spent fuel pool until that fuel could be transferred to dry storage. The amount of water withdrawn for these purposes would be a small fraction of water withdrawals during operations, would decrease over time, and would likely end within the first several years following shutdown. The reduced demand for cooling water would substantially decrease the effects of impingement, entrainment, and thermal effluent on aquatic organisms, and these effects would wholly cease following the transfer of spent fuel to dry storage. Effects from cold shock would be unlikely, given the small area of reservoir affected by thermal effluent under normal operating conditions, combined with the phased reductions in withdrawal and discharge of reservoir water that would occur following shutdown.

The NRC staff concludes that the impacts of the no-action alternative on aquatic resources would be SMALL.

3.7.5 Replacement Power Alternatives: Common Impacts

Construction impacts for many components of either replacement power alternative would be qualitatively and quantitatively similar. Construction could result in aquatic habitat loss, alteration, or fragmentation; disturbance and displacement of aquatic organisms; mortality of aquatic organisms; and increase in human access. For instance, construction-related chemical spills, runoff, and soil erosion could degrade water quality in Monticello and Parr Reservoirs and downsteam by introducing pollutants and increasing sedimentation and turbidity. Dredging and other in-water work could directly remove or alter the aquatic environment and disturb or kill aquatic organisms. Because construction effects would be short term, associated habitat degradation would be relatively localized and temporary. Effects could be minimized by the use of existing infrastructure that are onsite at V.C. Summer, and the utilization of existing transmission lines, roads, parking areas, and certain buildings. Aquatic habitat alteration and loss could be minimized by siting components of the alternatives farther from water bodies and away from drainages and other aquatic features.

Water quality permits required through Federal and State regulations would control, reduce, or mitigate potential effects on the aquatic environment. Through such permits, the permitting agencies could include conditions requiring Dominion to follow BMPs or to take certain mitigation measures if adverse impacts are anticipated. For instance, the USACE oversees Section 404 permitting for dredge and fill activities, and SCDHEC oversees NPDES permitting and general stormwater permitting. Dominion would likely be required to obtain each of these permits to construct a new replacement power alternative on the V.C. Summer site. Notably, the EPA final rule under Phase I of the CWA Section 316(b) regulations applies to new facilities and sets standards to limit intake capacity and velocity to minimize impacts on fish and other aquatic organisms in the source water (40 CFR 125.84-TN254). Any new replacement power alternative subject to this rule would be required to comply with the associated technology standards.

With respect to operation of a new replacement power alternative, operational impacts for any of the alternatives would be qualitatively similar but would vary in intensity, based on each alternative’s water use and consumption. Non-nuclear facilities, including natural gas-fired power plants, generally consume less water during operations.

3.7.6 Natural Gas Alternative

The types of impacts that the aquatic environment would experience from this alternative involving the construction and installation of a new natural gas-fired, two-unit combustion turbine power plant are characterized in the previous section that discusses impacts common to all replacement power alternatives (see Section 3.7.5 of this SEIS).

This alternative would involve construction of a natural gas plant within the existing footprint of the V.C. Summer Units 2 and 3 site, which would require no additional land for construction. It would also require construction of some short onsite natural gas pipelines to connect to the existing natural gas pipeline at the V.C. Summer site. Although some infrastructure upgrades like new MDCTs may be required, it is assumed that the existing transportation and transmission line infrastructure at V.C. Summer would be adequate to support the alternative (Dominion 2023-TN10387).

The NRC staff finds that the impacts of construction on aquatic resources would be SMALL. During the construction phase, the construction effects would be of limited duration, the new plant would use some of the existing site infrastructure and buildings. Required Federal and State water quality permits would likely include conditions requiring BMPs and mitigation strategies to minimize environmental effects.

With respect to operations, Federal and State water quality permits would control and mitigate many of the potential effects on the aquatic environment. This includes operation-related water withdrawal and discharge in a manner in which the associated effects would be unlikely to destabilize or noticeably alter any important attribute of the aquatic environment. Therefore, the NRC staff finds that the impacts of operation on aquatic resources would be SMALL.

Based on the above, the NRC staff concludes that the impacts on aquatic resources from construction and operation of a natural gas alternative would be SMALL.

3.7.7 New Nuclear (Small Modular Reactor) Alternative

This alternative would involve the installation and operation of two, 12-unit SMRs. A closed-cycle cooling system using mechanical draft cooling towers would withdraw makeup water from the existing Monticello Reservoir (Dominion 2023-TN10387).

The types of impacts that the aquatic environment would experience from this alternative would likely be similar to those described in the previous section discussing impacts common to all replacement power alternatives (see Section 3.7.5 of this SEIS). The SMR power plant would be built at the abandoned V.C. Summer Units 2 and 3 project site so they could use existing V.C. Summer infrastructure. The NRC staff concludes that these effects would be SMALL to MODERATE, depending on the extent to which construction would degrade, modify, or permanently alter nearby aquatic habitats. Required Federal and State water quality permits would likely include conditions requiring BMPs and mitigation strategies to minimize environmental effects.

With respect to operation, Federal and State water quality permits would control and mitigate many of the potential effects on the aquatic environment, including water withdrawals and discharges, such that the associated effects would be unlikely to noticeably alter or destabilize any important attribute of the aquatic environment. The NRC staff finds that the impacts of operation of a new nuclear alternative would be SMALL.

Based on the above, the NRC staff concludes that the impacts on aquatic resources from construction and operation of a new nuclear alternative would be SMALL to MODERATE.

3.7.8 Natural Gas and Solar Combination Alternative

This alternative would involve the construction and operation of a new natural gas-fired, two-unit combustion turbine power plant built at the abandoned V.C. Summer Unit 2 and Unit 3 project site, solar installation with battery storage located both on and offsite (Dominion 2023-TN10387).

The impacts of construction of new solar and natural gas of this alternative are discussed in the section that describes common impacts on all alternatives and impacts of the natural gas alternative (Sections 3.7.5 and 3.7.6). These effects would be SMALL to MODERATE, depending on the site(s) selected, the aquatic habitats present, and the extent to which construction would degrade, modify, or permanently alter those habitats.

The operation of the solar photovoltaic component would have no discernable effects on the aquatic environment. Impacts of operating a new natural gas power plant would be SMALL because the water withdrawals and discharges would be regulated under the CWA and applicable State regulations to ensure that impacts to the aquatic environmental are minimal. Impacts of the small amount of additional power generation from existing natural gas plants would be SMALL since the water withdrawals and discharges would be managed by the SCDHEC.

Based on the above, the NRC staff concludes that the impacts on aquatic resources for the natural gas and renewables alternative would be SMALL to MODERATE during construction and SMALL during operation. Impacts from the alternative would be managed and regulated by Federal and State water quality permits.

3.7.9 New Nuclear and Solar Combination Alternative

The types of impacts that the aquatic environment would experience from the SMR portion of the combination alternative are characterized in the previous sections discussing impacts common to all alternatives and impacts of the new nuclear alternative (see Section 3.7.5 and 3.7.7 of this SEIS). Construction and operation impacts of this portion of the combination alternative would be qualitatively similar. Because the nuclear portion of the combination alternative would involve construction and operation of one SMR facility instead of two, less cooling water would be required, which would result in fewer impacts on the aquatic environment. Therefore, the NRC staff finds that the impacts of construction and operation of the SMR portion of the combination alternative on aquatic resources would be SMALL.

Impacts of constructing the solar installation with battery storage portion of the combination alternative are also addressed in the previous section discussing impacts common to all alternatives. These impacts would be SMALL to MODERATE, depending on the site(s) selected, the aquatic habitats present, and the extent to which construction would degrade, modify, or permanently alter those habitats. Operation of the solar PV portion would have no discernable effects on the aquatic environment.

The NRC staff concludes that the impacts on aquatic resources from construction and operation of a combination alternative would be SMALL to MODERATE during construction and SMALL during operation.

3.8 Federally Protected Ecological Resources

The NRC must consider the effects of its actions on the ecological resources protected under several Federal statutes and must consult with the FWS or the National Oceanic and Atmospheric Administration (NOAA) prior to acting in cases where an agency action may affect those resources. These statutes include the following:

- ESA (16 U.S.C. § 1531 et seq.) (TN1010)
- Magnuson–Stevens Fishery Conservation and Management Act (MSA), as amended (16 U.S.C. § 1801 et seq.) (TN9966)
- National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 et seq.) (TN4482)

This section describes the species and habitats that are federally protected under these statutes and analyzes how the proposed SLR and alternatives may affect these resources.

3.8.1 Endangered Species Act

Congress enacted the ESA in 1973 to protect and recover imperiled species and the ecosystems upon which they depend. The ESA provides a program for the conservation of endangered and threatened plants and animals (collectively, "listed species") and the habitats in which they are found. The FWS and National Marine Fisheries Service (NMFS) are the lead Federal agencies for implementing the ESA, and these agencies determine the species that warrant listing. The following sections describe the V.C. Summer action area and the species and habitats that may occur in the action area under each of the Services' jurisdictions.

3.8.1.1 Endangered Species Act: Action Area

The implementing regulations for Section 7(a)(2) of the ESA define "action area" as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Part 402-TN4312). The action area effectively bounds the analysis of federally listed species and critical habitats because only species and habitats that occur within the action area may be affected by the Federal action.

For the purposes of assessing the potential impacts of the proposed V.C. Summer SLR, the NRC staff considers the action area to consist of the following:

V.C. Summer Site

The terrestrial region of the action area consists of approximately 2,200 ac (890 ha) within the V.C. Summer site in Fairfield County, South Carolina. The site is situated on the southern shore of the Monticello Reservoir. It includes developed land supporting nuclear power plant operations (1,156 ac [468 ha]), deciduous forest (58 ac [24 ha]), evergreen forest (421 ac [170 ha]), mixed forest (54 ac [22 ha]), shrub/scrub (153 ac [62 ha]), grassland/herbaceous (74 ac [30 ha]), woody wetlands (2 ac [1 ha]), emergent herbaceous wetlands (2 ac [1 ha]), and cultivated lands (55 ac [22 ha]) (Dominion 2023-TN10387). Sections 3.2 and 3.6 of this SEIS describe the developed and natural features of the site and the characteristic vegetation and habitats.

Monticello Reservoir

The aquatic region of the action area encompasses the regions of the Monticello Reservoir affected by cooling water withdrawals and discharges. This includes the area of hydraulic influence for the intake which could lead to impingement or entrainment (described in Section 3.7.3.1.2 of this SEIS). The area of the Monticello Reservoir that experiences increased temperatures from the discharge of heated effluent (Section 3.7.3.2 of this SEIS) includes the discharge bay, the discharge canal, and areas to the east of the discharge jetty.

The NRC staff recognizes that, although the described action area is stationary, federally listed species can move in and out of the action area. For instance, a migratory bird could occur in the action area seasonally as it forages or breeds within the action area. Thus, in its analysis, the NRC staff considers not only those species known to occur directly within the action area but those species that may passively or actively move into the action area. The NRC staff then considers whether the life history and habitat requirements of each species make it likely to occur in the action area where it could be affected by the proposed SLR. The following sections first discuss the listed species and critical habitats under FWS jurisdiction, followed by those under NMFS jurisdiction.

3.8.1.2 Endangered Species Act: Federally Listed Species and Critical Habitats under U.S. Fish and Wildlife Service Jurisdiction

This section evaluates two species; one species is proposed for listing under the ESA, and one species is a candidate for listing. No federally listed species or designated or proposed critical habitat occurs in the action area. Table 3-13 below identifies each of these species and its Federal status. The NRC staff determined these species to be relevant to this review based on desktop analysis of the V.C. Summer action area, available scientific literature and studies, the results of past ESA Section 7 consultations in connection with the V.C. Summer site, and an official species list generated from the FWS's Information for Planning and Conservation (IPaC) (FWS 2024-TN10473).

Table 3-13 Federally Listed Species Under U.S. Fish and Wildlife Jurisdiction, Evaluated for Virgil C. Summer Nuclear Station Subsequent License Renewal

Common Name	Species	Federal Status[(a)]
tricolored bat	*Perimyotis subflavus*	FPE
monarch butterfly	*Danaus plexippus*	FC

(a) Indicates protection status under the Endangered Species Act. FC = candidate for Federal listing and FPE = proposed for Federal listing as endangered.

During the NRC staff's environmental review for the initial V.C. Summer license renewal, the staff evaluated the effects of V.C. Summer operations on 10 species that were federally listed at that time and under FWS jurisdiction. These species were the Carolina heelsplitter (*Lasmigona decorata*), bald eagle, wood stork (*Myceteria americana*), red-cockaded woodpecker (*Picoides borealis*), pool sprite (*Amphianthus pusillus*), smooth coneflower (*Echinacea laevigata*), rough-leaved loosestrife (*Lysimachia asperulifolia*), Canby's dropwort (*Oxypolis canbyi*), harperella (*Ptilimnium nodosum*), and relict trillium (*Trillium reliquum*). In addition, the NRC staff evaluated the effects of LR on the candidate species Georgia aster (*Aster georgianus*). In 2003, the NRC (2003-TN10474) prepared a biological assessment for these species and requested the FWS's concurrence with its determination that V.C. Summer operations "may affect, but is not likely to adversely affect" the bald eagle. The FWS concurred with the NRC's finding for the bald eagle (2003-TN10475). While the bald eagle continues to occur in the area, the FWS has delisted this species from Federal protection under the ESA. The bald eagle remains federally protected under the Bald and Golden Eagle Protection Act, which is discussed in Section 3.6.3.3 of this SEIS. For the remaining 11 species, the NRC staff concluded that license renewal would have *no effect*.

The NRC staff reviewed FWS species profiles for each of the above federally listed species (2024-TN10476, 2024-TN10477, 2024-TN10478, 2024-TN10479, 2024-TN10480, 2024-TN10481, 2024-TN10482, 2024-TN10483, 2024-TN10484, and 2024-TN10485), the FWS Information for Planning and Consultation report (FWS 2024-TN10473, other publicly available information, and the ER (Dominion 2023-TN10387). The NRC staff found no information indicating that any of the previously evaluated federally listed species are present within the action area, and the FWS included none of these species in the IPaC report for the proposed SLR. Therefore, the NRC staff does not evaluate these species any further in this SEIS.

After the initial LR, the FWS proposed to list tricolored bat (*Perimyotis subflavus*) as endangered and added monarch butterfly (*Danaus plexippus*) to its candidate list. Based on the above information, the NRC staff finds that these are the only species that warrant further consideration to determine if they may occur in the action area. These species are discussed in detail below.

3.8.1.2.1 Tricolored Bat

The FWS issued a proposed rule to list the tricolored bat as endangered in 2022 (87 FR 56381-TN8546-TN8546). The FWS proposed no critical habitat with the rule because it found that such a designation could increase the degree of threat to the species. The information in this section is drawn from the FWS's species status assessment (2021-TN8589) unless otherwise cited.

The tricolored bat is a small insectivorous bat that can be distinguished by its unique tricolored fur, which often appears yellowish to orange. The species occurs across 39 States in the eastern and central United States, and in portions of southern Canada, Mexico, and Central America. During the winter, tricolored bats often inhabit caves and abandoned mines. In the southern United States, where caves are sparse, tricolored bats also roost in road culverts where they exhibit shorter hibernation bouts and may leave hibernacula to forage during warm nights. Tricolored bats hibernate singly, but sometimes in pairs or in small clusters of both sexes away from other bats. Between mid-August and mid-October, males and females converge at cave and mine entrances to swarm and mate, and females typically give birth to two young between May and July.

Tricolored bats disperse from winter hibernacula to a summer roosting habitat in the spring. Tracking studies have recorded migration paths that span from 27 mi (44 km) to 151 mi (243 km). During the spring, summer, and fall, tricolored bats occupy forested habitats. Individuals roost among leaves of live or recently dead deciduous hardwood trees, but individuals may also roost in pines (*Pinus* spp.), eastern red cedar (*Juniperus virginiana*), Spanish moss (*Tillandsia usneoides*), *Usnea trichodea* lichen, and occasionally human structures. Tricolored bats are opportunistic feeders and consume small insects including caddisflies (Trichoptera), flying moths (Lepidoptera), small beetles (Coleoptera), small wasps and flying ants (Hymenoptera), true bugs (Homoptera), and flies (Diptera).

Factors Affecting the Species

Tricolored bats face extinction primarily due to the range-wide impacts of white-nose syndrome, a deadly disease affecting cave-dwelling bats. The FWS estimates that white-nose syndrome has caused population declines of 90 percent or more in affected tricolored bat colonies across most of the species' range. Other drivers of its decline are wind-turbine mortality, habitat loss, and changing climate.

Occurrence within the Action Area

The FWS (2024-TN10473) identified the tricolored bat as potentially occurring in the action area in the IPaC report for the proposed action. Within South Carolina, the species is found throughout the State in the summer months. Dominion reports no occurrences of tricolored bats on the V.C. Summer site (2024-TN10391). However, Dominion has conducted no ecological surveys to specifically assess the species' presence or the suitability of onsite habitats.

Based on the above information, the NRC staff conservatively assumes that the deciduous forest habitat within the action area could support foraging, mating, and sheltering in the spring, summer, and fall. Accordingly, the staff assesses the potential impacts of the proposed action on this species in Section 3.8.5.1.1 of this SEIS.

3.8.1.2.2 Monarch Butterfly

The monarch butterfly is a candidate for Federal listing. In 2020, the FWS issued a 12-month finding announcing its intent to prepare a proposed rule to list the monarch butterfly as threatened (85 FR 81813-TN8590). In 2022, the FWS identified the monarch butterfly listing action as a priority because the magnitude of threats is moderate to low; however, these threats are imminent for the eastern and western North American populations. Although the ESA does not require consultation for candidates, the NRC staff considers this species here at the recommendation of the FWS (2024-TN10473) IPaC report for the proposed project. The information in this section is drawn from the FWS's candidate review unless otherwise cited (87 FR 26152-TN8591).

The monarch is a large butterfly with bright orange wings and black veining and borders. During the breeding season, females lay eggs on milkweed (primarily *Asclepias* spp.). Developing larvae feed on milkweed, which allows them to sequester toxic chemicals as a defense against predators, before pupating into a chrysalis to transform into the adult butterfly form. Monarchs produce multiple generations each breeding season, and most adult butterflies live 2–5 weeks. Overwintering adults, however, enter reproductive diapause and live 6–9 months.

Monarch butterflies occur in 90 countries, islands, or island groups. Monarch butterflies have become naturalized at most of these locations outside North America since 1840. The populations outside eastern and western North America (including southern Florida) do not exhibit long-distance migratory behavior. In many regions, monarchs breed year-round. In temperate climates such as eastern and western North America, monarchs migrate long distances and live for an extended period. In both eastern and western North America, monarchs begin migrating in the fall to their respective overwintering sites in the forests of California and Mexico. These overwintering sites provide protection from the elements and moderate temperatures as well as nectar and clean water sources located nearby. Migration distances can be greater than 1,900 mi (3,000 km) and span a 2-month period. In early spring (i.e., February–March), surviving monarchs break diapause and mate at overwintering sites before dispersing.

The same individuals that undertook the initial southward migration begin flying back through the breeding grounds, and their offspring restart the cycle of generational migration.

Factors Affecting the Species

The primary threats to the monarch's biological status include loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, logging or thinning at overwintering sites in Mexico, senescence and incompatible management of overwintering sites in California, urban development, drought, exposure to insecticides, and effects of climate change.

Occurrence within the Action Area

Monarchs are associated with prairie, meadow, and grassland habitats. Within South Carolina, 21 native species of milkweed provide a habitat for the development of monarch eggs and larvae (iNaturalist 2024-TN10555). Along publicly accessible roads directly adjacent to the site, five milkweed species are known to occur: clasping milkweed (*Asclepias amplexicaulis*), butterfly milkweed (*A. tuberosa*), whorled milkweed (*A. verticellata*), redwing milkweed (*A. variegata*), and swamp milkweed (*A. viridiflora)*.

Dominion reports no known occurrences of monarch butterfly on the V.C. Summer site (2024-TN10391). However, Dominion has conducted no ecological surveys to specifically assess the species' presence or the suitability of onsite habitat. Given the proximity of known milkweed occurrences adjacent to the site, the NRC staff conservatively assumes that milkweeds could occur onsite and that the site may provide a larval habitat. If milkweeds are not present, monarchs could occur in the action area during spring and fall migration when individuals are moving between areas of more suitable habitat. Accordingly, the NRC staff assesses the potential impacts of the proposed action on this species in Section 3.8.5.1.2 of this SEIS.

3.8.1.2.3 Summary of Potential Species Occurrences in the Action Area

Table 3-14 below summarizes the potential for each species discussed in this section to occur in the action area. No federally listed species or proposed or designated critical habitat occur within the action area.

Table 3-14 Summary of the Potential for Federally Listed Species Under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area at Virgil C. Summer Nuclear Station

Common Name	Type and Likelihood of Occurrence in the Action Area
tricolored bat	Presence possible in spring, summer, and fall in the deciduous forest habitat within the action area.
monarch butterfly	Larval habitat may be present if milkweeds are present. Otherwise, occasional transitory presence when moving between areas of more suitable habitat.

3.8.2 Endangered Species Act: Federally Listed Species and Critical Habitats Under NMFS Jurisdiction

During the NRC staff's environmental review for the initial V.C. Summer license renewal, the staff evaluated the effects of V.C. Summer operations on one species that was federally listed and under NMFS jurisdiction: the shortnose sturgeon (*Acipenser brevirostrum*). The NRC staff concluded that shortnose sturgeon were not present within the action area and so the SLR would have no effect on this species (2004-TN7262).

For the proposed action, the NRC staff reviewed its previous analysis and the NOAA Fisheries Southeast Region ESA Section 7 Mapper (2024-TN10486) and concluded that no federally listed species or designated critical habitats under NMFS jurisdiction occur in the action area. Therefore, this SEIS does not discuss any such species or habitats.

3.8.3 Magnuson–Stevens Act: Essential Fish Habitat

Congress enacted the MSA in 1976 to foster the long-term biological and economic sustainability of the Nation's marine fisheries (TN9966). The MSA directs the Fishery Management Councils, in conjunction with NMFS, to designate areas of essential fish habitat (EFH) and to manage marine resources within those areas. EFH includes the coastal and marine waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity (50 CFR Part 600-TN1342). For each federally managed species, the Fishery Management Councils and NMFS designate and describe the EFH by life stage (i.e., egg, larva, juvenile, and adult).

No coastal or marine waters occur near V.C. Summer. Therefore, this SEIS does not discuss EFH.

3.8.4 National Marine Sanctuaries Act: Sanctuary Resources

Congress enacted the NMSA in 1972 to protect areas of the marine environment that have special national significance. The NMSA authorizes the Secretary of Commerce to establish the National Marine Sanctuary System and designate sanctuaries within that system, which includes 15 sanctuaries and 2 marine national monuments, encompassing more than 600,000 mi^2 (1,553,993 km^2) of marine and Great Lakes waters from Washington State to the Florida Keys and from Lake Huron to American Samoa. Within these areas, sanctuary resources include any living or nonliving resource of a national marine sanctuary that contributes to the conservation, recreational, ecological, historical, educational, cultural, archaeological, scientific, or aesthetic value of the sanctuary.

No coastal or marine waters or Great Lakes occur near V.C. Summer. Therefore, this SEIS does not discuss national marine sanctuaries or their resources.

3.8.5 Proposed Action

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and shown in Table 3-2, the NRC staff identified four plant-specific Category 2 issues related to federally protected ecological resources applicable to V.C. Summer during the SLR term. These Category 2 issues are analyzed below.

3.8.5.1 Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Service Jurisdiction

In Section 3.8.1.2 of this SEIS, the NRC staff determined that no federally listed species occur in the action area. The tricolored bat, which the FWS has proposed for Federal listing as endangered, and the monarch butterfly, which is a candidate for Federal listing, may occur in the action area. Section 3.8.2 of this SEIS includes relevant information about the habitat requirements, life history, and regional occurrence of these species. In the sections below, the NRC staff analyzes the potential impacts of the proposed V.C. Summer SLR on these species. Table 3-15 summarizes the NRC staff's ESA effect determinations that resulted from the staff's analysis.

Table 3-15 Effect Determinations for Federally Listed Species under U.S. Fish and Wildlife Service Jurisdiction at the Virgil C. Summer Nuclear Station Site

Species	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]
tricolored bat	FPE	Yes	NLAA
monarch butterfly	FC	Yes	NLAA

(a) Indicates protection status under the Endangered Species Act. FC = candidate for Federal listing and FPE = proposed for Federal listing as endangered.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NLAA = not likely to adversely affect.

3.8.5.1.1 Tricolored Bat

In Section 3.8.2 of this SEIS, the NRC staff concludes that the tricolored bat may occur in the action area's forests in spring, summer, and fall. If present, these bats would occur rarely and in low numbers.

The potential stressors that tricolored bats could experience from the operation of a nuclear power plant (generically) are as follows:

- mortality or injury from collisions with nuclear power plant structures and vehicles
- habitat loss, degradation, disturbance, or fragmentation, and associated effects
- behavioral changes resulting from refurbishment or other site activities

This section addresses each of these stressors below.

<u>Mortality or Injury from Collisions with Nuclear Power Plant Structures and Vehicles</u>

Several studies have documented bat mortality or injury resulting from collisions with human-made structures. Saunders (1930-TN8504) reported that five bats of three species—eastern red bat, hoary bat (*L. cinereus*), and silver-haired bat—were killed when they collided with a lighthouse in Ontario, Canada. In Kansas, Van Gelder (1956-TN8505) documented five eastern red bats that collided with a television tower. In Florida, Crawford and Baker (1981-TN8506) collected 54 bats of seven species that collided with a television tower over a 25 year period, Zinn and Baker (1979-TN8507) reported 12 dead hoary bats at another television tower over an 18-year period, and Taylor and Anderson (1973-TN8508) reported 1 dead yellow bat (*Lasiurus intermedius*) at a third Florida television tower. Bat collisions with communications towers have been reported in North Dakota, Tennessee, and Saskatchewan, Canada; with convention center windows in Chicago, Illinois; and with power lines, barbed wire fences, and vehicles in numerous locations (Johnson and Strickland 2003-TN8509).

More recently, bat collisions with wind turbines have been of concern in North America. Bat fatalities have been documented at most wind facilities throughout the United States and Canada (USGS 2016-TN8510). For instance, during a 1996–1999 study at the Buffalo Ridge wind power development project in Minnesota, Johnson et al. (2003-TN8511) reported 183 bat fatalities, most of which were hoary bats and eastern red bats. The USGS Fort Collins Science

Center estimates that tens to hundreds of thousands of bats die at wind turbines in North America each year (USGS 2016-TN8510).

Bat collisions with human-made structures at nuclear power plants are not well documented but are likely rare based on available information. In an assessment of the potential effects of the operation of the Davis-Besse Nuclear Power Station in Ohio, the NRC staff (NRC 2014-TN7385) noted that four dead bats were collected at the nuclear power plant during bird mortality studies conducted from 1972 through 1979. Two red bats (*Lasiurus borealis*) were collected at the cooling tower, and one big brown bat and one tricolored bat were collected near other nuclear power plant structures. The NRC staff (NRC 2014-TN7385) found that future collisions of bats would be extremely unlikely and, therefore, discountable, given the small number of bats collected during the study and the marginal suitable habitat that the nuclear power plant site provides. The FWS (2014-TN7605) concurred with this determination. In a 2015 assessment associated with Indian Point Nuclear Generating Units 2 and 3 in New York, the NRC staff (2015-TN7382) determined that bat collisions were less likely to occur at Indian Point than at Davis-Besse because Indian Point does not have cooling towers or similarly large obstructions. The tallest structures on the Indian Point site are 134 ft (40.8 m) tall turbine buildings and 250 ft (76.2 m) tall reactor containment structures. The NRC staff (2015-TN7382) concluded that the likelihood of bats colliding with these and other nuclear power plant structures on the Indian Point site during the license renewal period was extremely unlikely to occur and, therefore, discountable. FWS concurred with this determination (2015-TN7612). In 2018, the NRC staff (2018-TN7381) determined that the likelihood of bats colliding with site buildings or structures on the Seabrook Station, Unit 1, site in New Hampshire would be extremely unlikely. The tallest structures on that site are the 199 ft (61 m) tall containment structure and the 103 ft (31 m) tall turbine and heater bay building. The FWS (2018-TN7610) concurred with the NRC staff's determination. Since that time, the FWS has concurred with similar findings for initial LRs and SLRs at multiple other nuclear power plant sites, including Surry Power Station, Units 1 and 2, in Surry, Virginia (2019-TN7609); Peach Bottom Atomic Power Station, Units 2 and 3, in Delta, Pennsylvania (2019-TN9742); Point Beach Nuclear Plant, Units 1 and 2, in Two Rivers, Wisconsin (2021-TN9740); North Anna Power Station, Units 1 and 2, in Louisa, Virginia (2023-TN9093); and Perry Nuclear Power Plant, Unit 1, in Perry, Ohio (2023-TN9741), among others.

The tallest structures on the V.C. Summer site are the reactor building and the primary MET, which are both 203.4 ft (62 m) above ground level (Dominion 2023-TN10387). The turbine buildings and transmission lines are also prominent features on the site. To date, Dominion has reported no incidents of injury or mortality of any species of bat on the V.C. Summer site associated with site buildings or structures. Accordingly, the NRC staff finds the likelihood of future tricolored bat collisions with site buildings or structures to be extremely unlikely and, therefore, discountable.

Vehicle collision risk for bats varies depending on factors including time of year, location of roads and travel pathways in relation to roosting and foraging areas, the characteristics of individuals' flight, traffic volume, and whether young bats are dispersing. Although collision has been documented for several species of bats, the Indiana Bat Draft Recovery Plan (FWS 2007-TN934) indicates that bat species do not seem to be particularly susceptible to vehicle collisions. However, the FWS also finds it difficult to determine whether roads pose a greater risk for bats colliding with vehicles or a greater likelihood of decreasing risk of collision by deterring bat activity (2016-TN7400). In most cases, the FWS expects that roads of increasing size decrease the likelihood of bats crossing the roads and, therefore, reduce collision risk (2016-TN7400).

During the proposed V.C. Summer SLR term, vehicular traffic from truck deliveries, site maintenance activities, as well as personnel commuting to and from the site would continue throughout the SLR period as they have during the current licensing period. Vehicle use would occur primarily in areas that bats would be less likely to frequent, such as along established county and State roads or within industrial-use areas of the V.C. Summer site. Additionally, most vehicle activity would occur during daylight hours when bats are less active. To date, Dominion has reported no incidents of injury or mortality of any species of bat on the V.C. Summer site associated with vehicle collisions. Accordingly, the NRC staff finds the likelihood of future tricolored bat collisions with vehicles to be extremely unlikely and, therefore, is not considered further.

Habitat Loss, Degradation, Disturbance, or Fragmentation, and Associated Effects

As previously discussed in this SEIS, the V.C. Summer action area includes a forested habitat that protected bats may rarely (to occasionally) inhabit in spring, summer, and fall. In its species status assessment for the tricolored bat (2021-TN8589), the FWS stated that forest removal may result in the following impacts to tricolored bats: loss of suitable roosting or foraging habitat, longer flights between suitable roosting and foraging habitats because of forest habitat fragmentation, fragmentation of maternity colonies due to loss/fragmentation of travel corridors, and direct mortality or injury during tree removal.

The proposed action would not involve forest removal or management and would generally not disturb the existing forested habitat on the site. Dominion states that it is not actively managing the forest within site boundaries but may selectively thin recently planted trees as necessary to maintain a healthy forest (2024-TN10391). Other vegetation maintenance on the site over the course of the proposed SLR term would be of grassy, mowed areas between buildings and along walkways within the industrial portion of the site (Dominion 2023-TN10387). Dominion would continue to maintain onsite transmission line ROWs in accordance with North American Electric Reliability Corporation standards. Less-developed areas and forested areas would be largely unaffected. Dominion does not intend to expand the existing facilities or otherwise perform construction or maintenance activities within these areas. Site personnel may occasionally remove select trees around the margins of existing forested areas if those trees are deemed hazardous to buildings, infrastructure, or other site facilities or to existing overhead clearances. Negative impacts on bats could result if such trees are potential roost trees. Bats could also be directly injured during tree clearing. However, tree removal would be infrequent, and Dominion personnel would follow company guidance to minimize potential impacts on bats.

The NRC staff finds that infrequent to rare hazardous tree removal in forested areas during the proposed SLR term would not measurably affect any potential bat habitat in the action area. Direct injury or mortality to bats during tree removal is also unlikely because Dominion company guidance would ensure that personnel take the appropriate measures to avoid this potential impact (2024-TN10391). For instance, Dominion could avoid this impact by removing hazardous trees in the winter when bats are unlikely to be present on the site. Additionally, the continued preservation of the existing forested areas on the site during the SLR term would result in positive impacts on tricolored bats if they are present within or near the action area.

Behavioral Changes Resulting from Refurbishment or Other Site Activities

Construction or refurbishment and other site activities, including site maintenance and infrastructure repairs, could prompt behavioral changes in bats. Noise, vibration, and general human disturbance are stressors that may disrupt normal feeding, sheltering, and breeding activities (FWS 2016-TN7400). At low noise levels or farther distances, bats initially may be startled but would likely habituate to the low background noise levels. At closer range and louder noise levels, particularly if accompanied by physical vibrations from heavy machinery, many bats would likely be startled to the point of fleeing from their daytime roosts. Fleeing individuals could experience increased susceptibility to predation and would expend increased levels of energy, which could result in decreased reproductive fitness (FWS 2016-TN7400: Table 4-1). Increased noise may also affect foraging success. Schaub et al. (2008-TN8867) found that the foraging success of the greater mouse-eared bat (*Myotis myotis*) diminished in areas with noise mimicking the traffic sounds that would be experienced within 15 m (49 ft) of a highway.

Within the V.C. Summer action area, noise, vibration, and other human disturbances could dissuade bats from using the action area’s forested habitat during migration, which could also reduce the fitness of migrating bats. However, bats that use the action area have likely become habituated to such disturbances because V.C. Summer has been consistently operating for several decades. According to the FWS, bats that are repeatedly exposed to predictable, loud noises may habituate to such stimuli over time (2010-TN8537). For instance, Indiana bats have been documented as roosting within approximately 1,000 ft (300 m) of a busy State route adjacent to Fort Drum Military Installation and immediately adjacent to housing areas and construction activities on the installation (U.S. Army 2014-TN8512). Tricolored bats would likely respond similarly.

Continued operation of V.C. Summer during the SLR term would not include major construction or refurbishment and would involve no other maintenance or infrastructure repair activities besides routine activities already performed on the site. Levels and intensity of noise, lighting, and human activity associated with continued day-to-day activities and site maintenance during the SLR term would be similar to ongoing conditions since V.C. Summer began operating, and such activity would only occur on the developed, industrial-use portions of the site. While these disturbances could cause behavioral changes in migrating or summer roosting bats, such as the expenditure of additional energy to find alternative suitable roosts, the NRC staff assumes that tricolored bats, if present in the action area, have already acclimated to regular site disturbances. Thus, continued disturbances during the SLR term would not cause behavioral changes in bats to a degree that would be able to be meaningfully measured, detected, or evaluated or that would reach the scale where a take might occur.

<u>Summary of Effects</u>

The potential stressors evaluated in this section are unlikely to result in effects on the tricolored bats that could be meaningfully measured, detected, or evaluated, and such stressors are otherwise unlikely to occur for the following reasons:

- Bat collisions with nuclear power plant structures in the United States are rare, and none have been reported at V.C. Summer.
- Vehicle collisions attributable to the proposed action are also unlikely, and none have been reported at V.C. Summer.
- The proposed action would not involve any construction, land clearing, or other ground-disturbing activities.
- Continued preservation of the existing forested areas on the site would result in positive impacts on bats.

- Bats, if present in the action area, have likely already acclimated to the noise, vibration, and general human disturbances associated with site maintenance, infrastructure repairs, and other site activities. During the SLR term, such disturbances and activities would continue at current rates and would be limited to the industrial-use portions of the site.

<u>Conclusion for the Tricolored Bat</u>

All potential effects on the tricolored bat resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the tricolored bat.

The ESA regulations in 50 CFR 402.10(a) (TN4312) require Federal agencies to confer with the Services any agency action that is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. Therefore, based on its “not likely to adversely affect” determination, the NRC is not required to confer with the FWS on the tricolored bat.

3.8.5.1.2 Monarch Butterfly

In Section 3.8.1.2.2 of this SEIS, the NRC staff concludes that monarch butterflies may occur in the action area when these butterflies move between areas with more suitable habitat. If present, monarchs would occur occasionally and for short periods of time.

The FWS (2020-TN8593) identifies the primary drivers affecting the health of the two North American migratory populations of monarch butterfly as: (1) habitat loss and degradation, (2) insecticide exposure, and (3) climate change effects.

Monarch habitat loss and degradation has resulted from the conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, senescence and incompatible management of overwintering sites in California, urban development, and drought (FWS 2020-TN8593). The proposed V.C. Summer SLR would not involve any habitat loss, land-disturbing activities, or any activities that would degrade existing natural areas or potential habitats for monarch butterflies. The continued preservation of existing natural areas on the site would result in positive impacts on monarch butterflies.

Most insecticides are nonspecific and broad-spectrum in nature. Furthermore, the larvae of many Lepidopterans are considered major pest species, and insecticides are specifically tested on this taxon to ensure that they will effectively kill individuals at the labeled application rates (FWS 2020-TN8593). Although insecticide use is most often associated with agricultural production, any habitat where monarchs are found may be subject to insecticide use. Studies looking specifically at the dose response of monarchs to neonicotinoids, organophosphates, and pyrethroids have demonstrated monarch toxicity (e.g., Krischik et al. 2015-TN8596; James 2019-TN8595; Krishnan et al. 2020-TN8597; Bagar et al. 2020-TN8594). Larvae and pupae experience reduced survival rates, while adult monarchs are less affected. Moreover, the magnitude of risk posed by insecticides may be underestimated, as research usually examines the effects of the active ingredient alone, while many of the formulated products contain more than one active insecticide.

During the proposed SLR period, Dominion would continue applying herbicides as needed, according to labeled uses, but has no plans to apply herbicides in natural areas. Application would primarily be confined to industrial-use and other developed portions of the site, such as perimeters of parking lots, roads, and walkways. Continued herbicide application could directly affect monarchs in the action area by injuring or killing individuals exposed to these chemicals. Certain herbicides such as glyphosate (e.g., Round Up) can kill milkweed, which can affect the ability of female monarchs to lay eggs. Although milkweed is not specifically known to occur on the V.C. Summer site, it has the potential to occur on site in the grasslands and open areas, given its occurrence in the V.C. Summer vicinity. Monarchs are only likely to occur in the action area seasonally during spring and fall migration when individuals are moving between areas of more suitable habitat. Because of the low likelihood of monarchs to be exposed to hazardous levels of chemicals, this potential impact is insignificant because it is unlikely to reach the scale where a take might occur.

Because the current and projected monarch population numbers are low, both the eastern and western populations are more vulnerable to catastrophic events, such as extreme storms at the overwintering habitat, and other climate change related phenomena. The FWS (2020-TN8593) anticipates that the eastern population will gain habitat in the northcentral region of North America as the species expands northward in response to increasing ambient temperatures. The degree and rate at which this expansion occurs will depend on the simultaneous northward expansion of milkweed. In the southern region of the continent, the population will either experience no gain or some loss of habitat.

Impacts on climate change during normal operations at nuclear power plants can result from the release of GHGs from stationary combustion sources, refrigeration systems, electrical transmission and distribution systems, and mobile sources. However, such emissions are typically very minor because nuclear power plants do not normally combust fossil fuels to generate electricity. During the proposed SLR term, the contribution of V.C. Summer operations to climate-change-related effects on monarch butterflies would be too small to be meaningfully measured, detected, or evaluated.

<u>Summary of Effects</u>

The potential stressors evaluated in this section are unlikely to result in effects on monarch butterflies that could be meaningfully measured, detected, or evaluated, and such stressors are otherwise unlikely to occur for the following reasons:

- The proposed action would not involve any habitat loss, land-disturbing activities, or any activities that would degrade existing natural areas or potential habitat for monarchs.
- Continued preservation of the existing natural areas on the site would result in positive impacts on monarchs.
- Herbicides would only be applied according to labeled uses in developed and manicured areas of the site. Herbicides would not be applied in natural areas. Monarchs would only have the potential to occur in the action area seasonally and infrequently, making the likelihood of herbicide exposure low. This represents an insignificant effect because it is unlikely to reach the scale where a take might occur.
- The contribution of V.C. Summer operations to climate-change-related effects on monarchs would be too small to be meaningfully measured, detected, or evaluated.

<u>Conclusion for the Monarch Butterfly</u>

All potential effects on the monarch butterfly resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action *may* *affect but is not likely to adversely affect* the monarch butterfly. Because the monarch is a candidate for Federal listing, the ESA does not require the NRC to consult with or receive concurrence from the FWS regarding this species.

3.8.5.2 Endangered Species Act: Federally Listed Species and Critical Habitats under NMFS Jurisdiction

No federally listed species or critical habitats under NMFS jurisdiction occur within the action area (see Section 3.8.2 of this SEIS). Therefore, the NRC staff concludes that the proposed action would have no effect on federally listed species or habitats under this agency's jurisdiction.

3.8.5.3 Magnuson–Stevens Act: Essential Fish Habitat

No EFH occurs within the affected area (see Section 3.8.3 of this SEIS). Therefore, the NRC staff concludes that the proposed action would have no effect on EFH.

3.8.5.4 National Marine Sanctuaries Act: Sanctuary Resources

No national marine sanctuaries occur within the affected area (see Section 3.8.3 of this SEIS). Therefore, the NRC staff concludes that the proposed action would have no effect on sanctuary resources.

3.8.6 No-Action Alternative

Under the no-action alternative, the NRC would not issue a subsequent renewed license, and V.C. Summer would shut down on or before the expiration of the current renewed facility operating license. Upon shutdown, the nuclear power plant would require substantially less cooling water and would produce little to no discernable thermal effluent. Thus, the potential for impacts on all aquatic species related to cooling system operation would be significantly reduced. The ESA action area under the no-action alternative would most likely be the same or similar to the area described in Section 3.8.1.1 of this SEIS, and so tricolored bats and monarch butterflies would likely occur within this action area (see Section 3.8.2 of this SEIS). The NRC would consult with the FWS, as appropriate, to address potential effects to these species resulting from the shutdown and decommissioning of the plant. No EFH or national marine sanctuaries occur in the region (see Sections 3.8.3 and 3.8.4 of this SEIS). Thus, shutdown would not result in impacts on EFH or sanctuary resources. Actual impacts would depend on the specific shutdown activities and whether any listed species or critical habitats are present when the no-action alternative is implemented.

3.8.7 Replacement Power Alternatives: Common Impacts

This section describes the common impacts for all four replacement power alternatives described in Section 2.3.2 of this SEIS. The ESA action area for any of the replacement alternatives would depend on various factors including site selection, current land uses, planned construction activities, temporary and permanent structure locations and parameters, and the timeline of the alternative. The ESA action area would occur within Dominion's region of influence (ROI).

The listed species, critical habitats, EFH, and national marine sanctuaries potentially affected by a replacement power alternative would depend on the boundaries of that alternative's effects and the species and habitats federally protected at the time that the alternative is implemented. For instance, if V.C. Summer continues to operate until the end of the current license term and a replacement power alternative is implemented at that time, the FWS and NMFS may have listed new species, delisted currently listed species whose populations have recovered, or revised EFH designations. These listing and designation activities would change the potential for the various alternatives to impact federally protected ecological resources. Additionally, requirements for consultation under ESA, MSA, and NMSA would depend on whether Federal permits or authorizations are required to implement each alternative. Federal permitting agencies would be required to consult with the FWS, NMFS, and/or NOAA under these statutes if a replacement power alternative could adversely affect federally protected ecological resources.

Sections 3.6 and 3.7 of this SEIS describe the types of impacts that terrestrial and aquatic resources would experience under each alternative. Impacts on federally protected ecological resources would likely be similar in type. However, the magnitude and significance of such impacts could be greater for federally protected ecological resources because such species and habitats are rare and more sensitive to environmental stressors.

3.8.8 Natural Gas Alternative

The NRC does not license natural gas or renewable energy facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for this alternative. The Federal and private responsibilities for addressing impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.7 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from the natural gas alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.8.9 New Nuclear (Small Modular Reactor) Alternative

The impacts of the new nuclear alternative are largely addressed in the impacts common to all replacement power alternatives described in the previous section. Because the NRC would remain the licensing agency under this alternative, the ESA and MSA would require the NRC to consult with the FWS and NMFS, as applicable, before issuing a license for the construction and operation of the new facility. During these consultations, the NRC would determine whether the new reactors would affect any federally listed species, adversely modify or destroy designated critical habitat, or result in adverse effects on EFH. If the new facility requires a CWA Section 404 permit, the USACE may be a cooperating agency for required consultations, or the USACE may be required to consult separately. Ultimately, the magnitude and significance of adverse impacts on special status species and habitats would depend on the site location and layout, nuclear power plant design, nuclear power plant operations, and the special status species and habitats present in the area when the alternative is implemented.

3.8.10 Natural Gas and Solar Combination Alternative

The NRC does not license renewable energy facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for this alternative. The Federal and private responsibilities for addressing the impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.7 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from the natural gas alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.8.11 New Nuclear and Solar Combination Alternative

The impacts of this alternative for the nuclear component of this alternative are the same as Section 3.8.9 of this SEIS. Because the NRC would remain the licensing agency for the nuclear component of this alternative, the ESA and MSA would require the NRC to consult with the FWS and NMFS, as applicable, before issuing a license for the construction and operation of the new SMR facility. If the new nuclear facility requires a CWA Section 404 permit, the USACE may be a cooperating agency for required consultations, or the USACE may be required to consult separately. The NRC does not license solar facilities or play a role in energy-planning decisions; therefore, the NRC would not be responsible for ESA or EFH consultation for the solar component of this alternative.

Ultimately, the magnitude and significance of adverse impacts on special status species and habitats would depend on the site location and layout, plant design, operations, and the special status species and habitats present in the area when the alternative is implemented.

3.9 Historic and Cultural Resources

This section of the SEIS describes the cultural background and the historic and cultural resources at V.C. Summer and its surrounding area. Historic and cultural resources describe material culture left behind from past human activity. Cultural resources include sites, objects, landscapes, structures, or other natural features of significance to groups of people who have traditional association with it. Section 106 of the NHPA (54 U.S.C. § 306108-TN4839) requires Federal agencies to take into account the effects of their undertakings on historic properties. Renewing the operating license of a nuclear power plant is an undertaking that could potentially affect historic properties. Historic properties are defined as resources eligible for listing in the National Register of Historic Places (NRHP). The NRHP is the Nation's official list recognizing buildings, structures, objects, sites, and districts of national, State, or local historical significance which merit preservation. The criteria for eligibility are listed in 36 CFR 60.4 "Criteria for Evaluation," (TN1682) and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) resources that have yielded, or are likely to yield, important information. In accordance with 36 CFR 800.8(c) (TN513), the NRC complies with the obligations required under NHPA Section 106 through its process under NEPA (42 U.S.C. 4321 et seq.-TN661) and has done so for this proposed action.

The proposed action is the SLR of the current renewed operating license, which would extend the current operating term for an additional 20 years. The Area of Potential Effect (APE) consists of the approximately 2,200 ac (890 ha) of the V.C. Summer site, a 2.6 mi (4 km) transmission line, and a 300 m (984 ft) buffer around the transmission line, to encompass the area where activities associated with the operation of the facility could potentially compromise the integrity of historic properties (Figure 3-11 below). The APE may extend beyond the nuclear plant site when these activities may indirectly (e.g., visual and auditory) affect historic properties. This determination is made irrespective of land ownership or control.

In accordance with NHPA's implementing regulations in 36 CFR Part 800 (TN513), the NRC is required to make a reasonable effort to identify historic properties within the APE. If the NRC finds that either there are no historic properties within the APE or the undertaking (SLR) would have no effect on historic properties, the NRC provides documentation of this finding to the State Historic Preservation Officer (SHPO). In addition, the NRC notifies all consulting parties, including Indian Tribes, and makes this finding public through the NEPA process prior to issuing the subsequent renewed operating license. Similarly, if historic properties are present and could be affected by the undertaking, the NRC is required to assess and resolve any adverse effects in consultation with the SHPO and any Indian Tribe that attaches religious and cultural significance to identified historic properties.

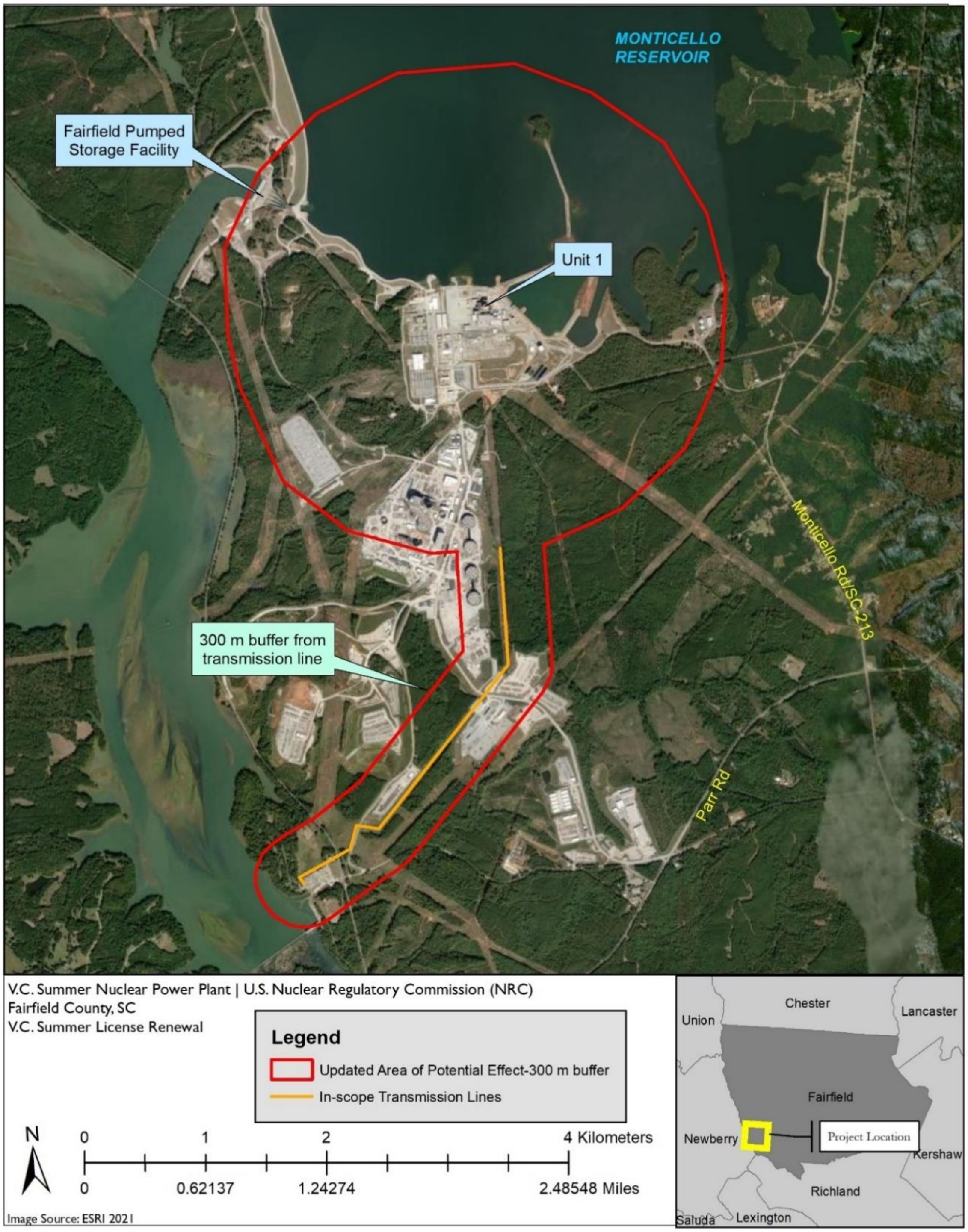


Figure 3-11 Map of the Area of Potential Effect for Virgil C. Summer Nuclear Station

In South Carolina, the South Carolina Department of Archives and History (SCDAH) is responsible for administering Federal and State-mandated historic preservation programs to identify, evaluate, register, and protect the State's archaeological and historic resources under the direction of the South Carolina SHPO. The SCDAH maintains the ArchSite electronic database, which inventories all registered cultural resources within the state, including those within the V.C. Summer plant.

3.9.1 Cultural Background

This section of the SEIS documents the precontact, ethnographic, and historic chronology of the proposed action's region. Cultural sequences are based on those described in Anderson and Sassaman (2012-TN10494). The chronology of the area is divided into the following periods: Paleoindian (13000 to 10000 before present [BP]), Archaic (10000 to 3000 BP), Woodland (3000 BP to Anno Domini [AD] 1100), Mississippian (AD 1100–1540), and Contact/Historic Period (1540 to present). The context described below helps archaeologists understand what previous research has been done in the area to inform cultural resources professionals what potential natural and cultural resources may be encountered in the project area. General patterns summarizing each time period are briefly described below.

3.9.1.1 Paleoindian Period (13000–10000 BP)

The Paleoindian Period is considered to represent the earliest documented human occupation in the region, extending more than 13,000 years ago to the terminal Pleistocene period. This period is typically characterized by small groups of highly mobile nomadic hunters who followed large game such as mammoths, mastodons, and bison and inhabited small semi-permanent camps. There has been ongoing dialogue in the archaeological community on what is considered the earliest documented human occupation in North America. Scholars typically associate the Clovis culture with the Paleoindian Period, although there are a number of well-known archaeological sites across North America that predate Clovis period sites. These include the Meadowcroft Rockshelter in Pennsylvania (Adovasio et al. 1990-TN10487), Paisley Caves in Oregon (Gilbert et al. 2008-TN10488), and White Sands in New Mexico (Pigati et al. 2023-TN10489).

Stone tool technologies of this era are mostly associated with the Clovis and Folsom (10,800 Before Christ [BC]–9500 BC) cultures. Both are known for their fluted points and large spear points made from high quality chert characterized by a groove notched out in the middle to bottom half of the point, allowing it to be attached to handles. Aside from fluted points, the Paleoindian toolkit also includes unfluted lanceolate projectile points, side scrapers, end scrapers, and drills (Adams and Young 2007-TN10490). Paleoindian varieties in the Southeast include Cumberland, Suwannee, Simpson, Dalton and Quad point types (Elliott and Sassaman 1995-TN10491).

In South Carolina, the Topper site has pre-Clovis and Clovis-era cultural deposits. Excavations below Clovis-era layers recovered small flakes tools, including side and end scrapers, spokeshaves, utilized flakes, gravers, blades, cores, and choppers (Goodyear and Sain 2018-TN10492; Adams and Young 2007-TN10490). Radiocarbon dates obtained from a possible hearth area date the site to over 50,000 years BP. Recent excavations by Smallwood (2015-TN10493) in Clovis-era deposits recovered over 37,000 flaked lithic artifacts, including cores, debitage, tools, and hammerstones (2015-TN10493).

3.9.1.2 Archaic Period (10000 BP–3000 BP)

The Archaic period is documented as starting around 10,000 years ago and marks the transition from nomadic to more sedentary settlement patterns and increased subsistence on multiple resources including smaller game and plants. The Archaic period was considered to be a period of transition; a slow, progressive trend toward exploitation of forest niches, better technologies and networks of interaction and cultural diffusion that helped spread pottery, as well as food production and customs of politics and religion (Anderson and Sassaman 2012-TN10494).

The Archaic toolkit is typified by smaller projectile points, stone grinding implements, and tools such as projectile points, knives, drills, and scrapers. This period also saw the introduction of the atlatl, a small wooden or bone stick with a hook at one end used to propel darts or spears (Bense 1994-TN10495). In the Southeast, the Archaic Period is divided into three subperiods: Early (10000–8000 BP), Middle (8000–5000 BP), and Late Archaic (5000–3000 BP).

Early Archaic (10000–8000 BP)

In the Early Archaic, there was a continuation of semi-nomadic hunting and gathering. Modern game species were consumed instead of megafauna, which had become extinct by that time. Early Archaic tools included end scrapers, side scrapers, gravers, adzes, and perishable items such as nets, traps, and basketry. Early Archaic typologies included side and corner notched projectile points such as Hardaway, Kirk, Taylor, and Big Sandy points and bifurcate points, such as MacCorkle, St. Albans, and LeCroy types (Elliott and Sassaman 1995-TN10491; Sassaman et al. 2002-TN10496).

Middle Archaic (8000–5000 BP)

During this time, temperatures were comparably higher than those of today. Deer population increased due to the abundance of vegetation. In the Southeast, levees, swamps, and oxbow lakes developed. Food resources such as mollusks and fowl increased (Anderson and Sassaman 2012-TN10494). Stemmed bifacial tool technology and the increased use of ground stones and bone mark this period. Stanley and Morrow Mountain stemmed points and lanceolate Guilford points are the most common point type of this subperiod. Adams and Young (2007) describe that Middle Archaic sites in South Carolina typically have more Morrow Mountain and Guildford types than Stanley points (Adams and Young 2007-TN10490). Other artifacts of the Middle Archaic include axes, atlatl weights, and grinding stones (Elliott and Sassaman 1995-TN10491).

Late Archaic (5000–3000 BP)

The Late Archaic is described as a time increased settlement permanence, growth in population, the intensification of subsistence, and technological innovation (Adams and Young 2007-TN10490). Stone tool assemblages marking the Late Archaic include Savannah River Stemmed, Paris Island, Otarre/Small Savannah River Stemmed, Kiokee Creek Stemmed and Gary Stemmed points.

A number of key developments emerged during this period. Axes, steatite vessels, and cooking stones appear more often in archaeological contexts. Settlement along river valleys increased, as seen in areas such as the Savannah River valley. Settlement along rivers provided consistent food sources such as shellfish and oyster, therefore allowing settlement for longer periods of time. Late Archaic populations also consumed resources such as nuts, acorns, and squash (Anderson and Sassaman 2012-TN10494).

The earliest pottery in the United States was developed during this period, around 4500 BP (Elliott and Sassaman 1995-TN10491). The earliest versions of ceramics were thick and tempered with fiber materials from plants, such as Spanish moss or palmetto palms. Pottery styles such as Stallings Island, Bilbo, St. Simons and Orange (Florida) correspond to this time period; however, Sassaman et al. (2006-TN10559) argues that Stalling Island pottery is the earliest form, originating in the coast and then diffusing to other parts of the region.

3.9.1.3 Woodland Period (3000 BP to 1100 BP)

The Woodland Period is represented by settled village life, more intensive plant cultivation (varieties of corn and wild rice), widespread adoption and elaborate variations of pottery, and the emergence of earthworks and associated burial complexes. Archaeologists typically consider the Woodland Period to be the era of regionalism, defined by Anderson and Sassaman (2012-TN10494) as the process of cultural differentiation leading to distinct traditions and communities across the Southeast. Similar to the Archaic, the Woodland Period is divided into three subperiods: the Early Woodland (3200–2200 BP), Middle Woodland (2200–1500 BP) and the Late Woodland (1500–1100 BP) (Anderson and Sassaman 2012-TN10494).

The development of agriculture was established in the Woodland Period. The scholarly understanding of agricultural practices of this phase is based on paleoethnobotanical evidence found in Woodland-era sites. Cultigens such as squash, sunflower, marshelder and chenopod began to be domesticated in the Late Archaic but their cultivation intensified during the Woodland Period (Anderson and Sassaman 2012-TN10494). Goosefoot, marshelder and sunflower were consumed during the Woodland, and these, along with maize, became more important during the subsequent Mississippian period.

<u>Early Woodland (3200–2200 BP)</u>

During the Early Woodland, populations remained largely hunting and gathering societies. Pottery became more widespread; sand and grit replaced fiber for tempering pottery. Regional variations were represented by the way they were decorated. For example, cord or fabric impressions were applied to the pottery of the Middle Atlantic and Mid-south. Pottery from the South Appalachian and Gulf coastal areas exhibited more elaborate designs (Anderson and Sassaman 2012-TN10494). In the Piedmont region, Dunlap fabric was impressed and cord marked pottery and Swannanoa ceramics were common during this period. Projectile points from this era included Savannah River Stemmed and Swannanoa Stemmed points (Adams and Young 2007-TN10490).

Little is known about the Early Woodland in the Piedmont. The Kellogg phase of this period, mainly observed in Georgia, demonstrates settled communities on upland locations with well-defined structures, storage pits, and dense middens (Anderson and Sassaman 2012-TN10494; Wellings et al. 2023-TN10497). Shellfish, which was consumed heavily during the Late Archaic, appeared to be consumed less during this phase.

<u>Middle Woodland (2200–1500 BP)</u>

Archaeologists distinguish the Middle Woodland Period primarily by variances in ceramics and artifacts. In the Piedmont, Pigeon, Cartersville, and Yadkin ceramics are typical Middle Woodland pottery types. Pigeon is quartz tempered and decorated with check stamped and simple stamped patterns. Cartersville pottery is tempered with either sand or grit, and is typically cord marked, although there have been some simple stamping and check stamping patterns observed (Adams and Young 2007-TN10490). Yadkin pottery is tempered with crushed quartz, and decorated with fabric impressed, check stamped, linear check stamped, and simple stamped patterns (Wellings et al. 2023-TN10497). Non-pottery artifacts found from Middle Woodland cultural deposits include clay platform pipes, ground and polished stone ornaments, bone tools, engraved shell and bone, bifacial knives, and shark tooth pendants (Wellings et al. 2023-TN10497).

One of the most defining features of this period is the emergence of burial mounds, which are characterized by monumental earth or stone works and elaborate mortuary practices (Bense 1994-TN10495). The complexes are mainly found in high locations, such as hilltops. Woodland era mounds are most associated with the Hopewell culture of Ohio. As described by Anderson and Sassaman (2012-TN10494), mound complexes in the southeast are similar to Hopewell mounds as they are typically conical with central tombs. In some cases, mound complexes include platform mounds, a trait seen with Mississippian era-mounds. Associations between the Hopewell mounds and the complexes of the Southeast are based on the presence on Hopewellian objects in the archaeological record. This includes quartz crystals, flint blades, mica cutouts, shell and pearl beads, copper and ceramic earspools, and other exotic materials like obsidian and galena (Anderson and Sassaman 2012-TN10494).

Middle Woodland occupations are not well documented in the State, especially further inland (Wellings et al. 2023-TN10497). Examples of Middle Woodland mound complexes are seen at the Kolomoki site in southwest Georgia and the Pinson site in southwest Tennessee (Anderson and Sassaman 2012-TN10494).

<u>Late Woodland (1500 BP–AD 1100)</u>

Cultural complexity declined during the Late Woodland. Smaller, political units began to appear and the production of elaborate burial complexes ceased. During this time, there was a shift toward smaller, more numerous dispersed habitation sites. This shift in settlement pattern appears to be a response to increased reliance on an agricultural subsistence strategy or intensification of resource procurement from upland areas (Adams and Young 2007-TN10490). Maize agriculture intensified, becoming more important by the end of the period. The bow and arrow was also introduced in the Late Woodland Period. Bow-launched points had greater impact, which further maximized wild game harvesting (Peskin 2011-TN9872). This change in technology allowed for greater hunting success over the dart and atlatl. It also may well be responsible for the dramatic increase in warfare seen in some areas (Bense 1994-TN10495; Walthall 1980-TN10498).

Increased use of ceramic vessels led to the manufacture of a variety of functional forms, such as larger storage vessels, jars, bowls, and plates. Ceramics began to be tempered with sand or grog (crushed potsherds). Late Woodland pottery includes the Napier type, fine sand-tempered ceramics with complicated stamped designs and the Hanover type, grog-tempered pottery with fabric impressed designs (Adams and Young 2007-TN10490; Wellings et al. 2023-TN10497). Middle Woodland era Cartersville pottery has also been found in Late Woodland deposits, although in reduced numbers.

3.9.1.4 Mississippian Period (AD 1100–1540)

The Mississippian period began around AD 1000 and ended around the period of European contact in the 16th century. This period marks the development of chiefdoms, the growth of mound centers, and the spread of the Southeastern Ceremonial Complex, a regional belief system with similarity of artifacts, iconography, ceremonial centers, and mythology (Bense 1994-TN10495). The De Soto expedition between 1539 and 1543 chronicled the various

Mississippian chiefdoms they encountered, providing an initial account of how Mississippian societies stood prior to the detrimental effects of contact (Anderson and Sassaman 2012-TN10494).

Mississippian societies were sociopolitical entities established along the floodplains of major rivers across the Southeast. Chiefdoms were large, fortified villages with central plazas surrounded by temple or mortuary mounds. Flat-topped temple mounds were constructed at these and other sites for religious practices. Surrounding settlements and farmsteads provided labor and services to the elite. Maize, along with beans and squash, was a major component of the precontact diet at this time (Anderson 1994-TN10499; Anderson and Sassaman 2012-TN10494). Sites such as Moundville in Alabama and Etowah in North Georgia were capitals of Mississippian chiefdoms.

Ceramics of this period include Pee Dee, Lamar, Savannah, and Etowah pottery. Pee Dee pottery consists of complicated stamping decoration along with reed punctation, and/or nodes, pellets, or narrow rim strips below the vessel rim (Adams and Young 2007-TN10490). Lamar, Savannah, and Etowah types are primarily identified by their complicated stamped designs, although simple stamped, checked stamped, and cord-marked varieties also occur.

The Mulberry site in central South Carolina is a major Mississippian site. Two Mississippian period archaeological sites located in the vicinity of the V.C. Summer site include the Blair Mound in Fairfield County and the McCollum Mound in Chester County (Adams and Young 2007-TN10490; NRC 2011-TN1723).

3.9.1.5 Contact and Historic Period (1540 to present)

The Contact period is defined as the time period where the Spanish initially made contact with Indigenous groups in the Southeast. Early European contact was mainly restricted to the coast; however, in the mid-sixteenth century, passages to the interior were successful. Expeditions led by Hernando de Soto (1539–1543), Tristan de Luna (1559–1561), and Juan Pardo (1566–1568) were both significant and catastrophic (Anderson and Sassaman 2012-TN10494). Europeans brought diseases with them, consequently killing a large portion of the Indigenous population who were not immune to such diseases.

South Carolina was established in 1670 with the founding of Charleston and was divided into South and North Carolina in 1710 (Adams and Young 2007-TN10490). Permanent European settlement did not occur in the Fairfield County area until the early 1740s with settlement occurring along the Broad River. South Carolina ratified the United States Constitution on May 23, 1788, becoming the eighth State to enter the Union. During the American Revolution, many settlers in the area were divided between the British and Patriot sides, which resulted in several skirmishes. With the culmination of the war during the nearby Battle of Cowpens, the British eventually withdrew from Charleston in 1782 (Adams and Young 2007-TN10490).

Early settlement of Fairfield County occurred in the mid-1700s. In December 1832, Winnsboro was incorporated as a town (NRC 2004-TN7262). Cotton production and plantations were established in the area in the 1800s and increased during the 1850s. An increase in slave populations accompanied the increase in cotton plantations in the area (Adams and Young 2007-TN10490). Cotton remained the main crop until the 1930s when it declined as a result of hard economic times, the boll weevil, and depletion of the area’s topsoil. During the late 19th century, the Civil War and Reconstruction period resulted in major economic social adjustments in the area. Camp Pearson, a Civilian Conservation Corps camp was established in 1933 as a soil erosion camp at Parr, which is located just south and west of the V.C. Summer site (Adams and Young 2007-TN10490).

3.9.1.6 Tribes

During the Contact period, at least 29 distinct Tribes and indigenous groups lived in South Carolina. Each group had a separate dialect, many of which were distinct languages. The common language families were Algonquian, Iroquoian, Muskogean, Siouan, and Yuchi. By 1750, the smaller Indian Tribes throughout South Carolina disappeared, most likely joining larger Tribes, such as the Catawba and Cherokee of South Carolina or the Creeks of Georgia (NRC 2004-TN7262).

The proposed action area is within the ancestral lands of the Catawba Nation (Catawba) and the Eastern Band of Cherokee Indians. The Catawba's lands originally extended through the Piedmont region of North and South Carolina through southern Virginia (Catawba 2024-TN10500). The Eastern Band of Cherokee Indians historically used the region north in present-day Kentucky and Tennessee through the northern regions of Alabama, Georgia, and South Carolina (NLD 2022-TN10501). It is estimated that the Catawba's population prior to contact was up to 25,000 people. By the 1800s, their population had been reduced to under 100 citizens (Catawba 2024-TN10500).

The Catawba signed the Treaty of Augusta in 1763, which established their reservation in now present-day Rock Hill, about 70 mi (113 km) north of the project area. In 1830, the Indian Removal Act was passed by the U.S. government. In 1838, the Cherokee Indians, along with other Indigenous groups in the Southeast, were forcibly removed from their homelands in Georgia, Alabama, and Tennessee to live in Indian Territory, located in present-day Oklahoma—which became known as the Trail of Tears (NPS 2023-TN10502). The Catawba were able to remain in South Carolina throughout the 1800s because of the 1763 Treaty of Augusta. In 1944, the Catawba established a constitution under the Indian Reorganization Act and were self-governed until 1959, when the Nation was terminated under several termination policies enacted by Congress (Loftis 1994-TN10503). In 1973, the Catawba filed a petition with Congress to gain Federal recognition. Twenty years later, in 1993, they received their Federal recognition.

Today, the Catawba are the only Federally recognized Tribe that resides in South Carolina, with over 3,300 enrolled members in the Nation. In addition to the Catawba, several Tribal groups and descendants still remain in South Carolina today, including the Cherokee, Pee Dee, Chicora, Edisto, Santee, and Chicora-Waccamaw Tribes (SCCMA 2024-TN10504).

3.9.2 Historic and Cultural Resources at V.C. Summer

Historic and cultural resources within the V.C. Summer site can include prehistoric and historic era archaeological sites, historic districts, buildings, structures, and objects. Historic and cultural resources also include traditional cultural properties that are important to a living community of people for maintaining their culture. "Historic property" is the legal term for a historic or cultural resource that is included on, or eligible for inclusion on, the NRHP. To gain a better understanding of the archaeological resources within the region, a literature review was conducted through the SCDAH's "ArchSite" electronic database using a 1 mi (1.6 km) radius to the APE to identify all historic properties that could be potentially affected by the undertaking. This information helps cultural resources professionals understand what resources may potentially be in the APE.

A total of 60 archaeological sites, 43 historic-age buildings, and one cemetery are within the APE and 1 mi (1.6 km) radius. Twenty-four sites are within the APE. Of the 24, 14 are precontact, 6 are historic, and 3 sites are multicomponent, consisting of both precontact and historic components. The discussions below describe the previously identified archaeological resources, cemetery, and historic-age buildings.

Previously Recorded Historic and Archaeological Resources

Three sites within the 1 mi (1.6 km) radius are eligible for the NRHP: FA360, FA366, and NE0008. Sites FA360 and FA366 were recorded in 2009 by New South Associates as part of an addendum survey for improvements within V.C. Summer. The site is a small Woodland Period ceramic and lithic scatter site recommended eligible for the NRHP. Site FA366 is a small undiagnostic lithic scatter site. The site was recommended as potentially eligible for its potential to yield information that may tie it to a particular time period. It was recommended that Phase II testing occur at the site to confirm NRHP eligibility if it could not be avoided by project activities.

NE0008 was first recorded in 1972 by George Teague as a small Archaic period lithic scatter consisting of quartzite flakes, secondary flakes, a scraper, biface fragments, and a possible Guilford projectile blank. Further testing was recommended at the time. S&ME revisited the site during their 2014 field investigations, excavating an additional 35 shovel tests within the site (Nagle and Carpini 2014-TN10505). Close to 400 precontact artifacts were collected from the surface and from the shovel testing, including Deptford pottery fragments, a Savannah River point, bifaces, scrapers, utilized flakes, steatite vessel fragment, and lithic debitage. The site was recommended as potentially eligible pending Phase II testing for eligibility confirmation and potential mitigation. In 2016, the site was revisited by Terracon for Phase II evaluative testing. Over 1,300 artifacts were recovered, and two features were identified from ten 1 × 1 m test units. Based on the fieldwork, the site was determined eligible for the NRHP (ArchSite 2024-TN10560).

Pearson Cemetery

The Pearson Cemetery is within the 1 mi (1.6 km) radius of the project APE. The cemetery is an early-to-late 19th century cemetery located approximately 1,000 m (3,820 ft) west of the in-scope transmission lines. The cemetery is named after General John Pearson, a Revolutionary War veteran who served as a major during the war. The Richard Winn chapter of the Daughters of the American Revolution erected a monument in 1934 at the (assumed) Pearson gravesite. The front of the monument reads, “Erected to the patriotism and valor of John Pearson May 30, 1743–Oct. 25, 1819. He served in state militia throughout the revolution rising to rank of major was promoted to brigadier general in 1800.” The back of the monument has a small bronze plate reading, “Revolutionary Solider 1775–1783.”

The cemetery was delineated in 2006 and formally registered as a site in 2007 by New South Associates. There are at least 32 known burials, although the presence of unmarked depressions suggest additional burials may be present (Adams and Young 2007-TN10490). The cemetery was recommended as potentially eligible under Criteria Consideration C, in which a birthplace or grave of a historical figure can be eligible if the person is of “outstanding importance” and if there is no other appropriate site or building directly associated with his or her productive life (Potter and Boland 1992-TN10506). Pearson’s grave and the associated Daughters of the American Revolution monument was recommended as eligible under Criteria Consideration D, in which a cemetery is eligible if it derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events” (Potter and Boland 1992-TN10506). New South recommended that a registered surveyor map their suggested boundaries and SCE&G construct a fence to protect the cemetery (Adams and Young 2007-TN10490). SCE&G installed the fence.

Historic Buildings

A total of 43 historic-age buildings have been documented within the APE and 1 mi (1.6 km) radius. Of those, two are considered eligible for the NRHP. The White Hall Elementary School is located approximately 1,370 ft (418 m) northeast of the APE, along SC 215. The elementary school is a 1954 equalization school constructed as part of South Carolina's effort to integrate African-American children in the State's education system following the lawsuit *Briggs vs. Elliott.* Local parents sued the Clarendon County School District in 1949 for lack of access to a school bus for black students (Dobrasko 2008-TN10507; NPS 2024-TN10508). The lawsuit eventually led Governor James Byrnes to fund a statewide school construction program in an attempt to improve and equalize schools for both black and white students. Over 700 equalization schools were constructed in the State, the majority between 1951 and 1959 (Dobrasko 2008-TN10507). In 1989, the school district sold the property to the original African-American land owners. The property remains in their family today (ArchSite 2024-TN10561).

The second historic property is the Fairfield Pumped Storage Development Facility, within the APE. The facility was registered by S&ME in 2014 as part of FERC's Parr Hydroelectric Project. At the time, it did not meet the 50-year age requirement to evaluate the facility for potential listing on the NRHP but was preliminarily done so as the building would become 50 years old within the duration of FERC's licensing period (around 2028). The facility was constructed between 1974 and 1978 and consists of a powerhouse, four steel penstocks, a substation, office/maintenance building, four earthen dams, and a reservoir. The facility produces hydroelectric power by using two reservoirs, discharging water from the upper Monticello Reservoir into the lower Parr Reservoir to generate power during peak times. Water used for generation is pumped back into the upper reservoir during lower power times. The process is considered unique in comparison to traditional hydroelectric generating facilities (Nagle and Carpini 2014-TN10505). S&ME recommended the facility as potentially eligible for the NRHP under Criterion A for its association with increased power consumption and growth in the Midlands area of South Carolina during the 1970s and under Criterion C for its engineering components associated with the pumped storage system (Nagle and Carpini 2014-TN10505). In 2023, SEARCH, Inc. revisited the facility during their architectural survey of the V.C. Summer plant for the proposed action. SEARCH concurred with S&ME's determination that the facility was eligible under Criteria A and C. On April 7, 2024, the South Carolina SHPO concurred with SEARCH's recommendation that the Fairfield Pumped Storage Development Facility remains eligible for listing in the NRHP (Dominion 2023-TN10387).

The remaining 41 historic-age properties include three homes constructed in 1900, 1940, and 1950 and V.C. Summer's facilities (ArchSite 2024-TN10562). The three homes were surveyed as part of local undertakings, all considered not eligible for the NRHP (Revels 2003-TN10563). SEARCH recorded and evaluated 38 facilities, recommending them as not eligible for inclusion on the NRHP due to their lack of historic, engineering, and/or architectural significance (Travisano et al. 2023-TN10509). The South Carolina SHPO concurred with the finding on April 7, 2023, and recommended re-evaluating the buildings as a historic district during NRC's next license renewal (around 2042).

Previous Surveys

A portion of the APE was reviewed by New South Associates for the construction of Units 2 and 3 at V.C. Summer (Adams and Young 2007-TN10490; Adams and Valk 2007-TN10564; Adams 2009-TN10510; NRC 2011-TN1723). Between 2006 and 2009, the majority of the southern portion of the APE was surveyed archaeologically as part of that proposed action. Section 2.7.2

of the V.C. Summer Units 2 and 3 COL EIS (NRC 2011-TN1723: pp. 2-131 through 2-142) provides a comprehensive discussion of the previously registered sites and surveys in the area, and the NRC hereby incorporates Section 2.7.2 of the V.C. Summer Units 2 and 3 COL EIS by reference. Since the publication of the 2011 Combined License Application EIS, four archaeological surveys and one architectural survey have been documented within 1 mi (1.6 km) of the project area. The four archaeological surveys and one architectural survey are discussed below.

In 2011, Brockington and Associates, Inc. (Brockington) led a Phase I archaeological survey of an approximately 20 mi (32.1 km) section of SCE&G's VCS2-Lake Murray 230 kV Line No. 2/SL George 230 kV Line No. I Transmission Line Corridor across Fairfield, Lexington, Newberry and Richland counties (Pappas and Bailey 2011-TN10511). A total of 1,415 shovel tests were excavated across the 20 mi (32.1 km) transmission line corridor, resulting in four archaeological sites being recorded. All the sites consisted of precontact lithic scatters with the exception of site RD1380, which also included an old outbuilding. None of the four sites were recommended eligible for the NRHP. A third transmission line project was performed by AF Consultants in summer 2011 for Santee Cooper. AF Consultants excavated 104 shovel tests for the proposed 3.1 mi (5 km) 230kV transmission line corridor. No cultural material was encountered (Drucker et al. 2012-TN10512).

In 2012, Brockington excavated an additional 158 shovel tests as part of an addendum survey to the Pappas and Bailey (2011-TN10511) one, surveying a 14 mi (22.5 km) stretch of the VCS1-Killian 230 kV Winnsboro Junction to the Winnsboro transmission line for proposed improvements (Futch 2012-TN10513). The survey occurred approximately 500 m (1640 ft) east of the proposed action APE. One archaeological site and two isolates were registered. Site FA373 was recorded as a high-density precontact lithic scatter site with artifacts dating the site to the Middle Archaic and Mississippian. Isolated Find 1 consisted of two historic ceramic sherds while Isolated Find 2 was identified as a flaked stone tool. None of the sites were eligible for the NRHP.

On behalf of SCE&G, S&ME did a Phase I survey for the Parr Hydroelectric Project in Fairfield and Newberry counties in 2014 as part of a FERC licensing project (Nagle and Carpini 2014-TN10505). The northern half of the proposed action APE intersects with portions of S&ME's 2014 archaeological survey. The Phase I survey consisted of surveying 70 different areas (totaling 3,375 ac [1,366 ha]) within the 15,637 ac (6,328 ha) APE considered to have a high probability of containing significant cultural resources. The remaining 12,262 ac (4,962 ha) were determined to have low potential for cultural resources. The field survey also included an architectural survey for above-ground resources. Inventories for eight previously recorded archaeological sites were also updated. S&ME recommended Lyles Ford and the Parr Shoals Development Facility (Structure 39-0081) eligible for the NRHP. Eleven archaeological sites were recommended as needing further work to determine their final NRHP eligibility. The Blair Mound site, which was already listed on the NRHP, was determined to not be impacted by the undertaking. All are outside of the APE.

The NRHP-eligible resource within the current project area, Fairfield Pumped Storage Development Facility, was recorded as part of the S&ME 2014 survey. Although the facility has not reached the 50-year age mark for consideration for inclusion on the NRHP, it was evaluated as the building would become 50 years old within FERC's licensing period (around 2028). S&ME recommended the facility as potentially eligible under Criterion A for its association with increased power consumption and growth in the Midlands area of South Carolina during the 1970s and under Criterion C for its engineering components associated with the pumped storage system (Nagle and Carpini 2014-TN10505).

On behalf of Enercon and as part of the proposed action, SEARCH performed an intensive-level architectural survey of the V.C. Summer site. As stated in the previous section, SEARCH inventoried 38 facilities (the nuclear reactor and its associated 11 buildings were considered one resource) and revisited the potentially NRHP-eligible Fairfield Pumped Storage Development Facility. SEARCH concurred with the original S&ME determination of eligibility that the facility is potentially eligible under Criteria A and C, and recommended the remaining 38 resources as not eligible for inclusion on the NRHP due to their lack of historic, engineering, and/or architectural significance (Travisano et al. 2023-TN10509). The South Carolina SHPO concurred with the finding from April 7, 2023, and recommended re-evaluating the buildings during the next license renewal (around 2042).

3.9.3 Procedures and Integrated Cultural Resources Management Plan

Dominion has one procedure to identify, protect, and minimize potential impacts to cultural resources. *Drilling, Digging, and Cutting (SA-AA-106)* outlines the appropriate actions to implement when historic or archaeological resources are discovered (2024-TN10391). It describes how to execute stop work notifications, including informing plant environmental personnel to evaluate any finding(s) and determine the appropriate course of action. The *Drilling, Digging, and Cutting* procedure includes how to address inadvertent discoveries of human remains.

During the environmental audit, the NRC staff requested additional information from Dominion pertaining to their procedure, including what steps were taken by their staff to protect unknown and known historic and archaeological resources prior to ground-disturbing activities in undisturbed areas, procedure(s) that stipulate that requirement, and procedures on how the unanticipated discovery of human remains is handled (2024-TN10391). Dominion responded that they engage their environmental group in the early planning stages of their projects to follow Dominion’s Corporate Environmental Due Diligence Policy. Part of the process is to learn what potential historic and cultural resources may be within their project area and, if applicable, conduct pertinent archaeological surveys for undisturbed areas. If cultural material is found during those surveys, the areas are flagged, and the information is shared during pre-job briefings with project personnel. Resources are avoided during the implementation of the project to minimize disturbances (Dominion 2024-TN10391).

3.9.4 Proposed Action

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and shown in Table 3-2, the NRC staff identified one plant-specific Category 2 issue related to historic and cultural resources applicable to V.C. Summer during the SLR term. This Category 2 issue (historic and cultural resources) is analyzed below.

Section 106 of the NHPA of 1966, as amended (54 U.S.C. § 306108-TN4839), requires Federal agencies to take into account the effects of their undertakings on historic properties. Issuing a subsequent renewed operating license to a nuclear power plant is a Federal undertaking that could potentially affect historic properties. Historic properties are defined as resources included on, or eligible for inclusion on, the NRHP. The criteria for eligibility are listed in 36 CFR 60.4 “Criteria for Evaluation,” (TN1682) and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) resources that have yielded, or are likely to yield, important information.

3.9.4.1 Consultation

In accordance with 36 CFR 800.8, “Coordination with the National Environmental Policy Act,” on November 3, 2023, the NRC staff initiated written Section 106 consultations with the Advisory Council on Historic Preservation (NRC 2023-TN10514), the SCDAH (NRC 2023-TN10514), and four Tribes, including the Catawba Nation, Cherokee Nation, Eastern Band of Cherokee Indians, and the Muskogee Creek Nation (NRC 2023-TN10514). In these letters, the NRC staff provided information about the proposed action, defined the APE, and indicated that the NHPA review would be integrated with the NEPA process, in accordance with 36 CFR 800.8(c) (TN513). The NRC staff invited participation in the identification of, and possible decisions concerning, historic properties and participation in the scoping process.

On November 22, 2023, the SCDAH concurred with the APE as described by the NRC but requested that the APE be defined and illustrated on maps. The SCDAH reaffirmed their review of SEARCH’s architectural survey report, and concurred with the recommendation that the 39 buildings and structures recorded at the V.C. Summer site do not meet the criteria for listing on the NRHP. The SCDAH recommended that the V.C. Summer site be re-evaluated for eligibility if a future subsequent license renewal was pursued (SCDAH 2023-TN10515). No additional responses were received. Appendix C to this SEIS lists all consultation documents.

On May 17, 2024, the NRC staff held a teleconference with the SCDAH (NRC 2024-TN10516). During the teleconference, the NRC and SCDAH staff discussed the scoping comments dated November 22, 2023, which were submitted by the SCDAH to the NRC with respect to this undertaking. This included consultation with Federally recognized Tribes, clarification of the APE, and the architectural survey commissioned by Dominion and conducted by SEARCH.

On September 23, 2024, the NRC staff provided written clarification of the APE to consulting parties. Written correspondence illustrated the APE on maps as shown in Figure 3-11 of this SEIS (NRC 2024-TN10592). On October 24, 2024, the SCDAH concurred with the NRC’s written clarification of the APE (SCDAH 2024-TN10836). On October 28, 2024, the Cherokee Nation acknowledged receipt of the APE clarification correspondence (Cherokee Nation 2024-TN10837).

3.9.4.2 Findings

NRHP-eligible sites FA360, FA366, and the Fairfield Pumped Storage Development Facility are within the APE and may be impacted by the proposed action. Site FA360 is a Middle and Late Woodland camp site determined eligible in 2009 under Criterion D. The site’s intact deposits can provide important information on Middle to Late Woodland settlement systems, patterns, and resource procurement from a time period that is overall poorly understood in the South Carolina Piedmont (Adams 2009-TN10510). Dominion has identified that one project is planned in 2025 to rebuild the remaining above-ground wooden H-frame style transmission poles on the Parr Generating Complex to V.C. Summer transmission line. Dominion indicated that the work would occur within the existing corridor in areas that have been previously disturbed (2024-TN10391). Site FA360 is adjacent to the transmission line corridor but outside of immediate areas where these planned activities may occur. Based on this, FA360 would not be adversely impacted by the proposed transmission pole upgrades or the SLR. Site FA366 is a small precontact lithic scatter recommended as potentially eligible in 2009 for its potential to yield information that may tie it to a particular time period (Adams 2009-TN10510). The site would be avoided by project activities and, therefore, would not be impacted by the proposed action.

The Fairfield Pumped Storage Development Facility (Structure 39-0082) was constructed between 1974 and 1978 and was recommended potentially eligible for the NRHP by S&ME in 2014. The facility was visited during the onsite environmental audit in May 2024 to determine if the proposed action would potentially affect the facility. Dominion has not identified any refurbishment activities that would change the facility or alter characteristics that continue to make the facility potentially eligible. Operations would continue as normal; therefore, the facility would not be adversely impacted by the SLR.

Three eligible sites are outside of the APE but may be indirectly affected by the undertaking given their proximity to the V.C. Summer site. The Pearson Cemetery (FA330) was recommended potentially eligible in 2007 by New South Associates under Criteria Consideration C, in which a birthplace or grave of a historical figure can be eligible if the person is of "outstanding importance" and if there is no other appropriate site or building directly associated with his or her productive life (Adams and Young 2007-TN10490). The cemetery is at a higher elevation than the rest of the V.C. Summer site and outside the viewshed of the V.C. Summer facilities. It is protected by a fence and a canopy of trees that obstructs the rest of the facilities from its viewshed. Any ongoing operations and maintenance activities would not impact the cemetery. Similarly, the proposed action would not adversely affect the NRHP-eligible 1954 White Hall Elementary School. The elementary school cannot be seen from the V.C. Summer site and is protected by trees and private homes which provide a buffer from the site.

Site NE0008 is an Archaic and Woodland Period lithic scatter site originally recorded in 1972. The site was recommended eligible in 2013 by S&ME when they revisited the site and conducted subsurface testing. Minor impacts to the site may occur based on the fluctuating river or reservoir levels associated with the Parr Shoals Dam. In 2013, S&ME noted the site erosion during their site visit. As a result in 2016, FERC, who has regulatory authority over the Parr Shoals Dam and the Fairfield Pumped Storage Facility, executed a Historic Properties Management Plan with the SCDAH and Dominion to address potential impacts to historic properties, including NE0008. It was recommended that erosion be minimized through stabilization of the shoreline. If that was not possible, it was recommended that adverse effects be resolved through data recovery of the site. While indirect, the renewal of the SLR would allow Dominion to continue operations on the Fairfield Pumped Storage Facility, which is connected to the Parr Shoals Dam. The NRC staff reviewed the Historic Properties Management Plan (HPMP) and determined that the SLR would not add additional impacts not already considered by FERC in their HPMP.

In conclusion, no new construction or modifications are anticipated for the proposed action. Plant operations and maintenance activities necessary to support the continued operation would be limited to previously disturbed areas and would be expected to be similar to current operations. For the purposes of NHPA, the proposed action will result in *No Adverse Effect* to historic properties, as defined in 36 CFR 800.5(b) (TN513).

3.9.5 No-Action Alternative

Under the no-action alternative, the NRC would not renew the operating license, and the power plant would begin decommissioning at or before the expiration of the current license. Land-disturbance activities or dismantlement would not be anticipated, as these would be conducted during decommissioning. Therefore, facility shutdown and adoption of the no-action alternative would have no immediate effect on historic properties, or on historic and cultural resources. Known historic properties and cultural resources at V.C. Summer would be unaffected if the NRC does not renew the operating license and Dominion terminates reactor operations.

As stated in the Decommissioning GEIS (2002-TN7254), the NRC staff concluded that impacts on cultural resources would be SMALL at nuclear plants where decommissioning activities would only occur within existing industrial site boundaries. Impacts cannot be predicted generically if decommissioning activities would occur outside of the previously disturbed industrial site boundaries, because impacts depend on site-specific conditions. In these instances, impacts could only be determined through site-specific analysis (NRC 2002-TN665). In addition, under 10 CFR 50.82, "Termination of License," power reactor licensees are required to submit a post-shutdown decommissioning activities report to the NRC, which must describe the plant's planned decommissioning activities (TN249).

Until the post-shutdown decommissioning activities report is submitted, the NRC staff cannot determine whether historic properties would be affected outside the existing industrial site boundary by decommissioning activities after the nuclear power plant ceases operations.

3.9.6 Replacement Power Alternatives: Common Impacts

Impacts to cultural resources from construction and operation of a replacement power alternative would be dependent on the site at which these efforts are localized. For construction, impacts to historic properties would vary depending on the degree of ground disturbance (i.e., land clearing, excavations), visual intrusions on the landscape, noise from the construction and operation of the alternative, etc. If the project has a Federal nexus (i.e., license, permit), the Federal agency would need to make a reasonable effort to identify historic properties within the area of potential effects and consider the effects of their undertaking on historic properties, in accordance with Section 106 of the NHPA. Identified historic and cultural resources would need to be recorded and evaluated for eligibility for listing on the NRHP. If historic properties are present and could be affected by the undertaking, adverse effects would be assessed, determined, and mitigated with the SHPO and any Tribe that attaches religious and cultural significance to identified historic properties through the Section 106 consultation process.

Similar to construction, the potential for impacts from the operation of replacement power alternatives would be dependent on ground disturbing activities, visual intrusions, noise, etc. associated with plant operations, ongoing maintenance, modifications to the facility, and/or transmission lines. Areas subject to ground disturbance would need to be surveyed to identify and record any historic and cultural material encountered, if applicable. The appearance of the alternative power-generating facility and transmission lines could also result in alterations to the visual setting which, whether temporary or permanent, could affect other types of historic and cultural resources such as cultural landscapes, architectural resources, or TCPs. Impacts would vary dependent on plant heights, associated exhaust stacks, or cooling towers.

3.9.7 Natural Gas Alternative

The NGCC plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. As proposed, the NGCC plant would be constructed at the abandoned V.C. Summer Units 2 and 3 site, south of Unit 1. The alternative could use the existing natural gas transmission pipeline within the site but would need minor construction to extend the pipeline for connectivity. Section E7.2.2.1.8 of the ER states that the extension could join the existing pipeline at the Parr Generating Complex crossing the abandoned V.C. Summer Unit 2 and Unit 3 site. This would also avoid property that was not reviewed under the 2011 Combined License Application EIS.

The ER identified that this alternative may result in a potential adverse effects due to potential impacts to the NRHP-eligible Pearson Cemetery. Specific site location, plant design, layout of buildings, vertical and horizontal depth of planned ground disturbance, operations, and maintenance activities would be needed to determine if impacts would be adverse or could be avoided. If impacts are to be adverse, additional consultation with the South Carolina's SHPO, Tribes, and consulting parties would be needed to mitigate such effects.

3.9.8 New Nuclear (Small Modular Reactor) Alternative

Impacts of this alternative would be similar to the common impacts described at the beginning of the section. Direct, indirect, visual, and auditory impacts would be dependent on the specific site location, plant design, layout of buildings, vertical and horizontal depth of planned ground disturbance, operations, and maintenance activities. Depending on where within the 130 ac (52.6 ha) the SMR is constructed, impacts to known cultural resources and historic properties may occur. Additional considerations to impacts would need to be considered if the existing (but abandoned) V.C. Summer Units 2 and 3 and associated facilities would be removed prior to construction. Removal of the facilities may directly or indirectly impact historic properties in the area.

3.9.9 Natural Gas and Solar Combination Alternative

Implementation of this alternative would require more land than the other alternatives considered. In general, using previously disturbed industrial sites for construction and land-based installations or associated infrastructure could minimize impacts to historic and cultural resources. The use of existing footprint within the Units 2 and 3 construction site for the natural gas component could avoid and/or minimize impacts to known resources in the area but would require minor construction to extend the pipeline for connectivity. For the solar component and the new 345 kV transmission line, impacts would be dependent on the locations chosen. However, if a previously disturbed site is not selected or is not within an existing ROW, natural and cultural resources surveys should occur prior to determine the presence or absence of potential features.

3.9.10 New Nuclear and Solar Combination Alternative

Impacts on historic and cultural resources from this alternative would include those discussed above as impacts common to all replacement alternatives. The use of the existing footprint within the abandoned V.C. Summer Units 2 and 3 construction site could avoid and/or minimize impacts to known resources in the area. For the solar component and the new 345 kV transmission line, impacts would be dependent on the locations chosen. If a previously disturbed site is not selected or is not within the existing ROW, natural and cultural resources surveys should occur prior to determine the presence or absence of potential features.

3.10 Socioeconomics

This section describes current socioeconomic factors that have the potential to be affected by changes in nuclear power plant operations at the V.C. Summer site. V.C. Summer and the communities that support it can be described as a dynamic socioeconomic system. The communities support the people, goods, and services required to operate the nuclear power plant. Nuclear power plant operations, in turn, supply wages and benefits for people as well as dollar expenditures for goods and services. The measure of a community's ability to support

V.C. Summer's operations depend on the community's ability to respond to changing environmental, social, economic, and demographic conditions.

3.10.1 Nuclear Power Plant Employment

The socioeconomic ROI is defined by the areas where V.C. Summer workers and their families reside, spend their income, and use their benefits, thus affecting the economic conditions of the region. In 2022, Dominion employed a permanent workforce of 613 workers and an additional 376 long-term contract workers (Dominion 2023-TN10387). Approximately 92 percent of V.C. Summer permanent workers reside in the counties of Lexington (41 percent of the workers), Richland (28 percent of the workers), Newberry (15 percent of the workers), and Fairfield (7 percent of the workers). The remaining workers are spread among other counties in South Carolina, North Carolina, Connecticut, Tennessee, and Virginia (Dominion 2023-TN10387). Because most of V.C. Summer's permanent workers are concentrated in the abovementioned four-county area, the greatest socioeconomic effects are likely to be experienced there. Consequently, for the analysis provided below, the focus is on the socioeconomic impacts of continued V.C. Summer operation on these four counties, which are defined as the "socioeconomic ROI."

Refueling and maintenance outages for V.C. Summer are on an 18-month cycle. Refueling outages last approximately 33–40 days and an additional 850 contract workers are onsite during a typical outage.

3.10.2 Regional Economic Characteristics

Goods and services are needed to operate V.C. Summer. Although procured from a wider region, some portion of these goods and services are purchased directly from within the socioeconomic ROI. These transactions sustain existing jobs and maintain income levels in the local economy. This section presents information on employment and income in the V.C. Summer socioeconomic ROI.

According to the U.S. Census Bureau's (USCB) 2018–2022 American Community Survey 5-Year Estimates, the educational services and healthcare and social assistance industry represented the largest employment section in the socioeconomic ROI, followed by retail trade (USCB 2022-TN10423). The civilian labor force in the socioeconomic ROI was 389,226 persons and the number of individuals employed was 366,939 (USCB 2022-TN10423). Estimated income information for the socioeconomic ROI is presented in Table 3-16 below. As shown in Table 3-16, people living in Lexington County had a higher median household income and per capita income than the State average, while people living in the other three counties had a lower median household income and per capita income less than the State average. Additionally, the percentages of individuals living below the poverty level in Richland County, Newberry County and Fairfield County are higher than the State average.

According the USCB 2018–2022 American Community Survey 5-Year Estimates, the unemployment rates in Lexington County, Richland County, Newberry County and Fairfield County were 4.4, 6.8, 3.9, and 6.9 percent, respectively. Comparatively, the unemployment rate in South Carolina during the same time period was 5.2 percent (USCB 2022-TN10423).

Table 3-16 Estimated Income Information for the Virgil C. Summer Nuclear Station Socioeconomic Region of Influence, 2018–2022, 5-Year Estimates

Parameter	Lexington County	Richland County	Newberry County	Fairfield County	South Carolina
Median household income (dollars)[a]	71,280	59,850	56,706	44,521	63,623
Per capita income (dollars)[a]	37,209	35,720	32,251	29,269	36,072
Families living below the poverty level (percent)	8.8%	11.5%	10.6%	16.4%	10.2%
People living below the poverty level (percent)	11.6%	16.8%	15.5%	18.7%	14.4%

(a) In 2022 inflation-adjusted U.S. dollars.
Source: USCB 2022-TN10423.

3.10.3 Demographic Characteristics

According to the 2020 Census, an estimated 177,057 people lived within 20 mi (32 km) radius of V.C. Summer, which equates to a population density of 141 persons per square mile (persons/mi^2) (Dominion 2023-TN10387). This amount translates to a Category 4, "Least sparse" population density using the LR GEIS (NRC 2024-TN10161) measure of sparseness, which is defined as "greater than or equal to 120 persons per square mile within 20 mi [32 km]." An estimated 1,245,777 people live within a 50 mi (80 km) radius of the V.C. Summer site, which equates to a population density of 159 persons/mi^2 (Dominion 2023-TN10387). This translates to a Category 4 proximity index. Therefore, V.C. Summer is in a "high" population area based on the LR GEIS spareness and proximity matrix (NRC 2024-TN10161).

Table 3-17 below shows population projections and percent growth from 2000 to 2070 for the four counties in the V.C. Summer Socioeconomic ROI. During the last two decades, the four-county ROI increased in population, while the population in Fairfield County declined by 14.4 percent during 2010–2020. Based on population projections, the populations in Lexington County, Richland County and Newberry County are expected to continue to increase through 2070 if current rates of fertility, mortality, and migration remain unchanged, while the population in Fairfield County is expected to decline significantly.

Table 3-17 Population and Percent Growth in Virgil C. Summer Nuclear Station's Socioeconomic Region of Influence

Metric	Year	Lexington County Popula-tion	Lexington County Percent Change	Richland County Popula-tion	Richland County Percent Change	Newberry County Popula-tion	Newberry County Percent Change	Fairfield County Popula-tion	Fairfield County Percent Change	ROI Popula-tion	ROI Percent Change
Recorded	2000	216,014	-	320,677	-	36,108	-	23,454	-	596,253	-
Recorded	2010	262,391	17.7%	384,504	19.9%	37,508	3.9%	23,956	2.1%	708,359	18.8%
Recorded	2020	293,991	12.0%	416,147	8.2%	37,719	0.6%	20,948	-14.4%	768,805	8.5%
Projected	2030	316,455	7.6%	431,616	3.7%	37,110	-1.6%	16,818	-24.6%	801,999	4.3%
Projected	2040	355,444	12.3%	479,351	11.1%	37,916	2.2%	15,565	-8.1%	888,276	10.8%
Projected	2050	388,736	9.4%	515,797	7.6%	38,238	0.8%	13,273	-17.3%	956,044	7.6%
Projected	2060	422,028	8.6%	552,243	7.1%	38,559	0.8%	10,981	-20.9%	1,023,811	7.1%
Projected	2070	455,320	7.9%	588,689	6.6%	38,881	0.8%	8,690	-26.4%	1,091,580	6.6%

ROI = region of influence.
Sources: USCB 2000-TN10464, 2010 data from USCB 2010-TN10565, USCB 2020-TN10465; SCRFAO 2022-TN10466; 2050–2070 projected data from NRC staff estimates.

The 2020 Census demographic profile of the V.C. Summer socioeconomic ROI population is presented in Table 3-18 below. According to the 2020 Census, minorities (race and ethnicity combined) comprised approximately 46 percent of the total population for the socioeconomic ROI. The largest minority population in the socioeconomic ROI were Black or African-American population (32.8 percent of the total population; 70.8 percent of the total minority population). According to both the USCB's 2020 Census and 2010 Census (USCB 2010-TN10565), since 2010, minority populations in the four-county ROI were estimated to have increased by approximately 55,811 persons, and now compose 46 percent of the population (see Table 3-18 below). The largest changes occurred in the population of people who identify themselves as two or more races, or Hispanic/Latino; these populations grew by more than 17,483 and 15,390 persons, respectively, since 2010.

Table 3-18 Demographic Profile of the Population in the Virgil C. Summer Nuclear Station's Socioeconomic Region of Influence, 2020

Demographic Parameter	Lexington County	Richland County	Newberry County	Fairfield county	Region of Influence
Total Population	293,991	416,147	37,719	20,948	768,805
Percent White race	71.0	41.5	60.0	40.6	53.7
Percent Black or African-American race	14.4	45.2	27.5	53.5	32.8
Percent American Indian and Alaska Native race	0.3	0.2	0.3	0.3	0.3
Percent Asian race	2.3	2.7	0.4	0.5	2.4
Percent Native Hawaiian and other Pacific Islander race	0.1	0.1	0.0	0.0	0.1
Percent some other race	0.4	0.4	0.2	0.3	0.4
Percent two or more races	4.1	3.5	2.9	2.8	3.7
Hispanic, Latino, or Spanish Ethnicity of any race (total population)	21,797	26,095	3,305	423	51,620
Percent Hispanic, Latino, or Spanish Ethnicity of any race of total population	7.4	6.3	8.8	2.0	6.7
Total minority	85,137	243,503	15,084	12,445	356,169
Percent of total population	29.0	58.5	40.0	59.4	46.3

Source: USCB 2020-TN10465.

3.10.3.1 Transient Population

Fairfield, Lexington, Newberry, and Richland counties can experience seasonal transient population growth as a result of local tourism, recreational activities, or college and university attendance. For instance, in the four-county socioeconomic ROI, there are numerous State parks with campgrounds, national forests, and national parks, which draw visitors to the region throughout the year (Dominion 2023-TN10387). A transient population may create a demand for temporary housing and services in the area. Based on the Census Bureau's 2018–2022 American Community Survey 5-Year Estimates (USCB 2022-TN10467), 5,307 seasonal housing units are located in the four-county socioeconomic ROI.

3.10.3.2 Migrant Farm Workers

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence in another area, and some may follow the harvesting of crops, particularly fruit and vegetables, throughout rural areas of the United States. Migrant workers may also be members of minority or low-income populations.

Since 2002, the Census of Agriculture reports the number of farms hiring migrant workers, which are defined as a farm worker whose employment required travel that prevented the worker from returning to their permanent place of residence the same day (USDA 2022-TN10552). The Census of Agriculture is conducted every 5 years and results in a comprehensive compilation of agricultural production data for every county in the Nation.

Information about both migrant and temporary farm labor (i.e., working fewer than 150 days) can be found in the 2022 Census of Agriculture. Table 3-19 below presents information on migrant and temporary farm labor in Fairfield, Lexington, Newberry, and Richland counties. According to the 2022 Census of Agriculture, 1,850 farm workers were hired to work for fewer than 150 days and were employed on 595 farms in the four-county socioeconomic ROI. However, only 32 farms in the socioeconomic ROI reported hiring migrant workers.

Table 3-19 Migrant Farm Workers and Temporary Farm Labor in the Virgil C. Summer Nuclear Station's Socioeconomic Region of Influence, 2022

County	Number of Farms with Hired Farm Labor[(a)]	Number of Farms Hiring Workers for Less Than 150 days[(a)]	Number of Farm Workers Working for Less Than 150 days[(a)]	Number of Farms Reporting Migrant Farm Labor[(a)]
Total	751	595	1,850	32
Fairfield	87	81	138	2
Lexington	347	271	810	12
Newberry	166	117	266	N/A
Richland	151	126	636	18

N/A = not available; ROI = region of influence.
(a) Source: National Agricultural Statistics Service: Quick Stats (USDA 2022-TN10552).

3.10.4 Housing and Community Services

This section of the SEIS presents information on housing and local public services, including education and water supply as it relates to the V.C. Summer socioeconomic ROI.

3.10.4.1 Housing

Table 3-20 below lists the total number of occupied and vacant housing units, vacancy rates, and median values in the four-county socioeconomic ROI. Based on the USCB's 2018–2022 American Community Survey 5-Year Estimates, there were 340,797 housing units in the socioeconomic ROI, of which 305,221 were occupied. The median values of owner-occupied housing units in the socioeconomic ROI range from $123,200 in Fairfield County to $201,200 in Richland County. The homeowner vacancy rate was approximately 1.3 percent in Fairfield County, 0.6 percent in Lexington County, 0.8 percent in Newberry County, and 1.5 percent in Richland County (USCB 2022-TN10468).

Table 3-20 Housing in the Virgil C. Summer Nuclear Station's Region of Influence, 2018–2022

Housing Characteristic	Fairfield County	Lexington County	Newberry County	Richland County	Region of Influence
Total housing units	10,943	128,830	18,313	182,711	340,797
Occupied housing units	8,795	118,673	15,027	162,726	305,221
Total vacant housing units	2,148	10,157	3,286	19,985	35,576
Percent total vacant	19.6	7.9	17.9	10.9	10.4
Owner-occupied units	6,609	90,689	11,167	97,287	205,752
Median value (dollars)	123,200	197,600	139,200	201,200	193,743[a]
Owner vacancy rate (percent)	1.3	0.6	0.8	1.5	1.1[b]
Renter-occupied units	2,186	27,984	3,860	65,439	99,469
Median rent (dollars/month)	830	1,061	855	1,142	1,101[c]
Rental vacancy rate (percent)	2.9	3.7	4.1	6.1	5.0[b]

(a) Weighted average by owner-occupied units in Fairfield, Lexington, Newberry, and Richland counties.
(b) Weighted average by total housing units in Fairfield, Lexington, Newberry, and Richland counties.
(c) Weighted average by occupied units paying rent in Fairfield, Lexington, Newberry, and Richland counties.
Source: USCB 2022-TN10468.

3.10.4.2 Education

As of the 2023–2024 school year, the four-county socioeconomic ROI includes 13 public school districts, which is comprised of 199 schools with 131,404 students, and 9,397 teachers, for a student-teacher ratio of 14:1 (NCES 2024-TN10469). Fairfield County Schools is the closest school district to the V.C. Summer plant and directly benefits from property tax payments. The Fairfield County district consists of 8 schools serving 2,278 K-12 students, all of which qualify for free or reduced lunch programs (NCES 2024-TN10469). Across the four-county socioeconomic ROI, 66.1 percent of students qualified for free or reduced lunch programs (NCES 2024-TN10469) in the 2023–2024 school year.

3.10.4.3 Public Water Supply

Six public water systems supply the Fairfield County residents who do not have individual onsite wells. The water is sourced 90 percent from various surface water resources and 10 percent from groundwater (Dominion 2023-TN10387). Based on the Fairfield County Comprehensive Plan (2021-TN10470: pp. 84–85), the public water systems appear to be utilizing just over 40 percent of their developed capacity and have addressed foreseeable future water supply needs.

Fairfield County is in the process of developing additional wastewater resources as the county is nearing design capacity on current systems (Dominion 2023-TN10387). Future growth in the county will be limited by the rate at which additional wastewater resources can be brought online (Fairfield County 2021-TN10470: pp.93–94).

V.C. Summer's domestic water supply is from the Monticello Reservoir. V.C. Summer treats sanitary wastewater at an onsite sanitary wastewater treatment facility (Dominion 2023-TN10387).

3.10.5 Tax Revenues

Dominion provides substantial annual property tax payments to Fairfield County, which allocates funds for county services on behalf of the V.C. Summer plant. Dominion also provides minor annual funding (less than $500,000) to South Carolina Emergency Management Division and SCDHEC for emergency planning activities within a 10 mi (16 km) radius of the plant (Dominion 2023-TN10387).

Table 3-21 presents total annual property tax payments to Fairfield County and its tax jurisdictions for the years 2018 through 2023, as well as an evaluation of the V.C. Summer property tax as a percent of Fairfield County's total revenues (Dominion 2023-TN10387, Dominion 2024-TN10391; Fairfield County 2024-TN10424). The V.C. Summer total annual property tax payment to Fairfield County in 2023 was $12.7 million, representing 46.5 percent of total county tax revenue. Dominion's annual property tax payments for V.C. Summer have remained consistent over the last 5 years, representing well over 40 percent of Fairfield County total tax revenue. Currently, no substantial future tax payment changes are expected.

Table 3-21 Total Property Tax Payments by Virgil C. Summer Nuclear Station, 2018–2023

Parameter	2018	2019	2020	2021	2022	2023
Fairfield County Revenues	26,628,308	28,475,796	26,897,144	27,088,507	25,325,000	27,308,000
Virgil C. Summer property tax payment	10,925,000	12,330,000	12,019,136	12,652,074	11,938,930	12,693,913
Virgil C. Summer proportion of total county revenue	41.0%	43.3%	44.7%	46.7%	47.1%	46.5%

Sources: Dominion 2023-TN10387, Dominion 2024-TN10391; Fairfield County 2024-TN10424.

3.10.6 Local Transportation

Transportation in the region surrounding V.C. Summer includes a rural and urbanized road network, as well as rail and air travel. SC 215 runs north-south along the eastern shore of the Monticello Reservoir, running south to Columbia, South Carolina, and north to Spartanburg, South Carolina, and providing plant access from the east. South Carolina Highway 213 (SC 213), which runs southwest-northeast to the south of the plant and intersects with SC 215 southeast of the plant, provides access from the west and from Winnsboro, South Carolina, on the east. South Carolina Highway 176 (SC 176) traverses the region northwest to southeast, roughly parallel to Interstate 26, both providing commuter access to the plant from the west (Dominion 2023-TN10387). The small, unincorporated community of Jenkinsville, South Carolina, lies immediately southeast of the site along SC 215 near its junction with SC 213.

Table 3-22 below shows the average annual daily traffic volumes for the main plant access routes. Traffic counts illustrate the construction period for now terminated Unit 2 and 3 project, which occurred between 2011 and 2021 (SCDOT 2012-TN10566, SCDOT 2017-TN10567, SCDOT 2022-TN10568, SCDOT 2024-TN10569). Current traffic levels have returned to similar levels observed during the pre-Unit 2 and Unit 3 construction period.

Table 3-22 Total Average Annual Daily Traffic Counts Near Key Access Points of Virgil C. Summer Nuclear Station

Roadway and Location	Annual Average Daily Traffic Volume Estimates for 2011	Annual Average Daily Traffic Volume Estimates for 2016	Annual Average Daily Traffic Volume Estimates for 2021	Annual Average Daily Traffic Volume Estimates for 2023
SC 213, Parr Rd (Station 140)	3,200	5,200	6,000	2,800
SC 213, Monticello Rd (Station 141)	950	1,650	1,150	1,600
SC 215, Rock Hill (Station 145)	1,750	3,500	4,300	2,300

Source: SCDOT 2012-TN10566, SCDOT 2017-TN10567, SCDOT 2022-TN10568, SCDOT 2024-TN10569.
SC 213 = South Carolina Highway 213; SC 215 = South Carolina Highway 215.

While Fairfield County has planned some transportation projects aimed at diversifying modes of transport within the county road system, none of these projects are anticipated to affect V.C. Summer site access. Current traffic levels in the vicinity of the site are well below highway capacities for two lane highways in South Carolina, and Level of Service values are estimated to range between “A” to “C” within Fairfield County (Dominion 2023-TN10387).

3.10.7 Proposed Action

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and cited in Table 3-1 for generic socioeconomic issues, the impacts of nuclear power plant SLR and continued operations would be SMALL for Category 1 issues applicable to V.C. Summer.

Socioeconomic effects of ongoing reactor operations at V.C. Summer have become well-established as regional socioeconomic conditions have adjusted to the presence of the nuclear power plant. Changes in employment and tax revenue could affect the availability of community services and housing, as well as traffic on roads near the nuclear power plant.

Dominion indicated in its ER that there are no SLR-related refurbishment activities, and that they have no plans to add additional permanent employees to support plant operations during the proposed SLR term (Dominion 2023-TN10387). There are also no plans to add additional permanent operations staff to support surveillance, monitoring, inspections, testing, trending, and recordkeeping activities during the proposed SLR term (Dominion 2023-TN10387). Consequently, people living near V.C. Summer would not experience any changes in socioeconomic conditions during the SLR term beyond what is currently being experienced.

The NRC staff’s review did not identify any new and significant information that would change the conclusion in the 2024 LR GEIS. Thus, as concluded in the 2024 LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on socioeconomic issues would be SMALL.

3.10.8 No-Action Alternative

3.10.8.1 Socioeconomics

Under the no-action alternative, the NRC would not issue a subsequent renewed operating license, and V.C. Summer would shut down on or before the expiration of the current operating license. This would have a substantial impact on socioeconomic conditions in the counties and communities near V.C. Summer–especially Fairfield County. The loss of jobs, income, and tax revenue would have an immediate adverse socioeconomic impact. As jobs are eliminated, some, but not all of the approximately 989 workers could leave the region. Income from buying and selling goods and services that are needed to maintain the nuclear power plant would also be reduced. In addition, loss of tax revenue could affect the availability of public services.

If V.C. Summer workers and their families move out of the region, increased vacancies and reduced demand for housing would likely cause housing prices to fall. The greatest socioeconomic impact would be experienced in Fairfield County from the loss of property tax revenue, and in Newberry County from the loss of relatively well-paying jobs in a rural county. However, the loss of jobs, income, and tax revenue may not be as noticeable in larger, more urban communities due to the larger and more diversified economy found in greater Columbia. Therefore, depending on the jurisdiction, socioeconomic impacts of not issuing a subsequent renewed operating license and terminating reactor operations at V.C. Summer (no-action alternative) could range from MODERATE to LARGE.

3.10.8.2 Transportation

Traffic volume on roads near V.C. Summer may be noticeably reduced after the termination of reactor operations. Any reduction in traffic volume would coincide with plant workforce reductions. Similarly, truck deliveries and shipments would also be reduced until active decommissioning. Therefore, due to the time and steps required to prepare the nuclear power plant for decommissioning, traffic-related transportation impacts would be SMALL.

3.10.9 Replacement Power Alternatives: Common Impacts

Workforce requirements for replacement power alternatives were evaluated to measure their possible effects on current socioeconomic and transportation conditions. Table 3-23 below summarizes socioeconomic and transportation impacts of replacement power alternatives. The following provides a discussion of the common socioeconomic and transportation impacts during construction and operations of replacement power-generating facilities.

3.10.9.1 Socioeconomics

Socioeconomic impacts are defined in terms of changes in the social and economic conditions of a region. For example, the creation of jobs and the purchase of goods and services during the construction and operation of a replacement power plant could affect regional employment, income, and tax revenue. For each alternative, two types of jobs would be created: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact, and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts.

While the selection of a replacement power alternative could create opportunities for employment and income and generate tax revenue in the local economy, employment, income, and tax revenue would be greatly reduced or eliminated in communities near V.C. Summer. These impacts on the communities near V.C. Summer are described in the Section 3.10.8 of this SEIS. The following provides a discussion of the common socioeconomic and transportation impacts on the communities near replacement power plants during the construction and operations of these alternatives.

Table 3-23 Socioeconomic and Transportation Impacts of Replacement Power Alternatives at Virgil C. Summer Nuclear Station

Alternative	Resource Requirements	Impacts	Discussion
Natural Gas	Construction: peak 1,200 workers for several months	MODERATE to LARGE[(a)]	Some operations workers could transfer from V.C. Summer. Increased demand for temporary housing and increased traffic volume impacts on local roads during peak construction activity.
Natural Gas	Operations: 150 workers	SMALL to MODERATE[(a)]	Some operations workers could transfer from V.C. Summer.
New Nuclear	Construction: peak 3,300 workers for several months;	MODERATE to LARGE	Site preparation for Units 2 and 3 may reduce construction time, but large workforce would increase demand for temporary housing and increased traffic volumes on local roads during peak construction activity.
New Nuclear	Operations: 500 workers	SMALL to MODERATE	Slightly smaller operations work force than V.C. Summer. Similar traffic volume impacts during shift changes.
Natural Gas and Solar Combination	Construction: peak 800 (NGCC), 500 (Solar) workers for several months	SMALL to MODERATE	Site preparation for Units 2 and 3 may reduce construction time. Increased demand for temporary housing and increased traffic volumes on local roads during peak construction activity.
Natural Gas and Solar Combination	Operations: 100 (NGCC), 60 (Solar)	SMALL to MODERATE	Fewer operations workers than V.C. Summer. Smaller traffic volume impacts during shift changes.
New Nuclear and Solar Combination	Construction: peak 3,300 workers for several months (Nuclear); 500 (Solar)	MODERATE to LARGE	Site preparation for Units 2 and 3 may reduce construction time, but large workforce would increase demand for temporary housing and increased traffic volumes on local roads during peak construction activity.
New Nuclear and Solar Combination	Operations: 500 workers (Nuclear); 60 (Solar)	SMALL to MODERATE	Similar number of operations workers as V.C. Summer. No noticeable difference in traffic volume impacts during shift changes.

NGCC = natural gas-fired combined-cycle; V.C. Summer = Virgil C. Summer Nuclear Station.
(a) Assuming that all combined-cycle combustion turbines are constructed or installed at the same time.
Sources: NRC 2019-TN6824, NRC 2019-TN6136; DOE 2011-TN8387; BLM 2019-TN8386; Tegen 2016-TN8826.

Construction

During construction of a replacement power alternatives facility, the relative economic effect of an influx of workers on the local economy and tax revenue would vary and depend on the size of the workforce and construction completion time. The greatest impact would occur in the communities where the majority of construction workers would reside and spend their income. As a result, some communities could experience a short-term economic boom during construction from increased tax revenue and income generated by expenditures for goods and services and increased demand for temporary (rental) housing. After construction, local communities would likely experience a return to preconstruction economic conditions.

Operation

Before the commencement of startup and operations at a replacement power alternatives facility, local communities would see an influx of operations workers and their families and increased demand for permanent housing and public services. These communities would also experience the economic benefits from increased income and tax revenue generated by the purchase of goods and services needed to operate a new power plant. Consequently, when compared to construction, power plant operations would have a greater potential for effecting permanent, long-term socioeconomic impacts on the region.

3.10.9.2 Transportation

Transportation impacts are defined in terms of changes in level-of-service conditions on local roads near the replacement power plant. Additional vehicles during construction and operations could lead to traffic congestion, level-of-service impacts, and delays at intersections.

Construction

Transportation impacts would consist of commuting workers and truck deliveries of equipment and material to the construction site. Traffic volumes would increase during shift changes. In addition, trucks would deliver equipment and material to the construction site and remove waste material, thus increasing the amount of traffic on local roads. The increase in traffic volumes could result in levels of service impacts and delays at intersections during certain hours of the day. In some instances, construction material could also be delivered and removed by rail.

Operation

Traffic-related transportation impacts on local roads would be greatly reduced after construction has been completed. Transportation impacts would include daily commuting by the operations workforce and deliveries of material, and the removal of commercial waste material.

3.11 Human Health

V.C. Summer is both an industrial facility and a nuclear power plant. Similar to any industrial facility or nuclear power plant, the operation of V.C. Summer during the SLR period would produce various human health risks for workers and members of the public. This section describes the human health risks resulting from the operation of V.C. Summer, including from radiological exposure, chemical hazards, microbiological hazards, electromagnetic fields, and other hazards. The description of these risks is followed by the NRC staff’s analysis of the potential impacts on human health from the proposed action (SLR) and alternatives to the proposed action.

3.11.1 Radiological Exposure and Risk

Operation of a nuclear power plant involves the use of nuclear fuel to generate electricity. Through the fission process, the nuclear reactor splits uranium atoms, resulting very generally in (1) the production of heat, which is then used to produce steam to drive the nuclear power plant’s turbines and generate electricity; and (2) the creation of radioactive byproducts. As required by NRC regulations specified in 10 CFR 20.1101, “Radiation protection programs,” (TN283) Dominion designed a radiation protection program to protect onsite personnel (including employees and contractor employees), visitors, and offsite members of the public from radiation and radioactive material at V.C. Summer. The V.C. Summer radiation protection program is extensive and includes, but is not limited to, the following:

- organization and administration (e.g., a radiation protection manager who is responsible for the program and ensures trained and qualified workers for the program)
- implementing procedures
- an ALARA program to minimize radiation dose to workers and members of the public
- dosimetry program (i.e., measure radiation dose to nuclear power plant workers)
- radiological controls (e.g., protective clothing, shielding, filters, respiratory equipment, and individual work permits with specific radiological requirements)
- radiation area entry and exit controls (e.g., locked or barricaded doors, interlocks, local and remote alarms, personnel contamination monitoring stations)
- posting of radiation hazards (i.e., signs and notices alerting nuclear power plant personnel of potential hazards)
- recordkeeping and reporting (e.g., documentation of worker dose and radiation survey data)
- radiation safety training (e.g., classroom training and use of mockups to simulate complex work assignments)
- radioactive effluent monitoring management (i.e., controlling and monitoring radioactive liquid and gaseous effluents released into the environment)
- radioactive environmental monitoring (e.g., sampling and analysis of environmental media, such as air, water, groundwater, milk, food products, and sediment to measure the levels of radiation emitted into the environment that may impact human health)
- radiological waste management (i.e., controlling, monitoring, processing, and disposing of radioactive solid waste)

To evaluate radiation exposure to V.C. Summer personnel, the NRC staff reviewed the data contained in NUREG-0713, Volume 43, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and other Facilities 2021: Fifty-Fourth Annual Report* (2024-TN9915). The Fifty-Fourth Annual Report was the most recent annual report available at the time of this environmental review. It summarizes the occupational exposure data in the NRC's Radiation Exposure Information and Reporting System database through 2021. Nuclear power plants are required by 10 CFR 20.2206, "Reports of individual monitoring," to report their occupational exposure data to the NRC annually (TN283).

NUREG-0713 contains a calculation of a 3-year average collective dose per reactor for workers at all nuclear power reactors licensed by the NRC. The 3-year average collective dose is one of the metrics that the NRC uses in the Reactor Oversight Process to evaluate the applicant's ALARA program. Collective dose is the sum of the individual doses received by workers at a facility licensed to use radioactive material during a 1-year time period. There are no NRC or EPA standards for collective dose. Based on the data for operating pressurized water reactors like the unit at V.C. Summer, the average annual collective dose per reactor year was 30 person roentgen equivalent man (rem) (NRC 2024-TN9915). In comparison, V.C. Summer had a reported annual collective dose per reactor year of 21 person-rem. Section 3.13.1 of this SEIS discusses offsite dose to members of the public.

3.11.2 Chemical Hazards

The Federal and State environmental agencies regulate the use, storage, and discharge of chemicals, biocides, and sanitary wastes. Such environmental agencies also regulate how facilities like V.C. Summer manage minor chemical spills. Chemical and hazardous wastes can potentially affect workers, members of the public, and the environment.

At V.C. Summer, chemical effects could result from discharge of waste, heavy metal leaching, the use and disposal of chemicals, and chemical spills. Workers may encounter chemicals when adjusting coolant systems, applying biocides, during maintenance activities on equipment containing hazardous chemicals, and when solvents are used for cleaning (Dominion 2023-TN10387).

Dominion currently controls the use, storage, and discharge of chemicals, biocides, and sanitary wastes at V.C. Summer in accordance with its NPDES and other permits, discussed in Section 3.5.1.3 of this SEIS, through the site's industrial safety program, waste management procedures, and hazardous waste contingency plan (2023-TN10387). These nuclear power plant procedures, plans, and processes are designed to prevent and minimize the potential for a chemical or hazardous waste release and, in the event of such a release, minimize the impact on workers, members of the public, and the environment.

There were three inadvertent nonradioactive releases due to V.C. Summer operations from 2017 through 2021 (Dominion 2023-TN10387). As discussed in ER Section E3.6.4.2.2, in June 2020 there was a transmission fluid spill of 1–2 ounces (oz) (29.6–59.1 milliliter [mL]) because of a hydraulic hose leak during equipment testing that was released to the Monticello Reservoir (Dominion 2023-TN10387). This spill was reported to the SCDHEC. This was a non-emergency notification, and the spill did not violate any NRC regulations nor did it exceed any reporting criteria. In September 2021, there was a lift station overflow due to a broken discharge pipe. The overflow was contained in the valve vault, basin gravel, and the nearby concrete surface. None of the overflow reached any storm drains or waters of the state. The release did not exceed any NRC regulations or reporting criteria and, although originally reported to the SCDHEC, the event notification was retracted once it was determined that the lift station overflow did not exceed any Federal, State, or local reporting criteria or violate any permits. In November 2021, the V.C. Summer reactor was manually tripped due to a main transformer fault that released mineral oil. The oil was mixed with a large amount of water from the transformer's suppression system, which surpassed the capacity of the plant's oil/water separator. The separator sump transferred the mixture to internal NPDES Outfall 06B, which drains to Outfall 014 and an oil sheen was observed at Outfall 014. Less than 50 gallons (gal) (189.2 liters [L]) of mineral oil was estimated to have entered the Monticello Reservoir. The oil was contained with booms and cleaned up. The EPA National Response Center and SCDHEC were notified. From the period of January 2022 until April 2024, Dominion confirmed that no reportable inadvertent releases or spills of nonradioactive contaminants occurred (2024-TN10391).

3.11.3 Microbiological Hazards

Microbiological hazards occur when workers or members of the public come into contact with disease-causing microorganisms, also known as etiological agents. Thermal effluents associated with nuclear power plants that discharge to a reservoir, such as V.C. Summer, have the potential to promote the growth of certain thermophilic microorganisms linked to adverse human health effects. Microorganisms of particular concern include several types of bacteria and the free-living amoeba *Naegleria fowleri* (*N. fowleri*). There are optimum growth temperatures for the microorganisms of concern as further discussed in the 2024 LR GEIS (NRC 2024-TN10161).

The public can be exposed to the thermophilic microorganisms during swimming, boating, or other recreational uses of freshwater. If these organisms are naturally occurring and a nuclear power plant's thermal effluent enhances their growth, the public could experience an elevated risk of infection when recreating in the affected waters. Public exposure to *Legionella* spp. from nuclear power plant operation is generally not a concern because exposure risk is confined to cooling towers and related components and equipment, which are typically within the protected area of the site and, therefore, not accessible to the public.

Nuclear power plant workers can be exposed to *Legionella* spp. when performing cooling system maintenance through inhalation of cooling tower vapors because these vapors are often within the optimum temperature range for *Legionella* spp. growth. Nuclear power plant personnel at V.C. Summer who are most likely to come into contact with aerosolized *Legionella* spp. include workers who clean and maintain the condenser tubes. Nuclear power plant workers can also be exposed to *N. fowleri* during cooling water discharges. V.C. Summer has an industrial safety program that includes procedures for entry to cooling water systems where *Legionella* spp. is possible (Dominion 2023-TN10387).

As discussed in Section E2.2 of the Dominion ER (2023-TN10387), V.C. Summer uses a once-through cooling water system that withdraws water from the Monticello Reservoir into its condensers. After the water cools the condenser, the heated water is transferred to a discharge bay and then flows back into the Monticello Reservoir via a 1,000 ft (304.8 m) long discharge canal about 10 ft (3.0 m) below the water surface. The effluent is diluted by the discharge canal's volume and then further diluted by the large volume of the Monticello Reservoir before reaching public areas. The Monticello Reservoir is open to the public for boating, swimming, and fishing but there is a 1 mi (1.6 km) radius exclusion zone surrounding the V.C. Summer site. While swimming in not restricted in the reservoir, the swimming beach that draws the greatest number of swimmers is at the north end of the waterbody. V.C. Summer uses a once-through cooling water system for its condenser circulating cooling but has a mechanical draft cooling tower for the Turbine Building closed-cooling water system. Condenser maintenance involves waterbox entry during outages which is covered by the nuclear power plant's confined space program. The NPDES permit incudes effluent limitations and monitoring requirements and the site has a health and safety program with procedures that implement industrial hygiene practices to minimize the potential for plant worker exposure.

3.11.4 Electromagnetic Fields

Electromagnetic fields (EMFs) are generated by any electrical equipment. All nuclear power plants have electrical equipment and power transmission systems associated with them. Power transmission systems consist of switching stations (or substations) located on the nuclear power plant site and the transmission lines needed to connect the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 hertz (Hz) (60 cycles per second), which is low compared with the frequencies of 55 to 890 megahertz (MHz) for television transmitters and 1,000 MHz and greater for microwaves.

The scope of the evaluation of transmission lines includes only those transmission lines that connect the plant to the switchyard where electricity is fed into the regional power distribution system (encompassing those lines that connect the plant to the first substation of the regional electrical power grid), and power lines that feed the plant from the grid are considered within the regulatory scope of the license renewal environmental review. Transmission lines in scope for V.C. Summer are shown in ER Figure E2.2-1 (Dominion 2023-TN10387). As discussed in Section 2.1.6.5 of this SEIS, the Parr 115 kV transmission corridor continues past the site boundary, but access to the corridor is controlled by Dominion. The 230 kV lines are within the nulcear power plant site's exclusion area.

Electric fields are produced by voltage and their strength increases with increases in voltage. A magnetic field is produced from the flow of current through wires or electrical devices, and its strength increases as the current increases. Electric and magnetic fields, collectively referred to as EMFs, are produced by operating transmission lines.

Occupational workers or members of the public near transmission lines may be exposed to the EMFs produced by the transmission lines. The EMF strength varies in time as the current and voltage change, so that the frequency of the EMF is the same (e.g., 60 Hz for standard alternating current, or AC). Electrical fields can be shielded by objects such as trees, buildings, and vehicles. Magnetic fields, however, penetrate most materials, but their strength decreases with increasing distance from the source. The EMFs resulting from 60 Hz power transmission lines fall under the category of non-ionizing radiation. The LR GEIS (NRC 2024-TN10161) summarizes NRC-accepted studies on the health effects of electromagnetic fields. There are no Federal standards limiting residential or occupational exposure to EMFs from transmission power lines in the United States, but some States have set electric field and magnetic field standards for transmission lines (NIEHS 2002-TN6560). A voluntary occupational standard has been set for EMFs by the International Commission on Non-Ionizing Radiation Protection (1998-TN6591). The National Institute of Occupational Safety and Health does not consider EMFs to be a proven health hazard (1996-TN6766).

3.11.5 Other Hazards

This section addresses two additional human health hazards: (1) physical occupational hazards and (2) occupational electric shock hazards.

Nuclear power plants are industrial facilities that have many of the typical occupational hazards found at any other electric power generation utility. Nuclear power plant workers may perform electrical work, electric powerline maintenance, repair work and maintenance activities, and may be exposed to potentially hazardous physical conditions. A physical hazard is an action, agent or condition that can cause harm upon contact. Physical actions could include slips, trips, and falls from height. Physical agents could include noise, vibration, and ionizing radiation. Physical conditions could include high heat, cold, pressure, confined space, or psychosocial issues, such as work-related stress.

The Occupational Safety and Health Administration (OSHA) is responsible for developing and enforcing workplace safety regulations. Congress created OSHA by enacting the Occupational Safety and Health Act of 1970, as amended (TN4453), to safeguard the health of workers. With respect to nuclear power plants, nuclear power plant conditions that result in an occupational risk, but do not affect the safety of licensed radioactive materials, are under the statutory authority of OSHA rather than the NRC as set forth in a Memorandum of Understanding (2013-TN10165) between the NRC and OSHA. Occupational hazards are reduced when workers adhere to safety standards and use appropriate protective equipment; however, fatalities and injuries caused by accidents may still occur. Dominion maintains a comprehensive industrial safety program for its workers in accordance with OSHA regulations (2023-TN10387).

Based on its evaluation in the LR GEIS (NRC 2024-TN10161), the NRC has not found electric shock resulting from direct access to energized conductors or from induced charges in metallic structures to be a problem at most operating nuclear power plants. Generally, the NRC staff also does not expect electric shock from such sources to be a human health hazard during the SLR period. However, a plant-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this SEIS. Transmission lines that are within the scope of the NRC's SLR environmental review are limited to: (1) those transmission lines that connect the nuclear power plant to the substation where electricity is fed into the regional electrical power grid system, and (2) those transmission lines that supply power to the nuclear power plant from the grid (2024-TN10161).

As discussed in Section 2.1.6.5 of this SEIS, the in-scope transmission lines are located within the site's exclusion area boundary and in a transmission corridor with access controlled by Dominion. These in-scope lines are in compliance with National Electrical Safety Code clearances (Dominion 2023-TN10387). Therefore, there is no potential shock hazard to off-site members of the public from these on-site transmission lines.

3.11.6 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for generic issues related to human health, the impacts of a nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on human health would be SMALL.

Table 3-2 identifies one uncategorized issue (EMFs) and two plant-specific (Category 2) issues (i.e., microbiological hazards to the public, and electric shock hazards) related to human health applicable to V.C. Summer SLR. These issues are analyzed below.

3.11.6.1 Microbiological Hazards to the Public

In the LR GEIS (NRC 2024-TN10161), the NRC staff determined that effect of thermophilic microorganisms on the public for nuclear power plants that use cooling ponds, lakes, canals or that discharge to publicly accessible surface waters is a Category 2 issue that requires plant-specific evaluation during each LR review.

The thermophilic microorganism *N. fowleri* can pose public health concerns in recreational use waters when these organisms are present in high enough concentrations to cause infection. Dominion requested that the SCDHEC provide information on any studies the agency might have conducted concerning thermophilic microorganisms in the Monticello Reservoir and any concerns the agency might have relative to these organisms. SCDHEC's response indicated that public health hazards from thermophilic organisms are largely theoretical and do not represent a significant health threat to offsite users of Monticello Reservoir's waters. SCDHEC also notes in their reply that cooling water from the facility has been discharged into the reservoir for the last 38 years, and no outbreaks of infections from *N. fowleri* or *P. aeruginosa* were associated with recreational activities in the reservoir (Dominion 2023-TN10387). During the proposed SLR term, the public health risk from *N. fowleri* remains extremely low and the proposed action would not result in operational changes that would affect thermal effluent temperature or otherwise create favorable conditions. The NRC staff concludes that the impacts of thermophilic microorganisms on the public due to continued nuclear power plant operations at V.C. Summer during the SLR term would be SMALL because thermal effluent discharges from V.C. Summer during the proposed SLR term would not contribute to the proliferation of microorganisms of concern in the Monticello Reservoir.

3.11.6.2 Effects of Electromagnetic Fields

The LR GEIS (NRC 2024-TN10161) does not designate the chronic effects of 60 Hz EMFs from powerlines as either a Category 1 or 2 issue. Until a scientific consensus is reached about the health implications of EMFs, the NRC will not include them as Category 1 or 2 issues.

The potential for chronic effects from these EMFs continues to be studied and is not known at this time. The NIEHS report (1999-TN78) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement was not sufficient to cause the NRC to change its position with respect to the chronic effects of EMFs. The NRC staff considers the LR GEIS finding of, “Uncategorized (Uncertain impact)” still appropriate and will continue to follow developments on this issue.

3.11.6.3 Electric Shock Hazards

Based on the LR GEIS (NRC 2024-TN10161), the NRC staff found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been identified as a problem at most operating nuclear power plants and generally is not expected to be a problem during the SLR term. However, a plant-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of the V.C. Summer SLR review.

As discussed in Section 2.1.6.5 and Section 3.11.5 of this SEIS, the Parr 115 kV transmission corridor continues beyond the site boundary of the V.C. Summer plant site, but corridor access is controlled by Dominion; therefore, although the corridor is outside the site boundary, it is not accessible to the public (Dominion 2024-TN10391). The 230 kV lines are within the site’s exclusion area. Therefore, there are no potential impacts on members of the public resulting from such transmission lines. There are two transmission corridors onsite containing 115 kV and 230 kV overhead transmission lines with the potential for electric shock to workers through induced currents. To address this occupational hazard, Dominion adheres to the National Electrical Safety Code for clearances and OSHA compliance requirements for shock hazard avoidance (2023-TN10387). As discussed in Section 3.11.5 of this SEIS, V.C. Summer maintains an occupational safety program in accordance with OSHA regulations for its workers, which includes protection from acute electric shock. Therefore, the NRC staff concludes that the potential impacts from acute electric shock during the SLR term would be SMALL.

3.11.6.4 Postulated Accidents

The 2024 LR GEIS evaluates the following two classes of postulated accidents as they relate to license renewal:

- Design-Basis Accidents: Postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety.
- Severe Accidents: Postulated accidents that are more severe than design-basis accidents because they could result in substantial damage to the reactor core.

As shown in Table 3-1 of this SEIS, the LR GEIS (NRC 2024-TN10161) addresses design-basis accidents and severe accidents as Category 1 issues and concludes that the environmental impacts of design-basis accidents and severe accidents are of SMALL significance for all nuclear power plants.

The NRC staff did not identify any new and significant information related to design-basis accidents during its independent review of Dominion's ER, through the scoping process, during the NRC staff's audit of the V.C. Summer ER (2023-TN10387), or in its evaluation of other available information (generic and plant-specific). Therefore, the NRC staff concludes there is no new and significant information on the environmental impacts of design-basis accidents at V.C. Summer during the SLR period that are not already discussed in the SEIS for initial license renewal (NRC 2004-TN7262) or generically evaluated for all nuclear power plants in the 2024 LR GEIS. Therefore, the NRC staff concludes that the potential impacts from design-basis accidents during the SLR term would be SMALL.

Additionally, as shown in Table 3-1 of this SEIS, the LR GEIS (NRC 2024-TN10161) also addressed severe accidents as a Category 1 issue and concluded that the environmental impacts from severe accidents are SMALL for all nuclear power plants. V.C. Summer was specifically included in the plants evaluated in the 2024 LR GEIS. V.C. Summer values (i.e., population dose risk, core damage frequency [CDF] values) were presented in 2024 LR GEIS Tables E.3-1, E.3-6, E.3-8, E.3-10, E.3-11, and E.3-12. As provided in Table E.3-1 of the 2024 LR GEIS, the 2 person-rem/reactor year calculated in the 2004 V.C. Summer severe accident mitigation alternatives (SAMA) analysis is almost three orders of magnitude lower than the 1996 LR GEIS estimate of the V.C. Summer population dose risk value of 1,381 person-rem/reactor year.

The NRC staff did not identify any new and significant information regarding severe accidents during its independent review of Dominion's ER (2023-TN10387), through the scoping process, or during the NRC staff's audit (Dominion 2024-TN10391), that would significantly increase the environmental impact associated with severe accidents above the values previously projected in the 1996 LR GEIS. Therefore, the aggregate effect of new V.C. Summer SLR information is consistent with the expectations of the 2013 and 2024 LR GEISs that the probability-weighted consequences of severe accidents for V.C. Summer are bounded by the 1996 LR GEIS estimates. This reflects a substantial decrease in risk associated with a better understanding of the V.C. Summer internal events CDF. Thus, the NRC staff conclusion is that the overall impact of new and significant information since initial LR on the environmental impacts of severe accidents at V.C. Summer continues to be well below the impact previously evaluated in the 1996 GEIS. Therefore, the conclusion in the 1996, 2013, and 2024 LR GEISs that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are SMALL" continues for V.C. Summer during the SLR period.

As part of its initial LR application submitted in 2002, the applicant included a SAMA analysis for V.C. Summer in its LR ER (SCE&G 2002-TN10558). As part of its review of the initial V.C.

Summer LR application, the NRC staff reviewed the analysis of SAMAs in Supplement 15 to NUREG-1437 (NRC 2004-TN7262).

Because the NRC staff has previously considered SAMAs for V.C. Summer, Dominion is not required to perform another SAMA analysis for its subsequent license renewal application (10 CFR 51.53(c)(3)(ii)(L)-TN10253). In its SLR application ER, Dominion evaluated areas of new and potentially significant information that could affect the environmental impact of postulated severe accidents during the SLR period (2023-TN10387). Dominion stated in its ER that it used the methodology in NEI 17-04, Revision 1, “Model SLR New and Significant Assessment Approach for SAMA,” (2019-TN6815) to evaluate new and significant information as it relates to the V.C. Summer SLR SAMAs. NEI 17-04 is endorsed in Regulatory Guide 4.2, Supplement 1, Revision 2 (NRC 2024-TN10280).

Table E4.15-1 of the V.C. Summer SLR ER, as modified by responses to NRC staff RAIs (Dominion 2024-TN10391), presented the quantitative screening results from the bounding SAMA evaluations. As modified, this table demonstrates that none of the quantitative screening evaluations resulted in a reduction in the aggregate Level 2 frequency greater than 50 percent. In response to an NRC staff RAI (Dominion 2024-TN10391), the applicant clarified that consistent with the NEI 17-04 methodology (2019-TN6815), the quantitative assessment considered reduction in CDF as well as in each individual Level 2 release category that contributed more than one percent to plant risk. The applicant further stated that for all but one SAMA evaluation case (steam generator tube rupture), neither the CDF nor any one of the consequential release category frequencies are reduced by more than 50 percent. For the SAMA evaluation case (steam generator tube rupture), the reduction in large early release frequency exceeded 50 percent (i.e., 61 percent). The applicant, however, identified modeling conservatisms and stated that if the conservatisms were removed, the reduction in CDF and all consequential release category frequencies, including large early release frequency, would all be well below the 50 percent threshold.

The NRC staff reviewed V.C. Summer’s onsite information process during a virtual audit (NRC 2024-TN10551). RAIs and requests for confirmation of information (NRC 2024-TN10551) were submitted to Dominion, and the NRC staff found that the Dominion responses (2024-TN10391) were sufficient to complete the review. Further, the NRC staff did not find any potentially new and significant SAMAs.

Based on the NRC staff’s review and evaluation of Dominion’s analysis of new and potentially significant information regarding SAMAs and the NRC staff’s independent analyses as described above, the staff finds that there is no new and significant information for V.C. Summer related to SAMAs.

3.11.7 No-Action Alternative

Under the no-action alternative, the NRC would not issue the subsequent renewed license, and V.C. Summer would shut down on or before the expiration of the current renewed license. Human health risks would be smaller following nuclear power plant shutdown. The reactor unit, which currently operates within regulatory limits, would emit less radioactive gaseous, liquid, and solid material to the environment. In addition, following shutdown, the variety of potential accidents at the nuclear power plant (radiological or industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. In Section 3.11.6 of this SEIS, the NRC staff concluded that the impacts of continued nuclear power plant operation on human health would be SMALL, except for “Chronic Effects of Electromagnetic Fields (EMFs),” for which the impacts are UNCERTAIN. In Section 3.11.6.4 of this SEIS, the NRC staff concluded that the impacts of accidents during operation are SMALL. Therefore, as radioactive emissions to the environment decrease, and as the likelihood and types of accidents decrease following shutdown, the NRC staff concludes that the risk to human health under the no-action alternative would be SMALL.

3.11.8 Replacement Power Alternatives: Common Impacts

Impacts on human health from the construction of a replacement power alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules, the use of personal protective equipment, training, and placement of engineered barriers would limit those impacts on workers to acceptable levels.

The human health impacts from the operation of a power station include public risk from inhalation of gaseous emissions. Regulatory agencies, including EPA and State of South Carolina agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits to protect human health.

3.11.9 Natural Gas Alternative

The construction impacts of the natural gas alternative would include those identified in Section 3.11.8 of this SEIS. Because the NRC staff expects that the licensee would limit access to active construction areas to only authorized individuals, consistent with NRC regulations, the impacts on human health from the construction of a natural gas facility would be SMALL.

The human health effects from the operation of the natural gas alternative would include those identified in Section 3.11.8 of this SEIS, as common to the operation of all replacement power alternatives. Health risks may be attributable to nitrogen oxide emissions that contribute to ozone formation (NRC 2024-TN10161). Given the regulatory oversight exercised by the EPA and State agencies, the NRC staff concludes that the human health impacts from the natural gas alternative would be SMALL, except for “Chronic Effects of Electromagnetic Fields (EMFs),” for which the impacts are Uncategorized (UNCERTAIN). Therefore, the NRC staff concludes that the impacts on human health from the operation of the natural gas alternative would be SMALL.

3.11.10 New Nuclear (Small Modular Reactor) Alternative

The construction impacts of the new nuclear (SMR) alternative would include those identified in Section 3.11.8 of this SEIS, described above. Because the NRC staff expects that the licensee would limit access to active construction areas to only authorized individuals, the impacts on human health from the construction of two new nuclear units would be SMALL.

The human health effects from the operation of the new nuclear (SMR) alternative would be similar to those of operating the existing V.C. Summer. SMR designs would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as the plants considered in the NRC staff’s evaluation in the LR GEIS (NRC 2024-TN10161). As such, their impacts would be similar to those at V.C. Summer. As presented in Section 3.11.6 of this SEIS, impacts on human health from the operation of V.C. Summer would be SMALL, except for “Chronic Effects of Electromagnetic Fields (EMFs),” for which the impacts are Uncategorized (UNCERTAIN). Therefore, the NRC staff concludes that the impacts on human health from the operation of the new nuclear alternative would be SMALL.

3.11.11 Natural Gas and Solar Combination Alternative

Impacts on human health from construction of the natural gas and solar combination alternative would include those identified in Section 3.11.8 of this SEIS, as common to the construction of all replacement power alternatives. Because the NRC staff expects that the builder will limit access to the active construction area to only authorized individuals, the impacts on human health from the construction of the natural gas and solar combination alternative would be SMALL.

Impacts to human health during the operation of a natural gas alternative would include those identified in Section 3.11.11 of this SEIS.

Solar PV panels are encased in heavy-duty glass or plastic. Therefore, there is little risk that the small amounts of hazardous semiconductor material that they contain would be released into the environment. In the event of a fire, hazardous PM could be released into the atmosphere. Given the short duration of fires and the high melting points of the materials found in the solar PV panels, the impacts from inhalation would be minimal. Also, the risk of fire at ground-mounted solar installations is minimal because of precautions taken during site preparation, such as the removal of fuels and the lack of burnable materials contained in the solar PV panels. Another potential risk associated with PV systems and fire is the potential for shock or electrocution from contact with a high-voltage conductor. Proper procedures and clear marking of system components should be used to provide emergency responders with appropriate warnings to diminish the risk of shock or electrocution (DOT 2011-TN3942). Solar PV panels do not produce EMFs at levels considered harmful to human health, as established by the International Commission on Non-Ionizing Radiation Protection. These small EMFs diminish significantly with distance and are indistinguishable from normal background levels within several yards (DOT 2011-TN3942). Based on this information, the human health impacts from the operation of the solar PV component for the combination alternative would be SMALL.

Lithium-Ion batteries are used for utility-scale storage and would fall under industrial safety plans, environmental protection rules, and OSHA regulations. Lithium-ion batteries have the potential to catch fire due to an effect called thermal runaway; although an uncommon occurrence, thermal runaway is one of the most recognized safety issues for lithium-ion batteries. The self-perpetuating process can end in battery destruction, release of toxic gases, and has a high risk of fire or explosion (Łukasz et al. 2023-TN9618). Although thermal runaway is a concern, industrial safety practices would limit the impacts on human health and, therefore, overall impacts would be SMALL as part of the solar alternative.

Given the expected compliance with worker and environmental protection rules and the use of personal protective equipment, training, and engineered barriers, the NRC staff concludes that the potential human health impacts for this combination natural gas and solar alternative would be SMALL.

3.11.12 New Nuclear and Solar Combination Alternative

Impacts to human health during the installation and operation of a new nuclear (SMR) alternative would include those identified in Section 3.11.10 of this SEIS. Impacts to human health during the construction and operation of a new solar installation would include those identified in Section 3.11.11 of this SEIS. Therefore, based on this information, the NRC staff concludes that the impact of this combination alternative on human health would be SMALL.

3.12 Environmental Justice

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (59 FR 7629-TN1450), directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law. Although independent agencies, such as the NRC, were only requested, rather than directed, to comply with the EO, NRC Chairman Ivan Selin, in a letter to the President, indicated that the NRC would endeavor to carry out the measures set forth in the EO and the accompanying memorandum as part of the NRC's efforts to comply with the requirements of NEPA (NRC 1994-TN7650). In 2004, the Commission issued its "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040-TN1009), which states that "[t]he Commission is committed to the general goals set forth in EO 12898, and strives to meet those goals as part of its NEPA review process."[1]

The Council on Environmental Quality (CEQ) provides the following information in "Environmental Justice: Guidance Under the National Environmental Policy Act" (1997-TN452):

> **Disproportionately High and Adverse Human Health Effects**
>
> When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable: (a) Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and (b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian Tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and (c) Whether health effects occur in a minority population, low-income population, or Indian Tribe affected by cumulative or multiple adverse exposures from environmental hazards.
>
> **Disproportionately High and Adverse Environmental Effects**
>
> When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable: (a) Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment; and

[1] Executive Order 14096, "Revitalizing Our Nation's Commitment to Environmental Justice for All," Section 4(h) states, "Independent regulatory agencies are strongly encouraged to comply with the provisions of this order and to provide notice to the Chair of the CEQ of their intention to do so. The Chair of CEQ shall make such notices publicly available and maintain a list online of such agencies." Given that the NRC is an independent regulatory agency, staff are awaiting Commission policy direction on addressing environmental justice in NRC NEPA reviews for licensing and regulatory actions in response to EO 14096. Regardless, NRC staff will continue to conduct the analysis of impacts on environmental justice populations consistent with Commission policy.

(b) Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and (c) Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

The following environmental justice analysis assesses whether the proposed action (V.C. Summer SLR and continued operations) causes disproportionately high and adverse human health or environmental effects on minority and low-income populations. The NRC staff also assesses whether any alternatives to the proposed action of license renewal could result in disproportionately high and adverse human health or environmental effects on minority or low-income populations. In assessing the environmental justice impacts, the NRC staff defined minority individuals, minority populations, and low-income population, based on CEQ guidance, as follows (CEQ 1997-TN452):

Minority Individuals

Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races, meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

Minority Populations

Minority populations are identified when (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Minority populations may be communities of individuals living in close geographic proximity to one another or they may be a geographically dispersed or transient set of individuals, such as migrant workers or Native Americans, who, as a group, experience common conditions with regard to environmental exposure or environmental effects. The appropriate geographic unit of analysis may be a political jurisdiction, county, region, or State, or some other similar unit that is chosen so as not to artificially dilute or inflate the affected minority population.

Low-Income Populations

Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P60, on Income and Poverty. Low-income populations may be communities of individuals living in close geographic proximity to one another, or they may be a set of individuals, such as migrant workers or Native Americans, who, as a group, experience common conditions of environmental exposure or effect.

In determining the location of minority and/or low-income populations, the NRC staff uses a 50 mi (80 km) radius from the facility as the geographic area to perform a comparative analysis. The 50 mi (80 km) radius is consistent with the impact analysis conducted for human health impacts. The NRC staff compares the percentage of minority and/or low-income populations in the 50 mi (80 km) geographic area to the percentage of minority and/or low-income populations in each census block group to determine which block groups exceeds the percentage, thereby identifying the location of these populations (2020-TN6399).

Minority Population

According to the USCB’s 2020 Census data, there are a total of 901 block groups within a 50 mi (80 km) radius of the V.C. Summer site, and approximately 40.3 percent of the population residing within a 50 mi (80 km) radius of the V.C. Summer plant identified themselves as minority individuals (USCB 2020-TN10465). The largest minority populations were Black or African-American (approximately 29.7 percent), and Hispanic, Latino, or Spanish origin of any race (approximately 5.3 percent).

According to the CEQ definition, a minority population exists if the percentage of the minority population of an area (e.g., census block group) exceeds 50 percent or is meaningfully greater than the minority population percentage in the general population. The NRC staff’s environmental justice analysis applied the meaningfully greater threshold in identifying higher concentrations of minority populations, with the meaningfully greater threshold being any percentage greater than the minority population within 50 mi (80 km) radius of V.C. Summer. Therefore, for the purposes of identifying higher concentrations of minority populations, census block groups within the 50 mi (80 km) radius of V.C. Summer were identified as minority block groups if the percentage of the minority population in the block group exceeded 40.3 percent, the percent of the minority population within the 50 mi (80 km) radius of V.C. Summer.

Based on this analysis, there are 391 minority block groups within a 50 mi (80 km) radius of V.C. Summer. Therefore, approximately 43.4 percent of block groups within a 50 mi (80 km) radius of V.C. Summer are minority block groups. As shown in Figure 3-12, minority block groups (race and ethnicity) are spread evenly throughout the 50 mi (80 km) radius, with concentrations in Fairfield and Richland counties and adjacent to the site.

Low-Income Population

The USCB’s 2018–2022 American Community Survey data identifies approximately 15.1 percent of individuals residing within a 50 mi (80 km) radius of the V.C. Summer site as living below the Federal poverty threshold (USCB 2022-TN10556). The 2022 Federal poverty threshold was $29,950 for a family of four (USCB 2023-TN10519).

Figure 3-12 below shows the location of predominantly low-income block groups within a 50 mi (80 km) radius of V.C. Summer. In accordance with NRC guidance (NRC 2020-TN6399), census block groups were considered low-income population block groups if the percentage of individuals living below the Federal poverty threshold within the block groups exceeded the percent of the individuals living below the Federal poverty threshold within 50 mi (80 km) radius of the V.C. Summer site.

Based on this analysis, there are 382 low-income block groups within a 50 mi (80 km) radius of the V.C. Summer site. Therefore, approximately 42.4 percent of the block groups within a 50 mi (80 km) radius of the site are low-income population block groups. As shown in Figure 3-12 below, the low-income population block groups are distributed throughout the 50 mi (80 km) radius of V.C. Summer as well as adjacent to the site.

As discussed in Section 3.10.2 of this SEIS, according to the USCB’s 2018–2022 American Community Survey 5 Year Estimates, people living in Fairfield, Richland and Newberry Counties had a median household income lower than the State average while people living in the

Lexington County had a household income higher than the State average. Additionally, the percentages of individuals living below the poverty level in Richland County, Newberry County, and Fairfield County are higher than the State average.

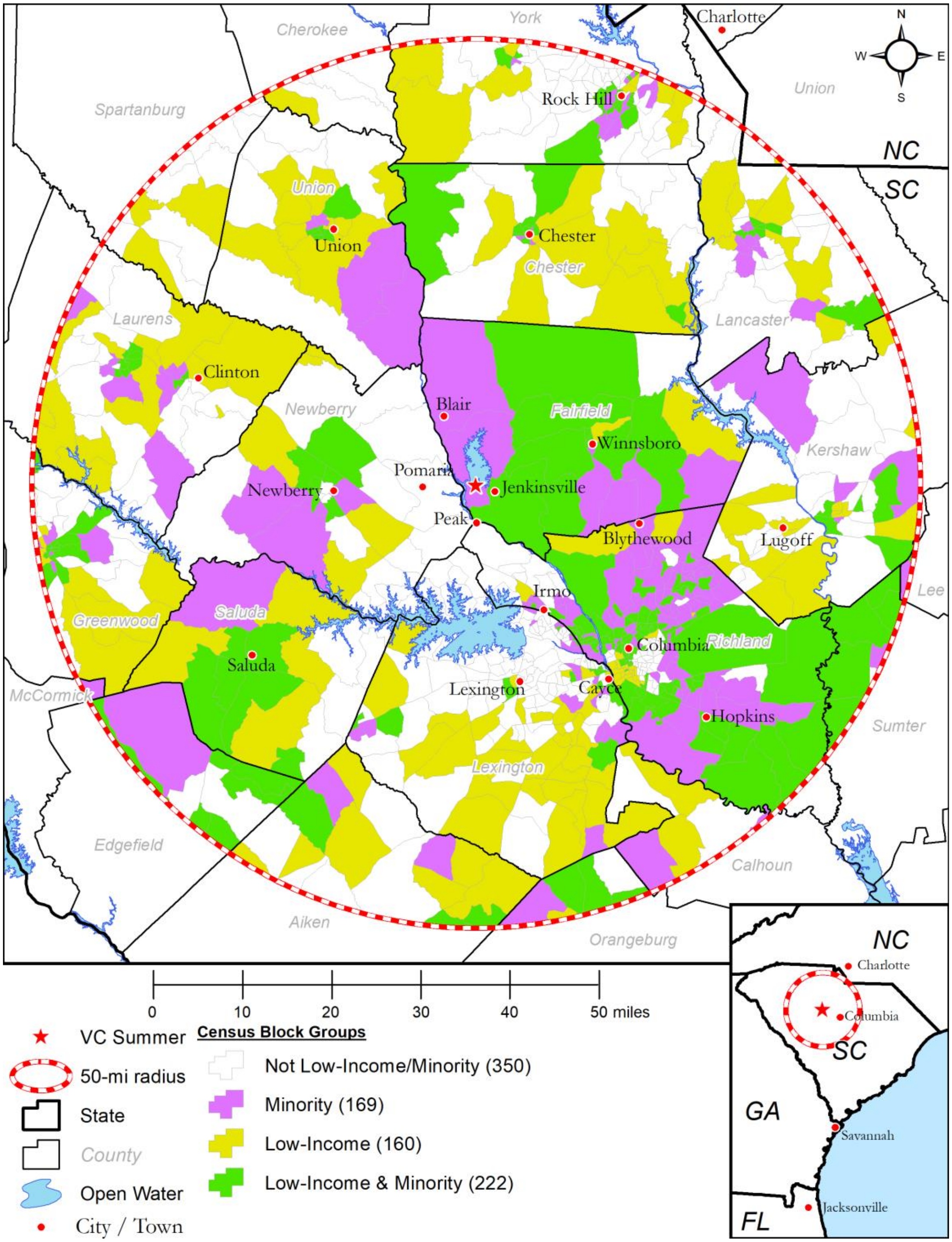


Figure 3-12 Minority and Low-Income Block Groups within a 50 mi (80 km) Radius of Virgil C. Summer Nuclear Station, South Carolina. Source: USCB 2022-TN10556, USCB 2023-TN10465.

3.12.1 Proposed Action

As documented in the 2024 LR GEIS (NRC 2024-TN10161) and shown in Table 3-2 of this SEIS, the NRC staff identified one plant-specific Category 2 issue related to environmental justice applicable to V.C. Summer during the SLR term. This Category 2 issue (Impacts on minority populations, low-income populations, and Indian Tribes) is analyzed below.

3.12.1.1 Minority and Low-Income Populations

The NRC addresses environmental justice matters for LR and SLR by: (1) identifying the location of minority and low-income populations that may be affected by the continued operation of the nuclear power plant during the license renewal term; (2) determining whether there would be any potential human health or environmental effects on these populations and special pathway receptors (groups or individuals with unique consumption practices and interactions with the environment; and (3) determining whether any of the effects may be disproportionately high and adverse.

Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high and adverse environmental effects refer to impacts or risks of impacts on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts.

Figure 3-12 shows the location of predominantly minority or low-income population block groups residing within a 50 mi (80 km) radius of the V.C. Summer site. This area of impact is consistent with the 50 mi (80 km) impact analysis for public and occupational health and safety. This chapter of this SEIS presents the assessment of environmental and human health impacts for each resource area. The analyses of impacts for all environmental resource areas indicated that the impact from SLR would be SMALL.

Potential impacts on minority and low-income populations (including migrant workers or Indian Tribes) would mostly consist of socioeconomic and radiological effects; however, radiation doses from continued operations during the SLR term are expected to continue at current levels, and they would remain within regulatory limits. Section 3.11.6.4 of this SEIS discusses the environmental impacts from postulated accidents that might occur during the SLR term, which include both design-basis and severe accidents. In both cases, the Commission has generically determined that impacts associated with design-basis accidents are small because nuclear power plants are designed and operated to withstand such accidents, and the probability-weighted consequences of severe accidents are SMALL.

Minority and low-income populations near V.C. Summer could experience human health and environmental effects from the continued operations. Based on the information and the analysis presented in this chapter, all human health and environmental impacts from the continued operation of V.C. Summer would be SMALL. Consequently, minority and low-income populations would not likely experience disproportionately high and adverse human health and environmental effects from the proposed action and the continued operation of V.C. Summer.

Subsistence Consumption of Fish and Wildlife

As part of addressing environmental justice concerns associated with V.C. Summer SLR, the NRC also assessed the potential radiological risk to special population groups (such as migrant workers or Indian Tribes) from exposure to radioactive material received through their unique consumption practices and interactions with the environment. Such exposure could occur through subsistence consumption of fish, wildlife, and native vegetation; contact with surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of airborne radioactive material released from the nuclear power plant during routine operation. The special pathway populations analysis is an important part of the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Section 4–4 of EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," (59 FR 7629-TN1450) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations that rely principally on fish and/or wildlife for subsistence and to communicate to the public the risks of these consumption patterns. In this SEIS, the NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts on American Indians, Hispanics, migrant workers, and other traditional lifestyle special pathway populations. Dominion queried V.C. Summer staff to identify whether there are any subpopulations near the V.C. Summer site that engage in a subsistence-like lifestyle (2023-TN10387). Dominion did not identify subsistence activity in the vicinity of the V.C. Summer site (2023-TN10387). In 2009, the NRC conducted detailed local reconnaissance as part of the environmental review for the Units 2 and 3 combined construction and operating license in which local community engagement revealed that subsistence fishing, hunting, and backyard gardening are practiced in the local vicinity of V.C. Summer, including the Monticello Reservoir, the Broad River, and in the Jenkinsville, Dawkins, and Blair communities (2010-TN10520). However, that detailed environmental review did not identify any disproportionately high and adverse impacts to subsistence resource practices from proposed construction or operations activities (NRC 2011-TN1723).

The assessment of special pathways considered the levels of radiological contaminants in air, drinking water, surface water, vegetation, fish, and shoreline sediment on or near the V.C. Summer plant. Radionuclides released to the atmosphere may deposit on soil and vegetation and may therefore eventually be incorporated into the human food chain. To assess the impact of reactor operations on humans from the ingestion pathway, Dominion collects and analyzes samples of air, water, sediment, fish, vegetation, if available, for radioactivity as part of its ongoing, comprehensive REMP. Each year a REMP land use census is conducted to assess the contribution of radionuclides to the environment resulting from V.C. Summer operation. The census is conducted within a 5 mi (8 km) radius of the V.C. Summer site with the locations of the nearest resident, available milk animal, and vegetable garden being recorded and mapped. The results for each sample type are discussed in the publicly available annual radiological environmental operating reports and compared to historical data to determine if there are any observable trends.

The REMP results for 2021 and 2022 concluded that there are no discernable trends or increase in radiological parameters when comparing current monitoring results to pre-operational studies. There is no detectable radiological effect on the surrounding environment due to operation of V.C. Summer (Dominion 2023-TN10387).

Based on the REMP data, special pathway receptor populations in the region would not likely experience disproportionately high and adverse human health impacts because of subsistence consumption. In addition, the continued operation of V.C. Summer would not have disproportionate and adverse human health and environmental effects on these populations.

3.12.2 No-Action Alternative

Under the no-action alternative, the NRC would not renew the operating license, and V.C. Summer would permanently shut down on or before the expiration of the current renewed facility operating license. Impacts on minority and low-income populations would depend on the number of jobs and the amount of tax revenues lost by communities in the immediate vicinity of the nuclear power plant after it ceases operations. Not renewing the operating license and terminating reactor operations could have a noticeable impact on socioeconomic conditions in the communities located near the V.C. Summer site. The loss of jobs and income could have an immediate socioeconomic impact. Some, but not all, of the approximately 989 permanent workers could leave the area. In addition, the V.C. Summer plant would generate less tax revenue, which could reduce the availability of public services. This reduction could disproportionately affect minority and low-income populations that may have become dependent on these services.

3.12.3 Replacement Power Alternatives: Common Impacts

The following discussions identify common impacts from the construction and operation of energy generating facilities that could disproportionately affect minority and low-income populations. Disproportionately high and adverse human health and environmental effects on minority and low-income populations would depend on the specific site location, power plant design, and operational characteristics of the new energy generating facility. These discussions encompass the specific impacts of each of the replacement power alternatives, which are the natural gas, new nuclear (small modular reactor), natural gas and solar combination, and new nuclear and solar combination.

<u>Construction</u>

Potential impacts to minority and low-income populations from the construction of a replacement power plant would mostly consist of environmental (e.g., noise, dust, and traffic) and socioeconomic effects (employment and housing impacts). The extent of the effects experienced by these populations is difficult to determine because it would depend on the specific location of the energy generating facility and affected transportation routes. Noise and dust impacts from construction would be short-term and primarily limited to onsite activities. Minority and low-income populations residing near access roads would be affected by increased truck and commuter vehicle traffic during construction, especially during shift changes. However, these effects would be temporary, limited to certain hours of the day, and would not likely be high and adverse. Increased demand for temporary housing during construction could disproportionately affect low-income populations reliant on low-cost rental housing. However, given the proximity of V.C. Summer to the Columbia metropolitan area, construction workers could commute to the site, thereby reducing the potential local demand for rental housing.

<u>Operation</u>

Minority and low-income populations living near new replacement power generating facilities that rely on subsistence consumption of fish and wildlife could be disproportionately affected. Emissions during power plant operations could disproportionately affect nearby minority and low-income populations, depending on the type(s) of replacement power generation facility. However, to operate, emissions must remain within regulatory limits.

<u>Conclusion</u>

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, it is unlikely that a new energy generating facility would be constructed and allowed to operate in a manner that would result in disproportionately high and adverse human health and environmental effects on minority and low-income populations. However, this determination would also depend on the specific location, power plant design, and operational characteristics of the energy generating facility. Ultimately, the NRC staff cannot determine whether the replacement power alternatives (i.e., natural gas, new nuclear [small modular reactor], natural gas and solar combination, and new nuclear and solar combination) would result in disproportionately high and adverse human health and environmental effects on minority and low-income populations.

3.13 Waste Management

Like any operating nuclear power plant, V.C. Summer would produce both radioactive and nonradioactive waste during the SLR period. This section of the SEIS describes waste management and pollution prevention at V.C. Summer. The description of these waste management activities is followed by the NRC staff's analysis of the potential impacts of waste management activities from the proposed action (SLR) and alternatives to the proposed action.

3.13.1 Radioactive Waste

The NRC licenses nuclear power plants with the expectation that they will release a limited amount of radioactive material to both the air and water during normal operations. The NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants meet radiation dose-based limits specified in 10 CFR Part 20 (TN283), "Standards for Protection Against Radiation," and the ALARA criteria in 10 CFR Part 50 (TN249), Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." In other words, the NRC places regulatory limits on the radiation dose that members of the public can receive from radioactive effluents of a nuclear power plant. For this reason, all nuclear power plants use radioactive waste management systems to control and monitor radioactive wastes.

V.C. Summer uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of nuclear power plant operations. Radioactive materials in liquid, gaseous, and solid effluents are reduced before being released into the environment so that the resultant dose to members of the public from these effluents is well within the NRC and EPA dose standards. Radionuclides that can be efficiently removed from the liquid and gaseous effluents before release are converted to a solid waste form for disposal in a licensed disposal facility.

Dominion maintains a REMP to assess the radiological impact, if any, to the public and the environment from radioactive effluents released during operations at V.C. Summer (2023-TN10387).

Dominion has an ODCM that contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from V.C. Summer meet NRC and EPA regulatory dose standards. The ODCM also contains the requirements for the REMP (ODCM) (Dominion 2020-TN10557).

3.13.1.1 Radioactive Liquid Waste Management

Dominion uses waste management systems to collect, analyze, and process radioactive liquids produced at V.C. Summer. The V.C. Summer liquid waste processing system (LWPS) meets the design objectives of 10 CFR Part 50 (TN249), Appendix I, and controls the processing, disposal, and release of radioactive liquid wastes.

The LWPS consists of five collection systems: (1) the waste holdup tank; (2) the floor drain tank; (3) the laundry and hot shower tank; (4) the excess LWPS; and (5) the laboratory drain system, wastewater treatment and spent resin processing. Liquid effluent is sampled before discharge. Based on the laboratory analysis, liquid effluents are either released under controlled conditions via the penstocks of the Fairfield Pumped Storage Facility or retained for further processing with eventual release to the circulating discharge canal or the Fairfield Pumped Storage Facility penstocks. Otherwise, the liquid waste may be reused in the plant.

The liquid waste disposal system was designed to receive, process, and discharge potentially radioactive liquid waste. Holdup capacity is provided for retention of liquid effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment. Radioactive fluids entering the waste disposal system are processed or collected in tanks until a determination of subsequent treatment can be made. The waste is sampled and analyzed to determine the quantity of radioactivity. Liquid wastes are processed as required and then released under controlled conditions. In summary, the liquid waste effluent is diluted as necessary to permissible concentration limits. Waste released from the three units is integrated and controlled by process radiation monitors, interlocks, and by the operator, to ensure that it does not exceed the station release limits.

All liquid wastes are monitored prior to release to ensure that they will not exceed the limits of 10 CFR Part 20 (TN283). The radiation monitoring system monitors the effluent, closing the discharge valve if the amount of radioactive material in the effluent exceeds preset values. Dominion performs offsite dose calculations based on effluent samples obtained at this release point to ensure that the limits of 10 CFR Part 50 (TN249), Appendix I are not exceeded. The ODCM prescribes the alarm/trip setpoints for the liquid effluent radiation monitors. Dominion's use of these radiological waste systems and the procedural requirements in the ODCM provides assurance that the dose from radiological liquid effluents at V.C. Summer complies with NRC and EPA regulatory dose standards. Dominion calculates dose estimates for members of the public using radiological liquid effluent release data.

Dominion's annual radioactive effluent release reports contain a detailed presentation of liquid effluents released from V.C. Summer and the resultant calculated doses (2024-TN10415). These reports are publicly available on the NRC's website (https://www.nrc.gov/).

The NRC staff reviewed five years of radioactive effluent release data from 2019 through 2023 (Dominion 2020-TN10411, Dominion 2021-TN10412, Dominion 2022-TN10413, Dominion 2023-TN10414, Dominion 2024-TN10415). This period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance, which can affect the generation of radioactive effluents into the environment. The NRC staff compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels or increasing radioactivity levels).

As discussed below, effluent release data for the 5-year period analyzed by the NRC staff were found to be well below regulatory standards. For example, the calculated doses from radioactive liquid effluents released from V.C. Summer during 2023 (Dominion 2024-TN10415) are summarized below:

- The total-body dose to an offsite member of the public from V.C. Summer radioactive effluents was 6.74×10^{-3} millirem (mrem) (6.74×10^{-5} millisievert [mSv]), which is well below the 3 mrem (0.03 mSv) dose criterion in Appendix I to 10 CFR Part 50 (TN249).
- The maximum organ dose (gastrointestinal tract) to an offsite member of the public from V.C. Summer radioactive effluents was 8.15×10^{-3} mrem (8.15×10^{-5} mSv), which is well below the 10 mrem (0.1 mSv) dose criterion in Appendix I to 10 CFR Part 50.

The NRC staff's review of Dominion's radioactive liquid effluent control program shows that radiation doses to members of the public were maintained within NRC and EPA radiation protection standards, as contained in Appendix I to 10 CFR Part 50 (TN249), 10 CFR Part 20 (TN283), and Title 40, "Protection of Environment," of 40 CFR Part 190 (TN739), "Environmental Radiation Protection Standards for Nuclear Power Operations." The NRC staff observed no adverse trends in the dose levels.

During the SLR term, Dominion will continue to perform routine nuclear power plant refueling and maintenance activities. Based on Dominion's past performance in operating a radioactive waste system at V.C. Summer that maintains ALARA doses from radioactive liquid effluents, the NRC staff expects that Dominion will maintain similar performance during the SLR term.

3.13.1.2 Radioactive Gaseous Waste Management

Radioactive gaseous wastes develop from gases in liquid contained in tanks and piping at V.C. Summer. The gaseous wastes are monitored and released at an acceptable rate designated by the ODCM. The ODCM determines the effluent release rate to ensure that releases are within predetermined limits, which ascertains compliance with dose limitations of licensee commitments (Dominion 2020-TN10557). The gaseous radioactive waste systems provide gas holdup for decay, and the site releases the gases under controlled conditions.

Dominion calculates dose estimates for members of the public based on radioactive gaseous effluent release data and atmospheric transport models. Dominion's annual radioactive effluent release reports present in detail the radiological gaseous effluents released from V.C. Summer and the resultant calculated doses. As described above in Section 3.13.1.1, the NRC staff reviewed five years of radioactive effluent release data from the 2019 through 2023 reports (Dominion 2020-TN10411, Dominion 2021-TN10412, Dominion 2022-TN10413, Dominion 2023-TN10414, Dominion 2024-TN10415). The NRC staff compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels) over the period.

As a representative year, the following summarizes the calculated doses from radioactive gaseous effluents released from V.C. Summer during 2023 (Dominion 2024-TN10415):

- The air dose due to noble gases with resulting gamma radiation in gaseous effluents was 4.76×10^{-4} millirad (mrad) (4.76×10^{-6} milligray), which is well below the 10 mrad/yr (0.1 milligray/yr) dose criterion in Appendix I to 10 CFR Part 50 (TN249).

- The air dose from beta radiation in gaseous effluents was 1.74×10^{-4} mrad (1.74×10^{-6} milligray), which is well below the 20 mrad/yr (0.2 milligray/yr) dose criterion in Appendix I to 10 CFR Part 50 (TN249).

- The critical organ dose to an offsite member of the public from radiation in gaseous effluents as a result of radioisotopes of iodine, particulates, tritium gases and carbon-14 was 2.03×10^{-2} mrem (2.03×10^{-4} mSv), which is below the 15 mrem/yr (0.15 mSv/yr) dose criterion in Appendix I to 10 CFR Part 50 (TN249).

The NRC staff's review of the V.C. Summer radioactive gaseous effluent control program showed radiation doses to members of the public that were well below NRC and EPA radiation protection standards contained in Appendix I to 10 CFR Part 50 (TN249), 10 CFR Part 20 (TN283), and 40 CFR Part 190 (TN739). The NRC staff observed no adverse trends in the dose levels over the five years reviewed.

During the SLR term, Dominion will continue to perform routine nuclear power plant refueling and maintenance activities. Based on Dominion's past performance in operating a radioactive waste system at V.C. Summer that maintains ALARA doses from radioactive gaseous effluents, the NRC staff expects that V.C. Summer will maintain similar performance during the SLR term.

3.13.1.3 Radioactive Solid Waste Management

V.C. Summer's solid waste disposal system provides for packaging and/or solidification of radioactive waste that will subsequently be shipped offsite to an approved burial facility. These activities reduce the amount of waste shipped for offsite disposal. Solid radioactive wastes are logged, processed, packaged, and stored for subsequent shipment and offsite burial. Solid radioactive wastes and potentially radioactive wastes include reactor components, equipment and tools removed from service, chemical laboratory samples, spent resins, used filter cartridges, and radioactively contaminated hardware, as well as compacted wastes such as contaminated protective clothing, paper, rags, and other trash generated from nuclear power plant design modifications and operations, and routine maintenance activities. In addition, nonfuel solid wastes result from treating and separating radionuclides from gases and liquids, and from removing containment material from various reactor areas.

3.13.1.4 Radioactive Waste Storage

At V.C. Summer, low-level radioactive waste (LLRW) is stored temporarily onsite at a low-level waste storage facility before being shipped offsite for processing or disposal at licensed LLRW treatment and disposal facilities. V.C. Summer has contracts with Alaron Nuclear Services, UniTech Services Group, and Energy*Solutions*—Barnwell Processing Facility for the processing and disposal of all radiologically contaminated material. LLRW is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A includes both dry active waste and processed waste (e.g., dewatered resins). Classes B and C normally include a low percentage of the LLRW generated. Radioactive waste that is greater than Class C waste is the responsibility of the Federal government. Low-level mixed waste is managed through Dominion's site procedures that meet the requirements of the SCDHEC Hazardous Waste Management Regulations. Dominion uses a contractor to characterize, label, and manifest the waste, and transport it to a facility that can encapsulate, treat, or otherwise prepare the waste for disposal. As indicated in Dominion's ER and as discussed with the NRC staff during the virtual audit (2024-TN10391), V.C. Summer has sufficient existing capability to store all generated LLRW onsite. No additional construction of onsite storage facilities is necessary for LLRW storage during the subsequent period of extended operation (Dominion 2023-TN10387).

V.C. Summer stores spent fuel in a spent fuel pool and in an onsite ISFSI. The ISFSI safely stores spent fuel onsite in licensed and approved dry cask storage containers. Spent fuel is stored in the ISFSI under the general license. Section E2.2.6.4 of the Dominion ER states that the ISFSI concrete pad is designed to store the spent fuel generation for 80 years of operation.

3.13.1.5 Radiological Environmental Monitoring Program

Dominion maintains a REMP to assess the radiological impact, if any, to the public and the environment from V.C. Summer operations. The REMP measures the aquatic, terrestrial, and atmospheric environment for ambient radiation and radioactivity. Monitoring is conducted for the following: direct radiation, air, precipitation, well water, river water, surface water, milk, food products and vegetation (such as edible broad leaf vegetation), fish, silt, and shoreline sediment. The REMP also measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). As part of the REMP, Dominion conducts analyses of selected wells for the presence of gamma emitters and tritium in groundwater on a quarterly basis (2023-TN10387).

The NRC staff reviewed five years of annual radiological environmental monitoring data from 2019 through 2023 (SCE&G 2019-TN10422; Dominion 2020-TN10416, Dominion 2021-TN10417, Dominion 2022-TN10418, Dominion 2023-TN10419, Dominion 2024-TN10420). This period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance that can affect the generation and release of radioactive effluents into the environment. The NRC reviewed the data for indications of adverse trends (i.e., increasing radioactivity levels) over the period of 2019 through 2023.

In addition to the REMP, Dominion established an onsite groundwater protection initiative program in 2008 in accordance with NEI 07-07, "Industry Groundwater Protection Initiative" (NEI 2007-TN1913). This program monitors the onsite nuclear power plant environment to detect leaks from nuclear power plant systems and pipes containing radioactive liquid. Section 3.5.2.3, of this SEIS contains information on V.C. Summer's groundwater protection initiative program.

Based on its review of the REMP data, the NRC staff finds no apparent increasing trend in concentration or pattern indicating persistently high tritium or other radionuclide concentration that might indicate an ongoing inadvertent release from V.C. Summer. The groundwater monitoring program data at V.C. Summer show that Dominion monitors, characterizes, and actively remediates spills, and that there were no significant radiological impacts to the offsite environment from operations at V.C. Summer.

3.13.2 Nonradioactive Waste

V.C. Summer generates nonradioactive waste as a result of nuclear power plant maintenance, cleaning, and operational processes. V.C. Summer manages nonradioactive wastes in accordance with applicable Federal and State regulations, as implemented through its corporate procedures. V.C. Summer generates and manages hazardous wastes, nonhazardous wastes, and universal wastes. Dominion maintains a list of waste vendors that it has approved for use across the entire company to remove and dispose of the nonradioactive wastes offsite (2023-TN10387).

Waste minimization and pollution prevention are important elements of operations at all nuclear power plants. Licensees are required to consider pollution prevention measures as dictated by the Pollution Prevention Act (Public Law 101 5084 TN6607) and the Resource Conservation and Recovery Act of 1976, as amended (Public Law 94 580 TN1281).

The Resource Conservation and Recovery Act governs the disposal of solid waste. The SCDHEC is authorized by the EPA to implement the Resource Conservation and Recovery Act and regulate solid and hazardous waste in South Carolina (Dominion 2023-TN10387). V.C. Summer has a nonradioactive waste management program to handle nonradioactive waste in accordance with Federal, State, and corporate regulations and procedures. V.C. Summer maintains a waste minimization program that uses material control, process control, waste management, recycling, and feedback to reduce waste.

The V.C. Summer SWPPP identifies potential sources of pollution that may affect the quality of stormwater discharges from permitted outfalls. The SWPPP also describes best management practices for reducing pollutants in stormwater discharges and assuring compliance with the site's NPDES permit (Dominion 2023-TN10387).

V.C. Summer also has an environmental management system (Dominion 2023-TN10387). Procedures are in place to monitor areas within the site that have the potential to discharge oil into or on navigable waters, in accordance with the regulations in 40 CFR Part 112, "Oil Pollution Prevention" (TN1041). The Pollution Incident/Hazardous Substance Spill Procedure identifies and describes the procedures, materials, equipment, and facilities that Dominion uses to minimize the frequency and severity of oil spills at V.C. Summer.

V.C. Summer is subject to the EPA reporting requirements in 40 CFR Part 110, "Discharge of Oil," under CWA Section 311(b)(4) (TN8485). Under these regulations, V.C. Summer must report to the U.S. Coast Guard National Response Center any discharges of oil if the quantity may be harmful to the public health or welfare or to the environment. Based on the NRC staff's review of Section E9.5.3.6 of the Dominion ER (2023-TN10387) and a review of records from 2017–2021, there have been two releases at V.C. Summer that were reported (2023-TN10387). In November 2021, less than 50 gal (189.2 L) of mineral oil was estimated to have entered the Monticello Reservoir. In 2020, and in accordance with 10 CFR 50.72(b)(2)(xi), V.C. Summer reported a transmission fluid spill to the SCDHEC, resulting in 1 to 2 oz (29 to 59 mL) of transmission fluid being released into the Monticello Reservoir (TN249). This spill did not violate any NRC regulations or reporting criteria.

V.C. Summer is also subject to the reporting provisions of SC R. 61-92.280.60 which requires reporting the release of a regulated substance from an underground storage tank containing a petroleum product or hazardous substance. Based on the NRC staff's review of Section E9.5.13.6 of the Dominion ER (2023-TN10387) and a review of records from 2019–2023, no reportable spills under the reporting provisions of SC R. 61-92.280.60 occurred to date. In addition, the applicant confirmed that there have been no reportable spills that would trigger this notification requirement since the ER was written (Dominion 2024-TN10391).

3.13.3 Proposed Action

As described in the 2024 LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1 for generic issues related to waste management, the impacts of nuclear power plant SLR and continued operations would be SMALL during the SLR term. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of V.C. Summer on waste management during the SLR term would be SMALL.

The ultimate disposal of spent fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this review. Per 10 CFR Part 51 (10 CFR Part 51-TN10253) Subpart A, Appendix B, the Commission concludes that the impacts presented in NUREG-2157 (NRC 2014-TN4117) would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 (TN4878) should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants. There are no plant-specific (Category 2) waste management issues applicable to V.C. Summer.

3.13.4 No-Action Alternative

Under the no-action alternative, V.C. Summer would cease operation at the end of the term of the current renewed facility operating license or sooner and enter decommissioning. After entering decommissioning, the nuclear power plant would generate less spent nuclear fuel, emit less gaseous and liquid radioactive effluents into the environment, and generate less low-level radioactive and nonradioactive wastes. In addition, following shutdown, the variety of potential accidents at the nuclear power plant (radiological and industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. Therefore, as radioactive emissions to the environment decrease, and the likelihood and variety of accidents decrease following shutdown and decommissioning, the NRC staff concludes that impacts resulting from waste management from implementation of the no-action alternative would be SMALL.

3.13.5 Replacement Power Alternatives: Common Impacts

Impacts from waste management common to all analyzed replacement power alternatives would be from construction-related nonradiological debris generated during construction activities. This waste would be recycled or disposed of in approved landfills.

3.13.6 Natural Gas Alternative

Impacts from the waste generated during the construction of the natural gas combined-cycle would include those identified in Section 3.13.5 of this SEIS as common to all replacement power alternatives.

Waste generation from operation of the natural gas technology would be minimal. The only significant waste generated at a natural gas combined-cycle power plant would be spent selective catalytic reduction catalyst (plants use selective catalytic reduction catalyst to control nitrogen oxide emissions). This spent catalyst is considered hazardous and would be disposed of at a facility that handles hazardous materials. Other than the spent selective catalytic reduction catalyst, waste generation at an operating natural gas-fired plant would be limited largely to typical operations and maintenance of nonhazardous waste. Based on this information, the NRC staff concludes that the waste impacts for the natural gas combined-cycle alternative would be SMALL.

3.13.7 New Nuclear (Small Modular Reactor) Alternative

Impacts from the waste generated during the construction of the new nuclear alternative would include those identified in Section 3.13.5 above, as common to all replacement power alternatives. During normal nuclear power plant operations, routine nuclear power plant maintenance and cleaning activities would generate radioactive low-level waste, spent nuclear fuel, high-level waste, and nonradioactive waste. Sections 3.13.1 and 3.13.2 of this SEIS discuss radioactive and nonradioactive waste management at V.C. Summer. Advanced light-water reactors would use the same type of fuel (i.e., form of the fuel, enrichment, burnup, and fuel cladding) as those nuclear power plants considered in the NRC staff's evaluation in the LR GEIS (NRC 2024-TN10161). As such, all wastes generated would be similar to those generated at V.C. Summer. According to the LR GEIS, the NRC does not expect the generation and management of solid radioactive and nonradioactive waste during the SLR term to result in significant environmental impacts. Based on this information, the NRC staff concludes that the impacts on waste from the operation of the new nuclear alternative would be SMALL.

3.13.8 Natural Gas and Solar Combination Alternative

Impacts from the waste generated during the construction of a natural gas plant would include those identified in Section 3.13.5 and Section 3.13.6 of this SEIS.

The construction of the solar PV facilities would create sanitary and industrial waste. This waste could be recycled or shipped to an offsite waste disposal facility. The battery storage system at each solar installation would have to be replaced after several years of operation; however, much of the components are recyclable, thereby minimizing the waste generation. All the waste would be handled in accordance with appropriate South Carolina regulations. Impacts on waste management resulting from the construction and operation of the solar PV facilities of the combination alternative would be minimal. In summary, the NRC staff concludes that the waste management impacts resulting from the construction and operation of the PV facilities would be SMALL.

Based on the above, the NRC staff concludes that the waste impacts for the natural gas and solar combination alternative would be SMALL.

3.13.9 New Nuclear and Solar Combination Alternative

Impacts from the waste generated during the construction of a new nuclear (SMR) alternative would include those identified in Section 3.13.7 of this SEIS. Impacts from the waste generated during the construction of a new solar installations would include those identified in Section 3.13.8 of this SEIS.

Based on the above, the NRC staff concludes that the waste impacts for the new nuclear and solar combination alternative would be SMALL.

3.14 Evaluation of New and Significant Information

As stated in Section 1.5 of this SEIS, for Category 1 (generic) issues, the NRC staff can rely on the analysis in the LR GEIS (NRC 2024-TN10161) unless otherwise noted. Table 3-1 lists the Category 1 issues that apply to V.C. Summer during the proposed SLR period. For these issues, the NRC staff did not identify any new and significant information based on its review of Dominion's ER (Dominion 2023-TN10387), the environmental site audits, review of available information as cited in this SEIS or information arising from the environmental scoping process that would change the conclusions presented in the LR GEIS.

New and significant information must be new based on information evaluated in the LR GEIS (NRC 2024-TN10161) as codified in Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 (TN10253). Such information must also bear on the proposed action or its impacts, presenting a picture of the impacts that are seriously different from those envisioned in the LR GEIS (i.e., impacts of greater severity than impacts considered in the LR GEIS, considering their intensity and context).

The NRC defines new and significant information in Regulatory Guide 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications" (NRC 2024-TN10280), as (1) information that identifies a significant environmental impact issue that was not considered or addressed in the LR GEIS and, consequently, not codified in Table B-1, in Appendix B to Subpart A of 10 CFR Part 51 (TN10253) or (2) information not considered in the assessment of impacts evaluated in the LR GEIS leading to a picture of the environmental consequences of the action that is significantly different than previously considered, such as an environmental impact finding different from that codified in Table B-1. Further, a significant environmental issue includes, but is not limited to, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or with an intensity and/or scope (context) not previously recognized.

In accordance with 10 CFR 51.53(c) (TN10253), "Operating License Renewal Stage," the applicant's ER must analyze the Category 2 (site-specific) issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Additionally, the applicant's ER must discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action. In accordance with 10 CFR 51.53(c)(3), the applicant's ER does not need to analyze any Category 1 issues unless there is new and significant information about a specific issue.

NUREG-1555, Supplement 1, Revision 2, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants for Operating License Renewal," describes the NRC process for identifying new and significant information (NRC 2024-TN10251). The search for new information includes:

- review of the applicant's ER (Dominion 2023-TN10387) and process for discovering and evaluating the significance of new information
- review of public comments
- review of environmental quality standards and regulations
- coordination with Federal, State, and local environmental protection and resource agencies
- review of technical literature as documented through this SEIS

New information that the NRC staff discovers is evaluated for significance using the criteria set forth in the LR GEIS and in NUREG-1555. For Category 1 issues in which new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to assessment of the new and significant information relevant to the proposed action; the scope of the assessment does not include other facets of an issue that the new information does not affect.

The NRC staff reviewed the discussion of environmental impacts associated with operation during the SLR term in the LR GEIS and has conducted its own independent review to identify new and significant issues for the V.C. Summer SLR application environmental review. The assessment of new and significant information for each resource is addressed in each resource area discussion.

3.15 Impacts Common to All Alternatives

This section describes the impacts that the NRC staff considers common to all alternatives discussed in this SEIS, including the proposed action and replacement power alternatives. In addition, the following sections discuss the termination of operations, the decommissioning of a power plant and potential replacement power facilities, and GHG emissions and climate change.

3.15.1 Fuel Cycle

This section describes the environmental impacts associated with the fuel cycles of both the proposed action and all replacement power alternatives that are analyzed in detail in this section of the SEIS.

3.15.1.1 Uranium Fuel Cycle

The uranium fuel cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. Section 4.14.1 of the LR GEIS describes in detail the generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes (NRC 2024-TN10161). The NRC staff incorporates the information in the LR GEIS, Section 4.14.1 (NRC 2024-TN10161: pp. 4-150 through 4-164), here by reference. The LR GEIS does not identify any plant-specific (Category 2) uranium fuel cycle issues.

As stated in the 2024 LR GEIS (NRC 2024-TN10161), the generic issues related to the uranium fuel cycle as identified in Table 3-1 of this SEIS would not be affected by continued operations associated with SLR. The NRC staff identified no new and significant information for these issues. Thus, as concluded in the LR GEIS, the impacts of generic issues related to the uranium fuel cycle would be SMALL.

3.15.1.2 Replacement Power Alternatives Fuel Cycles

Uranium fuel cycle impacts for a nuclear plant result from the initial extraction of fuel, transport of fuel to the facility, and management and ultimate disposal of spent fuel. The environmental impacts of the uranium fuel cycle are referenced above in Section 3.15.1.1 of this SEIS, and discussed in more detail in Section 3.14.1 and Appendix D, Section D.4.12.2 of the LR GEIS (NRC 2024-TN10161).

3.15.1.2.1 Fossil Fuel Energy Alternatives

Fuel cycle impacts for a fossil fuel-fired power plant result from the initial extraction of fuel, cleaning and processing of fuel, transport of fuel to the facility, and management and ultimate disposal of any solid wastes from fuel combustion. These impacts are discussed in more detail in Appendix D, Section D.4.12.1 of the LR GEIS (NRC 2024-TN10161) and can generally include the following: significant changes to land use and visual resources; impacts on air quality, including release of criteria pollutants, fugitive dust, volatile organic compounds, and methane into the atmosphere; noise impacts; geology and soil impacts caused by land disturbances and mining; water resource impacts, including degradation of surface water and groundwater quality; ecological impacts, including loss of habitat and wildlife disturbances; historic and cultural resource impacts within the mine or pipeline footprint associated with the extraction of the fuel; socioeconomic impacts from employment of both the mining workforce and service and support industries; environmental justice impacts; health impacts on workers from exposure to airborne dust and methane gases; and generation of industrial wastes.

3.15.1.2.2 Renewable Energy Alternatives

For renewable energy technologies that rely on the extraction of a fuel source (e.g., biomass), such alternatives may have fuel cycle impacts with some similarities to those associated with the uranium fuel cycle. However, as stated in Appendix D, Section D.4.12.3 of the LR GEIS (NRC 2024-TN10161) (under “Renewable Alternatives”), the fuel cycles for renewable technologies such as wind, solar, geothermal, and ocean wave and current are difficult to define. This is because the associated natural resources exist regardless of any effort to harvest them for electricity production. Impacts from the presence or absence of these renewable energy technologies are often difficult to determine (NRC 2024-TN10161).

3.15.2 Termination of Nuclear Power Plant Operations and Decommissioning

This section of the SEIS addresses the environmental impacts of the V.C. Summer SLR associated with the termination of operations and the decommissioning of a nuclear power plant and replacement power alternatives. All operating nuclear power plants will terminate operations and be decommissioned at some point after the end of their operating life or after a decision is made to cease operations. For the proposed action at V.C. Summer, SLR could delay this eventuality for an additional 20 years beyond the current license period.

3.15.2.1 Existing Nuclear Power Plant

The decommissioning process begins when a licensee informs the NRC that it has permanently ceased reactor operations, defueled, and intends to decommission the nuclear plant. The licensee may also notify the NRC of the permanent cessation of reactor operations prior to the end of the license term. Consequently, most nuclear plant activities and systems dedicated to reactor operations would cease after reactor shutdown. The environmental impacts of decommissioning a nuclear power plant are evaluated NUREG-0586, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors* (NRC 2002-TN665). Additionally, Section 4.14.2.1 of the 2024 LR GEIS (NRC 2024-TN10161) summarizes the incremental environmental impacts associated with nuclear power plant decommissioning activities. As noted in Table 3-1, there is one Category 1 issue, “Termination of Nuclear Power Plant Operations and Decommissioning,” applicable to V.C. Summer decommissioning following the SLR term. The LR GEIS did not identify any plant-specific (Category 2) decommissioning issues.

3.15.2.2 Replacement Power Plants

3.15.2.2.1 New Nuclear and Fossil Fuel Alternatives

The environmental impacts from the termination of power plant operations and the decommissioning of a power generating facility are dependent on the facility's decommissioning plan. Decommissioning plans generally outline the actions needed to restore the site to a condition equivalent in character and value to the site on which the facility was first constructed. General elements and requirements for a thermoelectric power plant decommissioning plan can include the removal of structures below grade, the removal of all accumulated waste materials, the removal of intake and discharge structures, and the cleanup and remediation of incidental spills and leaks at the facility.

The environmental consequences of decommissioning can generally include the following:

- short-term impacts on air quality and noise from the deconstruction of facility structures
- short-term impacts on land use and visual resources
- long-term reestablishment of vegetation and wildlife communities
- socioeconomic impacts caused by decommissioning the workforce and the long-term loss of jobs
- elimination of health and safety impacts on operating personnel and the general public

These impacts are representative of those associated with decommissioning any thermoelectric power generating facility. Activities that are unique to the termination of operations and the decommissioning of a nuclear power generating facility include the safe removal of the facility from service, the reduction of residual radioactivity to a level that permits the release of the property under restricted conditions or unrestricted use, and the termination of the license.

3.15.2.2.2 Renewable Energy Alternatives

The termination of power plant operation and decommissioning for renewable energy facilities would generally be similar to the activities and impacts discussed above for the new nuclear and fossil fuel alternatives. Decommissioning would involve the removal of facility components and any operational wastes and residues, if present, to restore sites to a condition equivalent in character and value to the site on which the facility was first constructed. In other circumstances, supporting infrastructure (e.g., buried utilities and pipelines) could be abandoned in place (NRC 2024-TN10161). The range of possible decommissioning considerations and impacts, depending on the renewable energy alternative considered, are discussed in Appendix D, Section D.4.13.3 of the LR GEIS (NRC 2024-TN10161). The NRC staff incorporates the information in the LR GEIS, Section D.4.13.3 (NRC 2024-TN10161: pp. D-45 and D-46), herein by reference.

3.15.3 Greenhouse Gas Emissions and Climate Change

3.15.3.1 Greenhouse Gas Emissions from the Proposed Action and Alternatives

Gases found in the Earth's atmosphere that trap heat and play a role in the Earth's climate are collectively termed GHGs. These GHGs include CO_2, methane (CH_4), nitrous oxide, water vapor, and fluorinated gases, such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The Earth's climate responds to changes in concentrations of GHGs in the atmosphere because these gases affect the amount of energy absorbed and heat trapped by the atmosphere. Increasing concentrations of GHGs in the atmosphere generally increase the Earth's surface temperature. Atmospheric concentrations of CO_2, CH_4, and N_2O have significantly increased since 1850 (IPCC 2013-TN7434, IPCC 2021-TN7435). For instance, since 1850, CO_2 concentrations have increased by almost 50 percent (USGCRP 2023-TN9762). In 2019, atmospheric concentrations of CO_2 (measured at 410 parts per million) were higher than any time in at least 2 million years (IPCC 2023-TN8557). The annual rate of increase in atmospheric CO_2 over the last 60 years is 100 times faster than previous natural increases (USGCRP 2023-TN9762).

Long-lived GHGs—CO_2, CH_4, N_2O, and fluorinated gases—are well mixed throughout the Earth's atmosphere, and their impact on climate is long-lasting and cumulative in nature as a result of their long atmospheric lifetimes (EPA 2016-TN7561). Therefore, the extent and nature of climate change is not specific to where GHGs are emitted. CO_2 is of primary concern for global climate change because it is the primary gas emitted as a result of human activities. In 2019, global net GHG emissions were estimated to be 59 ± 6.6 gigatons of CO_2 equivalents (CO_2eq), with the largest share in gross GHG emissions being CO_2 from fossil fuels combustion and industrial processes (IPCC 2023-TN8557).

The operation of V.C. Summer results in direct and indirect GHG emissions. Dominion calculated GHG emissions from stationary and portable combustion onsite sources and indirect emission sources (workforce commuting). GHG emissions generated from operation of V.C. Summer are presented in Table 3-24. Fluorinated gas emissions from refrigerant sources and from electrical transmission and distribution systems can result from leakage, servicing, repair, or disposal of sources. In addition to being GHGs, chlorofluorocarbons and hydrochlorofluorocarbons are ozone-depleting substances that are regulated by the CAA under Title VI, "Stratospheric Ozone Protection." Dominion maintains a program to manage stationary refrigeration appliances at the plant to recycle, recapture, and reduce emissions of ozone-depleting substances and is in compliance with Section 608 of the CAA. Section 608 of the CAA (40 CFR 82.154-TN10849) prohibits the intentional venting of ozone-depleting substances while maintaining, servicing, repairing or disposing of air conditioning or refrigeration equipment. Dominion uses sulfur hexafluoride in breakers within the switchyards and the turbine building. The breakers are sealed, continuously monitored and inspected for leaks (Dominion 2024-TN10391). Dominion did not identify fugitive emission to report associated with sulfur hexafluoride (Dominion 2024-TN10391). Consequently, fluorinated gas emissions are not included in Table 3-24.

Table 3-24 Annual Greenhouse Gas Emissions from Operations at Virgil C. Summer Nuclear Station, Unit 1

Emission Source	Carbon Dioxide Equivalents (tons)
Combustion Sources[(a)]	2,700
Workforce Commuting[(b)]	4,700

(a) Combustion sources include diesel generators and an auxiliary boiler. Greenhouse gas emissions for the diesel generators are based on maximum runtime (500 hours) and U.S. Environmental Protection Agency Compilation of Air Pollutant Emission Factors (AP-42). The auxiliary boiler is used only during outages and greenhouse gas emissions are estimated based on fuel usage and U.S. Environmental Protection Agency's Emission factors for Greenhouse Gas Inventories.
(b) Emissions assume 923 passenger vehicles per day based on 6.69 percent carpool rate and 989 employees.
Sources: Dominion 2023-TN10387, Dominion 2024-TN10391.

3.15.3.1.1 Proposed Action

As described in the 2024 LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1 of this SEIS, the GHG impacts on climate change from continued operations would be SMALL. The NRC staff did not identify any new and significant information that would change the conclusion in the LR GEIS. GHG emissions from routine operations at V.C. Summer include diesel generators, auxiliary boiler, as well as mobile sources and are minor. Dominion does not anticipate future upgrades or replacement activities of emission sources during the SLR term to support plant operation that could result in a significant increase in GHG emissions. Thus, as concluded in the LR GEIS, for the “Greenhouse gas impacts on climate change” generic issue, the impacts of continued operation of V.C. Summer on climate change would be SMALL.

3.15.3.1.2 No-Action Alternative

Under the no-action alternative, the NRC would not issue the renewed license, and V.C. Summer would permanently shut down on or before the expiration of the current license. At some point, all nuclear power plants will terminate operations and undergo decommissioning. The decommissioning GEIS (NRC 2002-TN7254) considers the environmental impacts of decommissioning. The scope of impacts considered under the no-action alternative includes the immediate impacts resulting from activities at V.C. Summer that would occur between plant shutdown and the beginning of decommissioning (i.e., activities and actions necessary to cease operation of V.C. Summer). When the facility stops operating, a reduction in GHG emissions from activities related to plant operation, such as the use of generators and employee vehicles would occur. The NRC staff anticipates that GHG emissions for the no-action alternative would be less than those presented in Table 3-24, which shows the estimated direct GHG emissions from operation of V.C. Summer and associated mobile emissions. Therefore, the NRC concludes that the impacts of the no-action alternative on climate change would be SMALL.

3.15.3.1.3 Natural Gas Combined Cycle Plant

The plant would have a design capacity of 1,110 MWe generation and 87 percent capacity factor. The 2013 LR GEIS (NRC 2013-TN2654) presents life-cycle GHG emissions associated with natural gas power generation. Life-cycle GHG emissions from natural gas power generation can range from 120 to 930 grams of carbon equivalent per kilowatt hour. GHG emission sources during construction would be similar to construction of an industrial facility and include construction equipment, engine exhaust, and workforce commuting. Applying emission factors developed by the DOE’s National Energy Technology Laboratory (2012-TN9604) for plant construction of natural gas combustion cycle, the NRC staff estimates that construction of the natural gas alternative would emit approximately 2,950 tons of CO_2eq (2,670 MT).

The NRC staff estimates that the natural gas alternative would emit 3.6 million tons of CO_2eq (3.3 MT of CO_2eq). As can be seen from Table 3-25, if V.C. Summer’s generating capacity were to be replaced by a natural gas alternative, there would be a significant increase in GHG emissions. Additionally, GHG emission of a natural gas alternative has the highest emissions of all the alternatives considered. Therefore, given the potential for a significant increase in GHG emissions, the NRC staff concludes that the impacts of natural gas alternative on climate change would be MODERATE.

3.15.3.1.4 New Nuclear (Small Modular Reactor) Alternative

The new nuclear alternative would consist of two, 12-unit SMRs. The 2013 LR GEIS (NRC 2013-TN2654) discusses life-cycle GHG emissions associated with nuclear power generation. Life-cycle GHG emissions from nuclear power generation can range from 1 to 288 grams of carbon equivalent per kilowatt hour. The nuclear life-cycle consists of the uranium fuel cycle phases, nuclear plant construction, operation, and decommissioning. GHG emission sources during construction would include equipment used, engine exhaust, and workforce commuting. GHG emissions would vary depending on the construction duration and equipment usage. In NUREG-2226, the NRC staff estimated that construction of two or more small modular reactors with maximum total electrical output of 800 MWe over the course of a 7-year period from equipment usage would result in a total of 42,990 tons (39,000 MT) of CO_2eq (NRC 2019-TN6136). The NRC estimates that GHG emissions from construction of the new nuclear alternative would be similar in magnitude and approximately 59,110 tons (53,620) of CO_2eq.

Sources of GHG emissions of the new nuclear portion from operations would include diesel generators, boilers, and pumps, similar to the existing sources at V.C. Summer. In NUREG-2226, the NRC estimated the total carbon footprint as a result of operating two or more SMRs with a maximum total electrical output of 800 MWe (NRC 2019-TN6136). In Section 5.7.1.2, of NUREG-2226 (p. 5-45) the NRC estimated that the carbon footprint for operations to be 4,990 tons of CO_2eq annually (4,525 MT). Therefore, the NRC staff estimates that a new nuclear alternative would be approximately 6,000 tons (5,440 MT). If V.C. Summer's generating capacity were to be replaced by the new nuclear alternative, GHG would be of similar magnitude and there would not be a significant increase in GHG emissions (see Table 3-25). Therefore, the NRC concludes that the impacts of a new nuclear alternative on climate change would be SMALL.

3.15.3.1.5 Natural Gas and Solar Combination Alternative

The natural gas and solar combination alternative would consist of a natural gas combined cycle plant and solar with battery storage. The 2013 LR GEIS (NRC 2013-TN2654) discusses life-cycle GHG emissions associated with natural gas power generation and solar power generation. Life-cycle GHG emissions from natural gas power generation can range from 120 to 930 grams of carbon equivalent per kilowatt hour and from solar power can range from 5 to 217 grams of carbon equivalent per kilowatt hour. GHG emission sources during construction of the natural gas and solar combination alternative would be similar to construction of an industrial facility and include construction equipment, engine exhaust, and workforce commuting. Applying emission factors developed by the DOE's National Energy Technology Laboratory (2012-TN9604) for plant construction of natural gas combustion cycle, the NRC staff estimates that construction of the natural gas portion of the combination alternative would emit approximately 1,860 tons of CO_2eq (1,690 MT). The NREL estimates that the upstream processes from solar PV (material production, system and plant component manufacturing, installation and plant construction) is responsible for 60–70 percent of life-cycle GHG emissions (2012-TN10546). Facility construction is responsible for 19 percent of solar PV lifecycle emissions (Nuget and Sovacool 2014-TN10553).

GHG emission associated with operation of the solar with battery storage portion would be negligible because no direct fossil fuels are burned to generate electricity. Therefore, for this alternative, GHG emissions primarily be from the natural gas combined cycle plant. The NRC staff estimates that a 700 MW natural gas cycle plant with an 87 percent capacity factor would result in 2.3 million tons of CO_2eq (2.1 MT tons of CO_2eq). As can be seen from Table 3-25 below, if V.C. Summer's generating capacity were to be replaced by a natural gas and solar combination alternative there would be a significant increase in GHG emissions. Therefore, given the potential for a significant increase in GHG emissions, the NRC staff concludes that the impacts of natural gas and solar combination alternative on climate change would be MODERATE.

3.15.3.1.6 New Nuclear and Solar Combination

The new nuclear and solar combination alternative would consist of one 12-unit SMR plant and solar with battery storage. The 2013 LR GEIS (NRC 2013-TN2654) discusses life-cycle GHG emissions associated with nuclear power generation and solar power generation. Life-cycle GHG emissions from nuclear power generation can range from 1 to 288 grams of carbon equivalent per kilowatt hour and from solar power can range from 5 to 217 grams of carbon equivalent per kilowatt hour. GHG emission sources during construction of the new nuclear and solar combination alternative would be similar to construction of an industrial facility and include construction equipment, engine exhaust, and workforce commuting. In NUREG-2226, the NRC staff estimated that construction of two or more SMRs with maximum total electrical output of 800 MWe over the course of a 7-year period from equipment usage would result in a total of 42,990 tons (39,000 MT) of CO_2eq (2019-TN6136). The NRC estimates that GHG emissions from construction of the new nuclear alternative would be similar in magnitude and approximately 47,500 tons (43,090 MT) of CO_2eq. The National Renewable Energy Laboratory estimates that the upstream processes from solar PV (material production, system and plant component manufacturing, installation and plant construction) is responsible for 60–70 percent of life-cycle GHG emissions (2012-TN10546). Facility construction is responsible for 19 percent of solar PV life-cycle emissions (Nuget and Sovacool 2014-TN10553).

GHG emissions associated with operation of the solar with battery storage portion would be negligible because no direct fossil fuels are burned to generate electricity. Sources of GHG emissions of the new nuclear portion would include diesel generators, boilers, and pumps, similar to the existing sources at V.C. Summer. In NUREG-2226, the NRC estimated the total carbon footprint as a result of operating two or more SMRs with a maximum total electrical output of 800 MWe (2019-TN6136). In Section 5.7.1.2 of the NUREG-2226 (p. 5-45), the NRC estimated that the carbon footprint for operations to be 4,990 tons of CO_2eq annually (4,525 MT). Therefore, the NRC staff estimates that the new nuclear portion of this combination alternative would be approximately 5,500 tons (4,990 MT). If V.C. Summer's generating capacity were to be replaced by new nuclear and solar combination alternative GHG would be of similar magnitude and there would not be a significant increase in GHG emissions (see Table 3-25 below). Therefore, the NRC concludes that the impacts of a new nuclear and solar power combination alternative on climate change would be SMALL.

3.15.3.2 Climate Change

Climate change is the decades or longer change in climate measurements (e.g., temperature and precipitation) that has been observed on a global, national, and/or regional level (IPCC 2007-TN7421; EPA 2016-TN7561; USGCRP 2014-TN3472). Worldwide, 2023 was the warmest year on record and 2014–2023 was the warmest decade on record since thermometer-based observations began (EPA 2024-TN10205). Climate change research indicates that the cause of the Earth's warming over the last 50 to 100 years is due to the buildup of GHGs in the atmosphere resulting from human activities (IPCC 2013-TN7434, IPCC 2021-TN7435, IPCC 2023-TN8557; USGCRP 2014-TN3472, USGCRP 2017-TN5848, USGCRP 2018-TN5847). Climate change can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Just as regional climate differs throughout the world, the impacts of climate change can vary among locations.

Table 3-25 Direct Greenhouse Gas Emissions from Facility Operations of Virgil C. Summer Nuclear Station Under the Proposed Action and Alternatives

Technology/Alternative	Carbon Dioxide Equivalent[(a)] (T/yr)
Proposed Action[(b)]	2,700
No Action Alternative[(c)]	<2,700
Natural Gas Alternative	3.6 million
New Nuclear Alternative	6,000
Natural Gas and Solar Combination Alternative[(d)]	2.3 million
New Nuclear and Solar Combination Alternative[(d)]	5,500

(a) Carbon dioxide equivalent (CO_2eq) is a metric used to compare the emissions of greenhouse gases (GHGs) based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP.
(b) GHG emissions include direct emissions from onsite combustion sources (e.g., emergency power generators).
(c) Emissions resulting from activities at V.C. Summer that would occur between plant shutdown and the beginning of decommissioning and assumed not to be greater than GHG emissions from operation at V.C. Summer.
(d) Direct air emissions associated with operation of the solar with battery storage portions of this alternative are negligible because no fossil fuels are burned to generate electricity.

3.15.3.2.1 Observed Trends in Climate Change

Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2,000 years (IPCC 2023-TN8557). From 2011 through 2020, the global surface temperature was 2°F (1.1°C) warmer than the preindustrial period (1850–1900) (IPCC 2023-TN8557). From 1901 to 2023, global precipitation has increased at an average rate of 0.03 in. (0.08 cm) per decade (EPA 2024-TN10205). From 1901 to 2023, average surface temperature across the contiguous United States has increased by 0.17°F (0.09°C) per decade (EPA 2024-TN10205). From 1901 to 2023, total annual precipitation in the contiguous United States has increased as a rate of 0.18 in. (0.45 cm) per decade (EPA 2024-TN10205)

The United States Global Change Research Program (USGCRP) reports that since 1970, the contiguous United States is warming at a faster rate than the global average. Since 1970, global temperature has increased by 1.7°F (0.9°C) while average surface temperature in the contiguous United States have increased by 2.5°F (1.4°C) (2023-TN9762). Observed climate change indicators across the United States include increases in the frequency and intensity of heavy precipitation, earlier onset of spring snowmelt and runoff, rise of sea level and increased tidal flooding in coastal areas, an increased occurrence of heat waves, and a decrease in the occurrence of cold waves. Average sea level rise along the continental U.S. coastline has risen by about 11 in. (27 cm) over the last century and between 1993–2020 average sea level rose 1.8 in. (4.6 cm) per decade (USGCRP 2023-TN9762).

Climate change and its impacts can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Observed climate changes and impacts have not been uniform across the United States. Annual average temperature data in the Southeast (where V.C. Summer is located) varies between 2002–2021 (relative to 1901–1960), with South Carolina exhibiting an increase of 0.5–1.5°F (0.28–0.83°C) (USGCRP 2023-TN9762: Figure 2.4). The number of hot days (days at or above 95°F [35°C]) has decreased by 9.7 days, the number of cold days (days at or below 32°F [0°C]) has increased by 3.0 days, and the number of warm nights (nights at or above 70°F [21°C]) have increased by 7.9 nights in the Southeast from 2002–2021 relative to 1901–1960 (USGCRP 2023-TN9762: Figure 2.7). Average annual precipitation from 2002–2021 (relative to the 1901–1960 average) for the

Southeast exhibits increases and decreases, with the northwestern portion of the South Carolina exhibiting a 0–10 percent decrease and the rest of South Carolina exhibiting an increase of 0 to 10 percent (USGCRP 2023-TN9762: Figure 2.4). The Southeast has experienced a 37 percent increase in the number of extreme precipitation days (defined as the top 1 percent of heaviest precipitation events) from 1958–2021 (USGCRP 2023-TN9762: Figure 2.8).

The NRC staff used the NOAA "Climate at a Glance" tool to analyze temperature and precipitation trends for the 1895–2023 period in the North Central climate division within South Carolina. A trend analysis shows that the average annual temperature has increased at a rate of 0.1°F (0.05°C) per decade, and average precipitation has decreased by 0.13 in. (0.33 cm) per decade (NCEI 2024-TN10602). Figure 3-5 of this SEIS presents monthly average intake temperatures from 2006 to 2023 from the Monticello Reservoir. No notable trend over the 18-year period is that apparent for monthly average intake temperatures.

3.15.3.2.2 Climate Change Projections

Future global GHG emission concentrations (emission scenarios) and climate models are commonly used to project possible climate change. Climate model projections indicate that changes in climate will not be uniform across the United States. Climate model simulations often use GHG emission scenarios to represent possible future social, economic, technological, and demographic development that, in turn, drive future emissions. Climate models indicate that over the next decade, warming is very similar across all emission scenarios (USGCRP 2023-TN9762). However, by mid-century (2040–2070) differences between projected temperatures under higher and lower emission scenarios become observable. The impacts of climate change increase with warming, and warming is certain to continue if emissions of CO_2 do not reach net zero (USGCRP 2023-TN9762).

The Intergovernmental Panel on Climate Change (IPCC) has generated various representative concentration pathway (RCP) scenarios commonly used by climate modeling groups to project future climate conditions (IPCC 2000-TN7652, IPCC 2013-TN7434; USGCRP 2017-TN5848, USGCRP 2018-TN5847). In the IPCC Fifth Assessment Report, four RCPs were developed and are based on the predicted changes in radiative forcing (a measure of the influence that a factor such as GHG emissions has in changing the global balance of incoming and outgoing energy) in the year 2100, relative to preindustrial conditions. The four RCP scenarios are numbered in accordance with the change in radiative forcing measured in watts per square meter (i.e., +2.6 [very low], +4.5 [lower], +6.0 [mid-high], and +8.5 [higher]) (USGCRP 2018-TN5847). For example, RCP 2.6 is representative of a mitigation scenario aimed at limiting the increase in the global mean temperature to 3.6°F (2°C) (IPCC 2014-TN7651). RCP 8.5 reflects a continued increase in global emissions resulting in increased warming by 2100. In the IPCC Working Group contribution to the Sixth Assessment Report, five shared socioeconomic pathways (SSPs) were used along with the associated modeling results as the basis for the climate change assessments (IPCC 2021-TN7435). These five socioeconomic pathway scenarios (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5) cover a range of GHG pathways and climate change mitigation.

The NRC staff considered the best available climate change studies performed by USGCRP as part of the staff's assessment of potential climate change projections during the V.C. Summer SLR term (2042–2062). The Fourth National Climate Assessment relies on the four RCPs and presents projected climate change by geographic regions in the United States (USGCRP 2018-TN5847). The Fifth National Climate Assessment (USGCRP 2023-TN9762) uses SSPs, RCPs, and global warming levels when presenting projected climate change. Global warming levels are used to describe the level of global temperature increase (e.g., 2.7°F or 1.5°C) relative to preindustrial temperature conditions (USGCRP 2023-TN9762).

Regional projections for annual mean temperature are available from the Fourth National Climate Assessment based on the RCP 4.5 and RCP 8.5 scenarios for the midcentury (2036–2065) as compared to the annual mean temperature for 1976–2005. The modeling predicts increases of 3.40 to 4.30°F (1.9–2.4°C) across the Southeast region by midcentury, with higher GHG emission scenarios leading to greater and faster temperature increases (USGCRP 2017-TN5848: Table 6.4). Specific to the portion encompassing South Carolina, predicted annual temperature increases range from 2–4°F (1.1–2.2°C) under the RCP 4.5, and 2–6°F (1.1–3.3°C) under the RCP 8.5 scenarios (USGCRP 2017-TN5848: Figure 6.7). Under the RCP 8.5 scenario, the coldest and warmest daily temperatures of the year are expected to increase by 4.97°F and 5.69°F (2.76°C and 3.16°C), respectively, in the Southeast by midcentury (USGCRP 2017-TN5848: Table 6.5).

As for precipitation, projections based on the intermediate (RCP 4.5) emission scenarios for the mid-century (2036–2065), indicates spatial differences in annual mean precipitation changes across the southeast. For instance, across South Carolina annual mean precipitation will increase by 0.5–2 in. (1.3–5.1 cm) for the mid-century relative to the previous five decades (1991–2020) (USGCRP 2023-TN9762: Figure 4.3). The USGCRP predicts continued increases in the frequency and intensity of heavy precipitation events across the United States, including across the Southeast. Generally, extreme precipitation events are observed to increase by 6–7 percent for each degree Celsius of temperature increase (USGCRP 2017-TN5848 and USGCRP 2023-TN9762). Increases in extreme precipitation, in turn, can increase annual runoff.

Decreases in average precipitation coupled with increases in extreme precipitation, temperatures, and evapotranspiration can result in increased aridity, more frequent droughts, and reduction in the average flow of rivers and streams (USGCRP 2018-TN5847; EPA 2023-TN8803). USGCRP reports that higher temperatures can cause a drought to develop or become more intense than would be expected from precipitation deficits alone (2023-TN9762). USGCRP defines drought as a mismatch between moisture supply and demand and driven by many climatic factors including temperature, potential evapotranspiration, soil moisture, or precipitation.

3.15.3.2.3 Climate Change Impacts on Environmental Resources

As described in the 2024 LR GEIS (NRC 2024-TN10161) and as cited in Table 3-2 of this SEIS, there is a Category 2 issue “Climate Change Impacts on Environmental Resources” applicable to V.C. Summer. According to the 2024 LR GEIS, the impacts of climate change on environmental resources during the SLR term are location-specific and cannot be generically evaluated. Changes in climate can have broad implications for certain resource areas. Climate change may impact the affected environment in a way that alters the environmental resources that are impacted by the proposed action (V.C. Summer SLR). In order for there to be a climate change impact on an environmental resource, the proposed action must have an incremental new, additive, or increased physical effect or impact on the resource or environmental condition beyond what is already occurring. Below, the NRC staff considers the effects of climate change on environmental resource areas that may also be directly affected by V.C. Summer continued operations during the SLR term.

The effects of climate change on V.C. Summer's structures, systems, and components (SSCs) are outside the scope of this Category 2 issue for SLR. Site-specific environmental conditions are considered when siting nuclear power plants. This includes the consideration of meteorological and hydrologic siting criteria as set forth in 10 CFR Part 100 (TN282), "Reactor Site Criteria." NRC regulations require that plant SSCs important to safety be designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform their safety functions. Further, nuclear power plants are required to operate within technical specifications in accordance with the NRC operating license, including coping with natural phenomena hazards. The NRC conducts safety reviews prior to allowing licensees to make operational changes due to changing environmental conditions. Additionally, the NRC evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations under the plant's operating license through the NRC's Reactor Oversight Program. If new information about changing environmental conditions (such as rising sea levels that threaten safe operating conditions or challenge compliance with the plant's technical specifications) becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed at licensed nuclear power plants. This is a separate and distinct process from the NRC staff's SLR environmental review that it conducts in accordance with NEPA.

<u>Air Quality</u>

Climate change can impact air quality as a result of changes in meteorological conditions. Air pollutant concentrations are sensitive to winds, temperature, humidity, and precipitation. Ozone levels and PM have been found to be particularly sensitive to climate change influences. Ozone is formed by the chemical reaction of NO_x and volatile organic compounds in the presence of heat and sunlight. The emission of ozone precursors also depends on the temperature, wind, and solar radiation (IPCC 2007-TN7421). Warmer temperatures, air stagnation, droughts, and wildfires are favorable conditions for higher levels of ozone and $PM_{2.5}$ (USGCRP 2023-TN9762). In the Southeast, recent studies indicate that the position of the Bermuda High in the summer influences surface ozone in the eastern part of the United States (Zhang and Wang 2016-TN10554). As discussed in Section 3.3.2 of this SEIS, Fairfield County is designated in attainment for all NAAQS. USGCRP reports that there is medium confidence that climate change is projected to worsen air quality in many U.S. regions (2023-TN9762). This is due to the uncertainty in how meteorology will respond to climate change and how these meteorological conditions will in turn change air pollutant concentrations. Under the RCP 4.5 emission scenario, East et al. 2024 (TN10550) found that by mid-century the average 1 year ozone concentrations may increase by 2 parts per billion (ppb) across most of the United States, including the Southeast, and the frequency of ozone levels of 70 ppb or higher for 8 hours or longer days to increase. East et al. 2024 findings suggest that increasing the frequency of high ozone concentrations can increase the risk of not meeting NAAQS by mid-century in areas currently attaining them. However, as discussed in Section 3.3.2 of this SEIS, air emissions from V.C. Summer are minor and exempted from air permitting requirements as they are not expected to significantly contribute to violations in NAAQS.

<u>Surface Water Resources</u>

Observational data and climate model projections both indicate changes in precipitation, runoff, and air temperature in South Carolina and the Southeast region that could influence surface water availability and water quality. Observations of precipitation and air temperature in South Carolina over the last two decades (2002–2021) compared to the 1901–1960 period show an increase in average annual temperature of 0.5-1.5 °F (0.27–0.83°C) and changes in annual average precipitation up to ±10 percent greater/lower than the historical baseline (USGCRP

2023-TN9762). Another relevant trend across the broader Southeast region has been a 37 percent increase in extreme precipitation events (top 1 percent of heaviest precipitation events) over 1958–2021 (USGCRP 2023-TN9762: Figure 2.8), and the frequency and severity of extreme precipitation events are projected to continue to increase across the southeast, including South Carolina (USGCRP 2023-TN9762: Figure 2.12). Increases in annual precipitation and heavy precipitation can increase runoff and increase the potential for riverine flooding. Increased runoff and high-flow events can result in the transport of a higher sediment load and other contaminants to surface waters with potential degradation of ambient water quality.

The USGCRP does not identify aridification as a major concern for the Southeast (2023-TN9762: Chapter 2). However, changes in the amount and timing of precipitation and seasonal evapotranspiration could alter the seasonal balance of surface water supply and demand (USGCRP 2023-TN9762: Chapter 2). Precipitation projections for mid-century (2036–2065) under the intermediate emission scenarios (RCP 4.5) on an average show 0.5–2 in. (1.27–5.08 cm) increase in annual precipitation compared to 1991–2020 (USGCRP 2023-TN9762: Figure 4.3). Projections for runoff show a smaller increase than precipitation, with an estimate of 0–0.5 in. (0– 1.27 cm) increase over the mid-century period for the RCP 4.5 scenarios and summer (June–August) soil moisture is estimated to slightly decrease 0–0.05 in. (0–0.127 cm) (USGCRP 2023-TN9762: Figure 4.6). Under an intermediate scenario (RCP 4.5), projected changes for South Carolina by mid-century (2036–2065, relative to 1991–2020) indicate an annual actual evapotranspiration increase of 0.5–2.0 in. (1.3–5.1 cm), average summer soil moisture decrease of 0–0.05 in. (0–0.12 cm), and annual climatic water deficit (defined as the shortfall of water necessary to fully supply vegetation requirements) increase of 0.0–0.5 in. (0–1.3 cm) (USGCRP 2023-TN9762: Figures 4.4, 4.6, 4.9). Climate change is also expected to increase the number of hot days (≥ 95°F [≥35°C]) and the number of warm nights (≥70°F [≥21°C]) (USGCRP 2023-TN9762: Figure 2.11), both of which could increase surface water temperatures and evaporation, although monthly average intake water temperatures at Monticello Reservoir for the 2006–2023 period have not shown any increasing trends (Figure 3-5 of this SEIS). However, it should be noted that observations show a 9.7 day reduction in the number of hot days (days at or above 95°F [35°C]) in the Southeast for 2002–2021 compared to 1901–1960 (USGCRP 2023-TN9762: Figure 2.7). Regulatory agencies would need to account for changes in water availability in their water resources allocation as well as environmental permitting programs. Regardless of water use permitting constraints, nuclear power plant operators would have to account for any changes in water temperature in operational practices and procedures.

3.16 Cumulative Effects of the Proposed Action

Actions considered in the cumulative effects analysis include the incremental effects of the proposed SLR action when added to the environmental effects of other past, present, and reasonably foreseeable future actions. The analysis considers all actions including minor ones, because the effects of individually minor actions may be significant when considered collectively over a period of time. The goal of the cumulative effects analysis is to identify potentially significant environmental impacts. The environmental effects of the proposed SLR action when combined with the effects of other actions could result in a cumulative effect.

The cumulative effects analysis only considers resources and environmental conditions that could be affected by the proposed SLR action, including the effects of continued reactor operations during the SLR term and any refurbishment activities at a nuclear power plant. For there to be a cumulative effect, the proposed action (i.e., V.C. Summer SLR) must have an incremental new, additive, or increased physical effect or impact on the resource or environmental condition beyond what is already occurring.

For the purposes of analysis, past and present actions include all actions that have occurred since the commencement of reactor operations up to the submittal of the SLR application. Older actions are accounted for in baseline assessments presented in the affected environment discussions in Sections 3.2 through 3.13. The time frame for the consideration of reasonably foreseeable future actions is the SLR term. Reasonably foreseeable future actions include current and ongoing planned activities at V.C. Summer through the end of the SLR period.

The incremental effects of the proposed action (V.C. Summer SLR) when added to the effects from past, present, and reasonably foreseeable future actions and other actions result in the overall cumulative effect. A qualitative cumulative effects analysis is conducted in instances where the incremental effects of the proposed action and past, present, and reasonably foreseeable future actions are uncertain or not well known.

Information from Dominion's ER; responses to requests for additional information; information from other Federal, State, and local agencies; scoping comments; and information gathered during the environmental site audit at V.C. Summer were used to identify past, present, and reasonably foreseeable future actions in the cumulative effects analysis.

According to Dominion, V.C. Summer SLR would not require any refurbishment or ISFSI expansion for additional spent fuel storage.

SCE&G Company submitted an application in 2008 requesting combined licenses for V.C. Summer Units 2 and 3. This request was terminated in 2019. The only other past action near V.C. Summer was the decommissioning of a firing range adjacent to the Broad River. Decommissioning work was conducted in 2020, with a termination notice filed for the NPDES land disturbance permit in 2021. Decommissioning of the firing range has since been completed.

3.16.1 Air Quality

The region of influence that the NRC staff considered in the cumulative air quality analysis consists of Fairfield County because air quality designations in South Carolina are made at the county level. Dominion has not proposed any refurbishment activities during the SLR term. As a result, the NRC staff expects that air emissions and sources from the nuclear power plant during the SLR term would be similar to those presented in Section 3.3.2 of this SEIS. Consequently, cumulative impacts to air quality in Fairfield County would be the result of future projects and actions that change present-day emissions within the county. Decommissioning of the former firing range may have resulted in temporary and localized air emissions from demolition activities.

3.16.2 Water Resources

3.16.2.1 Surface Water Resources

The description of the affected environment in Section 3.5.1 of this SEIS ("Surface Water Resources") provides the basis for the cumulative impacts assessment for surface water resources. V.C. Summer withdraws cooling water from the Monticello Reservoir, which is also the sink for cooling water discharge from V.C. Summer's once-through cooling system and receives the majority of plant effluent. Permit No. 20PN001 allows V.C. Summer to withdraw up to 26,243.86 MGM for cooling and plant operations. While V.C. Summer does not directly withdraw water from other surface water bodies, diversions from the Broad River, located 1 mi (1.6 km) west of the Monticello Reservoir (see Figure 2-2 of this SEIS), are the primary source of water for maintaining storage in the Monticello Reservoir. The Broad River is a major river in South Carolina. The lowest recorded mean daily flow 1.2 mi (1.9 km) downstream of the Parr Reservoir over the last 43 years (1980–2023) was 48.3 cfs (1.37 m^3/s) (USGS 2024-TN10403), while the lowest mean of mean daily flow (lowest mean flow for a specific day of the year) was 2,200 cfs (62.3 m^3/s) (USGS 2024-TN10517) and the lowest 5th percentile daily flow was 238 cfs (6.74 m^3/s) (USGS 2024-TN10518). As discussed in Section 3.5.3.1 of this SEIS, FERC requires the Parr Hydroelectric Project be operated, including minimum flow, in accordance with an Adaptive Management Plan (FERC 2020-TN10536). Previously, FERC did not express any concerns with the operations of V.C. Summer and its impacts on minimum flow in the Broad River (NRC 2004-TN7262).

The Monticello Reservoir serves the dual purpose as the source of surface water for V.C. Summer and as the upper storage reservoir for the Fairfield Pumped Storage Project. The pumped storage project generates hydroelectric power by releasing water from the Monticello Reservoir to the lower Parr Shoals Reservoir during peak power demand periods. Storage in the Monticello Reservoir is replenished during non-peak demand periods, with up to 29,000 ac-ft transferred between the lower and upper reservoirs each day. The Monticello Reservoir is a large reservoir with 431,000 ac-ft of storage (Dominion 2023-TN10387). Consumptive use from evaporative losses, which constitute the majority of V.C. Summer’s consumptive demand, is estimated at 14.3 MGD (44 ac-ft/day or 22 cfs) (Dominion 2023-TN10387). Dominion has not identified any SLR-related refurbishment activities and has not proposed to increase surface water withdrawals or consumptive use during the SLR term. No new or proposed projects with the potential to substantially impact surface water withdrawals or consumptive water use within the reach of the Broad River where V.C. Summer is located were identified during the review.

Discharges from V.C. Summer are regulated under current SCDHEC NPDES Permit No. SC0030856 (Dominion 2023-TN10387). The NPDES permit requires daily maximum discharge temperature to be less than 113°F [45°C]), but there are no limits on the intake temperature or the maximum difference between intake and discharge temperatures. SCDHEC would be expected to alter NPDES discharge conditions, as necessary, to protect the water quality of the Monticello Reservoir. Under the CWA, the NRC cannot issue a Federal permit or license unless the CWA Section 401 water quality certification has been issued or the water quality certification requirement has been waived by a State or another authorized agency. The SCDHEC approved a Section 401 waiver request for V.C. Summer on August 4, 2022 (Dominion 2023-TN10387). V.C. Summer will continue operating under the current and future renewed SCDHEC permits during the SLR period and will also continue to implement its SWPPP and spill prevention control and countermeasures plan. Moreover, any offsite projects would similarly have to comply with SCDHEC regulations. Dominion does not anticipate any dredge-and-fill activities during the SLR term (2023-TN10387). While several of the local water bodies do not meet water quality standards and are listed as impaired by SCDHEC, V.C. Summer does not contribute to these impairments. In summary, a substantial regulatory framework exists to address current and future water quality and water use considerations. Therefore, the proposed action would have no cumulative effect beyond what is already being experienced.

3.16.2.2 Groundwater Resources

The description of the affected environment in Section 3.5.2 of this SEIS ("Groundwater Resources") serves as the baseline for the cumulative impacts assessment for groundwater resources. V.C. Summer does not withdraw groundwater for plant use (e.g., operational needs, drinking water, sanitation, or irrigation/grounds maintenance). As described in Section 3.5.2.1, the site utilizes a dewatering system to prevent groundwater ingress to building foundations. The system discharges to two, onsite stormwater outfalls. Based on groundwater elevation contour data and the estimated rate of dewatering during steady-state flow, the radius of influence of the system is likely to be within the plant boundary. Groundwater withdrawal at the site is not anticipated to significantly increase during the proposed SLR operating term. The flow of groundwater within onsite aquifers is toward tributaries of the Broad River, to the south and southwest of the plant. As described in Section 3.5.2.2, the majority of registered groundwater users within the site's vicinity or located to the east or northeast of the site center, further limiting the potential for any noticeable cumulative groundwater use impacts.

Although tritium has been detected in onsite groundwater, levels do not exceed the EPA's MCL for tritium. V.C. Summer will continue to implement its groundwater protection program and spill prevention control plans to reduce groundwater quality impacts. Based on this information, the proposed action would have no cumulative impacts beyond those identified in Section 3.5.3.2.

3.16.3 Socioeconomics

As discussed in Section 3.10.7 of this SEIS, continued operation of V.C. Summer during the SLR term would have no impact on socioeconomic conditions in the region beyond what is already being experienced. Dominion has no planned activities at V.C. Summer beyond continued reactor operations and maintenance.

Because Dominion has no plans to hire additional workers during the SLR term, overall expenditures and employment levels at V.C. Summer would remain unchanged and there would be no new or increased demand for housing and public services. Therefore, the only contributory effects would come from reasonably foreseeable future planned operational activities at V.C. Summer and other planned offsite activities, unrelated to the proposed action. When combined with past, present, and reasonably foreseeable future activities, the proposed action would have no new or increased effect beyond what is currently being experienced.

3.16.4 Human Health

The NRC and the EPA have established radiological dose limits to protect the public and workers from both acute and long-term exposure to radiation and radioactive materials. These dose limits are specified in 10 CFR Part 20 (TN283) and 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" (TN739). As discussed in Section 3.11 of this SEIS, "Human Health," the impacts on human health from continued nuclear power plant operations during the SLR term would be SMALL.

For the purposes of this cumulative impact analysis, the geographical area considered is the area within a 50 mi (80 km) radius of V.C. Summer. There are no other operational nuclear power plants within this 50 mi (80 km) radius. As discussed in Section 3.13.1 of this SEIS, "Radioactive Waste," Dominion stores spent nuclear fuel from V.C. Summer in a storage pool and in an onsite ISFSI. Per the V.C. Summer ER (Dominion 2023-TN10387), the ISFSI is designed to store the spent fuel generated over 80 years of operation, so no expansion is planned during the period of extended operation.

The EPA regulations at 40 CFR Part 190 (TN739) limit the dose to members of the public from all sources in the nuclear fuel cycle, including nuclear power plants, fuel fabrication facilities, waste disposal facilities, and transportation of fuel and waste. As discussed in Section 3.13 of this SEIS, Dominion has a radiological environmental monitoring program that measures radiation and radioactive materials in the environment from V.C. Summer, its ISFSI, and all other sources. The NRC staff reviewed the radiological effluent and environmental monitoring reports for the 5-year period from 2019 through 2023 as part of this cumulative impacts assessment (Dominion 2020-TN10411, Dominion 2021-TN10412, Dominion 2022-TN10413, Dominion 2023-TN10414, Dominion 2024-TN10415, Dominion 2020-TN10416, Dominion 2021-TN10417, Dominion 2022-TN10418, Dominion 2023-TN10419, and Dominion 2024-TN10420). The NRC staff's review of Dominion's data showed no indication of an adverse trend in radioactivity levels in the environment from either V.C. Summer or the ISFSI. The data showed that there was no measurable impact on the environment from operations at V.C. Summer.

Based on this information, the NRC staff concludes that there would be no significant cumulative radiological effect on human health resulting from the proposed action (SLR), in combination with the cumulative effects from other sources. This conclusion is based on the NRC staff's review of radiological environmental monitoring program data, radioactive effluent release data, and worker dose data; the expectation that V.C. Summer would continue to comply with Federal radiation protection standards during the period of extended operation; continued NRC oversight of plant emissions and activities, and the continued regulation of any future development or actions in the vicinity of V.C. Summer by the State of South Carolina.

3.16.5 Environmental Justice

This cumulative effects analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from past, present, and reasonably foreseeable future actions, including the continued operational effects of the V.C. Summer during the SLR term. Everyone living near V.C. Summer, including minority and low-income populations, currently experience its operational effects. The NRC addresses environmental justice by identifying the location of minority and low-income populations, determining whether there would be any potential human health or environmental effects, and whether any of the effects may be disproportionately high and adverse to these populations.

Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high and adverse environmental effects refer to impacts or risks of impacts in the natural or physical environment in a minority or low-income community that appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Some of these potential effects have been identified in resource areas presented in preceding sections of this chapter. As previously discussed in this chapter, the SLR impacts for all resource areas (e.g., land, air, water, and human health) would be SMALL.

As discussed in Section 3.12.1 of this SEIS, minority and low-income populations would not likely experience disproportionately high and adverse human health and environmental effects from the proposed action of V.C. Summer SLR. Because Dominion has no plans to hire additional workers during the SLR term, employment levels at V.C. Summer would remain unchanged, and there would be no additional demand for housing or increase in traffic. Based on this information and the analysis of human health and environmental effects, it is not likely that there would be any disproportionately high and adverse contributory effects on minority and low-income populations from the continued operation of V.C. Summer during the SLR term beyond what is already being experienced. Therefore, the only contributory effects would come from reasonably foreseeable future planned activities at V.C. Summer, and other reasonably foreseeable future offsite activities, unrelated to the proposed action.

When combined with past, present, and reasonably foreseeable future activities, the proposed SLR action would not likely cause disproportionately high and adverse human health and environmental effects on minority and low-income populations near V.C. Summer.

3.16.6 Waste Management and Pollution Prevention

This section of the SEIS considers the incremental waste management impacts of the SLR term when added to the contributory effects of other past, present, and reasonably foreseeable future actions. In Section 3.13.3 of this SEIS, “Proposed Action,” the potential waste management impacts from continued operations at V.C. Summer during the SLR term would be SMALL.

As discussed in Sections 3.13.1 and 3.13.2 of this SEIS, Dominion maintains waste management programs for radioactive and nonradioactive waste generated at V.C. Summer and is required to comply with Federal and State permits and other regulatory waste management requirements. All industrial facilities, including nuclear power plants and other facilities within a 50 mi (80 km) radius of V.C. Summer, are also required to comply with appropriate NRC, EPA, and State requirements for the management of radioactive and nonradioactive waste. Current waste management activities at V.C. Summer would likely remain unchanged during the SLR term. Furthermore, the NRC staff expects that V.C. Summer will continue to comply with Federal and State requirements for radioactive and nonradioactive waste.

Therefore, the proposed action, including continued radioactive and nonradioactive waste generation during the SLR term, would have no cumulative effect beyond what is already being experienced. This is based on V.C. Summer’s expected continued compliance with Federal and State of South Carolina requirements for radioactive and nonradioactive waste management and the expected regulatory compliance of other waste producers in the area.

3.17 <u>Resource Commitments Associated with the Proposed Action</u>

This section of the SEIS describes the NRC’s consideration of potentially unavoidable adverse environmental impacts that could result from implementation of the proposed action and alternatives, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and the irreversible and irretrievable commitment of resources.

3.17.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all workable mitigation measures. Carrying out any of the replacement power alternatives considered in this SEIS, including the proposed action, would result in some unavoidable adverse environmental impacts.

Minor unavoidable adverse impacts on air quality would occur due to emission and release of various chemical and radiological constituents from power plant operations. Nonradiological emissions resulting from power plant operations are expected to comply with Federal EPA and State emissions standards. Chemical and radiological emissions would not exceed the national emission standards for hazardous air pollutants.

During nuclear power plant operations, workers and members of the public would face unavoidable exposure to low levels of radiation as well as hazardous and toxic chemicals. Workers would be exposed to radiation and chemicals associated with routine plant operations and the handling of nuclear fuel and waste material. Workers would have higher levels of exposure than members of the public, but doses would be administratively controlled and are not expected to exceed regulatory standards or administrative control limits. In comparison, the alternatives involving the construction and operation of a non-nuclear power generating facility would also result in unavoidable exposure to hazardous and toxic chemicals for workers and the public.

The generation of spent fuel and waste material, including low-level radioactive waste, hazardous waste, and nonhazardous waste, would be unavoidable. Hazardous and nonhazardous wastes would be generated at some non-nuclear power generating facilities. Wastes generated during plant operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and State regulations. Due to the costs of handling these materials, the NRC staff expects that power plant operators would optimize all waste management activities and operations in a way that generates the smallest possible amount of waste.

3.17.2 Relationship between Short-Term Use of the Environment and Long-Term Productivity

The operation of power-generating facilities would result in short-term uses of the environment, as described in Sections 3.2 through 3.13 of this SEIS (see sections titled, “Proposed Action,” “No Action,” and “Replacement Power Alternatives: Common Impacts”). Short-term is the period of time that continued power-generating activities take place.

Power plant operations require short-term use of the environment and commitment of resources (e.g., land and energy), indefinitely or permanently. Certain short-term resource commitments are substantially greater under most energy alternatives, including SLR, than under the no-action alternative because of the continued generation of electrical power and the continued use of generating sites and associated infrastructure. During operations, all energy alternatives entail similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Air emissions from nuclear power plant operations introduce small amounts of radiological and nonradiological emissions to the region around the plant site. Over time, these emissions would result in increased concentrations and exposure, but the NRC staff does not expect that these emissions would affect air quality or radiation exposure to the extent that they would impair public health and long-term productivity of the environment.

Continued employment, expenditures, and tax revenues generated during power plant operations directly benefit local, regional, and State economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could enhance economic productivity over the long term.

The management and disposal of spent nuclear fuel, low-level radioactive waste, hazardous waste, and nonhazardous waste require an increase in energy and consume space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to meet waste disposal needs would reduce the long-term productivity of the land.

Power plant facilities are committed to electricity production over the short term. After decommissioning these facilities and restoring the area, the land could be available for other future productive uses.

3.17.3 Irreversible and Irretrievable Commitment of Resources

Resource commitments are irreversible when primary or secondary impacts limit the future options for use of a resource. For example, the consumption or loss of nonrenewable resources is irreversible. An irretrievable commitment refers to the use or consumption of resources for a period of time (e.g., for the duration of the action under consideration) that are neither renewable nor recoverable for future use. Irreversible and irretrievable commitments of resources for electrical power generation include the commitment of land, water, energy, raw materials, and other natural and human-made resources required for power plant operations. In general, the commitments of capital, energy, labor, and material resources are also irreversible.

The implementation of any of the replacement power alternatives considered in this SEIS would entail the irreversible and irretrievable commitments of energy, water, chemicals, and—in some cases—fossil fuels. These resources would be committed during the SLR term and over the entire life cycle of the power plant, and they would be unrecoverable.

Energy expended would be in the form of fuel for equipment, vehicles, and power plant operations, and electricity for equipment and facility operations. Electricity and fuel would be purchased from off-site commercial sources. Water would be obtained from existing water supply systems or withdrawn from surface water or groundwater. These resources are readily available, and the NRC staff does not expect that the amounts required would deplete available supplies or exceed available system capacities.

NEPA Section 102(2)(C)(v), as amended by the Fiscal Responsibility Act of 2023, requires Federal agencies to describe any irreversible and irretrievable commitment of Federal resources which would be involved in the proposed agency action. The CEQ has stated that “federal resources” mean resources owned by the Federal Government or held in trust for Tribal Nations (89 FR 35442-TN10163).

This section discusses the irreversible and irretrievable commitment of resources such as land, water, raw materials, and other natural resources. However, this section also notes the use of resources such as the commitment of capital, energy, labor, and material resources, which are also irreversible. As some of these types of resources are expended by the NRC during its review of the V.C. Summer SLR application, the NRC staff considers that these could be considered Federal resources under the Fiscal Responsibility Act of 2023.

It is important to note that the NRC staff and applicant have no way at this time of identifying the specific origins of all future resources that might be consumed. Some of the committed resources may ultimately be derived from Federally controlled lands, waters, funds, or other origins and some from non-Federal origins. By addressing the entirety of the resources in this SEIS, the staff has ensured consideration of any possible Federal subcomponent.

4 CONCLUSION

4.1 Environmental Impacts of License Renewal

This SEIS contains the environmental review of the application for a subsequent renewed operating license for V.C. Summer. After reviewing the plant-specific (Category 2) environmental issues in this SEIS, the NRC staff concluded that issuing a renewed license for V.C. Summer would have SMALL impacts for the Category 2 issues identified. The NRC staff considered mitigation measures for each Category 2 issue, as applicable. The NRC staff concluded that no additional mitigation measures are warranted.

4.2 Comparison of Alternatives

In Chapter 3 of this SEIS, the NRC staff considered the following alternatives to issuing a subsequent renewed operating license for V.C. Summer:

- the no-action alternative
- natural gas
- new nuclear (small modular reactor)
- natural gas and solar combination
- new nuclear and solar combination

Based on the review presented in this draft SEIS, the NRC staff concludes that the environmentally preferred alternative is the proposed action. The NRC staff recommends that a subsequent renewed V.C. Summer operating license be issued. As shown in Table 2-1 of this SEIS, all other power-generation alternatives would have impacts in more than one resource area that are greater than the proposed action (i.e., SLR), largely due to the environmental impacts inherent to new construction projects. To make up for the lost power generation if the NRC does not issue a subsequent renewed license for V.C. Summer (i.e., the no-action alternative), energy decision-makers may implement one of the replacement power alternatives discussed in Chapter 3 or a comparable alternative capable of replacing the power generated by V.C. Summer.

4.3 Recommendation

The NRC staff’s preliminary recommendation is that the adverse environmental impacts of SLR for V.C. Summer are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. This preliminary recommendation is based on the following:

- the analysis and findings in the LR GEIS
- the ER submitted by the applicant
- the NRC staff’s consultation with Federal, State, Tribal, and local agencies
- the NRC staff’s independent environmental review
- the NRC staff’s consideration of public comments received during the scoping process

5 REFERENCES

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.” TN283.

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.” TN249.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” TN10253.

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” TN4878.

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, “Reactor Site Criteria.” TN282.

18 CFR Part 157. *Code of Federal Regulations*, Title 18, *Conservation of Power and Water Resources*, Part 157, “Applications for Certificates of Public Convenience and Necessity and for Orders Permitting and Approving Abandonment Under Section of the Natural Gas Act.” TN7483.

36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 60, “National Register of Historic Places.” TN1682.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.” TN513.

40 CFR Part 50. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50, “National Primary and Secondary Ambient Air Quality Standards.” TN1089.

40 CFR Part 51. Code of Federal Regulations, Title 40, Protection of Environment, Part 51, “Requirements for Preparation, Adoption, and Submittal of Implementation Plans.” TN1090.

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Air Programs*, Subchapter C, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.” TN7226.

40 CFR Part 82. *Code of Federal Regulations*, Title 40, *Air Programs*, Subchapter C, *Protection of Environment*, Part 82, “Protection of Stratospheric Ozone.” TN10849.

40 CFR Part 110. *Code of Federal Regulations*, Title 40, Protection of Environment, Part 110, “Discharge of Oil.” TN8485.

40 CFR Part 112. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 112, “Oil Pollution Prevention.” TN1041.

40 CFR Part 122. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." TN2769.

40 CFR Part 125. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System." TN254.

40 CFR Part 131. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 131, "Water Quality Standards." TN4814.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." TN739.

50 CFR Part 10. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 10, "National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce." TN5490.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as amended." TN4312.

50 CFR Part 600. *Code of Federal Regulations*. Title 50, *Wildlife and Fisheries*, Part 600, "Magnuson-Stevens Act Provisions." TN1342.

59 FR 7629. February 16, 1994. "Executive Order 12898 of February 11, 1994: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations." *Federal Register*, Office of the President. TN1450.

61 FR 28467. June 5, 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*, Nuclear Regulatory Commission. TN4491.

64 FR 6183. February 8, 1999. "Executive Order 13112 of February 3, 1999: Invasive Species." *Federal Register*, Office of the President. TN4477.

69 FR 52040. August 24, 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Nuclear Regulatory Commission. TN1009.

79 FR 48300. August 15, 2014. "National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities." *Federal Register*, Environmental Protection Agency. TN4488.

81 FR 88609. December 8, 2016. "Safeguarding the Nation from the Impacts of Invasive Species." Executive Order 13751. *Federal Register*, Office of the President. TN8375.

85 FR 81813. December 17, 2020. "Endangered and Threatened Wildlife and Plants: 12-Month Finding for the Monarch Butterfly." *Federal Register,* Fish and Wildlife Service. TN8590.

87 FR 26152. May 3, 2022. “Endangered and Threatened Wildlife and Plants; Review of Species that are Candidates for Listing as Endangered or Threatened; Annual Notification of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions.” *Federal Register*, Fish and Wildlife Service. TN8591.

87 FR 56381. September 14, 2022. “Endangered and Threatened Wildlife and Plants; Endangered Species Status for Tricolored Bat.” *Federal Register*, U.S. Fish and Wildlife Service. TN8546.

88 FR 71384. October 16, 2023. “Dominion Energy South Carolina, Inc.; Virgil C. Summer Nuclear Station, Unit No. 1, Subsequent license renewal application; opportunity to request a hearing and to petition for leave to intervene.” *Federal Register*, Nuclear Regulatory Commission. TN10867.

88 FR 75627. November 3, 2023. “Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Dominion Energy South Carolina, Inc.; Virgil C. Summer Nuclear Station, Unit 1.” *Federal Register*, Nuclear Regulatory Commission. TN10388.

89 FR 35442. May 1, 2024. “National Environmental Policy Act Implementing Regulations Revisions Phase 2." Final Rule, *Federal Registe*r, Council on Environmental Quality. TN10163.

89 FR 64166. August 6, 2024. “Renewing Nuclear Power Plant Operating Licenses - Environmental Review.” Final rule and guidance; issuance, *Federal Register*, Nuclear Regulatory Commission. TN10321.

89 FR 79975. October 1, 2024. “Dominion Energy South Carolina, Inc.; Virgil C. Summer Nuclear Station, Unit No. 1; Notice of Intent to Prepare Environmental Impact Statement.” *Federal Register*, Nuclear Regulatory Commission. TN10601.

54 U.S.C. § 306108. National Historic Preservation Act Section 106, “Effect of Undertaking on Historic Property.” TN4839.

Adams, N.P. 2009. *Phase II Examination of 38FA360: A Middle to Late Woodland Period Site Along Mayo Creek, V.C. Summer Nuclear Station*, *Fairfield County, South Carolina*. New South Associates Technical Report #1712, Columbia, South Carolina. TN10510.

Adams, N.P. and D. Valk. 2007. *An Addendum to the Archaeological Survey of Planned Improvements at V.C. Summer Nuclear Station, Fairfield County, South Carolina*. New South Associates, Stone Mountain, Georgia. TN10564.

Adams, N.P. and S. Young. 2007. *Archaeological Survey of Planned Improvements of V.C. Summer Nuclear Station*, *Fairfield County, South Carolina*. New South Associates Technical Report #1394, Columbia, South Carolina. TN10490.

Adovasio, J.M., J. Donahue, and R. Stuckenrath. 1990. “The Meadowcroft Rockshelter Radiocarbon Chronology 1975-1990.” *American Antiquity* 55(2):348-354, Society for American Archaeology, Washington, D.C. TN10487.

Anderson, D.G. 1994. *The Savannah River Chiefdoms: Political Change in the Later Precontact Southeast.* University of Alabama Press, Tuscaloosa. TN10499.

Anderson, D.G. and K.E. Sassaman. 2012. *Recent Developments in Southeastern Archaeology: From Colonization to Complexity*. Society for American Archaeology Press, Washington, D.C. TN10494.

APLIC (Avian Power Line Interaction Committee). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012*. Edison Electric Institute, Washington, D.C. Accessed November 23, 2020, at https://www.aplic.org/uploads/files/15518/Reducing_Avian_Collisions_2012watermarkLR.pdf. TN6779.

ArchSite. 2024. *Inventory Records Search for V.C. Summer, On file at SC ArchSite*. South Carolina Department of Archives and History ArchSite, Columbia, South Carolina. Accessed September 11, 2024, at http://www.scarchsite.org/overview.aspx. Records results restricted to professional archaeologists. TN10562.

ArchSite. 2024. *Site Inventory Record for site 38NE8, On file at SC ArchSite*. South Carolina Institute of Archaeology and Anthropology University of South Carolina, Columbia, South Carolina. Accessed September 11, 2024, at http://www.scarchsite.org/overview.aspx. Records results restricted to professional archaeologists. TN10560.

ArchSite. 2024. *Statewide Survey of Historic Properties, Inventory Record for White Hall Elementary School, On file at SC ArchSite*. South Carolina Department of Archives and History, State Historic Preservation Office, Columbia, South Carolina. Accessed September 11, 2024, at http://www.scarchsite.org/overview.aspx. Records results restricted to professional archaeologists. TN10561.

Army (U.S. Army). 2014. *Biological Assessment on the Proposed Activities on Fort Drum Military Installation, Fort Drum, New York (2015-2017) for the Indiana Bat (*Myotis sodalis*) and Northern Long-Eared Bat (*Myotis septentrionalis*)*. Fort Drum, New York. TN8512.

Atomic Energy Act of 1954. 42 U.S.C. § 2011 et seq. Public Law 112-239, as amended. TN663.

Bagar, T.A., M.L. Hladik, and J.C. Daniels. 2020. "Uptake and toxicity of clothianidin to monarch butterflies from milkweed consumption." *Peer J* 8:e8669, Bethesda, Maryland. TN8594.

Bald and Golden Eagle Protection Act. 16 U.S.C. § 668-668d *et seq.* TN1447.

Bense, J.A. 1994. *Archaeology of the Southeastern United States: Paleoindian to World War I.* Academic Press, San Diego, California. TN10495.

Bevanger, K. 1994. "Bird interactions with utility structures: collision and electrocution, causes and mitigating measures." *IBIS*:*International journal of Avian Science* 136(4):412-425, Farcet, Cambridgeshire, England. TN9619.

BLM (Bureau of Land Management). 2010. *North Steens 230-kV Transmission Line Project Draft Environmental Impact Statement*. DOI-BLM-OR-B060-2010-0035-EIS, Bureau of Land Management, Hines, Oregon. TN9626.

BLM (Bureau of Land Management). 2019. *Gemini Solar Project, Final Resource Management Plan Amendment and Environmental Impact Statement, Volume 1: Chapters 1 – 4.* DOI-BLM-NV-S010-2018-0051-EIS, Washington D.C. TN8386.

BOEM (Bureau of Ocean Energy Management). Undated. "Renewable Energy on the Outer Continental Shelf: Ocean Wave Energy." Washington, D.C. Accessed June 12, 2022, at https://www.boem.gov/Renewable-Energy-Program/Renewable-Energy-Guide/Ocean-Wave-Energy.aspx. TN7696.

BRBC (Broad River Basin Council). 2024. *Broad River Basin Plan.* South Carolina Department of Environmental Sciences, Columbia, South Carolina. TN10402.

Catawba (Catawba Indian Nation). 2024. "About the Nation." Rock Hill, South Carolina. Accessed September 18, 2024, at https://catawbaindian.net/about-the-nation. TN10500.

CEA (Consumer Energy Alliance). 2022. "Hydrogen Energy and How It's Looking to Become a Mainstream Fuel Alternative - Energy Explorer." Houston, Texas. Accessed September 23, 2024, at https://consumerenergyalliance.org/2022/01/hydrogen-energy-and-how-its-looking-to-become-a-mainstream-fuel-alternative-energy-explorer/. TN10547.

CEQ (Council on Environmental Quality). 1997. *Environmental Justice Guidance under the National Environmental Policy Act*. Washington D.C. ADAMS Accession No. ML103430030. TN452.

Cherokee Nation. 2024. Letter from E. Toombs, Tribal Historic Preservation Officer, Cherokee Nation Tribal Historic Preservation Office, to S. Lopas, Nuclear Regulatory Commission, dated October 28, 2024, regarding "Re: Docket 50-395, License Renewal for Virgil C. Summer Nuclear Station, Fairfield County, SC." Tahlequah, Oklahoma. ADAMS Accession No. ML24308A005. TN10837.

Clean Air Act. 42 U.S.C. § 7401 et seq. TN1141.

Clemson (Clemson University). 2024. "Imported Fire Ant." Clemson, South Carolina. Accessed September 12, 2024, at https://www.clemson.edu/public/regulatory/plant-industry/invasive/pest_infomation/imported-fire-ant.html#:~:text=Imported%20Fire%20Ant,-Pest%20Alerts&text=The%20state%20of%20South%20Carolina,the%20movement%20of%20regulated%20articles. TN10442.

Counts, C.L. III. 1985. *Distribution of Corbicula fluminea at Nuclear Facilities*. NUREG/CR-4233, College of Marine Studies, University of Delaware, Lewes, DE. ADAMS Accession No. ML20138Q450. TN10463.

Crawford, R.L., and W.W. Baker. 1981. "Bats Killed at a North Florida Television Tower: A 25-Year Record." *Journal of Mammalogy* 62(3):651-652. TN8506.

Dobrasko, R. 2008. *Equalization Schools in South Carolina, 1951-1959*. Columbia, South Carolina. TN10507.

DOE (U.S. Department of Energy). 2011. *Final Environmental Impact Statement: Volume 1 Department of Energy Loan Guarantee to Royal Bank of Scotland for Construction and Startup of the Topaz Solar Farm, San Luis Obispo County, California.* DOE/EIS-0458, Washington, D.C. TN8387.

DOE (U.S. Department of Energy). 2015. *Wind Vision: A New Era for Wind Power in the United States*. Washington, D.C. TN8757.

DOE (U.S. Department of Energy). 2021. *Hydrogen Shot: An Introduction.* Office of Energy Efficiency and Renewable Energy, Hydrogen and Fuel Cells Technology Office. Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/fuelcells/articles/hydrogen-shot-introduction. TN7693.

DOE (U.S. Department of Energy). 2021. *Land-Based Wind Market Report: 2021 Edition*. Washington, D.C. Accessed December 12, 2023, at https://www.energy.gov/sites/default/files/2021-08/Land-Based%20Wind%20Market%20Report%202021%20Edition_Full%20Report_FINAL.pdf. TN9562.

DOE (U.S. Department of Energy). Undated. "Fuel Cell Basics: Hydrogen and Fuel Cell Technologies Office." Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/fuelcells/fuel-cell-basics.TN7695.

DOE (U.S. Department of Energy). Undated. "Geothermal Basics: Geothermal." Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/geothermal/geothermal-basics. TN7698.

DOE (U.S. Department of Energy). Undated. "Types of Hydropower Plants." Washington, D.C. Accessed November 20, 2024, at https://www.energy.gov/eere/water/types-hydropower-plants. TN10854.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2013. *Annual Energy Outlook 2013 with Projections to 2040.* DOE/EIA-0383(2013), Washington, D.C. ADAMS Accession No. ML13253A313. TN2590.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2015. *Annual Energy Outlook 2015 with Projections to 2040*. DOE/EIA-0383(2015), Washington, D.C. ADAMS Accession No. ML16172A121. TN4585.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2021. "Today in Energy: Less Electricity Was Generated by Coal than Nuclear in the United States in 2020." Washington, D.C. Accessed June 12, 2022, at https://www.eia.gov/todayinenergy/detail.php?id=47196. TN7718.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2022. *Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2021*. Washington, D.C. Accessed June 12, 2022, at https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf. TN7694.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2023. *Electric Power Monthly with Data for August 2023, Table 6.07.B: Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels*. Washington, D.C. TN8821.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2024. "South Carolina State Energy Profile." Washington, D.C. TN10525.

Dominion (Dominion Energy). 2020. Letter from R.R. Haselden, General Manager, Organization Effectiveness, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 22, 2020, regarding "Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report." Jenkinsville, South Carolina. ADAMS Accession Package No. ML20122A199. TN10557.

Dominion (Dominion Energy). 2020. Letter from R.R. Haselden, General Manager, Organization Effectiveness, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 22, 2020, regarding "Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report [2019]." Jenkinsville, South Carolina. ADAMS Accession No. ML20115H976. TN10411.

Dominion (Dominion Energy). 2020. Letter from R.R. Haselden, General Manager, Organization Effectiveness, V.C. Summer Nuclear Station, to NRC Document Control Desk, Dated April 27, 2020, regarding "Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radiological Environmental Operating Report [2019]." Jenkinsville, South Carolina. ADAMS Accession No. ML20118D376. TN10416.

Dominion (Dominion Energy). 2021. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 27, 2021, regarding "Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report [2020]." Jenkinsville, South Carolina. ADAMS Accession No. ML21118A843. TN10412.

Dominion (Dominion Energy). 2021. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, Dated April 27, 2021, regarding "Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radiological Environmental Operating Report [2020]." Jenkinsville, South Carolina. ADAMS Accession No. ML21118B065. TN10417.

Dominion (Dominion Energy). 2022. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 27, 2022, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report [2021].” Jenkinsville, South Carolina. ADAMS Accession No. ML22117A228. TN10413.

Dominion (Dominion Energy). 2022. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, Dated April 27, 2022, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radiological Environmental Operating Report [2021].” Jenkinsville, South Carolina. ADAMS Accession No. ML22117A210. TN10418.

Dominion (Dominion Energy). 2023. Letter from J.E. Holloway, Vice President - Nuclear Engineering and Fleet Support, to NRC Document Control Desk, dated July 18, 2023, regarding “Dominion Energy South Carolina Virgil C. Summer Nuclear Station Unit 1 Updated Final Safety Analysis Report - Revision 23.” Dominion Energy South Carolina, Inc., Glen Allen, Virginia. ADAMS Accession Package No. ML23208A088. TN10409.

Dominion (Dominion Energy). 2023. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 27, 2023, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report [2022].” Jenkinsville, South Carolina. ADAMS Accession No. ML23119A000. TN10414.

Dominion (Dominion Energy). 2023. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, Dated April 27, 2023, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radiological Environmental Operating Report [2022].” Jenkinsville, South Carolina. ADAMS Accession No. ML23118A002. TN10419.

Dominion (Dominion Energy). 2023. Letter from J.E. Holloway, Vice President - Nuclear Engineering and Fleet Support, to NRC Document Control Desk, dated August 17, 2023, regarding “Dominion Energy South Carolina, Inc. Virgil C. Summer Nuclear Station Unit 1 Application for Subsequent Renewed Operating License.” Dominion Energy South Carolina, Inc., Glen Allen, Virginia. ADAMS Accession Package No. ML23233A179. TN10387.

Dominion (Dominion Energy). 2024. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, dated April 23, 2024, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radioactive Effluent Release Report [2023].” Jenkinsville, South Carolina. ADAMS Accession No. ML24116A205. TN10415.

Dominion (Dominion Energy). 2024. Letter from R.R. Haselden, Director, Nuclear Station Safety and Licensing, V.C. Summer Nuclear Station, to NRC Document Control Desk, Dated April 29, 2024, regarding “Dominion Energy South Carolina, Inc. (DESC) Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Annual Radiological Environmental Operating Report [2023].” Jenkinsville, South Carolina. ADAMS Accession No. ML24120A207. TN10420.

Dominion (Dominion Energy). 2024. Letter from J.E. Holloway, Vice President - Nuclear Engineering and Fleet Support, to NRC Document Control Desk, dated August 1, 2024, regarding “Dominion Energy South Carolina, Inc. Virgil C. Summer Nuclear Station Unit 1 Environmental Review Response to NRC Requests for Additional Information and Response to NRC Requests for Confirmation of Information Set 1.” Dominion Energy South Carolina, Inc., Glen Allen, Virginia. ADAMS Accession No. ML24218A300. TN10391.

DOT (U.S. Department of Transportation). 2011. *2009 National Household Travel Survey: Summary of Travel Trends*. Washington, D.C. ADAMS Accession No. ML14308A121. TN3942.

Drucker, L.M., C.U. Bastian, and W.B. Barr. 2012. *AFC Resource Studies Series #214, Intensive (Phase 1) Archaeological Survey of VC Summer-Winnsboro, 230kV Utility Corridor, Fairfield County, SC*. AF Consultants, Columbia, South Carolina. TN10512.

Duke Energy. 2021. Letter from S.M. Snider, Vice President, Oconee Nuclear Station, to NRC Document Control Desk, dated June 7, 2021, regarding “Duke Energy Carolinas, LLC (Duke Energy) Oconee Nuclear Station (ONS), Units 1, 2, and 3 Docket Numbers 50-269, 50-270, 50-287 Renewed License Numbers DPR-38, DPR-47, DPR-55 Application for Subsequent Renewed Operating Licenses.” Seneca, South Carolina. ADAMS Accession No. ML21158A193. TN8897.

East, J.D., E. Monier, R.K. Saari, and F. Garcia-Menendez. 2024. “Projecting Changes in the Frequency and Magnitude of Ozone Pollution Events Under Uncertain Climate Sensitivity.” *Earth’s Future* 12, Washington, D.C. https://doi.org/10.1029/2023EF003941. TN10550.

EIA (U.S. Energy Information Administration). 2022. *Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022*. Washington, D.C. TN10537.

Elliott, D.T. and K. Sassaman. 1995. “Archaic Period Archaeology of the Georgia Coastal Plain and Coastal Zone.” Georgia Archaeological Research Design Paper No. 11/Report No. 35, Laboratory of Archaeology Series, University of Georgia, Athens, Georgia. TN10491.

Endangered Species Act of 1973. 16 U.S.C. § 1531 et seq*.* TN1010.

EPA (U.S. Environmental Protection Agency). 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. Washington, D.C. ADAMS Accession No. ML12241A393. TN3941.

EPA (U.S. Environmental Protection Agency). 1981. *Noise Effects Handbook: A Desk Reference to Health and Welfare, Effects of Noise*. EPA 350/9-82-106. Washington, D.C. TN7412.

EPA (U.S. Environmental Protection Agency). 2016. *Climate Change Indicators in the United States 2016*. Fourth Edition, EPA 430-R-16-004, Washington D.C. Accessed June 7, 2022, at https://www.epa.gov/sites/default/files/2016-08/documents/climate_indicators_2016.pdf. TN7561.

EPA (U.S. Environmental Protection Agency). 2019. "Sole Source Aquifers." Washington, D.C. Accessed June 30, 2023, at https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Sole_Source_Aquifers_August_2019/FeatureServer. TN9022.

EPA (U.S. Environmental Protection Agency). 2020. "Mercury and Air Toxics Standards (MATS)." Washington D.C. Accessed October 3, 2024, at https://www.epa.gov/mats. TN8379.

EPA (U.S. Environmental Protection Agency). 2022. Letter from D. Diaz, Acting Director, Water Division, to J. Hughes, Chief, Bureau of Water, Department of Health and Environmental Control, dated December 28, 2022, regarding "South Carolina's 2020 and 2022 303(d) List Submittal." Region 4, Atlanta, Georgia. TN10535.

EPA (U.S. Environmental Protection Agency). 2022. Letter from D. Diaz, Acting Director, Water Division, to J. Hughes, Chief, Bureau of Water, Department of Health and Environmental Control, dated December 28, 2022, regarding "South Carolina's 2020 and 2022 303(d) List Submittal." EPA Region 4, Sam Nunn Atlanta Federal Center, Atlanta, Georgia. TN10448.

EPA (U.S. Environmental Protection Agency). 2023. "ECHO (Enforcement and Compliance History Online) Detailed Facility Report, Facility Summary, Comanche Peak Nuclear Power Plant." Washington, D.C. Available at https://echo.epa.gov/detailed-facility-report?fid=110001143227&ej_type=sup&ej_compare=US. TN8803.

EPA (U.S. Environmental Protection Agency). 2023. "Energy Recovery from the Combustion of Municipal Solid Waste (MSW)." Washington, D.C. Available at https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw#EnergyRecovery. TN8443.

EPA (U.S. Environmental Protection Agency). 2024. *Climate Change Indicators in the United States*, *Fifth Edition*. EPA 430-R-24-003, Washington, D.C. TN10205.

EPA (U.S. Environmental Protection Agency). 2024. "NPDES State Program Authority." Washington, D.C. Accessed June 11, 2024, at https://www.epa.gov/npdes/npdes-state-program-authority. TN10085.

EPA (U.S. Environmental Protection Agency). 2024. "South Carolina Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants." Washington, D.C. Accessed September 19, 2024, at https://www3.epa.gov/airquality/greenbook/anayo_sc.html. TN10527.

EPRI (Electric Power Research Institute). 2008. *Groundwater Protection Guidelines for Nuclear Power Plants.* Public Edition, 1016099, Palo Alto, California. ADAMS Accession No. ML080450056. TN1961.

EPRI (Electric Power Research Institute). 2011. *Mapping and Assessment of the United States Ocean Wave Energy Resource*. 1024637, EPRI, Palto Alto, California. TN8442.

Fairfield County. 2011. "Fairfield County Official Zoning Map." Fairfield County, South Carolina. Accessed July 30, 2024, at https://www.fairfieldsc.com/departments/county-council/boards-commissions. TN10392.

Fairfield County. 2019. "Code of Ordinances, Chapter 16, Environment, Article III, Noise." Fairfield County, South Carolina. Accessed September 19, 2024, at https://library.municode.com/sc/fairfield_county/codes/code_of_ordinances?nodeId=COOR_CH16EN_ARTIIINO. TN10529.

Fairfield County. 2021. *Comprehensive Plan, 2021*. Ordinance # 582, Fairfield County, South Carolina. Accessed September 14, 2024, at https://www.fairfieldsc.com/uploads/uploads/Comp-Plan-2021.pdf. TN10470.

Fairfield County. 2024. "County Audit Reports." Fairfield County, South Carolina. Accessed September 11, 2024, at https://www.fairfieldsc.com/departments/finance/county-audit-reports. TN10424.

Fairfield County. 2024. *Fairfield County Comprehensive Plan, Draft*. Fairfield County, South Carolina. TN10393.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 et seq. TN662.

FERC (Federal Energy Regulatory Commission). 2020. *Environmental Assessment for Hydropower License*. Parr Hydroelectric Project, FERC Project No. 1894-211, Jenkinsville, South Carolina. TN10457.

FERC (Federal Energy Regulatory Commission). 2020. *Order Issuing New License (November 25, 2020)*. Project No. 1894-211, Washington, D.C. TN10536.

Futch, J.J. and P. Stallings. 2012. *A Phase I Archaeological Resources Survey of the VCS1-Killian 230 kV Winnsboro Junction to Winnsboro Portion (section B2) Transmission Line*. Brockington and Associates, Inc., Charleston, South Carolina. TN10513.

FWS (U.S. Fish and Wildlife Service). 2003. Letter from E.M. Eudaly, Acting Field Supervisor, to P.T. Kuo, NRC, dated October 17, 2003, regarding "License Renewal at V.C. Summer Nuclear Station, TAC No. MB5227, Docket No. 50-395, FWS Log No. 4-6-03-I-490." Washington, D.C. ADAMS Accession No. ML033090341. TN10475.

FWS (U.S. Fish and Wildlife Service). 2007. *Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision*. Great Lakes-Big Rivers Region, Fort Snelling, Minnesota. ADAMS Accession No. ML14302A612. TN934.

FWS (U.S. Fish and Wildlife Service). 2010. Letter from S.E. Pruitt, Field Supervisor, to COL M.J. Bennett, NGB Chief, Environmental Programs Division, dated October 21, 2010, regarding "Programmatic Biological Opinion on the Effects of Ongoing and Future Military and Land Management Activities at the Camp Atterbury Joint Maneuver Training Center in Bartholomew, Brown, and Johnson Counties in Indiana on the Federally Endangered Indiana Bat (Myotis sodalist)." Bloomington, Indiana. TN8537.

FWS (U.S. Fish and Wildlife Service). 2014. Letter from F. Clark, Acting Field Supervisor to D.J. Wrona, NRC, dated September 30, 2014, regarding "Threatened and endangered species within the vicinity of the Davis-Besse Nuclear Power Station." Columbus, Ohio. ADAMS Accession No. ML14296A559. TN7605.

FWS (U.S. Fish and Wildlife Service). 2015. Letter from D.A. Stilwell, Field Supervisor, to D.J. Wrona, Chief Environmental Review and Guidance Update Branch Division of License Renewal Office of Nuclear Reactor Regulation, dated July 14, 2015, regarding "This responds to your July 1,2015, letter regarding the proposed renewal of Facility Operating Licenses DPR-26 and DPR-64 for an additional 20 years at the Indian Point Nuclear Generating Units 2 and 3 located in the Village of Buchanan, Westchester County, New York." Cortland, New York. ADAMS Accession No. ML15196A013. TN7612.

FWS (U.S. Fish and Wildlife Service). 2016. *Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions*. Midwest Regional Office, Bloomington, Minnesota. TN7400.

FWS (U.S. Fish and Wildlife Service). 2018. Letter from T.R. Chapman, Supervisor, New England Field Office, to B. Beasley, Office of Nuclear Reactor Regulation Division of Materials and License Renewal, dated September 20, 2018, regarding "Seabrook Station Unit 1 License Renewal, Seabrook NH, TAILS: 2018-I-2970." Concord, New Hampshire. ADAMS Accession No. ML18263A200. TN7610.

FWS (U.S. Fish and Wildlife Service). 2019. *Peach Bottom Atomic Power Station Units 2 and 3 Subsequent License Renewal.* Project number 2017-0333, State College, Pennsylvania. ADAMS Accession No. ML19247D287. TN9742.

FWS (U.S. Fish and Wildlife Service). 2019. Letter from Virginia Ecological Services Field Office, dated June 6, 2019, regarding "Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project." Gloucester, Virginia. ADAMS Accession No. ML19157A113. TN7609.

FWS (U.S. Fish and Wildlife Service). 2020. *Monarch (*Danaus plexippus*) Species Status Assessment (SSA) Version 2.1*. Washington, D.C. TN8593.

FWS (U.S. Fish and Wildlife Service). 2021. *Birds of Conservation Concern 2021, Migratory Bird Program*. Washington, D.C. TN8740.

FWS (Fish and Wildlife Service). 2021. *Species Status Assessment (SSA) for Tricolored Bat (*Perimyotis subflavus*) Version 1.1*. Fish and Wildlife Service Northeast Region, Hadley, Massachusetts. TN8589.

FWS (U.S. Fish and Wildlife Service). 2021. Letter from Green Bay Ecological Services Field Office to B. Grange, dated February 9, 2021, regarding "Verification letter for the 'Point Beach Nuclear Plant, Units 1 and 2, Subsequent License Renewal' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions." New Franken, Wisconsin. ADAMS Accession No. ML21040A485. TN9740.

FWS (U.S. Fish and Wildlife Service). 2023. Letter from Fish and Wildlife Service, Virginia Ecological Services Field Office, dated July 10, 2023, regarding "Federal agency coordination under the Endangered Species Act, Section 7 for 'North Anna Power Station, Units 1 and 2, Subsequent License Renewal'." Gloucester, Virginia. ADAMS Accession No. ML23191A537. TN9093.

FWS (U.S. Fish and Wildlife Service). 2023. Letter from Ohio Ecological Services Field Office to B. Arlene, dated October 19, 2023, regarding "Federal agency coordination under the Endangered Species Act, Section 7 for 'Perry Nuclear Power Plant, Unit 1, License Renewal'." Columbus, Ohio. ADAMS Accession No. ML23292A248. TN9741.

FWS (U.S. Fish and Wildlife Service). 2024. "Carolina heelsplitter*(Lasmigona decorata)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/3534. TN10476.

FWS (U.S. Fish and Wildlife Service). 2024. "Georgia aster *(Symphyotrichum georgianum)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/5254. TN10485.

FWS (U.S. Fish and Wildlife Service). 2024. "Harperella *(Ptilimnium nodosum)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/3739. TN10483.

FWS (U.S. Fish and Wildlife Service). 2024. "Little amphianthus *(Amphianthus pusillus)."* ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/6445. TN10480.

FWS (U.S. Fish and Wildlife Service). 2024. Letter from FWS to NRC dated February 20, 2024, regarding "Project Code 2024-0051347, Virgil C. Summer Nuclear Station Proposed Subsequent License Renewal, List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project." FWS South Carolina Ecological Services, Charleston, South Carolina. ADAMS Accession No. ML24051A011. TN10473.

FWS (U.S. Fish and Wildlife Service). 2024. "Red-cockaded woodpecker *(Picoides borealis)."* ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/7614. TN10479.

FWS (U.S. Fish and Wildlife Service). 2024. "Relict trillium *(Trillium reliquum)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/8489. TN10484.

FWS (U.S. Fish and Wildlife Service). 2024. "Rough-leaved loosestrife *(Lysimachia asperulaefolia)."* ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/2747. TN10482.

FWS (U.S. Fish and Wildlife Service). 2024. "Shortnose sturgeon *(Acipenser brevirostrum)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/6635. TN10477.

FWS (U.S. Fish and Wildlife Service). 2024. "Smooth coneflower*(Echinacea laevigata)."* ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/3473. TN10481.

FWS (U.S. Fish and Wildlife Service). 2024. "Wood stork *(Mycteria americana)*." ECOS-Environmental Conservation Online System, Washington, D.C. Accessed September 16, 2024, at https://ecos.fws.gov/ecp/species/8477. TN10478.

FWS (U.S. Fish and Wildlife Service). Undated. "3-200-81: Special Purpose- Utility." Washington, D.C. Accessed November 7, 2023, at https://www.fws.gov/service/3-200-81-special-purpose-utility. TN9282.

FWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. *Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultation and Conference*. Washington, D.C. ADAMS Accession No. ML14171A801. TN1031.

Gilbert, M.T.P., D.L. Jenkins, A. Gotherstrom, N. Naveran, J.J. Sanchez, M. Hofreiter, P.F. Thomsen, J. Binladen, T.F.G. Higham, R.M. Yohe II, R. Parr, L.S. Cummings, and E. Willerslev. 2008. "DNA from Pre-Clovis Human Coprolites in Oregon, North America." *Science* 320(5877):786-789, Washington, D.C. TN10488.

Goodyear, A.C. and D. Sain. 2018. "The Pre-Clovis Occupation of the Topper Site, Allendale County, South Carolina." In *Early Human Life on the Southeastern Coastal Plain*, University Press of Florida, Gainesville, Florida. TN10492.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Schafale, W.H. McNab, D.R. Lenat, T.F. MacPherson, J.B. Glover, and V.B. Shelburne. 2002. *Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs)*. Reston, Virginia. TN10429.

Griffith, G., J. Omernik, and J. Comstock. 2002. *Ecoregions of South Carolina, Regional Descriptions*. Corvallis, Oregon. ADAMS Accession No. ML112710639. TN10428.

Gucker, Corey. 2010. “Lespedeza cuneata.” In *Fire Effects Information System*, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, Montana. TN10437.

Harned, D.A. and C.C. Daniel III. 1992. “The transition zone between bedrock and regolith: Conduit for contamination.” In *Proceedings of a Conference on Ground Water in the Piedmont of the Eastern United States, Charlotte, North Carolina*, October 16-18, 1989. Clemson, South Carolina. TN9019.

Hathcock, C. 2019. *Literature review on impacts to avian species from solar energy collection and suggested mitigations*. Department of Energy. TN8470.

Horvath, G., G. Kriska, and B. Robertson. 2009. “Polarized Light Pollution: A New Kind of Ecological Photopollution.” *Frontiers in Ecology and the Environment* 7(6):317–325, Washington, D.C. TN897.

ICNIRP (International Commission on Non-Ionizing Radiation Protection). 1998. “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz).” *Health Physics* 74 (4): 494-522, Philadelphia, Pennsylvania. Accessed October 7, 2020, at https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf. TN6591.

IEA (International Energy Agency). 2007. *Biomass for Power Generation and CHP*. ETE03, IEA Energy Technology Essentials, License CC BY 4.0. Paris, France. TN8436.

iNaturalist. 2024. “iNaturalist observations evaluated for VC Summer SLR, 28 May 2024.” San Rafael, California. Accessed May 28, 2024, at https://www.inaturalist.org/. TN10555.

iNaturalist. 2024. “Observations, Custom Boundary, South Carolina.” San Rafael, California. Accessed September 11, 2024, at https://www.inaturalist.org/observations?introduced&nelat=34.377845278840226&nelng=-81.19706989265978&place_id=any&subview=map&swlat=34.20879542390632&swlng=-81.42160297371447. TN10433.

iNaturalist. 2024. “Red Imported Fire Ant.” San Rafael, California. Accessed September 12, 2024, at https://www.inaturalist.org/taxa/67598-Solenopsis-invicta. TN10443.

IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. ADAMS No. ML112710385. Accessed May 23, 2022, at https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf. TN7421.

IPCC (Intergovernmental Panel on Climate Change). 2013. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley, eds. Cambridge University Press, Cambridge, United Kingdom. Accessed May 25, 2022, at https://www.ipcc.ch/report/ar5/wg1/. TN7434.

IPCC (Intergovernmental Panel on Climate Change). 2021. "Climate Change 2021: The Physical Science Basis." Accessed May 24, 2022, at https://www.ipcc.ch/report/ar6/wg1/. TN7435.

IPCC (Intergovernmental Panel on Climate Change). 2023. *AR6 Synthesis Report: Climate Change 2023.* Intergovernmental Panel on Climate Change, Geneva, Switzerland. TN8557.

James, D.G. 2019. "A Neonicotinoid Insecticide at a Rate Found in Nectar Reduces Longevity but not Oogenesis in Monarch Butterflies, *Danaus plexippus* (L.). (Lepidoptera: Nymphalidae)." *Insects* 10(9):276, Bethesda, Maryland. TN8595.

Johnson, G.D., and Strickland, MD. 2003. *Biological Assessment for the Federally Endangered Indiana Bat (Myotis sodalis) and Virginia Big-eared Bat (Corynorhinus townsendii virginianus) NedPower Mount Storm Wind Project, Grant County, West Virginia*. West, Inc., Cheyenne, Wyoming. TN8509.

Johnson,G.D., W.P. Erickson, M.D. Strickland, M.F. Shepard, D.A. Shepard, and S.A. Sarappo. 2003. "Mortality of Bats at a Large-scale Wind Power Development at Buffalo Ridge, Minnesota." *The American Midland Naturalist* 15(2):332-342. TN8511.

Kaufman, M.G. and D.M. Fonseca. 2014. "Invasion Biology of *Aedes japonicus japonicus* (Diptera: Culicidae)." *Annual Review of Entomology* 59:31-49. San Mateo, California. TN10441.

Kleinschmidt (Kleinschmidt Group). 2013. *Baseline Fisheries Resources Report, Parr Hydroelectric Project, FERC No. 1894*. Lexington, South Carolina. TN10455.

Kleinschmidt (Kleinschmidt Group). 2014. *Water Quality Report, Parr Fairfield Hydroelectric Project*, *FERC No. 1894*. Lexington, South Carolina. TN10523.

Krischik, V., M. Rogers, G. Gupta, and A. Varshney. 2015. "Soil-Applied Imidacloprid Translocates to Ornamental Flowers and Reduces Survival of Adult *Coleomegilla maculata*, *Harmonia axyridis*, and *Hippodamia convergens Lady Beetles, and Larval Danaus plexippus* and *Vanessa cardui* Butterflies." *PLoS One* 10(3):e0119133, San Francisco, California. TN8596.

Krishnan, N., Y. Zhang, K.G. Bidne, R.L. Hellmich, J.R. Coats, and S.P. Bradbury. 2020. "Assessing Field-Scale Risks of Foliar Insecticide Applications to Monarch Butterfly (Danaus plexippus) Larvae." *Environmental Toxicology Chemistry* 39(4):923-941. TN8597.

Larson, A. 2020. "Innovative Byproduct-Hydrogen Fuel Cell Power Plant Completed." *POWER.* Rockville, Maryland. Available at https://www.powermag.com/innovative-byproduct-hydrogen-fuel-cell-power-plant-completed/. TN8401.

Lee, J.M., V.L. Chartier, D.P. Hartmann, G.E. Lee, K.S. Pierce, F.L. Shon, R.D. Stearns, and M.T. Zeckmeister. 1989. *Electrical and Biological Effects of Transmission Lines: A Review*. DOE/BP-945. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon. June. Accessed June 1, 2022, at https://doi.org/10.2172/5712107. TN7481

LeGrand, H.E. 2004. *A Master conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina: a guidance manual*. OCLC No. 57172312, N.C. Dept. of Environment and Natural Resources, Division of Water Quality, Groundwater Section, Raleigh, North Carolina. TN9017.

Lexington County. 2022. The Lexington County 2022 Comprehensive Plan, Public Hearing Draft - April 2022. Lexington County, South Carolina. TN10394.

Loftis, L. 1994. *The Catawbas' Final Battle: A Bittersweet Victory*. American Indian Law Review, Volume 19, Number 1, University of Oklahoma College of Law, Norman, Oklahoma. TN10503.

Loss, S.R., T. Will, and P.P. Marra. 2014. "Refining Estimates of Bird Collision and Electrocution Mortality at Power Lines in the United States." *Plos One* 9(7): e101565, San Francisco, California. TN9396.

Łukasz, B., I. Rybakowska, A. Krakowiak, M. Gregorczyk, And W. Waldman. 2023. "Lithium Batteries Safety, Wider Perspective." *International Journal of Occupational Medicine and Environmental Health* 36(1):3-20, Łódź, Poland. TN9618.

Magnuson Stevens Fishery Conservation and Management Reauthorization Act of 2006. 16 U.S.C. 1801 Note. Public Law 109-479, January 12, 2007, 120 Stat. 3575. TN7841.

Magnuson-Stevens Fishery Conservation and Management Act, Public Law 94-265, as amended through October 11, 1996. 16 U.S.C. § 1801 *et seq.* TN1061.

Maize, K. 2019. "Waste-to-Energy: A Niche Market in Decline?" *POWER*, Rockville, Maryland. Accessed June 12, 2022, at https://www.powermag.com/waste-to-energy-a-niche-market-in-decline. TN7699.

Mayhew, D.A., L.D. Jensen, D.F. Hanson, and P.H. Muessig. 2000. "A comparative review of entrainment survival studies at power plants in estuarine environments." *Environmental Science & Policy* (3) Supplement 1: 295-301, Hunt Valley, Maryland. TN8458.

Michaels T., and K. Krishnan. 2019. *Energy Recovery Council, 2018 Directory of Waste-to-Energy Facilities*. Washington, D.C. Accessed June 12, 2022, at http://energyrecoverycouncil.org/wp-content/uploads/2019/01/ERC-2018-directory.pdf. TN7700.

Nagle, K. and H. Carpini. 2014. *Phase I Cultural Resource Investigations for the Parr Hydroelectric Project Fairfield and Newberry Counties, South Carolina*. FERC Project No. 1894, S&ME Engineering, Columbia, South Carolina. TN10505.

Nash, V.S., R.W. Christie, and R.M. Stroud. 1990. *Fisheries Investigations in Lakes and Streams District IV*, *Annual Progress Report, F-11-25, July 1, 1989 to June 30, 1990*. South Carolina Wildlife and Marine Resources Department, Columbia, South Carolina. ADAMS Accession No. ML030300694. TN10456.

National Audubon Society. 2024. “Golden Eagle.” New York, New York. Accessed September 11, 2024, at https://www.audubon.org/field-guide/bird/golden-eagle#range_and_identification. TN10431.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 U.S.C. § 4321 et seq. TN661.

National Historic Preservation Act. 54 U.S.C. § 300101 et seq. TN4157.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 et seq. TN4482.

NC Cooperative Extension (North Carolina Cooperative Extension). Undated. “Lonicera japonica.” North Carolina State University and North Carolina A&T State University, Raleigh, North Carolina. Accessed September 11, 2024, at https://plants.ces.ncsu.edu/plants/lonicera-japonica/. TN10438.

NC Cooperative Extension (North Carolina Cooperative Extension). Undated. “Vinca major.” North Carolina State University and North Carolina A&T State University, Raleigh, North Carolina. Accessed September 12, 2024, at https://plants.ces.ncsu.edu/plants/vinca-major/. TN10440.

NCEI (National Centers for Environmental Information). 2024. *Placeholder for 2022 Local Climatological Data Annual Summary with Comparative Data, Columbia, South Carolina*. Asheville, North Carolina. Accessed September 5, 2024, at https://www.ncei.noaa.gov/pub/orders/IPS/IPS-96FD696A-2711-4F69-A00A-E39207618154.pdf. TN10570.

NCEI (National Centers for Environmental Information). 2024. *Placeholder for Monthly Global Climate Report for July 2024*. Asheville, North Carolina. Accessed August 15, 2024, at https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202407/supplemental/page-1. TN10602.

NCES (National Center for Education Statistics). 2024. “Data for Public School Districts in South Carolina.” Washington, D.C. Accessed September 14, 2024, at https://nces.ed.gov/ccd/schoolsearch/school_list.asp?Search=1&InstName=&SchoolID=&Address=&City=&State=45&Zip=&Miles=&County=&PhoneAreaCode=&Phone=&DistrictName=&DistrictID=&SchoolType=1&SchoolType=2&SchoolType=3&SchoolType=4&SpecificSchlTypes=all&IncGrade=-1&LoGrade=-1&HiGrade=-1. TN10469.

NEI (Nuclear Energy Institute). 2007. *Industry Ground Water Protection Initiative—Final Guidance Document.* NEI 07–07, Washington, D.C. ADAMS Accession No. ML091170588. TN1913.

NEI (Nuclear Energy Institute). 2019. *Industry Groundwater Protection Initiative – Final Guidance Document, Rev. 1.* NEI-07-07, Revision 1, Washington, D.C. ADAMS Accession No. ML19142A071. TN6775.

NETL (National Energy Technology Laboratory). 2012. *Life Cycle Analysis: Natural Gas Combined Cycle (NGCC) Power Plant*. DOE/NETL-403-110509, Pittsburgh, Pennsylvania. Accessed January 8, 2023, at https://www.netl.doe.gov/projects/files/FY13_LifeCycleAnalysisNaturalGasCombinedCycle(NGCC)PowerPlantFinal_060113.pdf. TN9604.

NETL (National Energy Technology Laboratory). 2022. *Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity*. DOE/NETL-2023/4320, Washington, D.C. TN10530.

NETL (National Energy Technology Laboratory). 2022. *Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity*. DOE/NETL-2023/4320, Pittsburgh, Pennsylvania. Available at https://netl.doe.gov/projects/files/CostAndPerformanceBaselineForFossilEnergyPlantsVolume1BituminousCoalAndNaturalGasToElectricity_101422.pdf. TN8820.

Newberry County. 2024. "Links, Planning-Zoning." Newberry, South Carolina. Accessed September 4, 2024, at https://www.newberrycounty.gov/planning-zoning/links. TN10395.

NIEHS (National Institute of Environmental Health Sciences). 1999. *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields*. NIH Publication No 99–4493, National Institutes of Health, Research Triangle Park, North Carolina. ADAMS Accession No. ML093240277. TN78.

NIEHS (National Institute of Environmental Health Sciences). 2002. *Electric and Magnetic Fields Associated with the Use of Electric Power: Questions and Answers*. National Institutes of Health, Research Triangle Park, North Carolina. ADAMS Accession No. ML112660024. TN6560.

NIOSH (National Institute for Occupational Safety and Health). 1996. *EMFs In The Workplace*. Washington, D.C. ADAMS Accession No. ML21145A339. TN6766.

NLD (Native Land Digital). 2022. "Territories Map for Eastern Band of Cherokee Indians." Vancouver, British Columbia, Canada. Accessed September 18, 2024, at https://native-land.ca/maps/territories/cherokee/. TN10501.

NOAA (National Oceanic and Atmospheric Administration). 2024. "Drawn Action Area & Overlapping S7 Consultation Areas, Approximate VC Summer Action Area boundaries." Endangered Species Act Section n7 mapper, Southeast Region, Silver Spring, Maryland. Accessed August 26, 2024, at https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=b184635835e34f4d904c6fb741cfb00d. TN10486.

NOAA (National Oceanic and Atmospheric Administration). 2024. "Storm Events Database, Fairfield County, South Carolina, 01/01/1950 - 05/31/2024." Silver Spring, Maryland. Accessed September 19, 2024, at https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=45%2CSOUTH+CAROLINA. TN10526.

NPS (National Park Service). 2023. "Trail of Tears, A Journey of Injustice." Washington, D.C. Accessed September 18, 2024, at https://www.nps.gov/trte/index.htm. TN10502.

NPS (National Park Service). 2024. "Brown v. Board of Education, National Historical Park, Kansas." Washington, D.C. Accessed September 18, 2024, at https://www.nps.gov/brvb/planyourvisit/the-story-of-brown.htm. TN10508.

NRC (U.S. Nuclear Regulatory Commission). 1981. *Final Environmental Statement related to the operation of Virgil C. Summer Nuclear Station Unit No. 1, Docket No. 50-395, South Carolina Electric and Gas Company*. NUREG-0719, Washington, D.C. ADAMS Accession No. ML072750234. TN10472.

NRC (U.S. Nuclear Regulatory Commission). 1994. Letter from I. Selin to The President dated March 31, 1994. Washington, D.C. ADAMS Accession No. ML033210526. TN7650.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2, NUREG-1437, Washington, D.C. ADAMS Accession Nos. ML040690705, ML040690738. TN288.

NRC (U.S. Nuclear Regulatory Commission). 2002. "Final Generic Environmental Impact Statement of Decommissioning of Nuclear Facilities (NUREG-0586)." NUREG–0586, Supplement 1, Volumes 1 and 2, Washington, D.C. ADAMS Accession Nos. ML023470327, ML023500228. TN665.

NRC (U.S. Nuclear Regulatory Commission). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1: Regarding the Decommissioning of Nuclear Power Reactors, Main Report - Final Report*. NUREG-0586, Supplement 1, Volume 1 and 2, Washington, D.C. ADAMS Accession Nos. ML023470304, ML023470323, ML023500187, ML023500211, ML023500223. TN7254.

NRC (U.S. Nuclear Regulatory Commission). 2003. Letter from P.T. Kuo, Program Director, License Renewal and Environmental Impacts, Division of Regulatory Improvement Programs, Office of Nuclear Reactor Regulation, to S. Abbott, FWS Ecological Services Office, dated June 26, 2003, regarding "Biological Assessment for License Renewal at V.C. Summer Nuclear Station and Request for Informal Consultation (TAC No. MB5227)." Washington, D.C. ADAMS Accession No. ML031770358. TN10474.

NRC (U.S. Nuclear Regulatory Commission). 2004. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 15: Regarding Virgil C. Summer Nuclear Station, Final Report*. NUREG-1437, Supplement 15, Washington, D.C. ADAMS Accession No. ML040540718. TN7262.

NRC (U.S. Nuclear Regulatory Commission). 2006. *Liquid Radioactive Release Lessons Learned Task Force Final Report*. Washington, D.C. ADAMS Accession No. ML083220312. TN1000.

NRC (U.S. Nuclear Regulatory Commission). 2010. Memorandum from R. Whited, Branch Chief, to P. Vokoun, Project Manager, dated March 18, 2010, regarding “Summary of the Environmental Site Audit and Alternative Site Visit Related to the Review of the Combined License Application for Virgil C. Summer Nuclear Station, Units 2 and 3.” Washington, D.C. ADAMS Accession No. ML100480082. TN10520.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3*. NUREG-1939, Volume 1, Washington, D.C. ADAMS Accession No. ML11098A044. TN10532.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3*. NUREG-1939, Volume 2, Washington, D.C. ADAMS Accession No. ML11098A057. TN10533.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3.* Final Report, NUREG-1939, Washington, D.C. ADAMS Accession No. ML11098A044. TN1723.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Revision 1, Washington, D.C. ADAMS Package Accession No. ML13107A023. TN2654.

NRC (U.S. Nuclear Regulatory Commission). 2013. Letter from R.K. Johnson, Chief Fuel Manufacturing Branch Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Materials Safety and Safeguards, to D.W. Johnson, Director, Office of Technical Programs and Coordination Activities, Department of Labor Occupational Safety and Health Administration, dated July 29, 2013, regarding “Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration.” Washington, D.C. ADAMS Accession No. ML11354A411. TN10165.

NRC (U.S. Nuclear Regulatory Commission). 2014. Email from B.A. Grange to U.S. Fish and Wildlife Service, dated June 17, 2014, regarding “Davis Besse Operating License Renewal.” Washington, D.C. ADAMS Accession No. ML14168A616. TN7385.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel.* Final Report, NUREG-2157, Washington, D.C. ADAMS Package Accession No. ML14198A440. TN4117.

NRC (U.S. Nuclear Regulatory Commission). 2015. *Biological Assessment on the Northern Long-Eared Bat (Myotis septentrionalis) and Indiana Bat (Myotis sodalis), Indian Point Nuclear Generating Units 2 and 3, Proposed License Renewal*. Docket Numbers 50-247 and 50-286, Rockville, Maryland. ADAMS Accession No. ML15161A086. TN7382.

NRC (U.S. Nuclear Regulatory Commission). 2015. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants; Supplement 53 Regarding Sequoyah Nuclear Plant, Units 1 and 2, Final Report.* NUREG-1437, Supplement 53, Washington, D.C. ADAMS Accession No. ML15075A438. TN5842.

NRC (U.S. Nuclear Regulatory Commission). 2018. *Biological Evaluation of Impacts to Northern Long-Eared Bat, Rufa Red Knot, Piping Plover, and Roseate Tern, Seabrook Station, Unit 1, Proposed License Renewal to Operating License No. NPF-86*. Docket No. 50-443, Rockville, Maryland. ADAMS Accession No. ML18186A692. TN7381.

NRC (U.S. Nuclear Regulatory Commission). 2019. *Environmental Impact Statement for an Early Site Permit (ESP) at the Clinch River Nuclear Site*. NUREG-2226, Washington, D.C. ADAMS Package Accession No. ML19087A266. TN6136.

NRC (U.S. Nuclear Regulatory Commission). 2019. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4*. NUREG-1437, Supplement 5, Second Renewal, Washington, D.C. ADAMS Accession No. ML19290H346. TN6824.

NRC (U.S. Nuclear Regulatory Commission). 2019. Letter from F.D. Brown, Director, Office of New Reactors, to D.G. Stoddard, Senior Vice President & Chief Nuclear Officer, South Carolina Electric & Gas Company, dated March 6, 2019, regarding “Virgil C. Summer Nuclear Station, Units 2 and 3, Termination of Combined Licenses NPF-93 and NPF-94.” Washington, D.C. ADAMS Accession Package No. ML18198A298. TN10390.

NRC (U.S. Nuclear Regulatory Commission). 2020. *Procedural Guidance for Preparing Categorical Exclusions, Environmental Assessments, and Considering Environmental Issues*. LIC-203, Revision 4, Washington, D.C. ADAMS Accession No. ML20016A379. TN6399.

NRC (U.S. Nuclear Regulatory Commission). 2020. Letter from R.J. Bernardo, Project Manager, Integrated Program Management and BDB Branch, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, to D.G. Stoddard, Senior Vice President and Chief Nuclear Officer, dated June 9, 2020, regarding “Virgil C. Summer Nuclear Station, Unit 1 - Documentation of the Completion of Required Actions Taken in Response to the Lessons Learned from the Fukushima Dai-ichi Accident.” Washington, D.C. ADAMS Accession No. ML20139A087. TN10401.

NRC (U.S. Nuclear Regulatory Commission). 2023. Letter from T.B. Smith, Chief, Environmental Review License Renewal Branch, Division of Rulemaking, Environment, and Financial Support, Office of Nuclear Material Safety and Safeguards, to R. Nelson, Executive Director, Advisory Council on Historic Preservation, dated November 3, 2023, regarding “Request for Scoping Comments Concerning the Environmental Review of the Virgil C. Summer Nuclear Station, Unit No. 1 Subsequent License Renewal Application (Docket Number: 50-395).” Washington, D.C. ADAMS Accession Package No. ML23289A111. TN10514.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from M. Rome, Chief, Environmental Technical Review Branch 1, Division of Rulemaking, Environmental, and Financial Support, Office of Nuclear Material Safety and Safeguards, to B. Harris, Chief, Catawba India Nation; C. Hoskin, Principal Chief, Cherokee Nation; W.E. Emerson, Ph.D., State Historic Preservation Officer, South Carolina Department of Archives and History; D. Hill, Principal Chief, The Muscogee (Creek) Nation; R. Sneed, Principal Chief, Eastern Band of Cherokee Indians, dated September 23, 2024, regarding "Clarification Regarding Area of Potential Effect for the Subsequent Operating License Renewal for Virgil C. Summer Nuclear Station Fairfield County, South Carolina (SHPO Project Number: 22-EJ0147) (Docket Number: 50-395)." Washington, D.C. ADAMS Accession Package No. ML24221A207. TN10592.

NRC (Nuclear Regulatory Commission). 2024. Letter from N. Martinez, Environmental Scientist Technical Review Branch 2, Division of Rulemaking, Environmental, and Financial Support, Office of Nuclear Material Safety and Safeguards, to M. Rome, Chief, Environmental Technical Review Branch 1, Division of Rulemaking, Environmental, and Financial Support, Office of Nuclear Material Safety and Safeguards, dated June 21, 2024, regarding "May 17, 2024, Teleconference Summary Between U.S. Nuclear Regulatory Commission and the South Carolina State Historic Preservation Office." Washington, D.C. ADAMS Accession No. ML24162A048. TN10516.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Energy and System Design Mitigation Alternatives White Paper, Final Report*. Washington, D.C. ADAMS Accession No. ML21225A754. TN10848.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volume 1-3, Revision 2, Washington, D.C. ADAMS Accession No. ML24087A133. TN10161.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2021, Fifty-Fourth Annual Report*. NUREG-0713, Volume 43, Washington, D.C. ADAMS Accession No. ML24060A017. TN9915.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal, Final Report*. NUREG-1555, Revision 2, Washington, D.C. ADAMS Accession No. ML23201A227. TN10251.

NREL (National Renewable Energy Laboratory). 2012. *Life Cycle Greenhouse Gas Emissions from Solar Photovoltaics*. Golden, Colorado. TN10546.

NREL (National Renewable Energy Laboratory). Undated. "Concentrating Solar Power Basics." Golden, Colorado. Accessed November 20, 2024, at https://www.nrel.gov/research/re-csp.html#:~:text=Linear%20Concentrator%20Systems&text=The%20mirrors%20are%20tilted%20toward,turbine%20generator%20to%20produce%20electricity. TN10852.

NREL (National Renewable Energy Laboratory). Undated. "State Clean Energy Employment Projection Support." Golden, Colorado. Accessed November 20, 2024, at https://www.nrel.gov/state-local-tribal/state-employment-projection-support.html. TN10853.

Nuget, D. and B.K. Sovacool. 2014. “Assessing the Lifecycle Greenhouse Gas Emissions from Solar PV and Wind Energy: A Critical Meta-Survey.” *Energy Policy* 65:229-244, Elsevier, Amsterdam, Netherlands. https://doi.org/10.1016/j.enpol.2013.10.048. TN10553.

Nystrom, P.G., Jr. 1996. *Earthquake Hazards of the South Carolina Coastal Plain*. South Carolina Department of Natural Resources and South Carolina Geological Survey, Columbia, South Carolina. TN10399.

Occupational Safety and Health Act of 1970, as amended. 29 U.S.C. § 651 *et seq*. TN4453.

Pappas, A. and R. Bailey. 2011. *A Phase I Archaeological Resources Survey of the VCS2-Lake Murray 230 kV Line No. 2/St. George 230 kV Line No. 1 Corridor, Fairfield, Lexington, Newberry and Richland Counties, South Carolina*. Brockington and Associates, Inc., Charleston, South Carolina. TN10511.

Peskin, L. 2011. “The Forgotten Indian Earthworks of Cleveland, Ohio.” *Ohio Archaeologist*, 61(2):33-37, Fairborn, Ohio. TN9872.

Petersen, M.D., A.M. Shumway, P.M. Powers, C.S. Mueller, M.P. Moschetti, A.D. Frankel, S. Rezaeian, D.E. McNamara, N. Luco, O.S. Boyd, K.S. Rukstales, K.S. Jaiswal, E.M. Thompson, S.M. Hoover, B.S. Clayton, E.H. Field, and Y. Zeng. 2020. “The 2018 update of the US National Seismic Hazard Model: Overview of model and implications.” *Earthquake Spectra* 36(1):5-41, Los Angeles, California. TN7281.

Petersen, M.D., A.M. Shumway, P.M. Powers, E.H. Field, M.P. Moschetti, K.S. Jaiswal, K.R. Milner, S. Rezaeian, A.D. Frankel, A.L. Llenos, A.J. Michael, J.M. Altekruse, S.K. Ahdi, K.B. Withers, C.S. Mueller, Y. Zeng, R.E. Chase, L.M. Salditch, N. Luco, K.S. Rukstales, J.A. Herrick, D.L. Girot, B.T. Aagaard, A.M. Bender, M.L. Blanpied, R.W. Briggs, O.S. Boyd, B.S. Clayton, C.B. DuRoss, E.L. Evans, P.J. Haeussler, A.E. Hatem, K.L. Haynie, E.H. Hearn, K.M. Johnson, Z.A. Kortum, N.S. Kwong, A.J. Makdisi, H.B. Mason, D.E. McNamara, D.F. McPhillips, P.G. Okubo, M.T. Page, F.F. Pollitz, J.L. Rubinstein, B.E. Shaw, Z.-K. Shen, B.R. Shiro, J.A. Smith, W.J. Stephenson, E.M. Thompson, J.A.T. Jobe, E.A. Wirth, and R.C. Witter. 2024. “The 2023 US 50-State National Seismic Hazard Model: Overview and Implications.” *Earthquake Spectra* 40(1):5-88, Thousand Oaks, California. http://dx.doi.org/10.1177/87552930231215428. TN9940.

Pigati, J.S., K.B. Springer, J.S. Honke, D. Wahl, M.R. Champagne, S.R.H. Zimmerman, H.J. Gray, V.L. Santucci, D. Odess, D. Bustos, and M.R. Bennett. 2023. “Independent age estimates resolve the controversy of ancient human footprints at White Sands.” *Science* 382(6666):73-75, Washington, D.C. TN10489.

Pollution Prevention Act of 1990. 42 U.S.C. § 13101 *et seq*. TN6607.

Potter, E.W. and B.M. Boland. 1992. *Guidelines for Evaluating and Registering Cemeteries and Burial Places*. National Park Service, Interagency Resources Division, National Register of Historic Places, Bulletin 41, Washington, D.C. TN10506.

Price, J. 2010. *Fish Passage on the Broad River: an assessment of the benefits to freshwater mussels, Completion Report to the Broad River Mitigation Fund*. University of South Carolina and South Carolina Department of Natural Resources, Columbia, South Carolina. TN10451.

Resource Conservation and Recovery Act of 1976. 42 U.S.C § 6901 *et seq*. Public Law 94-580, 90 Stat. 2795. TN1281.

Revels, J. 2003. *Historical and Architectural Survey of Newberry County, South Carolina, Final Report*. Palmetto Conservation Foundation, Columbia, South Carolina. TN10563.

Richland County. 2015. *Comprehensive Plan*. Richland County, South Carolina. TN10396.

Runkle, J., K.E. Kunkel, L.E. Stevens, R. Frankson, B.C. Stewart, W. Sweet, and S. Rayne. 2022. *South Carolina State Climate Summary 2022*. NOAA Technical Report NESDIS 150-SC, NOAA/NESDIS, Silver Spring, Maryland. Accessed February 16, 2022, at https://statesummaries.ncics.org/downloads/SouthCarolina-StateClimateSummary2022.pdf. TN7161.

Sammons, S.M., L.G. Dorsey, C. Scott Loftis, P. Chrisman, M. Scott, J. Hammonds, M. Jolley, H. Hatcher, J. Odenkirk, J. Damer, M.R. Lewis, and E.J. Peatman. 2023. “Alabama Bass Alter Reservoir Black Bass Species Assemblages When Introduced Outside Their Native Range.” *North American Journal of Fisheries Management* 43:384-399. American Fisheries Society, Bethesda, Maryland. TN10471.

Santee Cooper. 2019. Letter from J.E. Brogdon, Jr., Interim President and Chief Executive Officer, to R.T., Director of DLSE, Document Control Desk, U.S. Nuclear Regulatory Commission, dated January 29, 2019, regarding “Status Report on South Carolina Public Service Authority’s Position on the Termination of the COL for VCSNS Units 2&3.” Moncks Corner, South Carolina. ADAMS Accession Package No. ML19031B430. TN10389.

Sassaman, K.E., I.R. Daniel, Jr., and C.R. Moore. 2002. *G.S. Lewis-East, Early and Late Archaic Occupations along the Savannah River, Aiken County, South Carolina*. Savannah River Archaeological Research Papers 12, South Carolina Institute of Archaeology and Anthropology, University of South Carolina. TN10496.

Sassaman, K.E., M.E. Blessing, and A.R. Randall. 2006. “Stallings Island Revisited: New Evidence for Occupational History, Community Pattern, and Subsistence Technology.” *American Antiquity* 71(3):539-565. Society for American Archaeology, Washington, D.C. TN10559.

Saunders, W.E. 1930. “Bats in Migration.” *Journal of Mammalogy* 11(2):255. TN8504.

SC Code of Law § 50. Title 50, *Fish, Game, and Watercraft*. South Carolina Code of Laws, Columbia, South Carolina. TN10460.

SC Heritage Trust (South Carolina Heritage Trust Program). 2023. “Tracked Species by County, Fairfield County, Newberry County, and Richland County.” Columbia, South Carolina. Accessed April 16, 2024, at https://natural-heritage-program-scdnr.hub.arcgis.com/. TN10435.

SCCMA (South Carolina Commission for Minority Affairs). 2024. “South Carolina’s Recognized Native American Indian Entities, Federally Recognized Tribe, State Recognized Tribes.” Columbia, South Carolina. Accessed September 18, 2024, at https://cma.sc.gov/minority-population-divisions/south-carolinas-recognized-native-american-indian-entities. TN10504.

SCDAH (South Carolina Department of Archives History). 2023. Email from E.M. Johnson, Director, Historical Services, D-SHPO, State Historic Preservation Office, SC Department of Archives & History, dated November 22, 2023, regarding “RE: Request for Scoping Comments - Virgil C. Summer Nuclear Station.” Columbia, South Carolina. ADAMS Accession No. ML24037A319. TN10515.

SCDAH (South Carolina Department of Archives History). 2024. Letter from E.M. Johnson, Director of Historical Services, D-SHPO, State Historic Preservation Office, to S. Lopas, Senior Environmental Project Manager, Office of Nuclear Material Safety and Safeguards (NMSS), dated October 25, 2024, regarding “VC Summer Nuclear Station, Unit 1, Subsequent License Renewal Application Area of Potential Effect (APE) Clarification Fairfield County, South Carolina, SHPO Project No. 22-EJ0147, Docket No. 50-395.” Columbia, South Carolina. ADAMS Accession No. ML24308A006. TN10836.

SCDES (South Carolina Department of Environmental Services). 2024. “South Carolina 303(D) List of Impaired Waters & TMDLS.” Columbia, South Carolina. Accessed September 4, 2024, at https://des.sc.gov/programs/bureau-water/south-carolina-303d-list-impaired-waters-tmdls. TN10408.

SCDHEC (South Carolina Department of Health and Environmental Control). 2007. *Watershed Water Quality Assessment*, *Broad River Basin*. Columbia, South Carolina. TN10449.

SCDHEC (South Carolina Department of Health and Environmental Control). 2015. *Regulation 61-62, Air Pollution Control Regulations and Standards*. Statutory Authority Sections 48-1-10 *et seq.* of the 1976 South Carolina Code of Laws, as amended. Columbia, South Carolina. TN10528.

SCDHEC (South Carolina Department of Health and Environmental Control). 2019. *Regulation 61-9, Water Pollution Control Permits*. Columbia, South Carolina. Available at https://scdhec.gov/sites/default/files/Library/Regulations/R.61-9.pdf. TN9121.

SCDHEC (South Carolina Department of Health and Environmental Control). 2020. “Geographic Information Section, Monitoring Stations - Water Quality Ambient Active Stations.” Columbia, South Carolina. Accessed September 19, 2024, at https://sc-department-of-health-and-environmental-control-gis-sc-dhec.hub.arcgis.com/datasets/32839d00c8e7448d9efa431ce5ef1054/explore. TN10521.

SCDHEC (South Carolina Department of Health and Environmental Control). 2023. *South Carolina Water Use Report 2022 Summary*. Technical Document No. 008-2023, Columbia, South Carolina. TN10410.

SCDHEC (South Carolina Department of Health and Environmental Control). Undated. "SC Watershed Atlas." Columbia, South Carolina. Accessed September 13, 2024, at https://gis.dhec.sc.gov/watersheds/. TN10450.

SCDHEC (South Carolina Department of Health and Environmental Control). Undated. "South Carolina Fish Consumption Advisory." Columbia, South Carolina. Accessed September 13, 2024, at https://gis.dhec.sc.gov/gisportal/apps/webappviewer/index.html?id=c71943bc743b4ca196e0ef0406b1d7ab. TN10447.

SCDNR (South Carolina Department of Natural Resources). 2013. *An Overview of the Eight Major River Basins of South Carolina*. Columbia, South Carolina. TN10446.

SCDNR (South Carolina Department of Natural Resources). 2014. "Description, Lake Monticello." Columbia, South Carolina. Accessed September 13, 2024, at https://www.dnr.sc.gov/lakes/monticello/description.html#:~:text=Lake%20Monticello%20is. TN10459.

SCDNR (South Carolina Department of Natural Resources). 2014. "Lake Monticello Regulations." Columbia, South Carolina. Accessed September 13, 2024, at https://www.dnr.sc.gov/lakes/monticello/regs.html. TN10458.

SCDNR (South Carolina Department of Natural Resources). 2015. "Carolina Pygmy Sunfish." In *2015 Supplemental Volume* of *State Wildlife Action Plan*. Columbia, South Carolina. TN10461.

SCDNR (South Carolina Department of Natural Resources). 2020. "Diadromous Fish Research, Shortnose Sturgeon." Columbia, South Carolina. Accessed September 13, 2024, at https://www.dnr.sc.gov/marine/mrri/diadrofish/shortnosesturg.html. TN10462.

SCDNR (South Carolina Department of Natural Resources). 2020. "State Wildlife Action Plan (SWAP)." Columbia, South Carolina. Accessed September 11, 2024, at https://www.dnr.sc.gov/swap/index.html. TN10432.

SCDNR (South Carolina Department of Natural Resources). 2024. Email from P. Chrisman, Freshwater Fisheries Biologist, to C. Wessel, PNNL, M. Scott, SCDNR, and J. Bettinger, SCDNR, dated May 30, 2024, regarding "RE: Freshwater fishery monitoring data- Monticello and Parr Reservoirs." Rock Hill, South Carolina. TN10524.

SCDOT (South Carolina Department of Transportation). 2012. "Average Daily Traffic for Map Sales, Fairfield County, 2011." Columbia, South Carolina. Accessed October 2, 2024, at https://www.scdot.org/content/dam/scdot-legacy/travel/pdf/trafficcounts/2011/FAIRFIELD.pdf. TN10566.

SCDOT (South Carolina Department of Transportation). 2017. "Average Daily Traffic for Map Sales, Fairfield County, 2016." Columbia, South Carolina. Accessed October 2, 2024, at https://www.scdot.org/content/dam/scdot-legacy/travel/pdf/trafficcounts/2016/FAIRFIELD.pdf. TN10567.

SCDOT (South Carolina Department of Transportation). 2022. "Average Daily Traffic for Map Sales, Fairfield County, 2021." Columbia, South Carolina. Accessed October 2, 2024, at https://www.scdot.org/content/dam/scdot-legacy/travel/pdf/trafficcounts/2021/FAIRFIELD.pdf. TN10568.

SCDOT (South Carolina Department of Transportation). 2024. "Average Daily Traffic for Map Sales, Fairfield County, 2023." Columbia, South Carolina. Accessed October 2, 2024, at https://www.scdot.org/content/dam/scdot-legacy/travel/pdf/trafficcounts/2023/FAIRFIELD.pdf. TN10569.

SCE&G (South Carolina Electric & Gas Company). 2002. Letter from S.A. Byrne, Senior Vice President Nuclear Operations, to NRC Document Control Desk, dated August 6, 2022, regarding "Virgil C. Summer Nuclear Station Docket No. 50/395 Application for Renewed Operating License." RC-02-0123, Jenkinsville, South Carolina. ADAMS Accession Package No. ML022280300. TN10558.

SCE&G (South Carolina Electric and Gas). 2010. *V.C. Summer Nuclear Station Units 2 and 3 Combined License Application Part 3, Environmental Report.* Revision 2, Columbia South Carolina. ADAMS Accession No. ML101930231. TN2024.

SCE&G (South Carolina Electric & Gas Company). 2018. Letter from R.L. Justice, General Manager, Nuclear Plant Operations, to NRC Document Control Desk, dated April 25, 2018, regarding "Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Radiological Environmental Operating Report." Jenkinsville, South Carolina. ADAMS Accession No. ML18116A687. TN10421.

SCE&G (South Carolina Electric & Gas Company). 2019. *Cooling Water System Data V.C. Summer Nuclear Station Unit 1, 40 CFR § 122.21(r)(5)*. Jenkinsville, South Carolina. ADAMS Accession No. ML19056A413. TN10445.

SCE&G (South Carolina Electric & Gas Company). 2019. Letter from R.L. Justice, General Manager, Nuclear Plant Operations, to NRC Document Control Desk, dated April 25, 2019, regarding "Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-395 Operating License No. NPF-12 Radiological Environmental Operating Report." Jenkinsville, South Carolina. ADAMS Accession No. ML19121A418. TN10422.

SCEMD (South Carolina Emergency Management Division). Undated. *South Carolina Earthquake Guide*. Columbia, South Carolina. TN10400.

SC eRegs (South Carolina eRegulations). 2024. "Freshwater Game Fishing Regulations." Columbia, South Carolina. Accessed November 14, 2024, at https://www.eregulations.com/southcarolina/fishing/freshwater-game-fishing-regulations. TN10829.

Schaub, A., J. Ostwald, and B.M. Siemers. 2008. "Foraging Bats Avoid Noise." *The Journal of Experimental Biology*, 211:3174-3180. Cambridge, United Kingdom. TN8867.

SCPARC (South Carolina Partners in Amphibian and Reptile Conservation). 2020. “Pond Slider (*Trachemys scripta)*.” Columbia, South Carolina. Accessed September 12, 2024, at https://scparc.org/turtles-of-south-carolina/pond-slider/. TN10444.

SCRFAO (South Carolina Revenue and Fiscal Affairs Office). 2022. “Population Projections 2010-2035 - Revised September 2021.” Columbia, South Carolina. Accessed September 14, 2024, at https://rfa.sc.gov/data-research/population-demographics/census-state-data-center/population-data/population-projections-2000-2035-rev2019. TN10466.

Smallwood, A. 2015. “Context and spatial organization of the Clovis assemblage from the Topper site, South Carolina.” *Journal of Field Archaeology* 40(1):69-88. University of West Georgia, Carrollton, Georgia. TN10493.

Smith, C. 2008. *Invasive Exotic Plants of North Carolina*. North Carolina Department of Transportation, Raleigh, North Carolina. TN10436.

Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010. “Japanese Wisteria.” In *Plant Invaders of Mid-Atlantic Natural Areas*, *4th edition*, National Park Service, U.S. Fish and Wildlife Service, Washington, D.C. TN10439.

Taylor, W.K., and B.H. Anderson. 1973. “Nocturnal migrants killed at a central Florida TV tower; Autumns 1969-1971.” *The Wilson bulletin* 85(1):42-51. TN8508.

Tegen, S. 2016. “Wind Energy Workforce Development & Jobs.” *Nebraska Wind and Solar Conference*, Lincoln, Nebraska. TN8826.

Three Oaks Engineering. 2016. *Freshwater Mussel Survey Report, In Monticello Reservoir Parr Hydroelectric Project (FERC No. 1894), Fairfield and Newberry Counties, South Carolina*. Hillsborough, North Carolina. TN10452.

Travisano, M., K. Guerrieri, A. Downing, and A. Kent. 2023. *V.C. Summer Nuclear Station Architectural Survey and Evaluation, Fairfield County, South Carolina, Final Report*. SEARCH Project No. E22122, Jenkinsville, South Carolina. TN10509.

TVA (Tennessee Valley Authority). 2013. *Sequoyah Nuclear Plant, Units 1 and 2, License Renewal Application, Appendix E, Applicant’s Environmental Report, Operating License Renewal Stage*. Chattanooga, Tennessee: TVA. January 7, 2013. ADAMS Nos. ML13024A012, ML13024A013, ML13024A006, ML13024A007, ML13024A008, ML13024A009, and ML13024A010. TN7899.

University of Georgia. 2024. “EDD MapS, Query for Positive, Treated Infestation Status, United States, South Carolina.” Center for Invasive Species and Ecosystem Health, University of Georgia, Athens, Georgia. Accessed September 11, 2024, at https://www.eddmaps.org/tools/query/?observationDateStart=02/01/1970&observationDateEnd=04/17/2024&eradicationstatus=1,2&country=926&state=92645000&records=current. TN10434.

USCB (U.S. Census Bureau). 2000. "Decennial Census, DEC Summary File 4 Demographic Profile, Table DP1, Profile of General Demographic Characteristics: 2000 for Richland, Fairfield, Newberry, and Lexington County, South Carolina." Washington, D.C. Accessed September 14, 2024, at https://data.census.gov/table/DECENNIALDPSF42000.DP1?q=DP1&g=050XX00US45039,45063,45071,45079. TN10464.

USCB (U.S. Census Bureau). 2010. Decennial Census, Universe: Total Population, Richland County, South Carolina, Table P2, "Hispanic or Latino, and not Hispanic or Latino by Race." Washington, D.C. Accessed October 2, 2024, at https://data.census.gov/table/DECENNIALPL2010.P2?q=P2&g=050XX00US45039,45063,45071,45079. TN10565.

USCB (U.S. Census Bureau). 2020. "Decennial Census, DEC Redistricting Data (PL 94- 171), Table P2, Hispanic or Latino, and Not Hispanic or Latino by Race for Richland, Fairfield, Newberry, and Lexington County, South Carolina." Washington, D.C. Accessed September 14, 2024, at https://data.census.gov/table/DECENNIALPL2020.P2?q=P2&g=050XX00US45039,45063,45071,45079. TN10465.

USCB (U.S. Census Bureau). 2022. American Community Survey, 5-Year Estimates Detailed Tables, Table C17002, "Ratio of Income to Poverty Level in the Past 12 Months," All Block Groups within South Carolina. Washington, D.C. Accessed on October 1, 2024, at https://data.census.gov/table/ACSDT5Y2022.C17002?q=C17002:%20Ratio%20of%20Income%20to%20Poverty%20Level%20in%20the%20Past%2012%20Months&g=040XX00US45$1500000&y=2022. TN10556.

USCB (U.S. Census Bureau). 2022. "American Community Survey, ACS 5-Year Estimates Data Profiles, Table DP03, Selected Economic Characteristics for Richland, Fairfield, Newberry, and Lexington County, South Carolina." Washington, D.C. Accessed September 11, 2024, at https://data.census.gov/table/ACSDP5Y2022.DP03?q=DP03&g=040XX00US45_050XX00US45039,45063,45071,45079. TN10423.

USCB (U.S. Census Bureau). 2022. "American Community Survey, ACS 5-Year Estimates Data Profiles, Table DP04f or Richland, Fairfield, Newberry, and Lexington County, South Carolina." Washington, D.C. Accessed September 14, 2024, at https://data.census.gov/table/ACSDP5Y2022.DP04?g=050XX00US45039,45063,45071,45079&y=2022&d=ACS%205-Year%20Estimates%20Data%20Profiles&moe=false. TN10468.

USCB (U.S. Census Bureau). 2022. "American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B25004, Vacancy Status for Richland, Fairfield, Newberry, and Lexington County, South Carolina." Washington, D.C. Accessed September 14, 2024, at https://data.census.gov/table/ACSDT5Y2022.B25004?q=seasonal&g=050XX00US45039,45063,45071,45079&y=2022&moe=false. TN10467.

USCB (U.S. Census Bureau). 2023. “Poverty Thresholds for 2022 by Size of Family and Number of Related Children Under 18 Years (in Dollars).” Washington, D.C. Accessed September 18, 2024, at https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html. TN10519.

USDA (U.S. Department of Agriculture). 2022. “National Agricultural Statistics Service: Quick Stats, 2022 South Carolina.” Washington, D.C. Accessed September 18, 2024, at https://quickstats.nass.usda.gov/results/03EAB27A-53EE-3470-A103-8C4563B431C3. TN10552.

USDA (U.S. Department of Agriculture). 2024. *Custom Soil Resource Report for Fairfield County, South Carolina, VC Summer, ER APE*. Washington, D.C. TN10398.

USGCRP (U.S. Global Change Research Program). 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. J.M. Melillo, T.C. Richmond, and G.W. Yohe (eds.). U.S. Government Printing Office, Washington, D.C. ADAMS Accession No. ML14129A233. TN3472.

USGCRP (U.S. Global Change Research Program). 2017. *Climate Science Special Report: Fourth National Climate Assessment*. Volume I. Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.). Washington, D.C. ADAMS Accession No. ML19008A410. doi: 10.7930/J0J964J6. TN5848.

USGCRP (U.S. Global Change Research Program). 2018. *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*. Volume II. D.R. Reidmiller, C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.). Washington, D.C. ADAMS Accession No. ML19008A414. doi: 10.7930/NCA4.2018. TN5847.

USGCRP (U.S. Global Change Research Program). 2023. *The Fifth National Climate Assessment*. A.R. Crimmins, C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. Washington, D.C. Available at https://doi.org/10.7930/NCA5.2023. TN9762.

USGS (U.S. Geological Survey). 1990. *Ground Water Atlas of the United States: Alabama, Florida, Georgia, and South Carolina.* HA 730-G. J.A. Miller (editor), Reston, Virginia. ADAMS Accession No. ML100290484. TN6648.

USGS (U.S. Geological Survey). 2008. *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States*. Fact Sheet 2008–3082, Menlo Park, California. Accessed June 12, 2022, at https://pubs.usgs.gov/fs/2008/3082/pdf/fs2008-3082.pdf. TN7697.

USGS (U.S. Geological Survey). 2016. “Bat Fatalities at Wind Turbines- Investigating the Causes and Consequences.” Reston, Virginia. Available at https://www.usgs.gov/centers/fort-collins-science-center/science/bat-fatalities-wind-turbines-investigating-causes-and?qt-science_center_objects=0#qt-science_center_objects. TN8510.

USGS (U.S. Geological Survey). 2019. *2014 Mineral Yearbook, South Carolina [Advance Release]*. Washington, D.C. TN9149.

USGS (U.S. Geological Survey). 2023. *Mineral Commodity Summaries 2023*. Reston, Virginia. TN10591.

USGS (U.S. Geological Survey). 2024. “Mineral Resources Data System (MRDS), V.C. Summer Site.” Reston, Virginia. Accessed November 20, 2024, at https://mrdata.usgs.gov/mrds/. TN10855.

USGS (U.S. Geological Survey). 2024. “Peak Streamflow for South Carolina, USGS 02156500 Broad River Near Carlisle, SC.” Washington, D.C. Accessed August 8, 2024, at https://nwis.waterdata.usgs.gov/sc/nwis/peak?site_no=02156500&agency_cd=USGS&format=html. TN10405.

USGS (U.S. Geological Survey). 2024. “Peak Streamflow for South Carolina, USGS 02161000 Broad River at Alston, SC.” Washington, D.C. Accessed August 8, 2024, at https://nwis.waterdata.usgs.gov/sc/nwis/peak?site_no=02161000&agency_cd=USGS&format=html. TN10406.

USGS (U.S. Geological Survey). 2024. “Peak Streamflow for South Carolina, USGS 02161500 Broad River at Richtex, SC.” Washington, D.C. Accessed August 8, 2024, at https://nwis.waterdata.usgs.gov/sc/nwis/peak?site_no=02161500&agency_cd=USGS&format=html. TN10407.

USGS (U.S. Geological Survey). 2024. “Search Earthquake Catalog, Custom search for earthquakes within 200 miles of V.C. Summer Nuclear Station.” Reston, Virginia. Accessed August 26, 2024, at https://earthquake.usgs.gov/earthquakes/search/. TN10534.

USGS (U.S. Geological Survey). 2024. “USGS Current Conditions for USGS 0216100 Broad River at Alston, SC.” Reston, Virginia. Accessed November 13, 2024, at https://waterdata.usgs.gov/nwis. TN10828.

USGS (U.S. Geological Survey). 2024. “USGS 02160991 Broad River Near Jenkinsville, SC, Summary of All Available Data.” Reston, Virginia. Accessed September 19, 2024, at https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=02160991. TN10522.

USGS (U.S. Geological Survey). 2024. “USGS 02161000 Broad River at Alton, SC, 05th Percentile of Daily Mean Values for Each Day for Water Year of Record in, ft3/s (Calculation Period 1980-10-01 -> 2024-09-30).” Washington, D.C. Accessed September 18, 2024, at https://waterdata.usgs.gov/nwis/dvstat?referred_module=sw&site_no=02161000&por_02161000_125356=1098368,00060,125356,1896-10-01,2024-02-22&format=html_table&stat_cds=p05_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted_. TN10518.

USGS (U.S. Geological Survey). 2024. “USGS 02161000 Broad River at Alton, SC, Mean of Daily Mean Values for Each Day for Water Year of Record in, ft3/s (Calculation Period 1980-10-01 -> 2024-09-30).” Washington, D.C. Accessed September 18, 2024, at https://waterdata.usgs.gov/nwis/dvstat?referred_module=sw&site_no=02161000&por_02161000_125356=1098368,00060,125356,1896-10-01,2024-02-22&format=html_table&stat_cds=mean_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted. TN10517.

USGS (U.S. Geological Survey). 2024. “USGS Surface-Water Daily Statistics for the Nation, USGS 02156500 Broad River Near Carlisle, SC, 00060, Discharge, cubic feet per second.” Washington, D.C. Accessed August 10, 2024, at https://waterdata.usgs.gov/nwis/dvstat/?referred_module=sw&site_no=02156500&por_02156500_125195=1098239,00060,125195,1938-10-01,2024-07-02&format=html_table&stat_cds=mean_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. TN10426.

USGS (U.S. Geological Survey). 2024. “USGS Surface-Water Daily Statistics for the Nation, USGS 02156500 Broad River Near Carlisle, SC, 00060, Discharge, cubic feet per second, 5th percentile of daily mean values.” Washington, D.C. Accessed August 10, 2024, at https://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&search_site_no=02156500&agency_cd=USGS&referred_module=sw. TN10427.

USGS (U.S. Geological Survey). 2024. “USGS Surface-Water Daily Statistics for the Nation, USGS 02161000 Broad River at Alton, SC.” Washington, D.C. Accessed September 4, 2024, at https://waterdata.usgs.gov/nwis/dvstat?referred_module=sw&site_no=02161000&por_02161000_125356=1098368,00060,125356,1896-10-01,2024-02-22&format=html_table&stat_cds=min_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. TN10403.

USGS (U.S. Geological Survey). 2024. “USGS Surface-Water Monthly Statistics for the Nation, USGS 02156500 Broad River Near Carlisle, SC, 00060, Discharge, cubic feet per second.” Washington, D.C. Accessed August 10, 2024, at https://waterdata.usgs.gov/nwis/monthly/?referred_module=sw&site_no=02156500&por_02156500_125195=1098239,00060,125195,1938-10,2024-07&start_dt=1938-10&end_dt=2023-11&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. TN10425.

USGS (U.S. Geological Survey). 2024. “USGS Surface-Water Monthly Statistics for the Nation, USGS 02161000 Broad River at Alton, SC.” Washington, D.C. Accessed September 4, 2024, at https://waterdata.usgs.gov/nwis/monthly/?referred_module=sw&site_no=02161000&por_02161000_125356=1098368,00060,125356,1896-10,2024-02&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. TN10404.

Van Gelder, R.G. 1956. “Echo-Location Failure in Migratory Bats.” *Transactions of the Kansas Academy of Science* 59(2):220-222. TN8505.

Vukovich, M., K.L. Turner, T.E. Grazia, T. Mims, J.C. Beasley, and J.C. Kilgo. 2015. "Wintering Golden Eagles on the coastal plain of South Carolina." *J. Field Ornithology* 86(4):337-344. Association of Field Ornithologists, New Bedford, Massachusetts. TN10430.

Wachob, A., A.D. Park, and R. Newcome, Jr. 2009. *South Carolina State Water Assessment, Second Edition*. Land, Water & Conservation Division South Carolina Department of Natural Resources Columbia, South Carolina. Accessed September 26, 2023, at https://hydrology.dnr.sc.gov/pdfs/assessment/SC_Water_Assessment_2.pdf. TN9029.

Walthall, J.A. 1980. *Precontact Indians of the Southeast: Archaeology of Alabama and the Middle South.* University of Alabama Press, Tuscaloosa. TN10498.

Wellings, A., K. Nagle, and H. Carpini. 2023. *Cultural Resources Survey SCDOT I-77 Exit 26 Interchange Richland County, South Carolina*. S&ME Project No. 23610178/SHPO Project No. 18-KL0234, Columbia, South Carolina. TN10497.

Zhang, Y. and Y. Wang. 2016. "Climate-Driven Ground-Level Ozone Extreme in the Fall Over the Southeast United States." *Proceedings of the National Academy of Sciences*113(36): 10025–10030, National Academy of Sciences, Washington, D.C. TN10554.

Zinn, T.L., and W.W. Baker. 1979. "Seasonal Migration of the Hoary Bat, *Lasiurus cinereus*, through Florida." *Journal of Mammalogy* 60(3):634-635. TN8507.

6 LIST OF PREPARERS

Members of the U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards prepared this draft supplemental environmental impact statement (SEIS) with assistance from other NRC organizations and Pacific Northwest National Laboratory (PNNL). Table 6-1 identifies each preparer's name, education and experience, and function or expertise.

Table 6-1 List of Preparers

Name	Education and Experience	Function or Expertise
Beth Alferink, NRC	MS Environmental Engineering MS Nuclear Engineering BS Nuclear Engineering 25+ years of national laboratory, industry, and government experience including radiation detection and measurements, nuclear power plant emergency response, operations, health physics, decommissioning, shielding and criticality	Human Health, Termination of Operations and Decommissioning, Radiological and Nonradiological Waste Management, Uranium Fuel Cycle, Spent Fuel
Briana Arlene, NRC	Master's Certification, National Environmental Policy Act BS Conservation Biology 18 years of experience in ecological impact analysis, Endangered Species Act – Section 7 consultations, Essential Fish Habitat, and National Marine Sanctuaries Act consultations	Aquatic Resources, Special Status Species and Habitats, Endangered Species Act Section 7 Consultation, Essential Fish Habitat Consultation, National Marine Sanctuaries Act Consultation
Kim Conway, NRC	BS Mechanical Engineering 18 years of experience in NRC project management including decommissioning, licensing, and environmental reviews	Environmental Project Manager
Lloyd Desotell, NRC	MS Civil Engineering MS Water Resources Management BA Environmental Studies Over 20 years of experience conducting surface and subsurface hydrologic analyses	Surface Water Resources
Elijah Dickson, NRC	PhD Health Physics MS Health Physics BS Health Physics 18 years of conducting radiation protection, probabilistic risk assessment, and radiological consequence analyses	Severe Accident Mitigation Alternatives, Postulated Accidents
Jerry Dozier, NRC	MS Reliability Engineering MBA Business Administration BS Mechanical Engineering 31 years of experience including operations, reliability engineering, technical reviews, and NRC branch management	Severe Accident Mitigation Alternatives, Postulated Accidents

Table 6-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Caroline Hsu, NRC	BS Molecular Biology BA English Literature 13 years of government experience	Land Use and Visual Resources, Terrestrial Resources, Socioeconomics
Karen Loomis, NRC	MS Environmental Science and Technology BS Environmental Resource Management BS Agriculture and Extension Education 14 years of government experience in environmental compliance, program management, and project management	Environmental Project Manager
Sarah Lopas, NRC	MPA Environmental Policy BA Molecular Biology and Environmental Science 22 years of combined industry and government experience in environmental reviews and licensing and rulemaking project management	Historic and Cultural Resources
Nancy Martinez, NRC	BS Earth and Environmental Science AM Earth and Planetary Science 13 years of experience in environmental impact analysis	Historic and Cultural Resources, Meteorology, Air Quality, Noise, Greenhouse Gas Emissions and Climate Change
Leah Parks, NRC	PhD Environmental Management MS Environmental Engineering BS Systems and Information Engineering 17 years of academic and government experience including nuclear power plant operations, health physics, decommissioning, waste management, environmental impact analysis, and performance assessment	Radiological and Nonradiological Waste Management, Spent Nuclear Fuel
Jeffrey Rikhoff, NRC	MRP Regional Environmental Planning MS Development Economics BA English 44 years of combined industry and government experience in National Environmental Policy Act (NEPA) compliance for DOE Defense Programs/ National Nuclear Security Administration (NNSA) and Nuclear Energy, DoD, and DOI; project management; socioeconomics and environmental justice impact analysis, historic and cultural resource impact assessments, consultation with American Indian Tribes, and comprehensive land use and development planning studies	Land Use, Visual Resources, Alternatives, Environmental Justice, Cumulative Impacts
Gerry Stirewalt, NRC	PhD Structural Geology with two Post-Doctoral Appointments BA Geology/Mathematics Registered PG and CEG 50+ years relevant experience in Environmental and Engineering Geology, including 3-D geospatial modeling of subsurface stratigraphy, tectonic faults, and groundwater contaminant plumes	Geologic Environment; Groundwater Resources

Table 6-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
David Anderson, PNNL	MS Forest Economics BS Forest Resources 33 years of experiences in NEPA planning, national and regional economic impact modeling, socioeconomics, and environmental justice impact analysis	Socioeconomics, Environmental Justice
Caitlin Condon, PNNL	PhD Radiation Health Physics BS Environmental Health 6 years of experience in health physics, NEPA environmental impact assessments, waste management, radionuclide dispersion and dosimetry modeling	Project Management
Stephen Ferencz, PNNL	PhD Geosciences (Hydrogeology/Hydrology) MA Earth Sciences BA Geology 7 years of experience in hydrologic, groundwater, and water systems modeling; 3 years of experience in environmental remediation and site characterization	Surface Water Resources, Climate Change
Tracy Fuentes, PNNL	PhD Urban Design and Planning MS Plant Biology BS Botany Over 15 years of experience, including NEPA planning; environmental impact analysis, environmental resource monitoring, data analysis, and research	Terrestrial Resources
Dave Goodman, PNNL	JD Law BS Economics 12 years of experience including NEPA environmental impact assessments, ecological restoration, Endangered Species Act, land use and visual resources, and environmental law and policy	Land Use, Visual Resources, Cumulative Impacts, NEPA Regulatory Analyst
William Ivans, PNNL	PhD Fire Protection Engineering MS Fire Protection Engineering MS Nuclear Engineering BS Nuclear Engineering 18 years of experience in probabilistic risk assessment, nuclear safety analysis, and technical reviews of risk-informed license amendment requests and severe accident mitigation alternatives	Postulated Accidents, Severe Accident Mitigation Alternatives
Rebecka Iveson, PNNL	MS Hydrogeology and Water Resource Management BS Earth and Environmental Science 5+ years in groundwater resource assessment and environmental impact evaluation, contaminated land risk assessment and remediation, and natural resource management and monitoring	Groundwater Resources, Geologic Environment

Table 6-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
James Jackson, PNNL	MS Environmental and Resource Management BS Ecology and Evolutionary Biology 18 years of experience including NEPA, environmental impact analysis, construction management, site characterization and remediation, and waste management	Project Management
Hayley McClendon, PNNL	BS Environmental Science 8 years of experience in environmental compliance and technical document preparation and review.	Reference Coordinator
Philip Meyer, PNNL	PhD Civil Engineering MS Civil Engineering BA Physics 30 years relevant experience in subsurface hydrology and contaminant transport, including 15 years of experience in groundwater resource assessment and environmental impacts analysis	Groundwater Resources, Geologic Environment
Dan Nally, PNNL	MA Urban and Environmental Policy and Planning BS Biology 11 years of experience in preparation and review of NEPA documents, related regulatory compliance, and conducting public outreach and engagement	Project Management
Mike Parker, PNNL	BA English Literature 25 years of experience copyediting, document design, and formatting and 20years of experience in technical editing	Production
Rajiv Prasad, PNNL	PhD Civil and Environmental Engineering MTech Civil Engineering BE Civil Engineering 25 years of experience in applying hydrologic principles to water resources engineering, hydrologic design, flooding assessments, environmental engineering, and impacts assessment including 15 years of experience in NEPA environmental assessments of surface water resources	Surface Water Resources, Climate Change
Lindsey Renaud, PNNL	MA Anthropology BA Anthropology 12 years in cultural resource management, Section 106 and 110 compliance, and NEPA environmental impact assessments. Secretary of the Interior-qualified Registered Professional Archaeologist. Experience in Tribal engagement and Native American Graves Protection and Repatriation Act compliance	Historic and Cultural Resources

Table 6-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Kacoli Sen, PNNL	PhD Cancer Biology MS Zoology (Specialization Ecology) BS Zoology Diploma in Environmental Law Over 6 years of document editing and production experience	Production Editor
Steven Short, PNNL	MS Nuclear Engineering MBA Business Administration BS Nuclear Engineering 40 years of experience including nuclear safety analysis, probabilistic risk assessment, technical reviews of risk-informed license amendment requests and severe accident mitigation alternatives	Postulated Accidents, Severe Accident Mitigation Alternatives
Kazi Tamaddun, PNNL	PhD Civil and Environmental Engineering MS Civil Engineering 8 years of experience in hydrologic, hydraulic, ecosystem, and water systems modeling; hydro-climatology; climate change modeling and analysis	Surface Water
Caitlin Wessel, PNNL	PhD Marine Science MS Coastal, Marine, and Wetland Science BS Biology 11 years of relevant experience in environmental impact assessment and aquatic ecology	Aquatic Resources
Dana Vesty, PNNL	BS Environmental Science PWS (Professional Wetland Scientist) 8 years of experience in environmental assessments, permitting, environmental resource monitoring, and data analysis	Terrestrial Resources
Lin Zeng, PNNL	PhD Environmental Science and Engineering BE Civil Engineering 10 years of experience on socioeconomic analysis and environmental impact assessment	Socioeconomics, Environmental Justice

AA = associate degree; AM = Master of Arts; BA = Bachelor of Arts; BE = Bachelor of Engineering; BS = Bachelor of Science; DoD = U.S. Department of Defense; DOE = Department of Energy; DOI = U.S. Department of Interior; EFH = essential fish habitat; MBA Master of Business Administration; MHP = Master of Public Health; MPM = Master of Project Management; MRP = Master of Regional Planning; MS = Master of Science; MTech = Masters of Technology; NEPA = National Environmental Policy Act of 1969; NNSA = National Nuclear Security Administration; NRC = U.S. Nuclear Regulatory Commission; PhD = Doctor of Philosophy; PMP = Project Management Professional; PNNL = Pacific Northwest National Laboratory.

7 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM THE NRC SENDS COPIES OF THIS SEIS

Table 7-1 List of Agencies, Organizations, and Persons to Whom Copies of this Supplemental Environmental Impact Statement Are Sent

Name	Affiliation
W. Eric Emerson	South Carolina Office of Historic Preservation
Hon. Brian Harris	Catawba Indian Nation
Hon. David Hill	The Muscogee (Creek) Nation
Hon. Chuck Hoskin	Cherokee Nation
Ntale Kajumba	U.S. Environmental Protection Agency
Jamie Loichinger	Advisory Council on Historic Preservation
Hon. Richard Sneed	Eastern Band of Cherokee Indians
Tracy Watson	U.S. Environmental Protection Agency

This supplemental environmental impact statement will also be provided to commenters who provided their contact information during the scoping period. The NRC staff has listed the names of all commenters in the scoping summary report (Agencywide Documents Access and Management System [ADAMS] Accession No. ML24278A042).

APPENDIX A

COMMENTS RECEIVED ON THE VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1, ENVIRONMENTAL REVIEW

A.1 Comments Received During the Scoping Period

The U.S. Nuclear Regulatory Commission (NRC) staff began the scoping process for the environmental review of the Virgil C. Summer Nuclear Station, Unit 1, (V.C. Summer) subsequent license renewal application on November 2023, in accordance with the National Environmental Policy Act of 1969 (42 *United States Code* [U.S.C.] 4321 et seq.-TN661) (NEPA). On November 3, 2023, the NRC issued a notice of intent to conduct an environmental scoping process for subsequent license renewal of V.C. Summer that was published in the *Federal Register* (88 FR 75627-TN10388). In its notice of intent, the NRC requested that members of the public and stakeholders submit comments on the scope of the environmental review for the proposed V.C. Summer SLR.

The scoping process included two public meetings: a virtual meeting on November 9, 2023, and an in-person meeting in Blair, South Carolina, on November 14, 2023. Attendees made oral statements that were recorded and transcribed by a certified court reporter. A summary and a transcript of the public scoping meetings are available in the NRC's Agencywide Documents Access and Management System (ADAMS) under ADAMS Accession No. ML23331A789 (NRC 2023-TN10830). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. In addition to the comments received during the public meetings, comments were also received electronically via Regulations.gov and email.

At the conclusion of the scoping process, the NRC staff issued a scoping summary report (NRC 2024-TN10831). The report: (1) contains comments received during the scoping period" instead of confining to only public meetings and Regulations.gov, (2) groups these comments by subject area, and (3) contains NRC staff responses to these comments.

A.2 References

88 FR 75627. November 3, 2023. "Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Dominion Energy South Carolina, Inc.; Virgil C. Summer Nuclear Station, Unit 1." *Federal Register*, Nuclear Regulatory Commission. TN10388.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 U.S.C. § 4321 et seq. TN661.

NRC (U.S. Nuclear Regulatory Commission). 2023. *U.S. Nuclear Regulatory Commission Summary of Public Meetings, Environmental Scoping Meetings Related to the Virgil C. Summer Nuclear Station Subsequent License Renewal Application*. Washington, D.C. ADAMS Accession No. ML23331A789. TN10830.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from S.S. Koenick, Chief, Environmental Project Management Branch 1, Division of Rulemaking, Environment, and Financial Support, Office of Nuclear Material Safety and Safeguards, to E.S. Carr, President, Nuclear Operations and Chief Nuclear Officer, Innsbrook Technical Center, dated November 7, 2024, regarding "Issuance of Environmental Scoping Summary Report Associated with the U.S.

Nuclear Regulatory Commission Staff's Review of the Subsequent License Renewal Application for Virgil C. Summer Nuclear Station, Unit 1 (EPID Number: L-2023-0003) (Docket Number: 50-395)." Washington, D.C. ADAMS Accession Package No. ML24278A033. TN10831.

APPENDIX B

APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Several Federal laws and regulations affect environmental protection, health, safety, compliance, and consultation at every U.S. Nuclear Regulatory Commission (NRC) licensed nuclear power plant. Some of them require permits by or consultation with other Federal agencies or State, Tribal, or local governments. Certain Federal environmental requirements have been delegated to State authorities for enforcement and implementation. Furthermore, States have also enacted laws to protect public health and safety and the environment. It is the NRC's policy to make sure that nuclear power plants are operated in a manner that provides adequate protection of public health and safety and protection of the environment through compliance with applicable Federal and State laws, regulations, and other requirements, as appropriate.

The Atomic Energy Act of 1954, as amended (AEA) (42 *United States Code* [U.S.C.] 2011 et seq.; TN663), and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.; TN4466) give the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under the AEA through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR). The AEA also authorizes the NRC to enter into an agreement with any State that allows the State to assume regulatory authority for certain activities (see 42 U.S.C. 2021; TN10029). South Carolina entered into an agreement with the NRC in September 1969 to assume regulatory responsibility over certain byproducts, sources, and quantities of special nuclear materials not sufficient to form a critical mass. The South Carolina Department of Health and Environmental Control administers the South Carolina Agreement State Program.

In addition to carrying out some Federal programs, State legislatures develop their own laws. State statutes can supplement, as well as implement, Federal laws for the protection of air, surface water, and groundwater. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The U.S. Environmental Protection Agency (EPA) has the primary responsibility to administer the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq., herein referred to as the Clean Water Act [CWA]-TN662). The National Pollutant Discharge Elimination System (NPDES) program addresses water pollution by regulating the discharge of potential pollutants to waters of the United States. The EPA allows for primary enforcement and administration through State agencies if the State program is at least as stringent as the Federal program.

B.1 Federal and State Requirements

Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer) is subject to various Federal and State requirements. Table B-1 lists the principal Federal, State, and local laws that are used or mentioned in this supplemental environmental impact statement.

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station

Activity	Law/Regulation	Requirements
Current operating license and license renewal	Atomic Energy Act of 1954, 42 U.S.C. 2011 et seq. Energy Reorganization Act of 1974, 42 U.S.C. 5801 et seq.	The Atomic Energy Act of 1954, as amended (AEA), and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.) give the U.S. Nuclear Regulatory Commission (NRC) the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under the AEA through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR).
Current operating license and license renewal	National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.	The NEPA, requires Federal agencies to integrate environmental values into their decision-making process by considering the environmental impacts of proposed Federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. NEPA Section 102(2) contains action-forcing provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information. This environmental impact statement has been prepared in accordance with NEPA requirements and NRC regulations (10 CFR Part 51) for implementing NEPA to assure compliance with NEPA Section 102(2).
Current operating license and license renewal	10 CFR Part 20	Regulations in 10 CFR Part 20, "Standards for Protection Against Radiation," establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. These regulations are issued under the AEA, and the Energy Reorganization Act of 1974, as amended. The purpose of these regulations is to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this Part.

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station (Continued)

Activity	Law/Regulation	Requirements
Current operating license and license renewal	10 CFR Part 50	Regulations in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," are NRC regulations issued under the AEA, and Title II of the Energy Reorganization Act of 1974, as amended, to provide for the licensing of production and utilization facilities, including nuclear power reactors.
Current operating license and license renewal	10 CFR Part 51	Regulations in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," contain the NRC's regulations that implement NEPA.
Current operating license and license renewal	10 CFR Part 54	NRC regulations in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," govern the issuance of renewed operating licenses and renewed combined licenses for nuclear power plants licensed under Sections 103 or 104b of the AEA, as amended, and Title II of the Energy Reorganization Act of 1974, as amended (88 Stat. 1242). The regulations focus on managing the adverse effects of aging nuclear plants. The rule is intended to ensure that important systems, structures, and components will continue to perform their intended functions during the period of extended operation.
Air quality protection	Clean Air Act, 42 U.S.C. 7401 et seq.	The Clean Air Act (CAA) is intended to "protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population." The CAA establishes regulations to ensure maintenance of air quality standards and authorizes individual States to manage permits. Section 118 of the CAA requires each Federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants to comply with all Federal, State, inter-State, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the EPA to set National Ambient Air Quality Standards for criteria pollutants. The EPA has identified and set National Ambient Air Quality Standards for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires the establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated before permit approval to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each State and approved by the EPA. The CAA requires

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station (Continued)

Activity	Law/Regulation	Requirements
		sources to meet standards and obtain permits to satisfy those standards. Nuclear power plants may be required to comply with the CAA Title V, Sections 501–507, for sources subject to New Source Performance Standards or sources subject to National Emission Standards for Hazardous Air Pollutants. The EPA regulates the emissions of air pollutants using 40 CFR Parts 50 to 99.
Water resources protection	Clean Water Act, 33 U.S.C. 1251 et seq., and the NPDES (40 CFR Part 122)	The Clean Water Act (CWA) was enacted to “restore and maintain the chemical, physical, and biological integrity of the Nation’s water.” The CWA requires all branches of the Federal government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, State, inter-State, and local requirements. As authorized by the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program requires all facilities that discharge pollutants from any point source into waters of the United States to obtain an NPDES permit. A NPDES permit is developed with two levels of controls: (1) technology-based limits and (2) water quality-based limits. NPDES permit terms may not exceed 5 years, and the applicant must reapply at least 180 days prior to the permit expiration date. A nuclear power plant may also participate in the NPDES General Permit for Industrial Stormwater due to stormwater runoff from industrial or commercial facilities to waters of the United States. The EPA is authorized under the CWA to directly implement the NPDES program; however, the EPA has authorized many States to implement all or parts of the national program. Section 316(a) of the CWA addresses thermal effects and requires that facilities operate under effluent limitations that assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water. Section 316(b) of the CWA requires that cooling-water intake structures of regulated facilities must reflect the best technology available for minimizing impingement mortality and entrainment of aquatic organisms. These sections of the CWA are implemented and enforced through the NPDES program. Section 401 of the CWA requires that an applicant for a Federal license or permit to conduct any activity that may result in any discharge into navigable waters must provide the Federal licensing or permitting agency with a

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station (Continued)

Activity	Law/Regulation	Requirements
		certification (or waiver) from the State or appropriate water pollution control agency in which the discharge originates or will originate. This water quality certification assures that discharges from the activity or project to be licensed or permitted will comply with all limitations necessary to meet established State water quality requirements (40 CFR Part 121). The U.S. Army Corps of Engineers is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320, "General Regulatory Policies"). Under Section 404 of the CWA, the U.S. Army Corps of Engineers or a delegated State agency or Tribe has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge of dredge or fill material to waters of the United States, including wetlands.
Water resources protection	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.)	Congress enacted the Coastal Zone Management Act (CZMA) in 1972 to address the increasing pressures of overdevelopment upon the Nation's coastal resources. The National Oceanic and Atmospheric Administration administers the CZMA. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary. To encourage States to participate, the CZMA makes Federal financial assistance available to any coastal State or territory, including those on the Great Lakes, as long as the State or territory is willing to develop and implement a comprehensive coastal management program.
Waste management and pollution prevention	Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq.	The Resource Conservation and Recovery Act requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006, "Authorized State Hazardous Waste Programs" (42 U.S.C. 6926), allows States to establish and administer these permit programs with EPA approval. The EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station (Continued)

Activity	Law/Regulation	Requirements
Waste management and pollution prevention	Pollution Prevention Act, 42 U.S.C. 13101 et seq.	The Pollution Prevention Act establishes a national policy for waste management and pollution control that focuses first on source reduction, then on environmental issues, safe recycling, treatment, and disposal.
Waste management and pollution prevention	Nuclear Waste Policy Act of 1982 (42 U.S.C. § 10101 et seq.-TN740)	The Nuclear Waste Policy Act provides for the research and development of repositories for the disposal of high-level radioactive waste, spent nuclear fuel, and low-level radioactive waste. Title I includes provisions for disposal and storage of high-level radioactive waste and spent nuclear fuel. Subtitle A of Title I delineates requirements for site characterization and construction of the repository and participation of States and other local governments in the selection process. Subtitles B, C, and D of Title I deal with specific issues for interim storage, monitored retrievable storage, and low-level radioactive waste.
Waste management and pollution prevention	Low-Level Radioactive Waste Policy Act of 1980, as amended (42 U.S.C. § 2021b et seq.-TN6606)	The Low-Level Radioactive Waste Policy Act amended the AEA to improve the procedures for implementation of compacts providing for the establishment and operation of regional low-level radioactive waste disposal facilities. It also allows Congress to grant consent for certain inter-State compacts. The amended Act sets forth the responsibilities for disposal of low-level waste by States or inter-State compacts. The Act states the amount of waste that certain low-level waste recipients can receive over a set period of time. The amount of low-level radioactive waste generated by both pressurized and boiling water reactor types is allocated over a transition period until a local waste facility becomes operational.
Waste management and pollution prevention	Hazardous Materials Transportation Act, as amended (49 U.S.C. § 5101 et seq.-TN6605)	The Hazardous Materials Transportation Act regulates the intra-State and inter-State transportation of hazardous material (including radioactive material). According to the act, States may regulate the transport of hazardous material as long as their regulation is consistent with provisions of the act or U.S. Department of Transportation regulations provided in 49 CFR Parts 171–177 (TN5466). Other regulations regarding packaging for transportation of radionuclides are contained in 49 CFR Part 173, Subpart I.
Protected species	Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668-668d)	The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts (including feathers), nests, or eggs. The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Regulations further define “disturb” as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by

Table B-1 Federal and State Requirements for Virgil C. Summer Nuclear Station (Continued)

Activity	Law/Regulation	Requirements
		substantially interfering with normal breeding, feeding, or sheltering behavior."
Protected species	Endangered Species Act, 16 U.S.C. 1531 et seq.	The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7, "Interagency Cooperation," of the Act requires Federal agencies to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) on Federal actions that may affect listed species or designated critical habitats.
Protected species	Magnuson–Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 et seq.	The Magnuson–Stevens Fishery Conservation and Management Act, as amended, governs marine fisheries management in U.S. Federal waters. The Act created eight regional Fishery Management Councils and includes measures to rebuild overfished fisheries, protect essential fish habitat, and reduce bycatch. Under Section 305 of the Act, Federal agencies are required to consult with the NMFS for any Federal actions that may adversely affect essential fish habitat.
Protected species	Migratory Bird Treaty Act, 16 U.S.C. 703- 712 et seq.	The Migratory Bird Treaty Act (MBTA) implements four international conservation treaties that the U.S. entered with Canada (1916), Mexico (1936), Japan (1972), and Russia (1976). The MBTA has been amended with signing of each treaty, as well as when any of the treaties were subsequently amended. To ensure that populations of all protected migratory birds are sustained, the MBTA prohibits the take of protected migratory bird species without prior authorization from U.S. Fish and Wildlife Service. Under the MBTA, "take" includes killing, capturing, selling, trading, and transport of protected migratory bird species.
Historic preservation and cultural resources	National Historic Preservation Act, 54 U.S.C. 300101 et seq.	The National Historic Preservation Act was enacted to create a national historic preservation program, including the National Register of Historic Places and the Advisory Council on Historic Preservation. Section 106 of the Act requires Federal agencies to account for the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800, "Protection of Historic Properties." The regulations call for public involvement in the Section 106 consultation process, including involvement from Indian Tribes and other interested members of the public, as applicable.

AEA = Atomic Energy Act of 1954; CAA = Clean Air Act; CCR = *California Code of Regulations*; CFR = *Code of Federal Regulations*; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; EPA = U.S. Environmental Protection Agency; MBTA = Migratory Bird Treaty Act; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; U.S.C. = U.S. Code.

B.2 Operating Permits and Other Requirements

Table B-2 lists the permits and licenses issued by Federal, State, and local authorities for activities at V.C. Summer, as identified in Section E9.1 of the environmental report.

Table B-2 Operating Permits and Other Requirements for Virgil C. Summer Nuclear Station

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Operating license for Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer)	U.S. Nuclear Regulatory Commission (NRC)	NPF-12	August 6, 2042	Operation of V.C. Summer Unit 1
General license for storage of spent fuel	NRC	General permit	N/A	Storage of power reactor spent fuel and other associated radioactive materials in an independent spent fuel storage installation
Hazardous materials registration	U.S. Department of Transportation	062023550338F	June 30, 2024 (renewed annually)	Hazardous materials shipments
Hazardous waste generator registration	U.S. Environmental Protection Agency	SCD069311579	Does not expire	Generation of hazardous waste
Operation and maintenance of the Parr Hydroelectric Project	Federal Energy Regulatory Commission	1894-211	November 1, 2070	Operation and maintenance of Parr Hydroelectric Project (includes Monticello and Parr Reservoirs)
Migratory bird special utility permit	U.S. Fish and Wildlife Service	MB040209-2	March 31, 2024 Renewal submitted, administratively extended	Authorized to collect, transport, and temporarily possess carcasses and partial remains of migratory birds and emergency relocation of nests of migratory birds other than eagles or threatened and endangered species

Table B-2 Operating Permits and Other Requirements for Virgil C. Summer Nuclear Station (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Migratory bird special utility permit	South Carolina Department of Natural Resources (SCDNR)	MB-03-24	December 31, 2024	Authorized to collect, transport, and temporarily possess carcasses and partial remains of migratory birds and emergency relocation of nests of migratory birds other than eagles or threatened and endangered species
Scientific collecting permit	SCDNR	F-24-059	December 31, 2024	To conduct wildlife investigations for scientific purposes
Water treatment plant dischargers	South Carolina Department of Health and Environmental Control (SCDHEC)	SCG646000	July 31, 2027	Discharge effluent to Monticello Reservoir from offsite water treatment facility
Stormwater discharge permit	SCDHEC	General Permit No. SCR000000	June 30, 2027	Discharge stormwater to Monticello and Parr Reservoirs and Broad River (Outfalls 001, 014, 003)
Surface water withdrawal permit	SCDHEC	20PN001	March 9, 2044	Withdrawal of surface water from Monticello Reservoir
Permit to transport radioactive waste	SCDHEC	0163-39-24	December 31, 2024	Radioactive waste transportation in South Carolina
National Pollutant Discharge Elimination System (NPDES) permit	SCDHEC	SC0030856	August 31, 2027	Plant wastewater and cooling water discharges
Safe Drinking Water Act Permit	SCDHEC	203004	No expiration date	Operate public, nontransient, noncommunity water system
Registration certificate	SCDHEC	03157	July 31, 2024	Operation of underground storage tanks

Table B-2 Operating Permits and Other Requirements for Virgil C. Summer Nuclear Station (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
License to ship radioactive material	Tennessee Department of Environment and Conservation	T-SC001-L24	December 31, 2024	Shipment of radioactive material to a licensed disposal/processing facility in Tennessee

ISFSI = independent spent fuel storage installation; NRC = U.S. Nuclear Regulatory Commission; SCDHEC = South Carolina Department of Health and Environmental Control; SCDNR = South Carolina Department of Natural Resources; V.C. Summer = Virgil C. Summer Nuclear Station.

B.3 References

42 U.S.C. § 2021. U.S. Code Title 42, Public Health and Welfare, Section 2021, "Cooperation with States." TN10029.

Atomic Energy Act of 1954. 42 U.S.C. § 2011 et seq. Public Law 112-239, as amended. TN663.

Energy Reorganization Act of 1974, as amended. 42 U.S.C. § 5801 et seq. TN4466.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 et seq. TN662.

APPENDIX C

CONSULTATION CORRESPONDENCE

C.1 Endangered Species Act Section 7 Consultation

As a Federal agency, the U.S. Nuclear Regulatory Commission (NRC) must comply with the Endangered Species Act of 1973 (ESA), as amended (16 *United States Code* [U.S.C.] 1531 et seq.; TN1010), as part of any action authorized, funded, or carried out by the agency. In this case, the proposed agency action is whether to issue a subsequent renewed facility operating license for the continued operation of Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer). The proposed action would authorize Dominion Energy South Carolina, Inc. (Dominion) to operate V.C. Summer for an additional 20 years beyond the current renewed operating license term. Under Section 7 of the ESA, the NRC must consult with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) ("the Services" [collectively] or "Service" [individually]), as appropriate, to ensure that the proposed action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

C.1.1 Federal Agency Obligations under Section 7 of the Endangered Species Act

The ESA and the regulations that implement ESA Section 7 at Title 50 of the *Code of Federal Regulations* (CFR) Part 402 (TN4312) describe the consultation process that Federal agencies must follow in support of agency actions. As part of this process, the Federal agency shall either request that the Services (1) provide a list of any listed or proposed species or designated or proposed critical habitats that may be present in the action area or (2) request that the Services concur with a list of species and critical habitats that the Federal agency has created (50 CFR 402.12(c)). If any such species or critical habitats may be present, the Federal agency prepares a biological assessment to evaluate the potential effects of the agency action and determine whether the species or critical habitats are likely to be adversely affected by the action (50 CFR 402.12(a); 16 U.S.C. 1536(c)-TN4459).

Biological assessments are required for any agency action that is a "major construction activity" (50 CFR 402.12(b)) (TN4312). A major construction activity is a construction project or other undertaking having construction-type impacts that is a major Federal action significantly affecting the quality of the human environment under the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.) (NEPA) (51 FR 19926-TN7600). Federal agencies may fulfill their obligations to consult with the Services under ESA Section 7 and to prepare a biological assessment, if required, in conjunction with the interagency cooperation procedures required by other statutes, including NEPA (50 CFR 402.06(a)) (TN4312). In such cases, the Federal agency should include the results of ESA Section 7 consultation(s) in the NEPA document (50 CFR 402.06(b)).

C.1.2 Biological Evaluation

The proposed action of V.C. Summer subsequent license renewal (SLR) does not require the preparation of a biological assessment because it is not a major construction activity. Nonetheless, the NRC staff must consider the impacts of this action on federally listed species and designated critical habitats. In cases where the staff finds that SLR "may affect" ESA-protected species or habitats, ESA Section 7 requires the NRC to consult with the relevant Service(s).

To support such consultations, the NRC staff has incorporated its analysis of the potential impacts of the proposed SLR into Section 3.8 of this supplemental environmental impact statement (SEIS). The NRC staff refers to its ESA analysis as a “biological evaluation.”

The NRC staff structured its biological evaluation in accordance with the Services’ suggested biological assessment contents described at 50 CFR 402.12(f) (TN4312). Section 3.8.1.1 of this SEIS describes the action area as well as the ESA-protected species and critical habitats potentially present in the action area. Section 3.8.5.1 assesses the potential effects of the proposed V.C. Summer SLR on the ESA-protected species and critical habitats present in the action area and contains the NRC’s effect determination for each of those species and habitats. Finally, Sections 3.8.6 through 3.8.11 address the potential effects of the no-action alternative and the replacement power alternatives. The results of the NRC staff’s analysis are summarized below in Table C-1.

Table C-1 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Virgil C. Summer Nuclear Station Subsequent License Renewal

Species	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]	FWS Concurrence Date[(c)]
tricolored bat	FPE	Y	NLAA	N/A
monarch butterfly	FC	Y	NLAA	N/A

N/A = not applicable.
(a) Indicates protection status under the Endangered Species Act. FC = candidate for Federal listing and FPE = proposed for Federal listing as endangered.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NLAA = may affect but is not likely to adversely affect.
(c) The Endangered Species Act does not require Federal agencies to seek FWS concurrence for agency actions that are not likely to jeopardize the continued existence of any proposed species or for conclusions regarding effects on candidate species.

C.1.3 Chronology of Endangered Species Act Consultation

Endangered Species Act Section 7 Consultation with the U.S. Fish and Wildlife Service

ESA regulations in 50 CFR 402.10(a) require Federal agencies to confer with the Services regarding any agency action that is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. Therefore, based on its “not likely to adversely affect” determination, the NRC is not required to confer with the FWS on the tricolored bat. Because the monarch butterfly is a candidate for Federal listing, the ESA does not require the NRC to consult with or receive concurrence from the FWS regarding this species.

Table C-2 lists the correspondence between the NRC and the FWS pursuant to ESA Section 7 that has transpired to date.

Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service

As discussed in Section 3.8.1 and 3.8.5.2 of this SEIS, no federally listed species or critical habitats under NMFS’s jurisdiction occur within the action area. Therefore, the NRC staff did not engage the NMFS pursuant to ESA Section 7 for the proposed V.C. Summer SLR.

Table C-2 Endangered Species Act Section 7 Consultation Correspondence with the U.S. Fish and Wildlife Service about Virgil C. Summer Nuclear Station

Date	Description	ADAMS Accession No.[a]
February 20, 2024	South Carolina Ecological Services (FWS) to B. Arlene (NRC), List of threatened and endangered species for proposed Virgil C. Summer SLR	ML2405A1A011

ADAMS = Agencywide Documents Access and Management System; FWS = U.S. Fish and Wildlife Service; NRC = U.S. Nuclear Regulatory Commission; SLR = subsequent license renewal.
(a) Document in the NRC's ADAMS can be accessed at http://adams.nrc.gov/wba/.

C.2 Magnuson–Stevens Act Essential Fish Habitat Consultation

The NRC must comply with the Magnuson–Stevens Fishery Conservation and Management Act of 1976 (MSA), as amended (16 U.S.C. 1801 et seq.-TN9966), for any actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect any essential fish habitat (EFH) identified under the MSA. In Sections 3.8.3 and 3.8.5.3 of this SEIS, the NRC staff concludes that the NMFS has not designated any EFH under the MSA within the affected area and that the proposed V.C. Summer SLR would have no effect on EFH. Thus, the MSA does not require the NRC to consult with NMFS for the proposed action.

C.3 National Marine Sanctuaries Act Consultation

The National Marine Sanctuaries Act of 1966, as amended (16 U.S.C. § 1431 et seq.-2000-TN7197), authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities as national marine sanctuaries. Under Section 304(d) of the act, Federal agencies must consult with the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries if a Federal action is likely to destroy, cause the loss of, or injure any sanctuary resources.

In Sections 3.8.3 and 3.8.5.4 of this SEIS, the NRC staff concludes that no coastal or marine waters or Great Lakes occur near V.C. Summer and that the V.C. Summer SLR would have no effect on sanctuary resources. Thus, the National Marine Sanctuaries Act of 1966, as amended does not require the NRC to consult with the National Oceanic and Atmospheric Administration for the proposed action.

C.4 National Historic Preservation Act Section 106 Consultation

The National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. 306108 et seq.; TN4839), requires Federal agencies to consider the effects of their undertakings on historic properties and consult with applicable State and Federal agencies, Tribal groups, individuals, and organizations with a demonstrated interest in the undertaking before taking action. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places. The NHPA Section 106 review process is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800, "Protection of Historic Properties" (TN513). In accordance with 36 CFR 800.8(c), "Use of the NEPA Process for Section 106 Purposes," the NRC has elected to use the NEPA process to comply with its obligations under Section 106 of the NHPA.

Table C-3 lists the chronology of consultation and consultation documents related to the NRC's NHPA Section 106 review of the V.C. Summer SLR.

Table C-3 National Historic Preservation Act Correspondence for Virgil C. Summer Nuclear Station

Date	Sender and Recipient	Description	ADAMS Accession No.[(a)]
11/03/2023	T. Smith (NRC) to R. Nelson, Executive Director, Advisory Council on Historic Preservation	Request for Scoping Comments	ML23289A115
11/03/2023	T. Smith (NRC) to W.E. Emerson, State Historic Preservation Officer	Letter Initiating Consultation and Request for Scoping Comments	ML23289A116
11/03/2023	T. Smith (NRC) to B. Harris, Chief, Catawba Indian Nation	Letter Initiating Consultation and Request for Scoping Comments	ML23289A117
11/03/2023	T. Smith (NRC) to M. Hicks, Principal Chief, Eastern Band of Cherokee Indians	Letter Initiating Consultation and Request for Scoping Comments	ML23289A117
11/03/2023	T. Smith (NRC) to D. Hill, Principal Chief, The Muscogee (Creek) Nation	Letter Initiating Consultation and Request for Scoping Comments	ML23289A117
11/03/2023	T. Smith (NRC) to C. Hoskin, Principal Chief, Cherokee Nation	Letter Initiating Consultation and Request for Scoping Comments	ML23289A117
11/22/2023	E. M. Johnson, Director of Historical Services, State Historic Preservation Office	Response to NRC Request for Scoping Comments	ML24037A319
05/17/2024	N. Martinez (NRC) to M. Rome (NRC)	Teleconference Summary with the South Carolina Department of Archives and History	ML24162A048
09/23/2024	M. Rome (NRC) to B. Harris, Chief, Catawba Indian Nation	Clarification of Area of Potential Effect	ML24221A207
09/23/2024	M. Rome (NRC) to C. Hoskin, Chief, Cherokee Nation	Clarification of Area of Potential Effect	ML24221A207
09/23/2024	M. Rome (NRC) to W.E. Emerson, State Historic Preservation Officer	Clarification of Area of Potential Effect	ML24221A207
09/23/2024	M. Rome (NRC) to D. Hill, Principal Chief, The Muscogee (Creek) Nation	Clarification of Area of Potential Effect	ML24221A207
09/23/2024	M. Rome (NRC) to R. Sneed, Eastern Band of Cherokee Indians	Clarification of Area of Potential Effect	ML24221A207
10/25/2024	E.M. Johnson, Director of Historical Services, State Historic Preservation Office	Concurrence with Clarification of Area of Potential Effect	ML24308A006
10/28/2024	E. Toombs, Tribal Historic Preservation Office, Cherokee Nation Tribal Historic Preservation Officer	Acknowledgement of Clarification of Area of Potential Effect	ML24308A005

ADAMS = Agencywide Documents Access and Management System; NRC = U.S. Nuclear Regulatory Commission.
(a) Access these documents through the NRC's ADAMS at https://adams.nrc.gov/wba/.

C.5 References

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.” TN513.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, “Interagency Cooperation—Endangered Species Act of 1973, as amended.” TN4312.

51 FR 19926. 1986. “Interagency Cooperation - Endangered Species Act of 1973, as amended.” Final Rule, *Federal Register*, Fish and Wildlife Service, Interior; National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Commerce. TN7600.

16 U.S.C. § 1536. Endangered Species Act, Section 7, “Interagency Cooperation.” TN4459.

54 U.S.C. § 306108. National Historic Preservation Act Section 106, “Effect of Undertaking on Historic Property.” TN4839.

Endangered Species Act of 1973. 16 U.S.C. § 1531 *et seq.* TN1010.

FWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. *Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultation and Conference*. Washington, D.C. ADAMS Accession No. ML14171A801. TN1031.

Magnuson Stevens Fishery Conservation and Management Reauthorization Act of 2006. 16 U.S.C. 1801 Note. Public Law 109-479, January 12, 2007, 120 Stat. 3575. TN7841.

NMSA (National Marine Sanctuaries Act). 2000. “National Marine Sanctuaries Act, Title 16, Chapter 32 § 1431 *et seq.* United States Code as amended by Public Law 106-513.” Silver Spring, M.D. Available at https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/library/national/nmsa.pdf. TN7197.

APPENDIX D

CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of the agency's environmental review of the license renewal application for Virgil C. Summer Nuclear Station, Unit 1 (V.C. Summer). This appendix does not include consultation correspondence or comments received during the scoping process. For a list and discussion of consultation correspondence, see Appendix C of this supplemental environmental impact statement. For scoping comments, see Appendix A of this supplemental environmental impact statement and the NRC's "Scoping Summary Report" (Agencywide Documents Access and Management System [ADAMS] Accession No. ML24278A042; NRC 2024-TN10831). All documents are available electronically from the NRC's Public Electronic Reading Room found at https://www.nrc.gov/reading-rm.html. From this site, the public can gain access to ADAMS, which provides text and image files of the NRC's public documents. The ADAMS accession number for each document is included in the following table.

D.1 Environmental Review Correspondence

Table D-1 lists the environmental review correspondence, by date, beginning with the request by Dominion Energy South Carolina, Inc. to renew the V.C. Summer operating license.

Table D-1 Environmental Review Correspondence for Virgil C. Summer Nuclear Station

Date	Correspondence Description	ADAMS Accession No. or Federal Register Citing
08/17/2023	Dominion Energy – Application for Subsequent Renewal of Operating License for Virgil C. Summer Nuclear Station, Unit No. 1	ML23233A179
09/05/2023	Letter to E. Carr – Virgil C. Summer Nuclear Station, Unit No. 1 – Receipt and Availability of the Subsequent License Renewal Application	ML23235A037
09/11/2023	Dominion Energy; Virgil C. Summer Nuclear Station, Unit No. 1	88 FR 62409
10/11/2023	Letter to E. Carr - Virgil C. Summer Nuclear Station, Unit No. 1 – Determination of Acceptability and Sufficiency for Docketing and Notice of Opportunity to Request a Hearing	ML23275A014
10/16/2023	Subsequent License Renewal Application; Dominion Energy; Virgil C. Summer Nuclear Station, Unit No. 1	88 FR 71384
10/16/2023	Letter to E. Carr - Virgil C. Summer Nuclear Station, Unit No. 1 – Subsequent License Renewal Application Online Reference Portal	ML23284A179
10/27/2023	Letter to E. Carr - Virgil C. Summer Nuclear Station, Unit No. 1 – Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process	ML23285A038
10/30/2023	Public Meeting Announcement: Environmental Scoping Meeting Related to the Virgil C. Summer Nuclear Station, Unit No. 1, Subsequent License Renewal Application	ML23300A117

Table D-1 Environmental Review Correspondence for Virgil C. Summer Nuclear Station (Continued)

Date	Correspondence Description	ADAMS Accession No. or Federal Register Citing
10/30/2023	Public Meeting Announcement: Environmental Scoping Meeting Related to the Virgil C. Summer Nuclear Station, Unit No. 1, Subsequent License Renewal Application	ML23303A193
11/03/2023	Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Dominion Energy South Carolina; Virgil C. Summer Nuclear Station, Unit No. 1	88 FR 75627
11/09/2023	V.C. Summer Subsequent License Renewal Application Public Environmental Scoping Meeting Presentation	ML23312A020
11/14/2023	V.C. Summer Subsequent License Renewal Application Public Environmental Scoping Meeting Presentation	ML23313A129
12/06/2023	Meeting Summary: Public Scoping Meeting for the Environmental Review of the Subsequent License Renewal Application for Virgil C. Summer Nuclear Station, Unit No. 1	ML23331A789
04/19/2024	Letter to E. Carr - Virgil C. Summer Nuclear Station, Unit No. 1 – Regulatory Audit Regarding the Environmental Review of the Subsequent License Renewal Application	ML24108A039
07/05/2024	Letter to E. Carr - Virgil C. Summer Nuclear Station, Unit No. 1 – Summary of the May 2024 Environmental Audit Related to the Review of the Subsequent License Renewal Application Environmental Report	ML24162A279
08/05/2024	Dominion Energy Response to V.C. Summer Subsequent License Renewal Environmental Report Requests for Additional Information and Requests for Clarification	ML24218A300
10/01/2024	Notice of Intent To Prepare Environmental Impact Statement; Dominion Energy South Carolina, Inc.; Virgil C. Summer Nuclear Station, Unit No. 1	89 FR 79975

ADAMS = Agencywide Documents Access and Management System; Dominion = Dominion Energy South Carolina, Inc.

NRC FORM 335 (12-2010) NRCMD 3.7 U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER **(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)** NUREG-1437, Supplement 15, Second Renewal
2. TITLE AND SUBTITLE Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 15, Second Renewal, Regarding Subsequent License Renewal of Virgil C. Summer Nuclear Station, Unit 1	3. DATE REPORT PUBLISHED MONTH: November YEAR: 2024 4. FIN OR GRANT NUMBER
5. AUTHOR(S) See Chapter 6	6. TYPE OF REPORT Technical 7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Division of Rulemaking, Environmental, and Financial Support

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

Same as above

10. SUPPLEMENTARY NOTES

Docket No. 50-395; EISX-429-00-000-1723809600

11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission (NRC) prepared this supplemental environmental impact statement (SEIS) in response to Dominion Energy South Carolina, Inc.’s application to renew the operating license for Virgil C. Summer Nuclear Station, Unit 1, (V.C. Summer) for an additional 20 years. This SEIS evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include: (1) natural gas, (2) new nuclear (small modular reactor), (3) natural gas and solar combination, (4) new nuclear and solar combination, and (5) not renewing the operating license (the no-action alternative). The NRC staff’s preliminary recommendation is that the V.C. Summer subsequent license renewal is a reasonable option for energy-planning decision-makers.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	13. AVAILABILITY STATEMENT
Dominion Energy South Carolina, Inc. Dominion Energy Virgil C. Summer Nuclear Station V.C. Summer VCSNS Draft Environmental Impact Statement National Environmental Policy Act (NEPA)	unlimited 14. SECURITY CLASSIFICATION *(This Page)* unclassified *(This Report)* unclassified 15. NUMBER OF PAGES 16. PRICE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS

@NRCGOV

NUREG-1437
Supplement 15
Second Renewal, Draft

Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 15, Second Renewal, Regarding Subsequent License Renewal of Virgil C. Summer Nuclear Station, Unit 1

November 2024