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NUREG-2248

Environmental Impact Statement for the License Renewal of the Columbia Fuel Fabrication Facility in Richland County, South Carolina

Draft Report for Comment

Office of Nuclear Material Safety and Safeguards

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For any questions about the material in this report, please contact: Diana Diaz-Toro, Project Manager, at 301-415-0930 or by e-mail at Diana.Diaz-Toro@nrc.gov.

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) prepared this draft environmental impact statement (EIS) as part of its environmental review of the Westinghouse Electric Company, LLC (WEC) license renewal application to continue operating the Columbia Fuel Fabrication Facility (CFFF) for an additional 40 years. The CFFF is located in Hopkins, South Carolina, and has been operating since 1969. This draft EIS provides the NRC staff's evaluation of the potential environmental impacts of the proposed action, the no-action alternative, and a 20-year license renewal alternative. The proposed action is the renewal of the special nuclear material license SNM-1107 to allow the WEC to continue licensed operations and activities at the CFFF site for an additional 40 years.

On June 5, 2020, the NRC staff decided to prepare an EIS because new information related to the WEC's remedial investigations being conducted under a Consent Agreement (CA) with South Carolina Department of Health and Environmental Control (SCDHEC) revealed uncertainty related to the source and extent of contamination onsite and the potential future migration pathways offsite and precluded the NRC staff from making a finding of no significant impact through the environmental assessment process.

The WEC's ongoing remedial investigations under the CA with SCDHEC are being conducted in coordination with the State, not the NRC. However, the NRC staff considered these remedial investigations and associated actions in its description of the affected environment and environmental impact determinations in this draft EIS.

Based on its environmental review, the NRC staff preliminarily recommends that the WEC's license SNM-1107 for the operation of the CFFF be renewed for an additional 40 years. The NRC staff based its recommendation on the following:

- the license renewal application, which includes the environmental report and supplemental documents and the WEC's responses to the NRC staff's Requests for Additional Information
- consultation with Federal, State, and Tribal agencies and input from other stakeholders
- independent NRC staff review
- the assessments provided in this draft EIS.

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EXECUTIVE SUMMARY

In December 2014, the U.S. Nuclear Regulatory Commission (NRC) received a license renewal application (LRA) from Westinghouse Electric Company, LLC (WEC) for its Columbia Fuel Fabrication Facility (CFFF), located in Hopkins, South Carolina. The WEC requested that its NRC license be renewed for an additional 40 years to continue fabricating low-enriched uranium fuel assemblies for commercial nuclear power reactors. The WEC did not propose changes to their current licensed processes or construction of new buildings or structures. The WEC revised the LRA and associated environmental report (ER) in March 2019 mainly to incorporate responses to NRC's requests for additional information (RAI) dated January 18, 2019.

In June 2018, the NRC published a final environmental assessment (EA) and a finding of no significant impact (FONSI) concerning the license renewal request. The EA documented the potential environmental impacts of the proposed continued operation of the CFFF for another 40 years. Shortly thereafter, in July 2018, there was a leak from equipment at the CFFF that resulted in uranium entering the subsurface under the facility building. Additionally, the WEC initiated an investigation, under the purview of the South Carolina Department of Health and Environmental Control (SCDHEC), into a leak in 2011 from a buried pipe that also allowed uranium to enter the subsurface under the main facility building. Because of that new information and the public concerns about the releases, the NRC decided to reopen its environmental review. As a result, the NRC withdrew the June 2018 EA and FONSI and announced, in a *Federal Register* notice (84 FR 57777), the publication of an updated draft EA for public review and comment. After the draft EA public comment period, the NRC staff determined that a FONSI could not be reached after considering new information provided by the WEC related to the remedial investigations being conducted under a Consent Agreement (CA) with the SCDHEC. The information revealed uncertainty regarding the source and extent of contamination onsite and the potential future migration pathways offsite. Therefore, on June 5, 2020, the NRC staff informed the WEC that it would prepare an environmental impact statement (EIS). On July 31, 2020, the NRC published a Notice of Intent in the *Federal Register* (85 FR 46193) to prepare an EIS and began the EIS scoping comment period. The NRC staff issued the Scoping Process Summary Report on February 25, 2021. In support of the preparation of the EIS, the NRC staff issued RAIs, which were submitted to the WEC on November 3, 2020. On December 18, 2020, the WEC provided their responses to the NRC staff. Additional clarification requests related to the WEC's previous responses to the RAIs on the EIS were submitted by the NRC to WEC on March 18, 2021. The WEC's responses to the NRC staff's clarification requests were received on March 24, 2021.

This draft EIS considers and weighs the environmental impacts from the WEC's proposed renewal of the CFFF licensed operations for an additional 40 years, the no-action alternative, and the 20-year license renewal alternative on land use, geology and soils, surface and groundwater resources, ecological resources, climatology, meteorology, and air quality, noise, historic and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, transportation, waste generation and management, accidents, environmental justice, and assesses costs and benefits. This draft EIS also describes avoidance of potential adverse impacts and mitigation measures for the reduction of potential adverse impacts, including the new conditions that the WEC agreed to add to the license, if renewed, new commitments from the WEC that would be incorporated into the LRA, and additional measures that the NRC staff identified as having the potential to further reduce environmental impacts, but that the licensee did not commit to in its application.

The NRC's *Environmental Review Guidance for Licensing Actions Associated with Office of Nuclear Materials Safety and Safeguards (NMSS) Programs* (NUREG–1748) categorizes the significance of potential environmental impacts as follows:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

With respect to the WEC's proposed 40-year license renewal, the NRC staff evaluated the following resource areas and determined that the proposed action would have a SMALL impact on land use terrestrial and aquatic ecology, air quality, noise, historic and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, transportation, waste generation and management, accidents, and environmental justice.

While impacts on soils, surface water, and groundwater can be noticeable, the NRC staff determined that impacts on soils and surface water resources from the proposed action would be SMALL. Some soils near the plant buildings have been contaminated, but soils away from the operational areas have been only minimally affected to date. Under the CA, the WEC would assess remediation efforts, which are expected to disturb surface soils only near the plant buildings. Further, any soil contamination would be remediated during decommissioning for which funding is assured under NRC's decommissioning funding regulations.

Surface water withdrawals and consumptive use of water for CFFF operations would have negligible effects on other uses/users of the Congaree River during the proposed license renewal period. Future discharges to the Congaree River would continue in accordance with the NRC license and National Pollutant Discharge Elimination System (NPDES) permit and, thus, would have minor effects on water quality. Contamination of onsite water bodies from the proposed continued operation of the CFFF is possible during the proposed license renewal term, however, there is a low potential for contaminants to move offsite because of the implementation of activities and programs to minimize the effects of releases on other users of the local surface water resources (e.g., spill prevention controls, the environmental sampling and monitoring program, and Federal and State permitting requirements).

The existing groundwater sampling data indicate that the contaminant plumes resulting from past activities at the CFFF site currently remain onsite and occur only in the surficial aquifer. While actions taken by the WEC in response to past contaminant releases have reduced the likelihood of future inadvertent releases with continued operation of the CFFF, future inadvertent releases of contaminants to the subsurface are reasonably foreseeable considering the uncertainties about past leaks and the potential for the risk of leaks to increase with the age of plant components. Additionally, the current groundwater contamination is not likely to travel beyond the CFFF site boundary during the period of the proposed action. However, there are significant uncertainties that affect the evaluation of fate and transport of contaminants in groundwater. Based on these findings, the NRC staff concluded that impacts on groundwater from the proposed action would be SMALL to MODERATE.

The WEC has made changes to its NRC environmental sampling and monitoring program including new monitoring wells; additional surface water, groundwater, sediment, and soil sample locations; and use of a conceptual site model (CSM) as a decision-making tool. The WEC also developed procedures to help make decisions about the sampling program and

remediation based on analysis of environmental data. As more information and data are gathered through the WEC's implementation of the CA, these procedures will allow the WEC to further refine its environmental monitoring and sampling program and remediation activities. The WEC also agreed to two new license conditions related to the WEC's environmental monitoring and sampling program. The first license condition would require the WEC to enter groundwater and surface water results exceeding Federal and State standards into its Corrective Action Program. The second condition would require the WEC to submit its environmental monitoring and sampling program to the NRC for review and approval upon either SCDHEC's approval of the final Remedial Investigation Report, as required by the CA, or within 5 years of the license renewal (whichever comes first). Additionally, the WEC has committed to submit the environmental monitoring and sampling program to the NRC for review and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC. Further, per NRC regulations, the WEC must maintain records and funding to ensure the CFFF can be decommissioned to meet NRC's regulatory limits.

The NRC staff also evaluated potential cumulative impacts from the proposed action considering other past, present, and reasonably foreseeable future actions in the vicinity of the CFFF site. The NRC staff determined that the proposed license renewal would contribute SMALL incremental impacts on all resource areas, except for groundwater resources. However, because the past operation of the CFFF has had a noticeable effect on the water quality of the onsite groundwater that continues to be observed in the most recent data, and on the water quality of the onsite surface water bodies (including past exceedance of water quality standards and the current exceedance of uranium residential screening levels in Mill Creek sediments), the NRC staff concluded that the cumulative impacts to groundwater and surface water from past and current CFFF operations are MODERATE. Although the proposed continued operation of the CFFF for an additional 40 years could noticeably alter onsite groundwater quality, the continued operation would not destabilize or significantly affect the groundwater resource because there is a low potential for contaminants to move offsite.

Under the no-action alternative, the NRC would deny the WEC's request to renew CFFF's SNM-1107 license for an additional 40 years. The WEC, however, would continue to operate the CFFF under its current operating license until it expires on September 30, 2027. Upon license expiration, the WEC would be required to start the decommissioning process, including any site remediation, unless the WEC requests and obtains a renewed license. The NRC staff found that the environmental impacts from the no-action alternative would be SMALL on most environmental resource areas except for groundwater resources and socioeconomics. Potential impacts on groundwater resources under the no-action alternative would be similar to the potential impacts from the proposed action (as summarized above), however, the impacts would only be expected to be experienced through license expiration. Potential impacts on socioeconomics would be MODERATE because the CFFF would cease operations and begin decommissioning activities. Decommissioning would likely cause the WEC to employ a smaller workforce than the current CFFF operations workforce. Decommissioning activities would also be temporary and eventually the employment and other economic activity associated with the CFFF site would end, resulting in a noticeable adverse impact on the local economy.

The NRC staff also considered as an alternative approving the WEC's a license renewal request with a shorter license renewal term, i.e., a renewal term of 20 years. The NRC staff found that the potential environmental impacts from this alternative would be similar to the potential impacts from the proposed action except that the impacts would occur over a shorter timeframe.

The cost-benefit analysis in the draft EIS compares the costs and benefits of the proposed action to the alternatives identified above considering various scenarios and financial discounting rates. The proposed action would generate costs and benefits, both from an environmental and economic perspective. After assessing and weighing the costs and benefits, the NRC staff concludes that benefits of the proposed action outweigh the economic and environmental costs. Further, the staff concludes that the no-action alternative would result in environmental and economic costs to society that would exceed the costs for the proposed action. While the 20-year license renewal alternative also would result in a positive economic benefit-cost ratio similar to the proposed action, the duration of beneficial impacts and positive economic returns to CFFF operations would be shorter lived.

After weighing the impacts of the proposed action and comparing them to those of the no-action alternative and 20-year license renewal alternative, the NRC staff, in accordance with Section 51.71(f) of Title 10 of the *Code of Federal Regulations* sets forth its preliminary NEPA recommendation regarding the proposed action. The NRC staff preliminarily recommends that the NRC renews the WEC's operating license for the CFFF for an additional 40 years. This preliminary recommendation is based on (1) the LRA, which includes the ER and supplemental documents and the WEC's responses to the NRC staff's RAIs; (2) consultation with Federal, State, and Tribal agencies and input from other stakeholders; (3) independent NRC staff review; and (4) the assessments provided in this draft EIS.

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µCi	microcurie(s)
µg	microgram(s)
AADT	annual average daily traffic
ac	acre(s)
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ADAMS	Agencywide Documents Access and Management System
ADR	alternate dispute resolution
ADU	ammonium diuranate
AIT	Augmented Inspection Team
ALARA	as low as reasonably achievable
AOC	area of concern
APE	area of potential effect
AS/SVE	air sparging/soil vapor extraction
BACT	best available control technology
BAQ	(SCDHEC) Bureau of Air Quality
BMCU	Black Mingo Confining Unit
BTU	British thermal units(s)
CA	Consent Agreement
CAL	Confirmatory Action Letter
CAP	Corrective Action Program
CEB	Community Engagement Board
CEDE	Committed effective dose equivalent
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFFF	Columbia Fuel Fabrication Facility
CFR	Code of Federal Regulations
cfs	cubic feet per second
cis-1,2-DCE	cis-1,2-dichloroethylene
CO	confirmatory order
COC	constituent of concern
CO2eq	carbon dioxide equivalent
COPC	constituent of potential concern
CSM	Conceptual Site Model
CSX	CSX Transportation, Incorporated
CWW	contaminated wastewater
CVOC	chlorinated volatile organic compound

DFP	Decommissioning Funding Plan
DMR	Discharge Monitoring Report
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EA	environmental assessment
EF	Enhanced Fujita
EIS	environmental impact statement
EJ	environmental justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	environmental report
ERPG	emergency response planning guideline
ESA	Endangered Species Act
FONSI	finding of no significant impact
FS	feasibility study
ft	foot (feet)
ft^3	cubic foot (feet)
FWS	U.S. Fish and Wildlife Service
GHG	greenhouse gas
GPR	ground-penetrating radar
GHG	greenhouse gas
gpd	gallon(s) per day
ha	hectare(s)
HCL	hydrochloride
HDPE	high-density polyethylene
HEPA	high-efficiency particulate air
HF	hydrofluoric acid
HFSS	hydrofluoric acid spiking station
hr	hour(s)
Hwy	highway
IAEA	International Atomic Energy Agency
IROFS	item relied on for safety
ISA	Integrated Safety Analysis
ISO	International Organization for Standardization
IWSW	inactive water supply well
JFD	joint frequency distribution
IROFSs	items relied on for safety
ISA	integrated safety analysis
ISG	interim staff guidance
kg	kilogram(s)
km	kilometer(s)

L	liter(s)
LAR	license amendment request
lb	pound(s)
LLRW	low-level radioactive waste
LRA	license renewal application
LRCAC	Lower Richland Citizen Advisory Council
µg	microgram(s)
LLRW	low-level radioactive waste
m	meter(s)
m^3	cubic meter(s)
mbp	million years before present
MBTA	Migratory Bird Treaty Act
MCF	million cubic feet
mCi	millicurie(s)
MCL	maximum contaminant level
MDC	minimum detectable concentration
MEI	maximally exposed individual
mg	milligram(s)
Mgd	million gallons per day
mi	mile(s)
ml	milliliter(s)
MMBTU	metric million British thermal units
mpd	million years before present
mrem	millirem
MSL	mean sea level
mSv	millisievert(s)
MT	metric ton(s)
NAAQS	National Ambient Air Quality Standards
NCRP	National Council of Radiation Protection and Measurements
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NMSS	National Council of Radiation Protection and Measurements
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	nitrogen oxides

NPDES	National Pollutant Discharge Elimination System
NPS	National Parks Service
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
O_3	ozone
ORV	outstandingly remarkable value
OSHA	Occupational Safety and Health Administration
OU	operational unit
PA	Programmatic Agreement
PCE	perchloroethylene
PHE	public health emergency
pCi	picocurie(s)
PM2.5	particulate matter with an aerodynamic diameter of 2.5 microns or less
PM10	particulate matter with an aerodynamic diameter of 10 microns or less
ppm	parts per million
PSD	Prevention of Significant Deterioration
PVC	polyvinyl chloride
RAI	requests for additional information
rem	roentgen equivalent man
RIWP	Remedial Investigation Work Plan
RSL	residential screening level
RUSL	residential use screening level
SC	South Carolina
SCDAH	South Carolina Department of Archaeology and Historic Preservation
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCDOT	South Carolina Department of Transportation
SCDPS	South Carolina Department of Public Safety
SCE&G	South Carolina Electric and Gas
SCIAA	South Carolina Institute of Archaeology and Anthropology
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SNM	Special Nuclear Material
SR	State Route
SO_2	sulfur dioxide
SOLX	solvent extraction
sVOC	semi-volatile organic compound
sVOC	semi-volatile organic compounds
T	ton(s)
Tc-99	technetium-99

TCE	trichloroethene
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Officer
TSS	total suspended solids
U	uranium
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
UDP	Unanticipated Discovery Plan
UF6	uranium hexafluoride
UN	uranyl nitrate
U.S.	United States
UO_2	uranium dioxide
UO_2F_2	uranyl fluoride
URRS	uranium recycle and recovery services
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VC	vinyl chloride
VCC	Voluntary Cleanup Contract
VOC	volatile organic compound
WCM	wet combustible materials
WEC	Westinghouse Electric Company, LLC
WSW	water supply well
WWTP	wastewater treatment plant
yr	year(s)
χ/Q	atmospheric dispersion factor(s)

1.0 INTRODUCTION

The Westinghouse Electric Company, LLC's (WEC's) Columbia Fuel Fabrication Facility (CFFF), located in Hopkins, South Carolina, has been operating since 1969 and fabricates low-enriched uranium fuel assemblies for commercial nuclear power reactors. In December 2014, the WEC submitted an application, including an environmental report (ER), to the U.S. Nuclear Regulatory Commission (NRC) to renew its special nuclear material (SNM) license SNM–1107 (WEC 2014-TN6421) to continue to operate the CFFF for an additional 40 years. The NRC staff accepted the WEC's license renewal application (LRA) for detailed technical review on December 30, 2014 (NRC 2014-TN7073). A notice of opportunity to request a hearing for the LRA was published in the *Federal Register* (FR) on February 27, 2015 (80 FR 10727-TN7074). If granted as proposed, the renewed license would allow WEC to continue authorized operations and activities at the CFFF site for a period of 40 years from the date the NRC approves the license renewal request. The WEC's license (SNM-1107) was last renewed by the NRC in 2007 for 20 years and will expire in September 2027 (NRC 2007-TN6528).

As part of the review of the WEC's LRA, the NRC is preparing an environmental impact statement (EIS) in accordance with the National Environmental Policy Act of 1696 (NEPA, 42 U.S.C. § 4321 *et seq*.; TN661) and NRC's NEPA-implementing regulations at Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 (TN250), "Environmental Projection Regulations for Domestic Licensing and Related Regulatory Functions." The NRC staff is publishing this draft EIS for public review and comment in accordance with 10 CFR 51.73 (TN250). The NRC staff will issue a final EIS after addressing comments from the public and external stakeholders on the draft EIS. The comments received and the NRC staff's responses to those comments will be included as an appendix to the final EIS.

The NRC staff is also conducting a detailed safety analysis of the WEC's LRA to assess compliance with applicable NRC regulations, including 10 CFR Part 70 (TN4883), "Domestic Licensing of Special Nuclear Material," and 10 CFR Part 20 (TN283), "Standards for protection against radiation." The NRC staff's safety analysis will be documented in a separate Safety Evaluation Report (SER). The NRC's decision about whether to renew the WEC license as proposed will be based on the results of the NRC staff's review as documented in the SER and the EIS.

1.1 Proposed Action

The proposed action, as requested by the WEC, is the continued operation of the CFFF for an additional 40 years in Hopkins, South Carolina. Current operations at CFFF include receiving natural and low-enriched uranium hexafluoride (UF_6) in cylinders, converting it to uranium dioxide (UO_2) powder, and processing the UO_2 powder into fuel assemblies (pellet pressing, sintering, fuel rod loading and sealing, assembly fabrication). The CFFF has a production capacity of 1,500 MTU/yr with a maximum capacity of 1,600 MTU/yr. In its LRA, the WEC did not request changes to its NRC license related to operations nor construction of new buildings or structures within the controlled access area or restricted area (WEC 2019-TN6510).

1.2 Purpose of and Need for the Proposed Action

The CFFF is one of three facilities in the United States currently licensed by the NRC to manufacture fuel assemblies for commercial nuclear power plants. The WEC's license renewal request, if granted as proposed, would allow the CFFF to continue to be a source of nuclear fuel for commercial nuclear power plants for 40 years from the date the NRC approves the renewal.

Fuel fabrication facilities convert low-enriched uranium into fuel for commercial nuclear power reactors that generate electricity.

1.3 NEPA Environmental Review Process

NEPA established national environmental policy and goals to protect, maintain, and enhance the environment and established a process for Federal agencies to implement these specific goals for actions under their jurisdiction. The purpose of this EIS is to assess the potential environmental impacts of the WEC's proposed license renewal and alternatives to the proposed action. The NRC staff has prepared this draft EIS following NRC regulations 10 CFR Part 51 (TN250) and pursuant to guidance in NUREG–1748, *Environmental Review Guidance for Licensing Actions Associated with Office of Nuclear Materials Safety and Safeguards (NMSS) Programs* (NRC 2003-TN1983). The NRC staff's environmental review process for the license renewal of the CFFF is depicted in Figure 1-1.

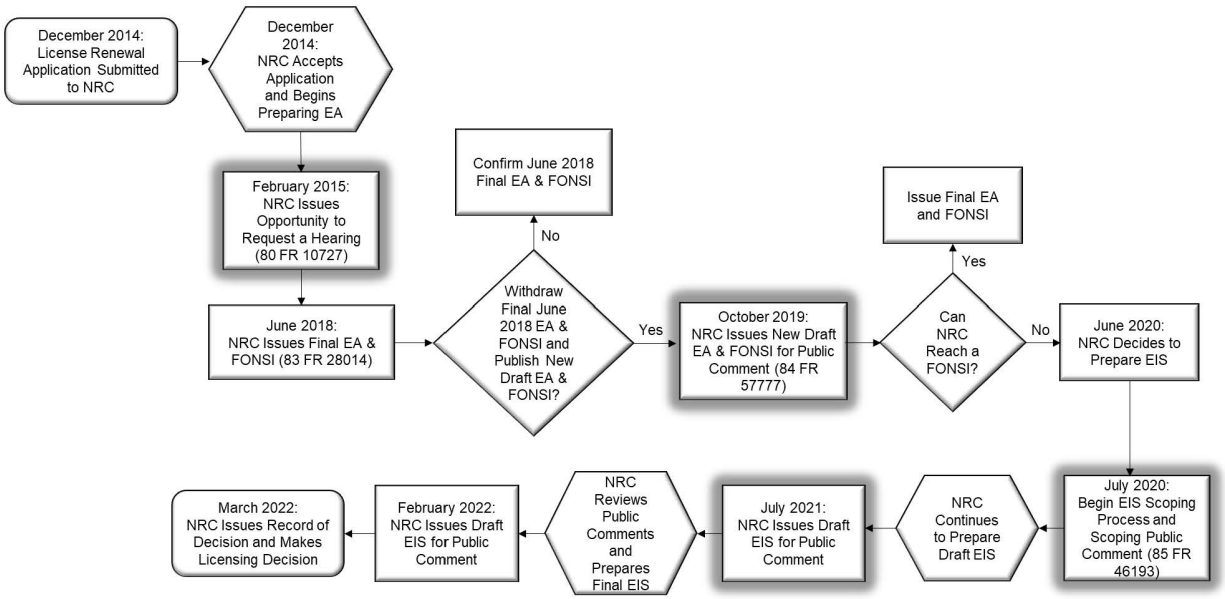

Figure 1-1 The NRC's Environmental Review Process for the License Renewal of the CFFF

1.3.1 Decision to Prepare an EIS

On June 15, 2018, the NRC published a final environmental assessment (EA) (NRC 2018-TN6416) and a finding of no significant impact (FONSI) in the *Federal Register* (83 FR 28014-

TN6415). In July 2018, the WEC identified a leak that released uranium and hydrofluoric acid (HF) into the subsurface environment. Additionally, under the purview of the South Carolina Department of Health and Environmental Control (SCDHEC), the WEC initiated an investigation into a leak from a buried pipe that occurred in 2011, which allowed uranium to enter the subsurface under the main building. Based on this new information and public concern about the releases, the NRC staff decided to reopen its environmental review. On October 28, 2019, the NRC concurrently withdrew its June 2018 EA and FONSI and published a new draft EA (NRC 2019-TN6472) for public review and comment (84 FR 57777-TN6422).

On February 26, 2019, SCDHEC executed a Consent Agreement (CA) with the WEC (SCDHEC/WEC 2019-TN6554) to conduct remedial investigations and address historical contamination at the CFFF site. Subsequently, on June 5, 2020, the NRC staff decided to prepare an EIS (NRC 2020-TN6519) because new sampling and monitoring data from the remedial investigations conducted by the WEC (2020-TN6751) under a CA with SCDHEC revealed uncertainty related to the source and extent of contamination onsite and the potential future migration pathways offsite (SCDHEC/WEC 2019-TN6554) and precluded the NRC staff from making a FONSI through the EA.

1.3.2 Notice of Intent to Prepare an EIS and Scoping Process

In accordance with 10 CFR 51.26 (TN250), the NRC published a Notice of Intent (NOI) in the *Federal Register* to prepare an EIS and conduct a scoping process on July 31, 2020 (85 FR 46193-TN6417). Through this *Federal Register* Notice (FRN), e-mails sent to the WEC e-mail distribution lists, and posts on social media (e.g., Facebook and Twitter), the NRC staff invited potentially affected Federal, State, and Tribal local governments; organizations; and the public to provide comments on the scope of the EIS. The NRC staff conducted the EIS scoping process between July 31 and August 31, 2020 (85 FR 46193-TN6417). The NRC received more than 60 written comments from the public, local, State, and Federal agencies, and Indian Tribes. In February 2021, the NRC published a Scoping Process Summary Report (NRC 2021-TN6934) documenting its determinations regarding the EIS's scope. The Scoping Process Summary Report (incorporated by reference) describes the scoping process and addresses the comments received during the scoping comment period, as well as written and oral comments gathered during the previous environmental review public comment period for the October 2019 draft EA (NRC 2019-TN6472), which preceded the development of this EIS. The NRC staff also held a public meeting to discuss the status of its review of the WEC CFFF LRA on February 4, 2021 (WEC 2021-TN6913, NRC 2021-TN6914, NRC 2021-TN6915, NRC 2021-TN7001).

1.3.3 Scope of the EIS

This EIS evaluates the environmental impacts of the proposed action—continuing the currently licensed operations through the requested 40-year license renewal period. The EIS considers the operations and activities occurring at the CFFF site, the affected environment, and the interaction between the two. This EIS incorporates by reference information from EAs prepared for the previous license renewals and the draft EA published for public comment in October 2019, where noted.

In preparing this EIS, the NRC staff considered various documents and sources of information, including documents from the WEC regarding the LRA and ER: the WEC's March 2019 updated LRA and ER (WEC 2019-TN6423, WEC 2019-TN6510), August 2019 subsequent update to LRA (which included additional environmental monitoring data) (WEC 2019-TN6423), and December 2020 update to the ER (WEC 2020-TN6869). The NRC staff also considered

documents published as part of the CA between the WEC and SCDHEC, and previous NRC reports and publications relevant to licensing of the CFFF.

Additionally, the NRC staff provided requests for additional information (RAIs) to the WEC on November 3, 2020 (NRC 2020-TN6788) to which the WEC responded on December 18, 2020 (WEC 2020-TN7076). Additional clarification requests related to the WEC's previous responses to the RAIs on the EIS were submitted by NRC to WEC on March 18, 2021(NRC 2021-TN7047). The WEC's responses to NRC staff's March 2021 requests for additional clarifications were received on March 24, 2021 (WEC 2021-TN7043, WEC 2021-TN7048). In conducting its independent review, the NRC staff also considered information provided by Federal, State, and Tribal governments, and public comments received during the EIS scoping process.

1.3.3.1 Issues Studied in Detail

In accordance with NEPA, the NRC staff conducted an independent and detailed evaluation of the potential environmental impacts from the proposed continued operation of the CFFF for an additional 40 years, the no-action alternative, and the 20-year license renewal alternative. This EIS provides a detailed analysis of the following environmental resource areas:

- land use,
- geology, seismology, and soils,
- water resources – surface and groundwater,
- ecological resources – terrestrial and aquatic,
- protected species and habitat,
- climatology, meteorology, and air quality,
- noise,
- historic and cultural resources,
- visual and scenic resources,
- socioeconomics,
- public and occupational health,
- transportation,
- waste generation and management,
- accidents,
- environmental justice, and
- costs and benefits.

1.3.3.2 Issues Eliminated from Detailed Study

This EIS evaluates the environmental impacts of continued operation of the CFFF. Some issues and concerns raised during the October 2019 draft EA public comment period and the EIS scoping process (NRC 2021-TN6934) were determined to be beyond the scope of the EIS. These topics include (but are not limited to) the following:

- use of other nuclear fuel types;
- concerns about the safety and security of nuclear fuel, nuclear energy and future demand for nuclear energy in general;
- consideration of the business structure of the WEC and contractors used to operate CFFF;
- issues related to financial assets and ownership of the WEC and its subsidiary;
- concerns regarding regulation and oversight of dual-use facilities, including the relationships to U.S. Department of Energy's National Nuclear Security Administration;
- concerns regarding compensation to potentially affected landowners;
- concerns regarding emergency plans and evacuation routes;
- concerns regarding security and terrorist attack prevention; and
- general disagreement with nuclear power and the need for nuclear fuel.

1.4 Applicable Regulatory Requirements, Permits and Authorizations

In addition to obtaining an NRC license renewal for continued operation of the CFFF, the WEC is required to obtain all other necessary permits and approvals from other Federal and State agencies. Table 1-1 lists the status of the required permits and approvals.

Table 1-1 Environmental Approvals for the CFFF Continued Operation

Regulatory Agency	License/ Permit	Description	Status[(a)]
U.S. Nuclear Regulatory Commission	SNM-1107	SNM-1107 LRA (WEC 2019-TN6571, WEC 2021-TN6920)	License renewal application submitted. Under review.
South Carolina Department of Health and Environmental Control	SC00001848	National Pollutant Discharge Elimination System (NPDES) Permit	Under review. Permit renewal request submitted. Draft 5-year renewal permit underwent 30-day public comment period ending October 12, 2019 (WEC 2019-TN6777).
South Carolina Department of Health and Environmental Compliance	1900-0050-R1	Air Quality Permit	Permit renewal request submitted. Under review. Draft renewal permit underwent 30-day public comment period ending October 12, 2019 (WEC 2019-TN6777).
South Carolina Department of Health and Environmental Compliance	094	Radioactive Materials License	Current.

Regulatory Agency	License/ Permit	Description	Status[(a)]
South Carolina Department of Health and Environmental Compliance	40-0846	X-Ray Facility Registration	Current. No expiration date.
South Carolina Department of Health and Environmental Compliance	0046-39-20-X	Radioactive Waste Transport	Renewal permit request submitted.
South Carolina Department of Health and Environmental Compliance	SCR000000	Stormwater Permit	Current.
South Carolina Department of Health and Environmental Compliance	40561001	Environmental Laboratory Qualification	Current.
South Carolina Department of Health and Environmental Compliance	SC40-0332G	Infectious Waste Generator Permit	Current.

(a) Under Review indicates that the WEC has submitted its application for the permit. Current indicates the permit/license are active and valid.

1.5 Consultation and Coordination with Other Agencies

Federal agencies are required to comply with the Section 106 process of the National Historic Preservation Act of 1966 (NHPA; 54 U.S.C. § 300101 *et seq.*; TN4157), as amended, and Section 7 of the Endangered Species Act of 1973 (ESA; 16 U.S.C. § 1531 *et seq.*; TN1010), as amended. The consultations conducted for the proposed action are summarized in EIS Sections 1.5.1 and 1.5.2. A list of the consultation correspondence and a more detailed consultation history is provided in EIS Appendix A.

1.5.1 Consultation

1.5.1.1 NHPA Section 106 Consultation

Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to review and comment on the undertaking. The ACHP is an independent Federal agency that promotes the preservation, enhancement, and productive use of our nation's historic resources. The NHPA-implementing regulations are found in 36 CFR Part 800 (TN513), “Protection of Historic Properties.” In accordance with 36 CFR 800.8, the NRC staff is coordinating its NHPA Section 106 review with its NEPA environmental review. Throughout the NRC’s environmental review of the WEC’s LRA, the NRC staff has been consulting with the South Carolina State Historic Preservation Office (SHPO) and federally recognized Indian Tribes. The NRC staff initially reached out to the South Carolina SHPO in May 2015 requesting concurrence with the NRC staff’s determination that no historic properties listed in or eligible for listing in the National Register of Historic Places (NRHP) would be affected by the proposed action (SCAHC 2015-TN5608) because the WEC did not request changes to its currently licensed operations or construction of new buildings or structures. The South Carolina SHPO concurred and further explained that the CFFF site has a high probability of the existence of significant archaeological properties and any future proposed expansion or

ground disturbance in undisturbed areas should be submitted to their office for review and comment (SCAHC 2015-TN5608). The South Carolina SHPO also noted that if archaeological materials are encountered during construction, procedures described in 36 CFR 800.13(b) (TN513) would apply and the Federal agency or licensee should contact the SHPO office immediately. The NRC staff sent a similar letter to the Catawba Indian Nation also requesting concurrence (NRC 2015-TN5595). The NRC staff did not receive a response from the Catawba Indian Nation.

The NRC staff continued its consultation with the South Carolina SHPO (NRC 2019-TN6541) and Catawba Indian Nation (NRC 2019-TN6542) during the publication of the October 2019 draft EA for public review and comment (NRC 2019-TN6472). The NRC staff explained that the WEC would be conducting further investigation into onsite water and soil contamination under q CA executed with the SCDHEC (SCDHEC/WEC 2019-TN6554), which would require the installation of groundwater monitoring wells and sediment sampling in disturbed and previously undisturbed areas of the CFFF site (NRC 2019-TN6472). Installation of the new groundwater wells and sediment sampling would be short-term and involve minimal land disturbance. The WEC's contractor would follow established procedures to address inadvertent discoveries of cultural resources and avoid subsurface objects during installation of the wells. The contractor would also use ground-penetrating radar prior to conducting ground-disturbing activities as part of well installation.

In November 2019, the Catawba Indian Nation provided comments to the NRC staff indicating no "immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas," and requesting that the Tribe "be notified if Native American artifacts and/or human remains are located during the ground disturbance phase of the project" (Catawba Indian Nation 2019-TN6418).

On July 31, 2020, the NRC staff notified the Catawba Indian Nation (NRC 2020-TN6531), and the South Carolina SHPO (NRC 2020-TN6529) of the NRC staff's intent to prepare an EIS for the WEC's LRA, and invited comments during the EIS scoping process (NRC 2020-TN6539). No response was received from the South Carolina SHPO. On August 31, 2020 the Catawba Indian Nation indicated its desire to be consulted about the proposed action (Catawba Indian Nation 2020-TN6534).

On June 29, 2021, the NRC staff held a call with the South Carolina SHPO to provide a status update and share additional information provided by the WEC in response to the NRC staff's RAIs (NRC 2020-TN6788 and NRC 2021-TN7047). The NRC staff provided the sitewide cultural resources procedures the WEC has in place (RA-432 [WEC 2021-TN7060], SYP-233 [WEC 2021-TN7064], RA-136 [WEC 2021-TN7062], and TRN-170 [AECOM Undated-TN7063]). As discussed in Section 3.9 of this EIS, the NRC staff does not anticipate that the proposed action would affect historic properties. The NRC staff anticipates providing its effects determination to the South Carolina SHPO for concurrence prior to finalization of this EIS. The NRC staff will notify the South Carolina SHPO and the Catawba Indian Nation upon issuance of this draft EIS. A detailed discussion of the NHPA Section 106 consultation is provided in Appendix A.

Additionally, during the preparation of this EIS, the NRC staff reached out to the Pine Hill Indian Tribe and interested members of the public to discuss the scope of the proposed action and the NRC's regulatory role. The NRC staff will notify the Pine Hill Indian Tribe and Waccamaw Indian People as well as other interested stakeholders upon issuance of this draft EIS.

1.5.1.2 ESA Section 7 Consultation

The ESA was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. ESA Section 7 (16 U.S.C. § 1531 *et seq.*; TN1010) requires that agencies consult with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to ensure that actions they authorize, permit, or otherwise carry out, will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. The NRC staff has consulted with the FWS and the NMFS as required under Section 7 of the ESA. For a detailed discussion of the NRC staff's consultations under ESA and impacts on federally listed species see Appendix A and Section 3.6 of this EIS, respectively.

1.5.1.2.1 FWS Consultation

Consultation with the FWS began in May 2015 during the development of the 2018 EA and FONSI when the NRC staff requested concurrence that the proposed 40-year license renewal is not likely to adversely affect terrestrial species under FWS jurisdiction (NRC 2015-TN5594). The FWS concurred and requested to be kept informed if new impacts were identified (NRC 2015-TN5594). In June 2019, the NRC staff informed FWS about the onsite contamination investigations and installation of groundwater monitoring wells and sampling, currently being conducted by the WEC under the CA with the SCDHEC (SCDHEC/WEC 2019-TN6554). Installation of the new groundwater wells and sampling at the CFFF site is approved by SCDHEC and is conducted under the WEC's current NRC license (NRC 2019-TN6473). Both the NRC staff and FWS determined that installation of new monitoring wells would only cause minimal land disturbances, and FWS continued to concur that the proposed 40-year license renewal would be unlikely to cause adverse effects (NRC 2019-TN6473; FWS 2019-TN6429). After review of the October 2019 draft EA, the FWS reconfirmed that the proposed CFFF 40-year license renewal was not likely to adversely affect federally listed species (FWS 2019-TN6426).

On July 31, 2020, the NRC staff notified the FWS of the NRC's intent to prepare an EIS for the WEC's LRA and invited them to participate in the scoping process (NRC 2020-TN6556).

During the development of this EIS, the NRC staff determined that no new information would call into question the staff's previous finding that the proposed action is not likely to adversely affect federally listed species under the FWS's jurisdiction. The impacts on federally listed species evaluated and documented in this EIS have not changed from those discussed in the 2019 draft EA, which considered the impacts from installation of new monitoring wells at the CFFF site and that the FWS reviewed. As previously discussed, the FWS determined then that the proposed CFFF 40-year license renewal is not likely to adversely affect federally listed species (FWS 2019-TN6426). Therefore, reinitiation of consultation with FWS is not required (NRC 2020-TN6520). The NRC staff will notify the FWS upon issuance of this draft EIS.

1.5.1.2.2 NMFS Consultation

The NRC staff requested informal consultation in 2017 with NMFS during the development of the 2018 EA and FONSI (NRC 2017-TN5603). The main focus of this consultation was the potential for impacts associated with the release of chemical pollutants from effluent releases into the Congaree River. Shortnose sturgeon were the original focus of the consultation because they are the only ESA federally listed species under the purview of NMFS that are known to occur in the action area (i.e., the Congaree River); however, NMFS determined that

Atlantic sturgeon should also be considered because they could recolonize the area in the future if fish passages are added to downriver dams that impede their migration (NRC 2018-TN5588).On April 12, 2018, following its review of the NRC staff's biological evaluation (NRC 2017-TN5603) and additional information exchanges with NRC staff to better understand the potential impacts of radioactive and nonradioactive constituents (NRC 2017-TN5603; NMFS 2017-TN5577; NRC 2017-TN5605; NMFS 2017-TN5589; NRC 2017-TN5611), NMFS concurred with the NRC's determination that the proposed 40-year license renewal is not likely to adversely affect the shortnose sturgeon or Atlantic sturgeon under NMFS jurisdiction (NRC 2018-TN5588). Additionally, NMFS re-concurred with its *may affect, but is not likely to adversely affect* determination during the preparation of the October 2019 draft EA (NRC 2019-TN6419).

On July 31, 2020, the NRC notified the NMFS of the NRC staff's intent to prepare an EIS for the WEC's LRA and invited them to participate in the scoping process (NRC 2020-TN6520).

During the development of this EIS, the NRC staff determined that no new information would call into question the staff's previous findings for shortnose and Atlantic sturgeon because (1) installation of new groundwater monitoring wells would not adversely affect the two sturgeon species (NRC 2019-TN6419) and (2) the analysis in this EIS further analyzed onsite contamination in Sunset Lake and Mill Creek, which are within health standards and not expected to adversely impact listed sturgeons downstream in the Congaree River (see Sections 3.5 and 3.6). Therefore, reinitiation of consultation with NMFS is not required (NRC 2020-TN6520). The NRC staff will notify NMFS upon issuance of this draft EIS.

1.5.2 Coordination with Other Agencies

1.5.2.1 Congaree National Park

The Congaree National Park provided information about the geology and hydrology of the site during the NRC staff's preparation of the October 2019 draft EA. During a site visit to the CFFF site, staff from SCDHEC and NRC met with park staff to discuss the various reviews being undertaken and the local hydrogeology at the site. Park staff provided geology plates of the Congaree River Basin, which provided information about the heterogeneity of the site's subsurface.

1.5.2.2 SCDHEC

As part of information-gathering activities during the environmental review process, the NRC staff has met with SCDHEC staff to discuss and understand the remedial investigations and activities the WEC is conducting under the CA and other permit reviews. The SCDHEC provided comments to the NRC during the draft EA public comment period explaining the new data that the WEC was gathering as a result of the CA with SCDHEC and recommending that the new data be considered in the environmental review process. As discussed in Section 1.3.2 of this EIS, the NRC staff addressed comments received during the 2019 draft EA comment period in the February 2020 Scoping Summary Report (NRC 2021-TN6934). Additionally, the NRC staff continued to reach out to SCDHEC and review SCDHEC's website to keep abreast of the progress of the implementation of the CA.

On July 31, 2020, the NRC staff notified SCDHEC of the NRC staff's intent to prepare an EIS for the WEC's LRA and invited them to participate in the scoping process (NRC 2020-TN6520).

1.5.2.2.1 Consent Agreement with the WEC

On February 26, 2019, SCDHEC executed a CA with the WEC (SCDHEC/WEC 2019-TN6554) to conduct remedial investigations to address historical contamination at the CFFF site, and implement a communication protocol for any future contamination. Under the CA, the WEC will conduct remedial investigations that would provide information and data to determine the source and extent of contamination at the site. After the remedial investigations are completed, remediation alternatives would be determined by the WEC in coordination with SCDHEC and then implemented.

The CA follows the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; 42 U.S.C. § 9601 *et seq*.; TN6592) process (SCDHEC/WEC 2019-TN6554). The CA replaces a Voluntary Cleanup Contract that the WEC and SCDHEC had entered into in August 2016 in response to the volatile organic compound (VOC) contamination in groundwater at the site. Under the CA, the WEC submitted a Remedial Investigation Work Plan (RIWP) (WEC 2019-TN6553) to SCDHEC that outlines the WEC's evaluation of the CFFF site's groundwater, surface water, and soil, and the source and extent of contamination. SCDHEC approved the RIWP (also referred to as Phase I RIWP) on June 19, 2019. The RIWP focuses the investigation and remediation efforts on eight operational units (OUs) and Western Groundwater Area of Concern (AOC) (WEC 2019-TN6546). Figure 2-4 in Section 2.1.2 of this draft EIS shows the AOC and OUs: Northern Storage Area, Mechanical Area, the Chemical Area, West Lagoons Area, Primary Wastewater Treatment Area, Sanitary Lagoon Area, Southern Storage Area, and Western Storage Area.

As a requirement of the CA, the WEC has developed a site Conceptual Site Model (CSM) (WEC 2020-TN6526). The CSM describes the physical, chemical, and biological processes that govern the transport, fate, risk, and level of impact of contamination to ecological and/or human receptors. The CSM provides insights about data gaps and uncertainty to inform environmental assessments of the CFFF site.

The WEC's implementation of the approved RIWP is being conducted using a phased approach. Upon full implementation of the RIWP (Phase I and Phase II), the WEC would submit a Remedial Investigation Report to SCDHEC for approval. This final report would document the results of the remedial investigations. The Remedial Investigation Report would also include the results of a human health and ecological risks evaluation that the WEC would conduct upon completion of the remedial investigations. The results of this risk evaluation would be included in a Baseline Risk Assessment as an appendix to the Remedial Investigation Report. After SCDHEC's approval of the Remedial Investigation Report, the WEC would submit a Feasibility Study evaluating remedial alternatives for the CFFF site. SCDHEC would then issue a Record of Decision identifying the remediation for the CFFF site. The WEC would implement the Remedial Action upon SCDHEC approval of the WEC's Remedial Design of the chosen remedy for any given OU. The results of the implementation of the Remedial Design for any given OU would be documented in a Remedial Action Completion report. Finally, after completion of all the CA requirements, the WEC would provide a final report to SCDHEC documenting the remediation of the CFFF site (SCDHEC/WEC 2019-TN6554).

Additionally, the WEC has submitted to SCDHEC several addenda to the approved RIWP:

- Addendum 1 – Southern Storage Area Sampling Work Plan (WEC 2019-TN6552)
- Addendum 2 – East Lagoon Characterization RIWP (WEC 2019-TN6555)

- Additional Floodplain Assessments (WEC 2019-TN7010)
- Sediment Transect Sampling Plan (WEC 2019-TN7009)
- Southern Storage Area Operable Unit Intermodal Container Work Plan (WEC 2019-TN6884)
- Updated Communication Protocol (WEC 2019-TN7008)
- Technetium Source Investigation Work Plan (WEC 2020-TN7011)
- HFSS#1 Soil Sampling Work Plan (WEC 2020-TN6537)
- Addendum 3 – Sanitary Lagoon Operable Unit Sludge Characterization Work Plan (WEC 2021-TN6921).

In June 2019, the WEC began to execute the activities described in the approved RIWP (also referred to as Phase I). Additionally, each month, the WEC provides a status update to SCDHEC, which can be found on SCDHEC's website at https://scdhec.gov/environment/ongoing-projects-updates/westinghouse/westinghouse-bureau-land-waste-management.

In July 2020, the WEC submitted its *Interim Remedial Investigation Data Summary Report* to SCDHEC, which discussed the results of the WEC's implementation of Phase I of the RIWP (June 2019 through January 2020) (WEC 2020-TN6526). The report discussed the extent of previously identified groundwater impacts; areas of the plant operations that had not been previously evaluated; potential surface water and sediment impacts; potential sources of technicium-99 (Tc-99) contamination; depths of surface water bodies; and evaluation of private water supply wells. The WEC also used the data and analysis gathered through the implementation of Phase I of the RIWP to develop the CSM.

The WEC also executed the SCDHEC-approved Tc-99 source investigation work plan (WEC 2020-TN7011) to evaluate the source of the Tc-99 contamination at the CFFF site. Based on the sampling data and analysis discussed in the *Technetium-99 Source Investigation Report* (WEC 2020-TN6538), the WEC concluded that there are no active sources of Tc-99 from current operations of the CFFF, and that potential sources would be from past surface releases. The WEC will continue to evaluate the horizontal and vertical extent of Tc-99 during the implementation of the Phase II RIWP (WEC 2020-TN6538).

The evaluation of the data gathered through implementation of the Phase I RIWP identified areas that required additional assessment to further define the source, location, and extent of the contamination, further develop the CSM, and complete the Tc-99 investigation work plan (SCDHEC 2020-TN7003). The WEC submitted the Phase II RIWP to SCHDEC for approval in September 2020 (WEC 2020-TN6707), which SCDHEC approved in October 2020 (SCDHEC 2020-TN7012) with a few exceptions. The WEC submitted an addendum to the RIWP to address these exceptions (WEC 2020-TN6917), which SCDHEC approved in November 2020 (SCDHEC 2020-TN7005). Implementation of the Phase II RIWP began in November 2020 and is ongoing. Phase II RIWP planned activities include continued monitoring and assessment of the impact on groundwater and soil from sources of constituents of potential concern (e.g., chlorinated volatile organic compounds, nitrate, fluoride, Tc-99, and uranium) and assessment of sediment, groundwater, and sludge in the Sanitary Lagoon, Gator Pond, middle ditches, and other areas of concern (WEC 2020-TN6707, WEC 2020-TN6917). The following addenda were subsequently approved by SCDHEC:

- Additional Well Monitoring Permits (WEC 2021-TN7007)

- Addendum 3 – Sanitary Lagoon Operable Unit Sludge Characterization Work Plan (WEC 2021-TN6921)
- Addendum 4 – Sediment Sampling Plan to Bound the Extent of Uranium Around SED-44 (WEC 2021-TN7006).

2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter of the environmental impact statement (EIS) describes the licensed Columbia Fuel Fabrication Facility (CFFF) site and operations that would continue during the proposed 40-year license renewal period if the U.S. Nuclear Regulatory Commission (NRC) grants the license renewal request, and the alternatives to the proposed action the NRC staff considered the (1) no-action alternative and (2) 20-year license renewal alternative.

2.1 Proposed Action

The proposed action, as requested by Westinghouse Electric Company, LLC (WEC), is the continued operation of the CFFF for an additional 40 years. The WEC CFFF is located in Hopkins, South Carolina, and fabricates low-enriched uranium fuel assemblies for commercial nuclear power reactors. The WEC did not request changes to its NRC operating license or construction of new buildings or structures within the controlled access area or restricted area (WEC 2019-TN6510).

2.1.1 Site Location and Layout

The CFFF site occupies 469 hectares (ha) (1,151 acres [ac]) in Hopkins, South Carolina, in Richland County. The site is approximately 13 kilometers (km) (8 miles [mi]) southeast of the city limits of Columbia, South Carolina. Figure 2-1 provides the general location of the CFFF site. Approximately 28 ha (68 ac) of the property area are used for facility operations and support activities.

Figure 2-2 shows the CFFF's controlled area boundary, which is bounded by South Carolina highway S 48 (Bluff Road) to the north and private property owners in all other directions. Access to the site is controlled by fencing, security barriers, and natural barriers (e.g., land contours). The manufacturing facilities are located about 490 meters (m) (1,600 feet [ft]) from the nearest point on the site boundary. The main manufacturing building for the CFFF is located approximately 760 m (2,500 ft) from the roadway. Physical access is through the main plant road that connects CFFF to Bluff Road, which is controlled by a continuously staffed security guard station located on the main access road. The controlled area boundary is equivalent to the site's property boundary and encompasses the restricted area, which is defined in the license as the area within the fenced area, including the main manufacturing building on the site.

The CFFF site lies within the flood basin of the Congaree River, which flows approximately 6.4 km (4 mi) southwest of the main plant (WEC 2019-TN6510). Stormwater from the CFFF drains into Sunset Lake and Mill Creek, which subsequently drains into the Congaree River. Figure 2-3 shows that the remaining property (approximately 441 ha [1,083 ac]) is mostly undeveloped (WEC 2019-TN6571).

As shown in Figure 2-3, the restricted area is a physically defined area bounded by the administration and main manufacturing buildings on one side and security fence on the remaining three sides. Physical access to the restricted area is limited to authorized individuals and visitors who are escorted.

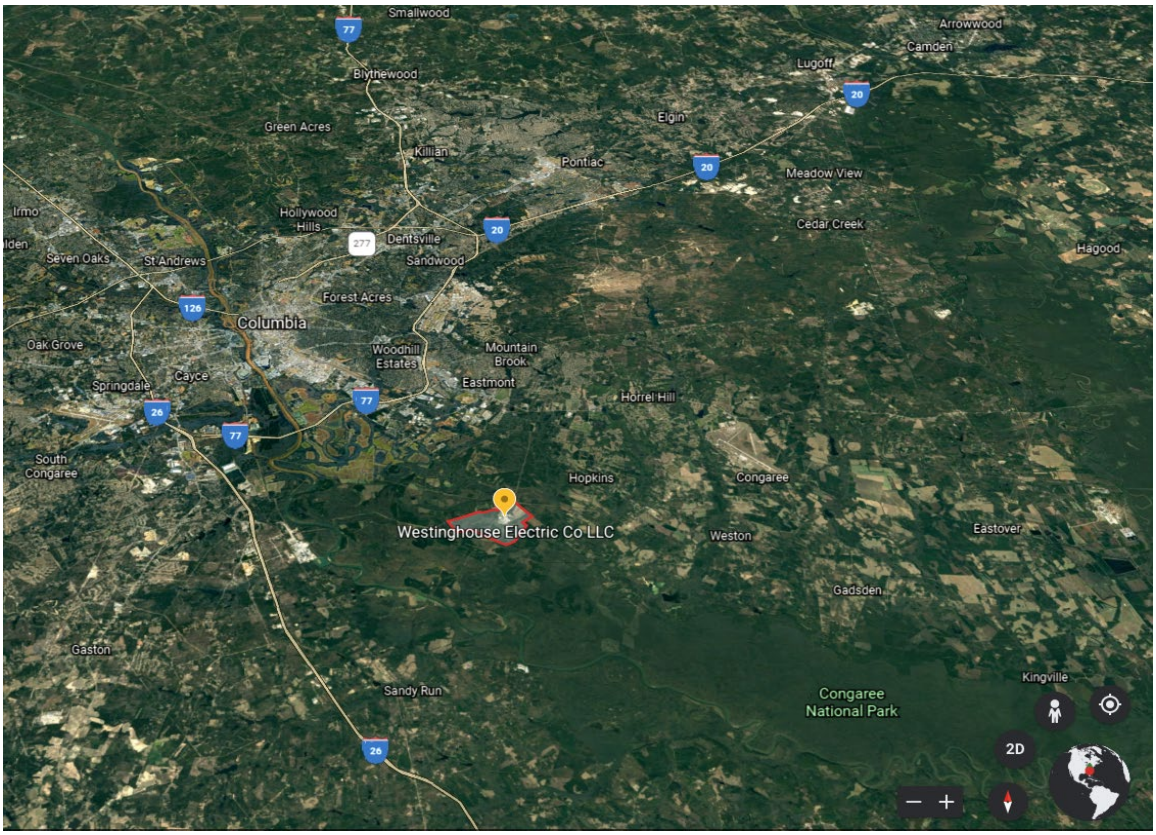

Figure 2-1 General Site Location (Source: Modified from Google Earth)

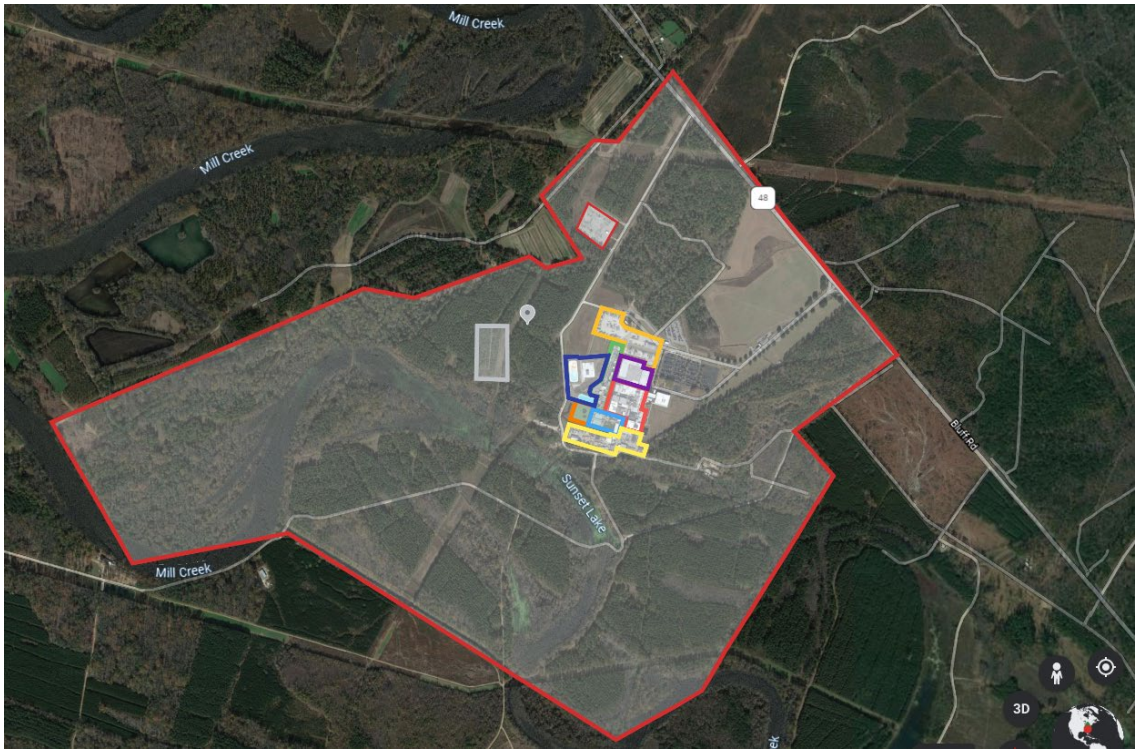

Figure 2-2 CFFF's Controlled Area Boundary (Source: Modified from Google Earth)

Figure 2-3 CFFF Site Layout (Source: Modified from Google Earth)

2.1.2 Facility Operations during the License Renewal Term

The WEC manufactures nuclear fuel assemblies containing natural and low-enriched uranium oxide fuel for use in light-water commercial nuclear power reactors. The WEC also produces other fuel-related products, such as control rods and mechanical components. The primary facilities consist of a main fuel fabrication plant, laboratory, wastewater treatment plant (WWTP) and lagoons, raw material storage buildings, parking lots, and office space. As illustrated in Figure 2-4, the WEC divided the CFFF into eight operational units (OUs) based on the different types of site activities and operations: Northern Storage Area, Mechanical Area, Chemical Area, West Lagoons Area, Wastewater Treatment Area, Sanitary Lagoon Area, Southern Storage Area and Western Storage Area. Figure 2-4 also shows a Western Groundwater Area of Concern just west of the main facilities area that the WEC is also monitoring. This area is discussed further in Section 2.2.2.3 of this EIS.

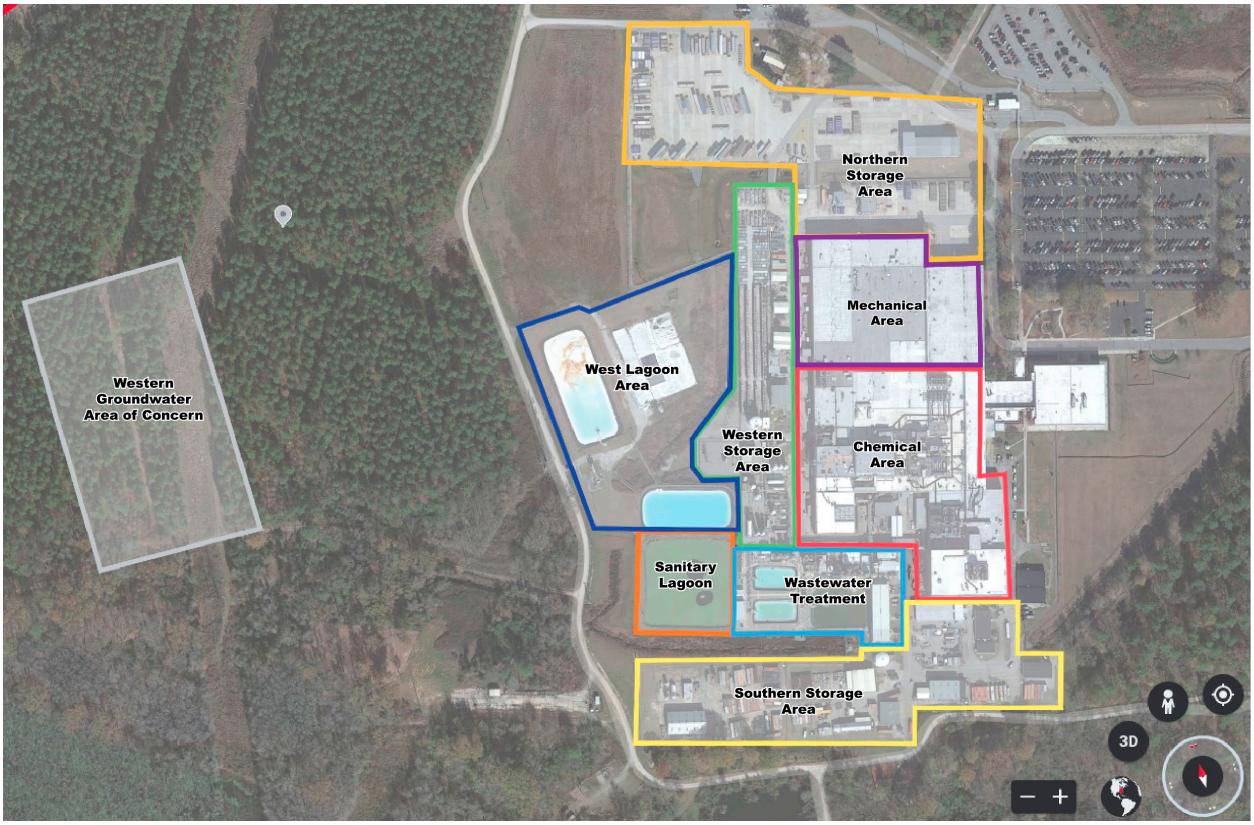

Figure 2-4 CFFF Operational Units (Source: Modified from Google Earth)

Manufacturing of the fuel assemblies is conducted in the main manufacturing building, which is divided into the Chemical Area and Mechanical Area. The Chemical Area includes uranium operations involving uranium hexafluoride (UF_6) conversion, powder blending, pellet manufacturing, fuel rod loading, and scrap processing. The Mechanical Area includes operations involving encapsulated and sealed materials for rod certification and storage, and final fuel rod assembly. The WEC receives cylinders of natural and low-enriched UF_6 via truck shipment. The production of nuclear fuel assemblies at the CFFF (see Figure 2-5) starts with the chemical conversion of UF_6 into uranium dioxide (UO_2). This is accomplished via the ammonium diuranate (ADU) process, which uses water and ammonium hydroxide.[1] The UO_2 is processed and pressed into fuel pellets heated to form a ceramic material, and then further processed through a grinding operation. These fuel pellets are loaded and sealed into metal fuel rods. The rods are assembled into bundles that form the nuclear fuel assemblies.

[1] In 2011, the WEC replaced the use of anhydrous ammonia with aqueous ammonium hydroxide (WEC 2019-TN6510).

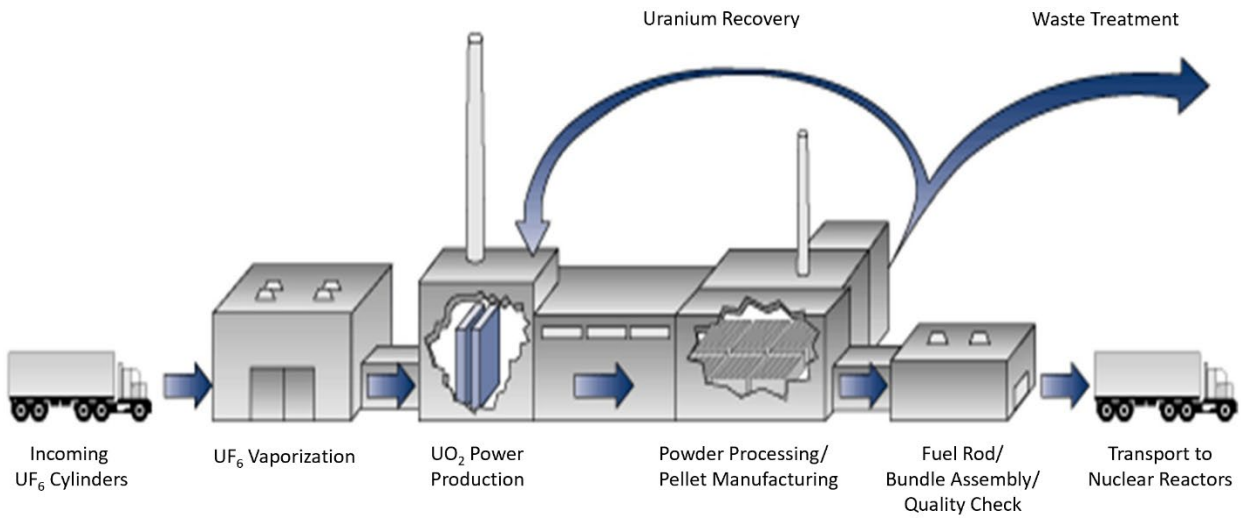

Figure 2-5 Typical Light-Water Reactor Fuel Fabrication Facility (Source: NRC 2020-TN6835)

Other facilities and processes that support the ADU chemical conversion process and pellet fabrication include oxidation of recycled fuel pellets, chemical receipt, storage and handling, cylinder recertification, cylinder washing, respirator cleaning, scrap recovery, laboratory analysis, incineration, solvent extraction (SOLX), waste treatment, welding, metal fabrication, quality control testing, and shipping container refurbishing. During scrap recovery, the material is converted to U_3O_8 powder and uranyl nitrate (UN). The UN is subsequently processed through the ADU process (WEC 2019-TN6510). All manufacturing operations are governed by approved radiation and environmental protection, nuclear criticality safety, industry safety and health, SNM safeguards, and quality assurance controls. The completed fuel assemblies are shipped in NRC-approved containers to the WEC's customers for use at commercial nuclear power plants. The shipments of nuclear materials from the CFFF are governed by the NRC, the U.S. Department of Transportation (DOT), and State of South Carolina regulations.

Low-level radioactive combustible scrap is incinerated to permit the recovery of uranium and to minimize the volume of waste disposal at a licensed low-level radioactive waste (LLRW) disposal facility. Typical incinerator feed materials include uranium-contaminated paper, shoe covers, gloves, mops, plastic bags, tape, and fiberboard containers (WEC 2012-TN7017). The incineration process consists of primary and secondary combustion chambers; off-gas scrubbing and filtration systems, and an ash transfer milling and leaching system. As clarified by the WEC, ash generated by the incineration process is dissolved and the uranium is recovered in the form of UN, which is the CFFF recycle feedstock. The gases given off during the burning of solid wastes are carbon, carbon dioxide (CO_2), and mineral acid hydrochlorides (HCLs) and HF due to the burning of rubber, plastics, and other chemicals. The incinerator off-gas is treated by scrubbing and filtration. The scrubber solution is treated and cooled such that excess solution is automatically or manually transferred to the liquid waste treatment and the condensed liquid is returned to the scrubber system for reuse. Prefilters and high-efficiency particulate air (HEPA) filters are used to support various air filtration processes throughout the plant. When filters have exceeded their useful, life, they are transported to a cutting room where they are disassembled. The frames are removed from the filter media and shredded prior to drumming, assaying, and shipping offsite as LLRW. Operators attempt to remove additional particulate matter, including small amounts of uranium, from the filter media in the cutting room and subsequently recycle the uranium in the process.

The SOLX process separates uranium from contaminants, recovers it as clean UN solution, and delivers it to storage tanks for conversion back to usable product UO_2. In 2019, the WEC modified its management practices for the SOLX mixture (WEC 2020-TN6844). The WEC no longer adds SOLX mixture to wet combustible material (WCM) and revised its process to segregate WCM containing the SOLX mixture into a dedicated Satellite Accumulation Area. The WEC has also ceased charging WCM containing the SOLX mixture into the incinerator. Any bulk SOLX mixture that existed as of July 1, 2019 was processed to recover uranium and then sent offsite to a licensed facility as mixed hazardous waste for treatment and disposal. In April 2020, the WEC eliminated its use of perchloroethylene (PCE) in the SOLX process and replaced it with dodecane. In 2021, the WEC anticipates resuming the incineration of SOLX materials containing dodecane and will submit a revised air permit application to reflect this change, including new emissions calculations.

The CFFF site has six lagoons that support the uranium recycle and recovery services (URRS) process streams. The West Lagoons Area includes the West I and West II lagoons. The Wastewater Treatment Area includes the South, North, and East Lagoons; and the Sanitary Lagoon Area includes the Sanitary Lagoon. Figure 2-6 describes the URRS process streams at CFFF. In December 2008, the liner of West Lagoon II was replaced, and in 2012, the liners of four lagoons (West I, West II, South, and North Lagoons) were replaced with 80-millimeter (mm; 3.1 inches [in.]) high-density polyethylene (HDPE) in response to groundwater monitoring data that indicated increasing trends of fluoride and nitrate in the groundwater around the lagoons (WEC 2019-TN6510). The East Lagoon has a 36 mil Hypalon liner (NRC 2018-TN6549) and was last relined around 1980 when the site's Waterglass system was installed (NRC 2019-TN6472). The WEC, however, has decided to decommission the East Lagoon (WEC 2020-TN6844). Characterization of the East Lagoon sludge and closure processes are ongoing in accordance with the Consent Agreement (CA) and the closure plan approved by the South Carolina Department of Health and Environmental Control (SCDHEC) (WEC 2020-TN7020, WEC 2020-TN7004). The Sanitary Lagoon is unlined. The WEC also intends to characterize the Sanitary Lagoon sludge to prepare a closure plan for SCDHEC's approval (WEC 2020-TN6844, WEC 2021-TN6921).

A contaminated wastewater (CWW) line was installed as part of the 1978 expansion of the west side of the manufacturing building. The CWW line receives wastewater streams that contain contaminants. The various input lines, some of which run underground and external to the building, are routed to a single external line and sump for collection and onsite treatment. The primary source streams are the shower/sink water from the operators' locker rooms, the respirator cleaning facility, and the UF_6 vaporization steam condensate/trench, overflow of the 8A scrubber, and various laboratories sinks and floor drains.

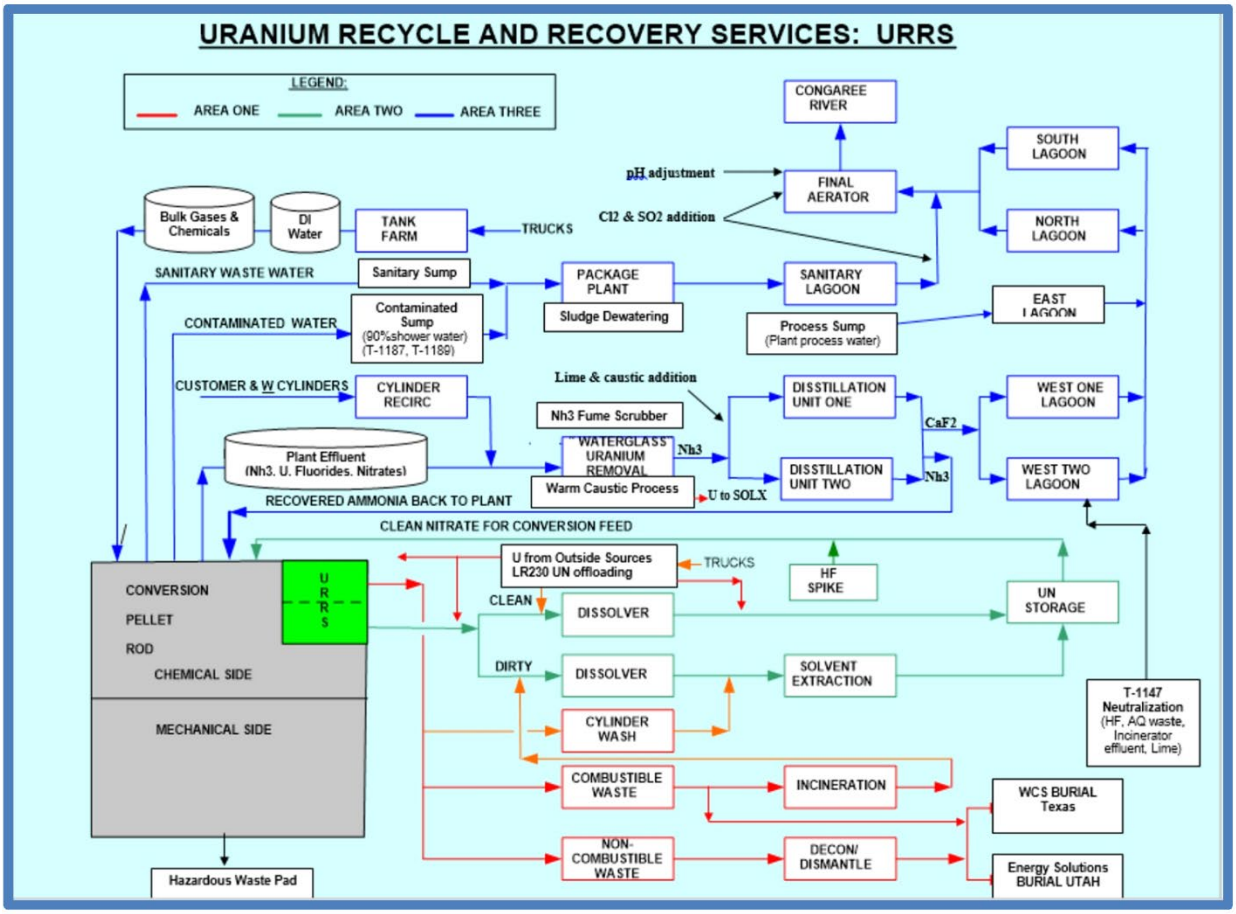

Figure 2-6 URRS Process Streams (Source: WEC 2019-TN6510)

2.1.3 Facility Events and Changes since the 2007 License Renewal

Since the 2007 license renewal (NRC 2007-TN5598), a historic flooding event occurred (2015) and multiple leaks or spills have resulted in the contamination of the subsurface at the CFFF site (WEC 2019-TN6546) and in changes at the CFFF site. Other events at the CFFF site have not resulted in contamination of the environment or dose to the public or workers, and therefore, those events are not discussed here.

The WEC submits an annual Facility Change Report to the NRC in accordance with 10 CFR 70.72 (TN4883) describing facility changes that were made without prior NRC approval. The latest Facility Change Report was submitted in January 2021 (WEC 2021-TN6918). Additionally, the WEC license SNM-1107 has been amended multiple times to reflect administrative changes (e.g., change in management or notification procedures), and renewed. The license is currently on Amendment 21 (NRC 2019-TN6472). Some of the substantial changes that have occurred since the 2007 license renewal have potentially affected the environment.

2.1.3.1 Facility Events and Changes

Facility events and changes range from line breaches to storage drum leakage, as described below.

- Contaminated Wastewater Line Breaches
  - Leaks from a buried pipe (CWW line), discovered in 2008 and 2011, released an unknown amount of uranium into the subsurface (WEC 2019-TN6510). In 2008, CFFF maintenance personnel inspected an underground external section of the CWW line and identified a breach at a connection point near Dock 3. Samples of the water from the CWW line and soil near the breach were collected and analyzed for radionuclides. The analysis identified radionuclides in the CWW and subsurface soils. In response to the 2008 leak, the WEC replaced the underground piping system using a pipe burst system.
  - In 2011, CFFF personnel discovered breaches at two locations in the CWW line buried underneath the manufacturing building floor. Samples of the soil and process wastewater in one breach were collected and analyzed. The analysis identified radionuclides in both the soil and wastewater at the source of the breach. Samples could not be collected at the second breach due to access issues related to the plant infrastructure. In response to the 2011 leak, the affected buried piping under the building floor was abandoned in place and replaced with aboveground polyvinyl chloride (PVC) piping. Due to its location underneath the building, no remediation of the soil was performed at the time the leak was discovered. Consistent with the WEC's remediation activities procedure, the WEC will continue to monitor the area and, based on the monitoring results, will determine when the area will be remediated (WEC 2019-TN6546).
  - In early 2018, CFFF personnel performed an additional assessment and characterization of the data from the 2008 and 2011 leaks (WEC 2019-TN6510). On August 29, 2018, the WEC requested approval from SCDHEC to install nine temporary monitoring wells (later converted to permanent monitoring wells) at the same locations of the direct-push borings to collect additional samples (WEC 2019-TN6546). CFFF personnel also completed an assessment of the CWW line piping integrity outside of the building and found the system to be intact, and no concerns were identified (WEC 2019-TN6510).
- South Lagoon Leakage Event
  - In March 2012, level readings of the South Lagoon indicated that a leak had developed in the lagoon's liner, which had been recently replaced. The South Lagoon is one of the lagoons used for settling solids from the treated process wastewater prior to discharge (WEC 2012-TN7045).
- Cylinder Recertification Transfer Line
  - In January 2014, there was a leak from a tank transfer line from the Cylinder Recertification Tank (T1405) to the Waterglass Processing Tank (T-1160A) (WEC 2019-TN6510). In immediate response to the leak, the WEC positioned absorbent pads to further reduce liquid migration into the soil. The estimated volume of uranium-contaminated process solution spilled was approximately 20–25 gallons. The WEC initiated soil sampling in the affected area prior to soil remediation, with measured results equaling 26.3 parts per million (ppm) uranium concentration. Based on these results, the WEC removed approximately 1,033 ft^3 of contaminated soil from the affected area and transported it offsite for disposal as LLRW. Additionally, a leak check was performed on the repaired transfer line prior to its return to service (WEC 2019-TN6510).
- Historic Flooding Event
  - In October 2015, a historic flooding event occurred in the area. Columbia, South Carolina, received a total of 31.5 centimeters (cm) (12.4 in.) of rain over 4 days, of which

20 cm (8.19 in.) were received within a 12-hour (hr) period. This is a historic event because 29.22 cm (11.5 in.) and 33.8 cm (13.3 in.) of rain in 24 hr correspond respectively to a 500-year and 1,000-year recurrence for the Columbia area. In the vicinity of the CFFF site, the Congaree River crested at 37.6 meters (m) (123.3 feet [ft]) above mean sea level (MSL), and the CFFF site experienced flooding of low-lying areas. The main manufacturing building was not affected by floodwater. Two process lagoons overfilled beyond containment (WEC 2019-TN6510). The Sanitary Lagoon overflowed into the adjacent North and South Lagoons. The West II Lagoon depth was measured to be approximately 38 cm (15 in.) beyond the liner onto the surrounding ground and remained within the berm. In accordance with CFFF procedure, an emergency discharge to the Congaree River was initiated to allow the levels in the lagoons to be decreased at a faster rate. No long-term impacts on groundwater wells within the existing monitoring well network and the water table on the bluff are anticipated, because the majority of the rainfall left the site via overland flow in CFFF's network of stormwater ditches (WEC 2019-TN6510).

- Scrubber Event
  - In 2016, while conducting an annual inspection and cleaning of a scrubber, the WEC found a large mass of material inside the scrubber inlet transition. The WEC believed that the material was low in uranium content, but upon further analysis the WEC found that the uranium mass limit was exceeded. The WEC reported the event to the NRC on July 14, 2016 (EN #52090; NRC 2016-TN5604). On July 31, 2016, the WEC updated the event notification to report that material found in the scrubber packing and floor also exceeded the uranium mass limit for the scrubber criticality safety evaluation (NRC 2016-TN5604). The NRC established an Augmented Inspection Team (AIT) to inspect and assess the facts and circumstances surrounding the event. The AIT completed the inspection on September 1, 2016 and provided its report to the WEC on October 26, 2016 (NRC 2016-TN5604). The AIT found that items relied on for safety (IROFSs) for the scrubber did not ensure that a criticality accident was highly unlikely and found that the controls and measures to protect against a criticality were not sufficient to assure subcriticality conditions. The AIT also found that the WEC did not establish adequate management measures to ensure the availability and reliability of the IROFSs and that the WEC failed to provide adequate levels of oversight, enforcement, and accountability to the organizations directly involved with configuration management, operations, and maintenance of the wet ventilation systems (NRC 2016-TN5604).
  - On August 9, 2016, the WEC provided its commitments to the NRC addressing the actions to be taken to identify the causes of the event and corrective actions (WEC 2016-TN5623). The NRC issued a Confirmatory Action Letter (CAL) on August 11, 2016, (NRC 2016-TN5591) to confirm the WEC's commitments and ensure that the root causes of the event were adequately evaluated, and appropriate corrective actions were implemented before resumption of operations. Accordingly, in September 2016, the NRC staff conducted an inspection of the actions in the CAL to verify that the commitments necessary to restart the conversion process equipment and scrubber system were completed and that the actions taken provided reasonable assurance of the WEC's ability to safely operate the facility (NRC 2016-TN5590). By letter dated October 20, 2016, the NRC staff informed the WEC that there were no issues with the licensee's plan to restart the conversion process equipment and scrubber (NRC 2016-TN5610). On February 27, 2017, the NRC staff completed a follow-up inspection, and issued an Inspection Report (NRC 2017-TN6596), which documented four apparent violations that were considered for escalated enforcement in accordance with the NRC's Enforcement

Policy. The NRC's Inspection Report offered the WEC a choice to (1) attend a Pre-decisional Enforcement Conference, (2) provide a written response, or (3) request an alternate dispute resolution (ADR) session with the NRC in an attempt to resolve any disagreement regarding whether violations occurred, the appropriate enforcement action, and the appropriate corrective actions.

  - In response, the WEC requested an ADR to resolve the enforcement aspects and to discuss corrective actions. The ADR process culminated in the issuance of a confirmatory order (NRC 2017-TN6597) requiring corrective actions and enhancements that the NRC staff determined would be sufficient to address the underlying cause of the scrubber event. The confirmatory order was closed via a final confirmatory inspection report issued on March 11, 2020 (NRC 2020-TN7013).

- HFSS#2 Leakage Event
  - In July 2018, the WEC informed SCDHEC of the discovery of contamination within the sub-slab soils beneath Hydrofluoric Spiking Station (HFSS) #2, which resulted from a leak. Uranium concentration was 4,001 ppm at a depth of 170.18 cm (67 in.) beneath the hole that penetrated the concrete (SCDHEC/WEC 2019-TN6554). To evaluate the extent of the contamination and condition of the subsurface beneath HFSS#2, the WEC completely disassembled each HFSSs (there are two HFSSs in the facility), and removed the liner in each berm to inspect the floor (WEC 2020-TN6521). After receiving SCDHEC's approval, the WEC remediated the station and returned it to normal operation (WEC 2020-TN6521).
  - After receiving approval from SCDHEC on the work plan for the subsurface investigation of the HFSS#1 area, the WEC collected soil samples. The WEC found that neither fluoride nor nitrate exceeded the CFFF action levels; technetium-99 (Tc-99) was not detected, but uranium was detected at levels exceeding the remedial action levels (WEC 2020-TN6521). After evaluating the residual contamination and taking into consideration the operating configuration of the HFSS, the WEC concluded that the concrete floor slab serves as a barrier between the residual contamination and an industrial worker. The WEC's highest dose calculated using a 100-year timeframe was 0.324 millirem per year (mrem/yr). The WEC will be leaving the material in place and updated the decommissioning cost estimate for the removal of material (WEC 2020-TN6521).
  - The WEC also improved the design for both spiking stations and diked areas to prevent spills of process solution from impacting the concrete, protect the concrete with a floor coating that is impervious to acidic materials, and guard against undetected deterioration of the concrete floor (WEC 2020-TN6521). In addition, the WEC described other modifications, such as replacing tanks, installing removable polypropylene catch pans, replacing couplings and piping, installing automatic shutoff valves to remove hydrofluoric system pressure, and modifying the berms (WEC 2020-TN6521).
- Storage Drum Leakage Event
  - In May 2019, during a routine inspection of storage containers (intermodal or sea-land containers) holding drums of uranium-bearing materials, located in the Southern Storage Area OU, the WEC discovered the structural integrity of the storage containers and the drums within them had been compromised (NRC 2019-TN6472; WEC 2020-TN6844). Rainwater had penetrated the roof of the containers and compromised the storage containers, its flooring, the drum lids, and drums contained within.

- As part of the implementation of the CA, the WEC-developed Addendum 1 to the Phase I RIWP to address remediation activities in the Southern Storage Area OU (WEC 2019-TN6552).
- The WEC has emptied the intermodal storage containers. Some are sent offsite for recycling and others are reloaded and sent offsite for disposal as low-level waste. As of November 2020, the WEC had removed 62 intermodal containers (WEC 2020-TN6844). Drums potentially containing PCE were separated and stored at the CFFF site. As the intermodal containers were removed, the WEC sampled the soil and removed contaminated soil in accordance with its site remediation procedure, RA-433, "Environmental Remediation." The WEC has remediated soils in which the uranium levels were detected above the WEC-established residential cleanup standard. With the exception of intermodal container C-21, the soil-sampling results for Tc-99, fluoride, and PCE were below the residential screening levels identified in the WEC's site remediation procedure (WEC 2019-TN6552). In February 2021, the WEC reported that soil samples for the footprint underneath intermodal container C-21 exceeded the residential screening level for PCE (0.0023 mg/kg). Soils were excavated, and affected areas were sampled again. The results of these confirmatory sampling were below the residential screening level for PCE (WEC 2021-TN7046). The WEC is or will transport affected soil to an approved LLRW disposal site (WEC 2019-TN6552). The WEC anticipates completing the removal of the remaining intermodal containers that do not contain radioactive materials in 2021 (WEC 2020-TN6844).
- The WEC also explained that procedures have been revised to prohibit future storage of uranium-containing materials in intermodal containers (WEC 2019-TN6552).

2.1.3.2 Additional Facility Changes

Additional facility changes have included the following:

- In early 2012, the WEC extended the controlled access area fence to allow better control of incoming and outgoing shipments of materials related to CFFF operations (WEC 2019-TN6510).
- The WEC has increased its storage limits for UF_6 cylinders and built a concrete storage pad on previously disturbed land.
- The WEC no longer uses anhydrous ammonia in its ADU process.
- The WEC replaced the liners of four WWTP lagoons between 2008 and 2012 with a 80-millimeter HDPE.
- In July 2019, the WEC stopped the practice of incinerating SOLX materials containing residual quantities of PCE. In April 2020, the WEC eliminated its use of PCE in the SOLX process and replaced it with dodecane (WEC 2020-TN6844). In its response to the NRC staff's requests for additional information (NRC 2020-TN6788), the WEC explained its plans to resume the incineration of SOLX materials containing dodecane in 2021 and submit a revised air permit application to the SCDHEC reflecting the change, which would include new emissions calculation (WEC 2020-TN6844). The anticipated new permit would also reflect the elimination of plating activities that occurred in 2020 (WEC 2020-TN6844).
- In March 2020, the WEC decommissioned the grid strap nickel plating. The hazardous waste generated from the cleaning operations was shipped offsite (WEC 2020-TN7044).

- In March 2020, the WEC reported the completion of the fifth and last shipment of the V-1454 bulk mixture (consisting of tributyl phosphate [TBP] solvent/tetrachloroethylene/kerosene/ uranium) to Energy Solutions (WEC 2020-TN7044).

2.1.3.3 Additional Ongoing Changes

Ongoing changes are threefold:

- As discussed in Section 1.5.2.2.1, in June 2019, under the CA, the WEC began to execute in phases the activities identified in the RIWP. To improve monitoring of liquid effluents, the WEC began to install a series of wells throughout the groundwater monitoring network. As of January 2021, the WEC had installed 19 lithologic borings, 4 surface water staff gauges, and had upgraded 29 monitoring stations (wells W-69 through W-97), which includes four new floodplain wells (W-94 through W-97) (WEC 2020-TN6526). And, an additional 12 permanent monitoring wells (wells W-98 through W-100, W-102 through W-105, and W-107 through W-112) were installed using sonic drilling as part of the implementation of Phase II of the RIWP under the CA (WEC 2021-TN6919).
- The WEC has decided to decommission the East Lagoon (NRC 2020-TN6935). Closure of the East Lagoon is planned for 2021. The WEC's plan to characterize the sludge in the East Lagoon, submitted in accordance with the CA, was approved by SCDHEC via letter dated October 2, 2019 (WEC 2019-TN6555, WEC 2019-TN6555). The WEC submitted the results of the characterization in the *East Lagoon Characterization Summary Report* on December 6, 2019 (WEC 2020-TN7021) and subsequently submitted a closure plan (WEC 2020-TN7020). SCDHEC approved the closure plan on October 14, 2020 (SCDHEC 2020-TN7012). The WEC intends to remove and evaluate the East Lagoon liner, to the extent practicable, to inform sampling locations. After removal of the liner, the WEC will collect and analyze soil samples for constituents of potential concern (COPCs) (WEC 2020-TN6844), and remediate the soil, if needed (SCDHEC 2020-TN7003; WEC 2020-TN7011). In a related action, the NRC approved disposal of low-level radioactive materials including, in part, materials dredged from the East Lagoon settling pond at the U.S. Ecology Idaho Facility instead of a previously approved low-level waste disposal facility (NRC 2020-TN6935). Additionally, the WEC anticipates permanently closing the Sanitary Lagoon after closure of the East Lagoon is completed (WEC 2020-TN6844). Closure of the Sanitary Lagoon would include modifications to the WWTP. Characterization of the Sanitary Lagoon sludge in preparation for closure is a commitment in the Phase II RIWP, and a closure plan would be submitted to SCDHEC for approval.
- In December 2018, during a pre-application meeting with the NRC, the WEC described plans to remodel its administration building, which they anticipated would require a license amendment (NRC 2018-TN6925). However, the WEC has since stated it does not plan to request those changes at this time (NRC 2019-TN6474). For any future license amendment request, the NRC would review the request and conduct a safety analysis and the appropriate environmental review.

2.2 Effluent and Environmental Monitoring Programs

The WEC manages effluent waste streams and conducts radiological and nonradiological effluent and environmental monitoring and sampling.

2.2.1 Facility Effluents

Operations at CFFF generate gaseous and liquid effluents. This section briefly describes the two effluent waste streams and how the WEC manages them. Solid waste generation, management, and disposal are discussed in Section 3.14 of this EIS.

2.2.1.1 Gaseous Effluents

Under the WEC's license renewal application (LRA), operations at the CFFF would continue to generate gaseous effluents. According to the WEC, the annual average discharge rate for uranium, based on discharge rates from 2003 to 2018 is 444 uCi/yr (see Table 2.1-1 and Section 2.1.4 of WEC 2019-TN6510). These effluents would come mainly from the process stacks, equipment, and from fugitive dust and would consist of fluorides (NF_4F and HF), ammonia (NH_3), and uranium compounds. The gas effluents are treated by HEPA filters, scrubbers, or both prior to discharge through the 47 exhaust stacks at the CFFF, which are typically short stacks or roof vents that release gaseous effluents into the air. In the fuel manufacturing facility and laboratory, the ventilation system include treatment to remove uranium prior to discharging effluents to the atmosphere.

The emissions are treated by HEPA filters, scrubbers, or both prior to release to the environment. HEPA filtration is used on systems that have the potential to discharge radioactive materials. The stacks that have the potential to emit radiological effluents are continuously sampled for uranium to ensure concentrations are below the WEC's action level, which is set lower than regulatory limits and would trigger further investigation by the WEC (2019-TN6510). HEPA filters and scrubbers are commonly used pollution control equipment employed at CFFF.

The WEC also operates gas-fired boilers, calciners, and oil-fired diesel generators, all of which generate air emissions. Table 2-1 provides the most current information about nonradiological air pollutants released, as provided by the WEC (2019-TN6510).

Table 2-1 Emission Summary for CFFF Nonradiological Air Pollutants

Facility-wide Emissions	
Pollutant	**Uncontrolled Emissions (T/yr)**
PM	5.74
PM_{10}	5.39
$PM_{2.5}$	5.39
SO_2	3.04
NO_x	28.47
CO	16.01
VOC	4.11
Nitric Acid (HNO_3) [TAP]	0.77

Source: WEC 2019-TN6546

The WEC has an air operating permit (No. SOP-1900-0050) from SCDHEC (2012-TN6778). The permit does not require direct monitoring for nonradiological pollutants but does allow the WEC to provide modeled emission rates that SCDHEC uses to determine compliance with South Carolina air quality control regulations (Regulations 61-62) (WEC 2019-TN6510). The WEC's air operating permit renewal application is currently with SCDHEC for review (WEC 2019-TN6777). On September 12, 2019, SCDHEC provided public notice of the draft air operating permit for a 30-day comment period (SCDHEC 2019-TN6598).

2.2.1.2 Liquid Effluents

Operations at CFFF generate two liquid effluent streams: process liquid wastes and sanitary waste sewage, as shown in Figure 2-6. The liquid process wastes are generated primarily from the ADU process, and, to a lesser extent, from the mechanical side of the fuel fabrication process where fuel rods are bundled to form assemblies, as well as from laboratory and controlled area sinks. The ADU process liquid waste is treated to remove uranium and nonradiological components, such as ammonium fluoride. The waste is sampled for levels of uranium and other contaminants prior to consolidation with other waste streams. Treatment includes filtration, flocculation (i.e., clumping), lime addition, distillation, and precipitation (WEC 2019-TN6510). The other process stream is sanitary waste sewage, which is initially treated in an extended aeration package plant. The effluent is chlorinated and mixed with the process liquid waste. The combined liquid waste is ultimately discharged into the Congaree River (WEC 2019-TN6510). The liquid effluent must meet NRC regulatory limits in 10 CFR Part 20, Appendix B, Table 2 (TN283), and must also meet the limits established in the NPDES permit. The average combined liquid waste is measured to be 100,000 gal/d over the 10-year period from 2007–2017 (WEC 2019-TN6510).

The WWTP includes a system of six lagoons—North, South, West I, West II, East, and Sanitary. The East Lagoon is no longer in operation and the WEC anticipates decommissioning the lagoon in the near future. Figure 2-4 shows the location of the six onsite lagoon storage basins in the West Lagoons Area, Wastewater Treatment Area, and Sanitary Lagoon Area. These lagoons are for settling solids from treated process wastewater prior to discharging liquid effluents to the Congaree River. Treated wastewater from the West I and West II lagoons is then sent to the North and South Lagoons for further treatment. The treated sanitary wastewater is mixed with the stream from the North and South Lagoons, receives further treatment (aeration, dichlorination, pH adjustment), and is then pumped to the Congaree River, in accordance with the CFFF site's NPDES permit. The licensee monitors wells W-18R, W-22, W-29, and W-30, which are part of the Wastewater Treatment Area, in accordance with the NPDES permit. The WEC stated that wells W-6 and W-28 are sampled to comply with SCDHEC CA requirements (WEC 2020-TN6844).

The WEC stated that new maintenance requirements were implemented for the North, South, West I, and West II Lagoons in 2020, which include monthly visual inspections of the exposed portions of the lagoon liners to identify degradation of the liners, such as holes and tears (WEC 2020-TN6844). Additionally, every 2 years, the lagoon liners are inspected during a period of the lowest water and sludge level achievable after a dredging campaign. The licensee explained that, at a minimum, the inspection includes observation of the impoundment liners for damage, such as rips, tears or punctures; ; spillway integrity; and changes in the discharge of all outlets of hydraulic structures, which pass underneath the base or through the dike, of the surface impoundment, including abnormal discoloration, flow or discharge sediment; and any other changes that may indicate a potential compromise to impoundment integrity. The WEC stated that additional inspection is also performed to observe signs of erosion, cracks or bulges, seepage, or wet or soft soil in the dams, dikes, and toe areas. The additional inspection also includes observation of changes in geometry, the depth and elevation of the impounded water, sediment, slurry, or freeboard, and changes in vegetation, such as overly lush, dead, or unnaturally tilted vegetation or other vegetation growing in or on the basin or basin dikes; and evidence of animal burrows (WEC 2020-TN6844). The lagoons are also inspected on an annual basis by the State.

Two lined settling ponds exist within the West Lagoons Area. West II Lagoon receives treated wastewater from the Waterglass and SOLX uranium removal processes, as well as still bottoms from ammonia distillation (WEC 2020-TN6844). The effluent from West II Lagoon typically flows to West I Lagoon. Calcium fluoride solids settle out from the treated wastewater in both lagoons. The West Lagoon Area OU contains monitoring wells W-39 and W-43, which are required by the CFFF site's NPDES permit. The WEC also samples wells (W-65 and W-66) to comply with SCDHEC CA requirements (SCDHEC/WEC 2019-TN6554). The analytical results for all COPCs, including uranium and Tc-99, are used for comparison with previous results and serve as one method for detecting potential leaks (WEC 2020-TN6844).

The main constituents of the process liquid waste streams are uranium and ammonium fluoride. The ammonium fluoride is mixed with lime and caustic to create an insoluble calcium fluoride, which is then physically removed (via centrifugation or settling). The WEC sends the calcium fluoride offsite for reuse in concrete, if uranium concentrations are less than 30 pCi/g. The ammonia is recovered and returned to the ADU process (WEC 2019-TN6510). The WEC samples the liquid waste stream before it is discharged into the Congaree River.

Table 2-2 summarizes the uranium and Tc-99 discharged into the Congaree River since the last license renewal in 2007. The WEC started sampling for Tc-99 in 2010 after elevated gross beta results were found in groundwater wells and determined to be from Tc-99. The 2020 effluent monitoring report indicated that the measured concentration for liquid effluent from July 1 through December 31, 2020, was 12.0 pCi/L for uranium, compared to the NRC limit of 300 pCi/L, and was 21.0 pCi/L for Tc-99 compared to the NRC limit of 60,000 pCi/L (WEC 2021-TN6904).

Table 2-2 Measured Uranium and Tc-99 Discharged to Congaree River (Sources: WEC 2019-TN6510, WEC 2020-TN7016, WEC 2021-TN6904)

Year	U (mCi)	Tc-99 (mCi)
2007	10.5	Not Sampled
2008	10.2	Not Sampled
2009	10.3	Not Sampled
2010	8.12	19.2
2011	6.92	14.1
2012	3.1	18.5
2013	5.2	9.2
2014	3.8	10.1
2015	4.3	10.1
2016	3.9	4.0
2017	4.1	7.2
2018	3.4	1.1
2019	3.8	1.1
2020	3.8	5.8

The liquid waste stream is discharged into the Congaree River through a submerged pipe, about 6 m (20 ft) from the shore. The flow rate into the river is 405,000 liters per day (L/d) (107,000 gallons/day [gpd]) based on rates averaged during the 3-year period from 2017–2020 (EPA 2021-TN7052).

The East Lagoon was used to receive and store liquid waste streams from the Deionized Water building and rainwater from tank containments. The East Lagoon also provided overflow from other lagoons or for containment for spills or emergency events (NRC 2019-TN6472). When the lagoon was full, its contents were pumped into the North or South Lagoon. As discussed previously, the WEC decided to close and decommission the East Lagoon in accordance with the SCDHEC-approved closure plan (WEC 2020-TN6844; NRC 2020-TN6935). The process will also include removal and disposal of the lagoon liner and evaluation of the subsurface soils underneath the liner to identify necessary remedial actions in consultation with SCDHEC (NRC 2020-TN6935; WEC 2020-TN7015). Additionally, the WEC anticipates rerouting the streams and the lagoon's current function with a storage tank, backfilling the East Lagoon area with virgin materials, and seeding the area for erosion control (WEC 2020-TN7015).

The Sanitary Lagoon, as shown in Figure 2-4, receives sanitary and contaminated water processed in the Package Plant. The wastewater is treated (aeration, dichlorination, pH adjustment) prior to being pumped to the Congaree River. Groundwater monitoring well W-17 is downgradient of the Sanitary Lagoon, and data from this well and other wells (W-10, W-26, W-42, W-46, and W-48) can be used to determine if there is leaking or leaching from the sludge in the lagoon (WEC 2020-TN6844). The WEC is also installing an upper and lower surficial and a lower surficial zone well west of the Sanitary Lagoon to collect groundwater quality data downgradient from the lagoon and anticipates evaluating the sediment quality downgradient of the lagoon (WEC 2020-TN6844). Additionally, the WEC anticipates permanently closing the Sanitary Lagoon after decommissioning the East Lagoon.

2.2.2 Facility Monitoring Programs

The WEC conducts radiological and nonradiological effluent and environmental monitoring and sampling to comply with SCDHEC's NPDES permit, SCDHEC CA (SCDHEC/WEC 2019-TN6554), and its NRC license.

2.2.2.1 Monitoring for the NRC License

2.2.2.1.1 Effluent Monitoring Program

Section 2.2.1 of this EIS describes the liquid and gaseous effluents released from the operations of the CFFF. As required by 10 CFR 70.59 (TN4883), "Effluent Monitoring Reports," the WEC submits semiannual reports about its effluents to the NRC (e.g., WEC 2019-TN6550, WEC 2020-TN7016, WEC 2020-TN6911, WEC 2020-TN6912). Using the sampling results, the WEC calculates the estimated dose to the public and worker. The WEC conducts representative stack sampling from 47 stacks to monitor gaseous effluents. Sampling and monitoring methods and frequencies are determined by the WEC. The WEC also samples its liquid effluents before they are discharged to the Congaree River. The NRC's limits for liquid and gaseous effluents are provided in Table 2 of Appendix B to 10 CFR Part 20 (TN283). For uranium, the limit is 300 pCi/L and for Tc-99 it is 60,000 pCi/L.

2.2.2.1.2 Environmental Monitoring Program

The WEC samples air, surface water, groundwater, the Congaree River, sediment, soil, and vegetation as part of its environmental monitoring program (WEC 2019-TN6423). Monitoring and sampling criteria have evolved during each subsequent license renewal (NRC 1985-TN5602, NRC 1995-TN5600, NRC 2007-TN5598). Any change made to the environmental monitoring program by the WEC must be reflected in updates to the license application and are

subject to review by the NRC during inspections (WEC 2019-TN6423). The inspection reports are publicly available.

Since June 2018, the WEC has proposed substantial changes to its environmental monitoring and sampling program, adding monitoring wells and adding sediment, soil, surface water, and groundwater sample locations. Table 2-3 and Table 2-4 summarize the proposed environmental sampling program. A significant change is the direct analysis for uranium and Tc-99 for all media, except air particulates, instead of the analysis of gross alpha and gross beta activity as surrogates. Past laboratory analysis had indicated that gross beta was a reasonable indicator of Tc-99; however, a direct correlation between gross alpha and uranium concentrations attributed to CFFF operations was not as clear. Because there is known uranium in the subsurface, the WEC will be able to identify impacts on the various mediums from operations at CFFF by performing isotopic analyses for uranium and accurately delineating areas of subsurface residual radioactivity that will need to be decommissioned to meet the unrestricted release criteria. Gross alpha is retained for the air particulate due to limitations in the sampling methodologies.

The WEC has agreed to two new license conditions related to the WEC's environmental monitoring and sampling program. If renewed, a new license condition would require the WEC to submit its environmental monitoring and sampling program to the NRC for review and approval upon either SCDHEC's approval of the Remedial Investigation Report (SCDHEC/WEC 2019-TN6554); as required by the CA (see Section 1.5.2.2.1 of this EIS), or within 5 years of the license renewal, whichever comes first. The Remedial Investigation Report would document the results of the WEC's remedial investigations per the SCDHEC-approved RIWP. The data gathered through the remedial investigations, analysis, and findings would inform the WEC's environmental monitoring and sampling program to be submitted to the NRC. The WEC would also be required by new license condition to enter exceedances of Federal and State standards into its Corrective Action Program (CAP) (WEC 2019-TN6423), such as the maximum contaminant level (MCL) under the U.S. Environmental Protection Agency's (EPA's) National Primary Drinking Water Regulations (66 FR 76708-TN5061). The MCL for uranium is 30 µg/L, based in part on the chemical toxicity of uranium. The WEC uses the MCL to calculate an activity-based limit of 84 pCi/L to account for the fact that an impact on the environment from the facility will likely be enriched rather than naturally occurring uranium.

Table 2-3 Environmental Sampling Program

Type of Sample	Number of Locations	Analyses	Minimum Sampling Frequency
Air Particulates	4	Alpha	Continuous (Collection Weekly)
Surface Water	7	Uranium, Tc-99	Quarterly
Soil	5	Uranium, Tc-99	Annually
Vegetation	4	Uranium, Tc-99, Fluoride	Annually
Fish	1	Uranium, Tc-99	Annually
Well Water	59	Uranium, Tc-99	Semiannually
River Water	4	Uranium, Tc-99	Quarterly
Sediment	3	Uranium, Tc-99	Annually

Source: Table 10-1 from WEC 2019-TN6423

Table 2-4 Environmental Sampling Quantities and Detection Levels

Type of Sample	Analyses	Typical Sample Quantity	Nominal Minimum Detection Level
Air Particulates	Alpha	571 m^3	6.0E-14 µCi/ml
Surface Water	Uranium	1 L	0.5 pCi/l
	Tc-99	1 L	50 pCi/l
Well Water	Uranium	1 L	0.5 pCi/l
	Tc-99	1 L	50 pCi/l
River Water	Uranium	1 L	0.5 pCi/g
	Tc-99	1 L	50 pCi/l
Sediment	Uranium	100 g	0.5 pCi/g
	Tc-99	100 g	1 pCi/g[(a)]
Soil	Uranium	100 g	0.5 pCi/g
	Tc-99	100 g	1 pCi/g[(a)]
Vegetation	Fluoride	100 g	Variable (based on dilution level)
	Uranium	100 g	0.5 pCi/g
	Tc-99	100 g	1 pCi/g[(a)]
Fish	Uranium	1 kg	0.5 pCi/g
	Tc-99	100 g	1 pCi/g[(a)]

(a) These values were updated per the WEC's responses to the RAIs (WEC 2020-TN6844)
Source: WEC 2019-TN6510 (Table 6.1-2 Revised Environmental Report)

Air Sampling

In addition to effluent monitoring of the stacks, the WEC will continuously monitor ambient air at four onsite locations (see Figure 2-7) for alpha activity (WEC 2019-TN6423). This is the same ambient air monitoring performed for the 2007 license.

Soil and Vegetation Sampling

During the proposed license renewal period, the WEC will collect four co-located soil and vegetation samples annually and evaluate them for uranium and Tc-99 content (WEC 2019-TN6423). A fifth soil sample will be analyzed to monitor for potential migration of uranium from the groundwater to surface water (Sample #5). The vegetation samples will also be analyzed for fluoride. The soil and vegetation samples are collected at the same locations as the ambient air samples (see Figure 2-7).

Surface Water and Sediment Sampling

The WEC will take seven surface water samples quarterly from the locations shown in Figure 2-8 (WEC 2019-TN6423). The WEC will analyze the samples for uranium and Tc-99. The samples are collected at the entrance of Upper Sunset Lake, the causeway between the Upper and Lower Sunset Lakes, the spillway from Lower Sunset Lake into Mill Creek, the location where Mill Creek exits the WEC property, and the confluence of two onsite ditches ("C" valve/"roadway"). A new sample location was added at Gator Pond and another location to monitor a newly identified ditch that runs from Lower Sunset Lake and rejoins Mill Creek near the point where the creek crosses the CFFF property line. The ditch was identified on maps but

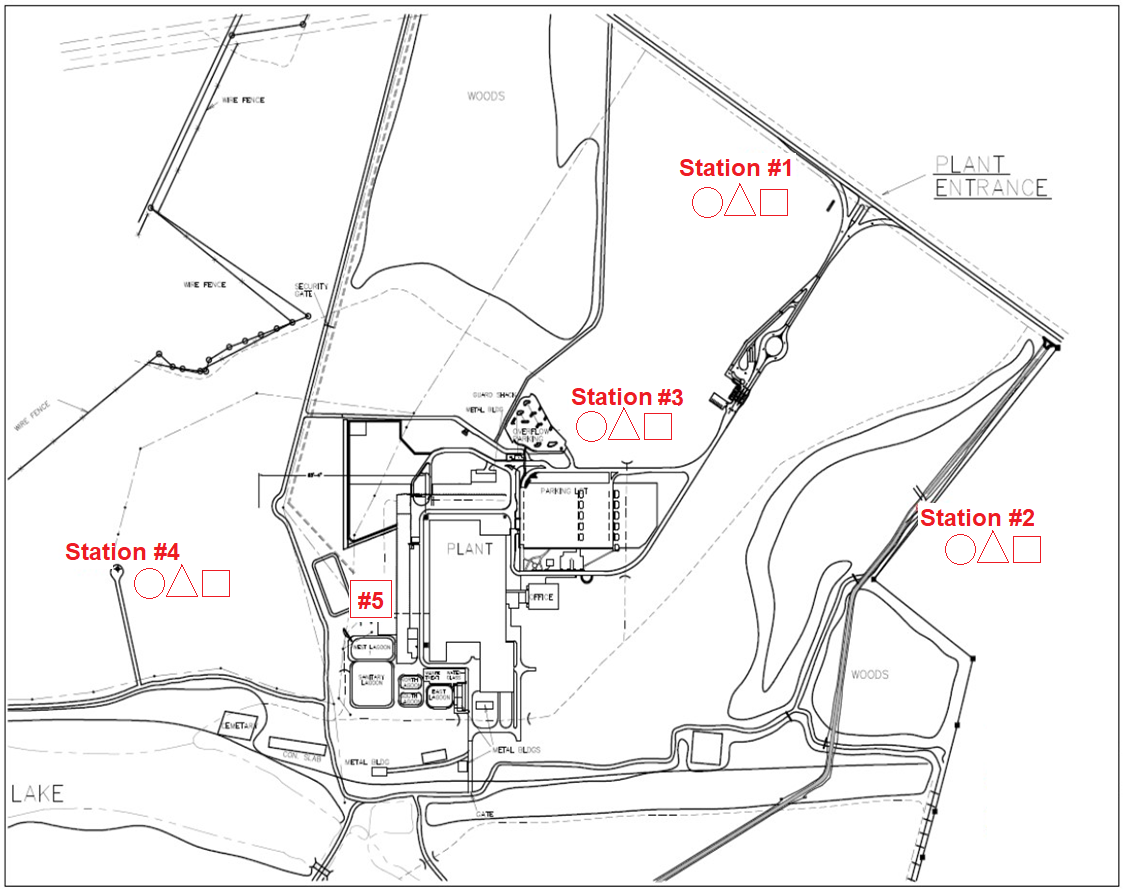

Figure 2-7 Sampling Locations for Air, Vegetation, and Soil (Source: WEC 2019-TN6423, with enhancements to label clarity)

has not been ground-truthed at this time. If uranium and Tc-99 levels in surface water samples exceed Federal or State regulatory limits, the WEC is required to enter the exceedance into its CAP (WEC 2019-TN6423). Through its CAP, the WEC will determine what, if any, actions need to be taken. Examples could include additional sampling, reanalysis of the sample, or additional sampling locations. The WEC will collect three sediment samples from Gator Pond, Lower Sunset Lake, and at or near the point of discharge into the Congaree River. Two new onsite sediment sample locations were added to the monitoring program to monitor the potential accumulation of contamination in the sediment of onsite surface water bodies. Samples will be collected annually and will be analyzed for uranium and Tc-99 (WEC 2019-TN6423).

Congaree River Sampling

During the proposed license renewal period, the WEC will collect quarterly Congaree River water samples from four locations: (1) at the Blossom Street Bridge 16 km (10 mi) upstream of the CFFF discharge point; (2) 457 m (500 yards [yd]) upstream; (3) 457 m (500 yd) downstream of the discharge point; and (4) where Mill Creek enters the Congaree River. Samples will be evaluated for uranium and Tc-99. This is the same monitoring the WEC has conducted since the 2007 license renewal (WEC 2019-TN6423).

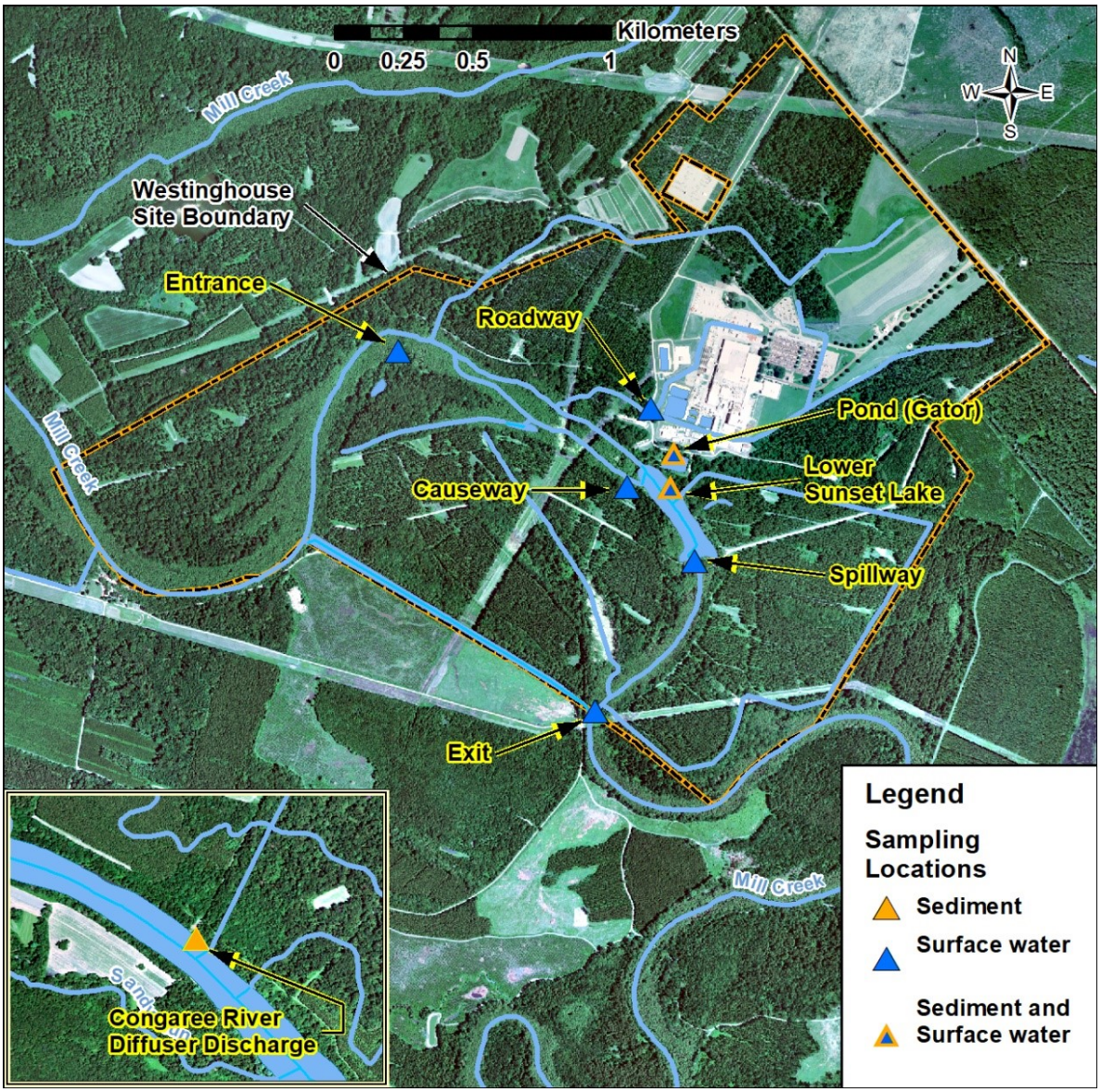

Figure 2-8 Surface Water and Sediment Sampling Locations (Source: WEC 2019-TN6423)

From 2010 through 2015, the WEC collected river samples at two additional locations—at the discharge point into the Congaree River and at the highway 601 bridge, which is approximately 30 km (18 mi) from the CFFF site. The samples were collected for additional data points, but the uranium levels were below the EPA drinking water standards so the WEC discontinued the sampling. The gross alpha concentrations ranged from zero to less than 5 pCi/L (WEC 2019-TN6423).

Fish Sampling

During the proposed license renewal period, the WEC will annually collect one fish from near the discharge point into the Congaree River (WEC 2019-TN6423). The fish will be analyzed for uranium and Tc-99.

Groundwater Sampling

For the proposed license renewal period, the WEC developed a monitoring program for groundwater that is substantially different from its current program because of known groundwater contamination and implementation of the CA. Under the current program, the WEC is required to sample 10 groundwater wells annually and analyze samples for gross alpha, gross beta, and ammonia (WEC 2019-TN6571). The WEC, however, is installing additional groundwater monitoring wells per the SCDHEC-approved RIWP under the CA (see Section 1.5.2.2.11 of this EIS). As of completion of the Phase I RIWP, the groundwater monitoring well network consisted of 90 permanent groundwater monitoring wells, including the 29 newly installed wells (WEC 2020-TN6526). As part of the implementation of the Phase II RIWP, the WEC plans to install additional monitoring wells. Additionally, the WEC is transitioning from monitoring groundwater for gross alpha and gross beta to monitoring for isotopic uranium and Tc-99 (WEC 2020-TN6875). Going forward, the WEC will sample these groundwater wells and analyze for uranium and Tc-99 to determine (1) whether the source of the current shallow groundwater contamination is leaks from plant operation and/or (2) if existing contamination of uranium or Tc-99, from a known or unknown source, is moving offsite. The WEC continues to monitor for gross alpha and gross beta, but is relying on the site-specific COPC monitoring results for isotopic uranium and Tc-99 to evaluate radionuclide concentrations in groundwater now that there are data from four separate sampling events (WEC 2020-TN6875).

The groundwater monitoring wells at the CFFF are binned into four categories—perimeter wells, NPDES wells, sentinel wells, and plume wells:

- Perimeter wells will help the WEC detect if groundwater contamination is migrating toward the site boundary. The perimeter wells are the outermost monitoring wells at the CFFF site.
- NPDES wells are those identified in the NPDES permit to detect leaks from the WWTP.
- Sentinel wells are the wells that monitor for releases from each OU.
- Plume wells are those that monitor for known groundwater contamination plumes. The WEC will monitor, at a minimum, three wells per known plume of radioactive contamination, with one well monitoring the maximum concentration and two wells monitoring downgradient. These wells are expected to change as the plume moves. Based on previous groundwater assessment activities, COPCs in groundwater are chlorinated volatile organic compound (CVOCs), nitrate, fluoride, uranium, and Tc-99 (WEC 2020-TN6875). Four types of CVOCs were detected in the upper and lower zones of the surficial aquifer: PCE, trichloroethylene (TCE), cis-1,2-dichloroethene, and vinyl chloride [VC] (WEC 2020-TN6875).

The monitoring wells might fall into one or more bins. Figure 2-9 shows the locations of the groundwater monitoring and sampling wells, including the wells that are planned to be installed as part of the implementation of the Phase II RIWP.

The WEC stated that analytical results for all COPCs, including uranium and Tc-99, are used for comparison with previous results and serve as one method for detecting potential leaks (WEC 2020-TN6844).

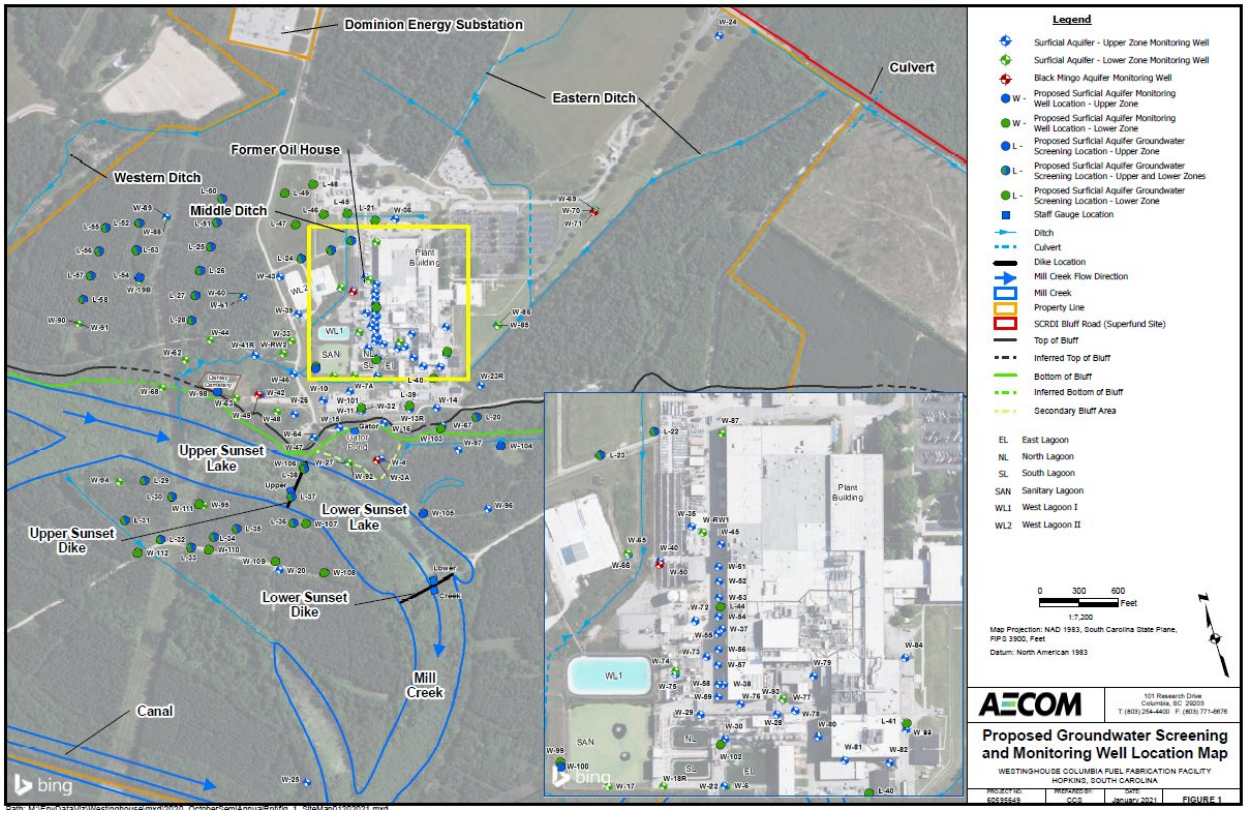

Figure 2-9 Groundwater Well Locations at the CFFF Site (Source: WEC 2021-TN7007)

2.2.2.2 Monitoring for SCDHEC NPDES Permit

As part of the NPDES permit (SC0001848) issued by SCDHEC, the WEC monitors its discharges to the Congaree River and collects groundwater monitoring samples. The WEC's NPDES permit sets the requirements for its discharge into the Congaree River. In September 2015, SCDHEC informed the WEC that regulatory oversight for groundwater monitoring related to previous releases determined to be from the WWTP lagoons would be managed by the SCDHEC's Bureau of Water (AECOM 2017-TN5512). As a result, groundwater monitoring requirements were added to the NPDES permit. To comply with its current NPDES permit requirements, the WEC monitors groundwater conditions for water-table elevation, pH, specific conductance, fluoride, nitrate, VOC, gross alpha, gross beta, fission, activation products, and tritium (SCDHEC 2017-TN5607). The current NPDES permit requires semi-annual sampling, instead the WEC takes groundwater samples quarterly, typically in October, January, April, and July. The WEC provides annual reports to SCDHEC that include the sampling results. The frequency of the reports could change as part of the NPDES permit renewal application. The WEC will also submit these annual NPDES groundwater sampling reports, or as established by a renewed NPDES permit, to the NRC during the proposed license renewal period (WEC 2019-TN6423). The WEC stated that the monthly Discharge Monitoring reports sent to SCDHEC monthly, as required by the NPDES permit, will also be reported to the NRC on a semiannual basis (WEC 2020-TN6844).

The NPDES permit must be renewed every 5 years. The NPDES permit was last modified in May 2017 and expired in March 2018; however, the WEC submitted a renewal application in September 2017 (WEC 2017-TN5621) and is operating under the old permit while the State

completes its review. The SCDHEC submitted the NPDES permit for a 30-day public comment period on September 12, 2019 (SCDHEC 2019-TN6598). The monitoring requirements of the NPDES permit are subject to change, including the number of wells monitored, the frequency of monitoring, and the constituents that are monitored. The draft NPDES permit for public comment currently requires the WEC to monitor 40 wells related to the lagoons. The WEC will notify the NRC any time the NPDES permit is renewed, revoked, or revised, and if the WEC receives an NPDES Notice of Violation (WEC 2019-TN6423). The WEC also has a general NPDES permit for stormwater runoff/discharges associated with industrial activity, but not construction activities. The permit requires the WEC to have a Stormwater Pollution Prevention Plan.

2.2.2.3 Monitoring for Consent Agreement with SCDHEC

In February 2019, SCDHEC and the WEC entered into a CA (#19-02-HW) to address radiological and nonradiological contamination at the CFFF site and establish protocols for communicating and responding to future releases (SCDHEC/WEC 2019-TN6554). The CA is described in Section 1.5.2.2.1 of this EIS.

Under the CA, the WEC is also developing a CSM (see Section 1.5.2.2.1 of this EIS). The CSM is a graphical visualization of the CFFF site's hydrogeology, including the location of existing and past contamination releases to the environment and the constituents of concern. An example of the visualization capability of the CSM is shown in Figure 2-10, which includes the location of wells that are monitored and sampled.

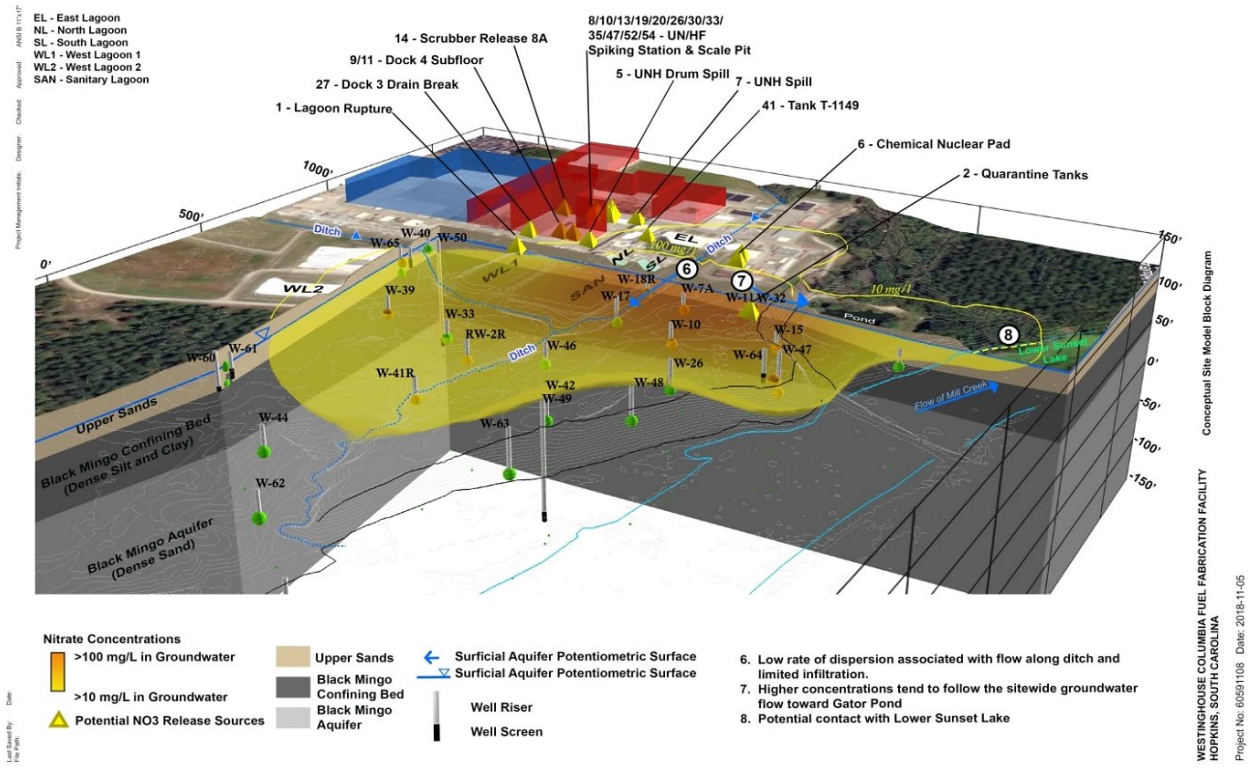

Figure 2-10 Conceptual Site Model Identifying the Location of Monitoring Wells (WEC 2020-TN6526)

The WEC has installed permanent monitoring wells consistent with the implementation of the Phase I RIWP (WEC 2019-TN6553), and installation of new monitoring wells continues under the implementation of the Phase II RIWP.

New environmental monitoring data are included to update the CSM on a periodic frequency. The CSM would be used to provide insight about contamination release that is observed or measured in the site's environment (WEC 2021-TN6920). The WEC would use data obtained from the CSM to inform decisions involving environmental monitoring and sampling. Sampled data would be used for comparison against previous results to detect potential leaks consistent with the site's Environmental Data Management Procedure RA-434 (WEC 2020-TN6844). Additionally, the WEC-developed Remediation procedure RA-433, "Environmental Remediation," (a commitment in the WEC's LRA), which establishes a risk-based process for determining the path forward in the event of a release of contaminants that is protective of human health and the environment (WEC 2020-TN6844).

2.3 Decommissioning

Decommissioning is the safe removal of a facility from service and reduction of residual radioactivity to a level that permits either unrestricted or restricted release. The NRC requires that licensees comply with the License Termination Rule in 10 CFR Part 20, Subpart E (TN283), "Radiological Criteria for License Termination." This rule provides radiological criteria for restricted and unrestricted use, financial assurance, recordkeeping, and timeliness conditions. The NRC guidance for implementation of the License Termination Rule is found in NUREG-1757, *Consolidated Decommissioning Guidance* (NRC 2006-TN6599).

Depending on the WEC's plans for the site after decommissioning, the WEC would have to ensure the site meets applicable NRC regulations for either unrestricted or restricted use. As defined in 10 CFR 20.1402 (TN283), a site is deemed acceptable for unrestricted use when the residual radioactivity has been reduced to as low as reasonably achievable (ALARA), and results in a total effective dose equivalent (TEDE) that does not exceed 25 mrem/yr, including dose from groundwater sources of drinking water.

Per 10 CFR 70.38(g) (TN4883), SNM licensees must submit a decommissioning plan to the NRC for review and approval, if required by its license condition or if the procedures necessary to decommission have not been previously approved by the Commission and could increase potential health and safety impacts on workers or the public. The decommissioning plan describes in detail how the facilities and grounds will be decontaminated, so that they can be released for unrestricted or restricted use.

Adequate planning and funding must be in place for the eventual decommissioning of the CFFF site. The WEC is required to submit its Decommissioning Funding Plan (DFP) to the NRC at intervals not to exceed 3 years in accordance with 10 CFR 70.25(e)(2) (TN4883). As required by 10 CFR 70.25(e)(1), the DFP must contain a detailed cost estimate for decommissioning, including consideration of the volume of onsite subsurface material containing residual radioactivity that will require remediation. In the LRA, the WEC stated that its remediation process would be used to "…prevent migration of licensed material offsite and/or to minimize decommissioning impacts…" (WEC 2019-TN6423). The WEC submitted its 2019 DFP and updated it to reflect recent environmental investigations (WEC 2019-TN6926). The NRC considered the current state of site contamination and expected remediation that the WEC would implement when reviewing the DFP for approval. The NRC staff approved the revised DFP in August 2020 and amended the license accordingly (NRC 2020-TN7002).

2.4 Alternatives to the Proposed Action

This section describes the alternatives to the proposed action, including the no-action alternative and the 20-year license renewal alternative.

2.4.1 No-Action Alternative

Under the no-action alternative, the NRC would deny the WEC's request to renew CFFF's SNM-1107 license for an additional 40 years. The WEC, however, can continue to operate the CFFF under its current operating license until it expires on September 30, 2027. The NRC staff previously evaluated the environmental impacts of the operation of the CFFF until September 2027 when it approved the WEC's license renewal in 2007 (NRC 2007-TN6528). The NRC staff concluded in the 2007 license renewal environmental assessment (EA) that the continued operation of the CFFF would not result in a significant impact on the environment (NRC 2007-TN5598).

Notwithstanding the previous finding, the NRC staff considered the potential environmental impacts of the no-action alternative in light of the information that led to the NRC's decision to prepare an EIS. Known onsite contamination is currently being addressed by the WEC as part of the implementation of the CA with the SCDHEC. The data gathered through these ongoing remedial investigations would be used to continue to develop the CSM and the monitoring well network. The WEC would also use the data analysis results for comparison with previous results to detect potential leaks consistent with the WEC's Environmental Data Management Procedure RA-434. Procedure RA-433, "Environmental Remediation," would also be used to assess the remediation activities that are protective of human health and the environment. The new proposed license conditions (i.e., entering exceedances Federal and State standards into the CAP and submitting the environmental monitoring and sampling program to the NRC for review and approval) are not considered within the scope of the no-action alternative. Therefore, the nature/type of potential environmental impacts of the no-action alternative would be similar to those of the proposed action (i.e., the 40-year license renewal process), but the impacts would differ in light of the uncertainties associated with the outcome of the ongoing remedial investigations per the CA process. The WEC, however, could choose to incorporate the new license conditions and commitments into its current operating license.

Upon license expiration, the WEC would be required to start the decommissioning process, including any site remediation, or request and obtain a renewed license. The environmental impacts of this alternative are discussed in Section 3.17 of this EIS.

2.4.2 License Renewal for 20 Years

The NRC staff also considered as an alternative approving the WEC's a license renewal request for a shorter license renewal term, i.e., a renewal term of 20 years. In SRM-SECY-06-0186 (NRC 2006-TN6558, NRC 2006-TN6985), the Commission approved license terms for up to 40 years for new fuel cycle facilities licenses and license renewals that are required to submit integrated safety analysis summaries in accordance with 10 CFR Part 70, Subpart H (TN4883). Additionally, the Commission approved license terms for less than 40 years on a case-by-case basis where there are concerns about safety risk to the facility or where a licensee introduces a new process or technology. The NRC staff evaluated a 20-year license renewal term as an alternative based on the effects on the environment from the 2015 historic flooding event and multiple leaks or spills that have resulted in the contamination of the subsurface at the CFFF

site since the last license renewal, and the ongoing remedial investigations under the CA with SCDHEC (see section 1.5.2.2.1 of this EIS).

The nature/type of potential environmental impacts from continued licensed operations for an additional 20 years would be similar to those from the proposed action (i.e., proposed 40 years of continued operation). However, the extent of the impacts would differ in light of the amount of time the CFFF would operate and uncertainties associated with the outcome of the ongoing remedial investigations per the CA process. These uncertainties are relevant to reasonably foreseeable impacts from the proposed 40-year license renewal and a 20-year license renewal alternative. The NRC staff reasonably assumes that new proposed license conditions (i.e., entering exceedances Federal and State standards into the CAP and submitting the environmental monitoring and sampling program to the NRC for review and approval) would also apply under the 20-year license renewal. The data gathered through the WEC's remedial investigations would be used to continue to develop the CSM and to inform the WEC's environmental monitoring and sampling program and remediation strategies. Procedure RA-433, "Environmental Remediation," outlines the decision-making process for remediating releases of licensed material and/or contamination offsite that is protective of human health and the environment. In the event of a release, RA-433 requires updating and analyzing data in the CSM, including the migration pathways and potentially affected receptors. The data analysis results would also be used for comparison with previous results to detect potential leaks consistent with the WEC's Environmental Data Management Procedure RA-434.

Upon license expiration, the WEC would be required to start the decommissioning process, including any site remediation, or request and obtain a renewed license. Therefore, the timing of decommissioning would be different if license renewal was granted for 20 years but the nature/types of impacts from decommissioning would be similar. Whether the WEC operates for 40 years or less, the WEC must maintain the necessary funding to assure they can successfully complete decommissioning and meet NRC's regulatory requirements. The environmental impacts of this alternative are discussed in Section 3.17 of this EIS.

2.5 Comparison of Potential Environmental Impacts

In evaluation of environmental impacts in this EIS, the NRC staff uses the designations found in NUREG–1748 (NRC 2003-TN1983), which categorizes the significance of potential environmental impacts as follows:

- SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.
- MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource considered.
- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

Chapter 3 presents the NRC staff's detailed evaluation of the environmental impacts from the proposed action, the no-action alternative, and the 20-year license renewal alternative. EIS Table 2-5 compares the significance level (SMALL, MODERATE, or LARGE) of potential environmental impacts of the proposed action and alternatives.

Table 2-5 Summary of Resource Impact Determinations for the Proposed Action and Alternatives

Resource Area	Impact Determination
Land Use	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Geology, Seismology and Soils	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Surface Water	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Groundwater	
Proposed action	SMALL to MODERATE
No-action alternative	SMALL to MODERATE
20-year license renewal alternative	SMALL to MODERATE
Ecological Resources – Terrestrial and Aquatic	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Climatology, Meteorology, and Air Quality	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Noise	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Historic and Cultural Resources	
Proposed action	SMALL
No-action alternative	SMALL to MODERATE
20-year license renewal alternative	SMALL
Visual and Scenic Resources	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Socioeconomics	
Proposed action	SMALL
No-action alternative	MODERATE
20-year license renewal alternative	SMALL
Public and Occupational Health	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Transportation	
Proposed action	SMALL
No-action alternative	SMALL
20-year license renewal alternative	SMALL

Resource Area	Impact Determination
Waste Generation and Management	
Proposed action	SMALL – operations
No-action alternative	SMALL
20-year license renewal alternative	SMALL
Environmental Justice	
Proposed action	No disproportionately high and adverse human health and environmental effects
No-action alternative	No disproportionately high and adverse human health and environmental effects
20-year license renewal alternative	No disproportionately high and adverse human health and environmental effects

2.6 Preliminary Recommendation

Based on its review, the NRC staff has determined that the proposed action—renewal of license SNM-1107 authorizing continued operations at the WEC's CFFF in Hopkins, South Carolina, for a period of 40 years—would result in SMALL impacts on most resource areas (see Table 2-5) except for groundwater resources for which the impacts would be SMALL to MODERATE. Chapter 3 of this EIS describes the analyses for each resource area, how the resource may be affected by the proposed action, and the incremental contribution of the proposed action when considered with cumulative effects of reasonably foreseeable past, present, and future actions.

3.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL IMPACTS, AND MITIGATION MEASURES

This section provides a discussion of each environmental resource and describes the region of interest or area for potential impacts, assesses the potential impacts of the proposed action (Westinghouse Electric Company, LLC's [WEC's] proposed continued operation of the Columbia Fuel Fabrication Facility [CFFF]) for an additional 40 years) and alternatives. This section also describes mitigation measures for the reduction or avoidance of potential adverse impacts that (1) the licensee has committed to in its license renewal application (LRA), or (2) additional measures the U.S. Nuclear Regulatory Commission (NRC) staff identified as having the potential to reduce environmental impacts, but that the applicant did not commit to in its application.

This chapter addresses the potential environmental impacts on the following resource areas: land use, transportation, geology and soils, water resources, ecology, noise, air quality, historic and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, waste management, and environmental justice, and presents a discussion of accidents.

The NRC staff uses the Council on Environmental Quality (CEQ) regulations-based standards of significance for assessing environmental impacts, as described in the NRC guidance in NUREG–1748 (NRC 2003-TN1983) and summarized as follows:

- SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource.
- LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

This section of the environmental impact statement (EIS) also summarizes the cumulative impacts that can result from individually minor but collectively significant actions taking place over a period of time. The NRC's regulations implementing the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. § 4321 *et seq.*; TN661) in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental," Section 51.71(d), require that the draft EIS "include a preliminary analysis that considers and weighs the environmental effects, including any cumulative effects, of the proposed action…" (10 CFR Part 51-TN250). A proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions. Appendix B in this EIS discusses in detail the cumulative impact analysis.

3.1 Land Use

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on land use from the proposed action.

3.1.1 The CFFF Site and Vicinity

The CFFF site is located in Hopkins, South Carolina, on an approximately 469-hectare (ha) (1,151-acre [ac]) site in Richland County, approximately 13 kilometers (km) (8 miles [mi]) southeast of the City of Columbia. CFFF operations and support activities occur on about 28 ha (68 ac) or 5 percent of the entire site; the remaining portions of the site are mainly undeveloped and consist of swamps and wetlands, woodland areas, and hardwood forests (see Figure 2-2).

In the undeveloped portions of the site, forested areas are used for timber production and hay fields are harvested. Recreational facilities for employees include a fitness trail and a picnic pavilion (WEC 2019-TN6510).

There is an electrical substation, owned by South Carolina Electric and Gas, on approximately 2.8 ha (7 ac) of the CFFF site near Bluff Road. The land was purchased from the WEC in 2005 (WEC 2019-TN6510).

In 2012, the WEC notified the NRC that it had completed a uranium hexafluoride (UF_6) storage pad project, located within the controlled access area (WEC 2012-TN5522). The concrete storage pad holds additional cylinders of UF_6 and was built on previously disturbed land.

Within an 8 km (5 mi) radius around the CFFF site, 90 percent of the area falls in Richland County, while the remaining 10 percent falls within Calhoun County (WEC 2019-TN6510).

The CFFF site is bordered by privately owned property to the east, south, and west. Manufacturing facilities are located about 0.5 km (0.3 mi) from the site boundary, at the nearest point. Farms, single-family dwellings, and light commercial activities are located chiefly along nearby highways. Within a 1.6 km (1 mi) radius of the CFFF site, agricultural use makes up 44 percent of the land use (see WEC 2019-TN6510, Figure 3.1-2). The remaining 56 percent is classified as “other” (WEC 2019-TN6510).

The WEC’s March 2019 environmental report (ER) shows manufacturing and distribution business locations within the 8 km (5 mi) site radius (WEC 2019-TN6510, Figure 3.1-3). These businesses and their products are (1) DAK Americas [formerly Carolina Eastman] (man-made production fibers); (2) Nephron Pharmaceuticals (eye drop medications, respiratory medicine, vaccines, and injectable drugs); (3) Knight’s Redi-Mix (concrete batching plant for commercial use); (4) Wallace Concrete Products (manhole production); (5) Schneider Electric (industrial motor control production); (6) Devro Inc. (collagen casings for food); and (7) an Amazon Distribution Center.

Five farms are located within 8 km (5 mi) of the CFFF site. They provide quail, strawberries, fish for pond stocking, and full-service equestrian services (WEC 2019-TN6510).

Two schools (Hopkins Elementary and Hopkins Middle School) are located northeast of the CFFF site, approximately 6.4 km (4 mi) and 7.4 km (4.6 mi) away. Three other schools (Lower Richland High School, Mill Creek Elementary, and Sandhills School) are located to the northeast and north northeast of the CFFF site, slightly more than 8 km (5 mi) away (WEC 2019-TN6510). Nine churches are located within the 8 km (5 mi) radius of the CFFF site.

No hospitals are located within 8 km (5 mi) of the CFFF site. The Alvin S. Glenn (Richland County) Detention Center is located 8 km (5 mi) north of the CFFF site (WEC 2019-TN6510).

Two military bases, Ft. Jackson U.S. Army Base and McEntire Joint National Guard Base, are located, respectively, 11 km (7 mi) north and 10 km (6 mi) northeast of the CFFF site (WEC 2019-TN6510). The Congaree National Park, located 8 km (5 mi) southeast of the CFFF site, is a Globally Important Bird Area, and a federally designated wilderness (NPS 2018-TN6975, NPS 2019-TN6974), and the Congaree River Swamp within the park is a National Natural Landmark (NPS 2020-TN6973). The park also is part of the internationally recognized Congaree Biosphere Reserve and is on the Ramsar Convention list of Wetlands of International Importance (NPS 2018-TN6975; Ramsar 2012-TN6976). The park contains important high-quality habitats including unique bottomland hardwood forests and well-preserved, species-rich, and dynamic floodplains. These protected floodplains provide a unique ecosystem when the Congaree and Wateree Rivers flood the area, bringing nutrients and sediments to help contribute to the productivity of the area. The diversity of habitats within the Congaree National Park supports a wide variety of biota, including fish, birds, amphibians, reptiles, mammals, insects, and other aquatic life (NPS 2020-TN6577).

3.1.2 Land Use Impacts

Under the proposed action, the WEC did not request changes to its NRC license related to any new construction or changes to current facility operations or buildings within the controlled access area (WEC 2019-TN6510). The WEC is conducting characterization and environmental investigations, including remedial investigations, under the Consent Agreement (CA) with the South Carolina Department of Health and Environmental Control (SCDHEC) in several areas of the site, including areas that were previously undisturbed (SCDHEC/WEC 2019-TN6554). In December 2018, during a pre-application meeting with the NRC, the WEC shared plans to remodel its administration building, which they anticipated would require a license amendment (NRC 2018-TN6925). However, the WEC has since stated it does not plan to request those changes at this time (NRC 2019-TN6474). For any future license amendment request, the NRC would review the request and conduct a safety analysis and the appropriate environmental review. In the future, the WEC can also undertake activities that do not require prior NRC approval under 10 CFR 70.72 (TN4883), which could potentially result in new construction or land disturbance, such as new concrete storage pads. Onsite landowners could also change the current use of the land (agricultural, logging).

A current and expected future activity on the undeveloped portions of the CFFF site is logging and farming. Logging operations have been practiced on the undeveloped parcels of the WEC property for decades and have not been incompatible with CFFF operations.

Planning documents for future growth in Richland County as a whole (Richland County 2015-TN6578) and for the southern or “lower” part of the county (Richland County 2014-TN6600) were issued in 2014. The county-wide document provides guidance relative to Richland County’s growth over the next 20 years and direction on future decisions so that the county can achieve its vision regarding that growth. The CFFF site is located in an area designated as the “southeast” in the county-wide plan, and Richland County expects that land use around the CFFF site will not change during the assessed upcoming 20 years (Richland County 2015-TN6578). Additionally, development over the next 20 years in the area around the CFFF site is constrained by limited water and sewer service and by environmental constraints (Richland County 2014-TN6600). Within 24 km (15 mi) to the northwest of the CFFF site, several road expansion projects are planned off of and along Bluff Road to encourage development within an existing industrial park. A fiberglass manufacturing facility is operational (Wilkinson 2018-TN7022). These projects could result in an increase in local traffic.

Installation of groundwater monitoring wells and collection of soil samples at the CFFF site are part of the remedial investigations the WEC is conducting under the CA with the SCDHEC. Installation of the groundwater monitoring wells involve minimal land disturbance. These monitoring wells and collection of surface water and soil samples are part of the remedial investigation being conducted to address known onsite contamination and to develop a Conceptual Site Model (CSM) that will be used by the WEC as a decision-making tool, for example, when determining the extent of contamination, migration pathways, and when and how to remediate. Potential future construction proposed by the WEC could require subsequent environmental review. The use of the land in the surrounding area is not expected to change from its current uses, including the CFFF's operations. Therefore, the NRC staff does not expect a significant impact on land use during continued operations at CFFF for the proposed period of 40 years. Accordingly, the NRC staff considers direct and indirect impacts on land use from renewing the CFFF license for an additional 40 years to be SMALL. Based on these minor impacts on land use, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.1.3 Mitigation Measures

Because the proposed action would result in minimal land use impacts that are consistent with the current use of the site, no additional mitigation measures have been identified beyond the remedial investigations the WEC is conducting under the CA with the SCDHEC and the new proposed license conditions agreed to by the WEC as part of the review of the LRA: (1) the WEC would be required to submit its environmental monitoring and sampling program to the NRC for review and approval upon either SCDHEC's approval of the Remedial Investigation Report, as required by the CA (SCDHEC/WEC 2019-TN6554), or within 5 years of the license renewal (whichever comes first), and (2) the WEC will be required to enter exceedances of Federal and State standards into its Corrective Action Program (CAP) such as the maximum contaminant level (MCL) under the U.S. Environmental Protection Agency's (EPA's) National Primary Drinking Water Regulations. Additionally, the WEC has committed to submit the environmental monitoring and sampling program to the NRC for review and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC (WEC 2021-TN7042). The WEC's additional commitments in its LRA address (i) the use of the CSM in informing decisions about the environmental monitoring program and maintaining the CSM (procedure RA-435); (ii) establishing and maintaining remediation procedure RA-433, which is used to prevent migration of licensed material and/or contamination off-site and inform decisions about remediation; and (iii) establishing and maintaining environmental data management procedure RA-434, which is used to manage the site's environmental data and assess potential trends within the environmental monitoring program (WEC 2021-TN7042).

3.2 Geology, Seismology, and Soils

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on the site's geology, seismology, and soils from the proposed action.

3.2.1 Regional Geology

The geology of South Carolina is characterized by the fall line, which marks the division between the older, more-resistant crystalline or metamorphic rocks of the Piedmont and Blue Ridge physiographic provinces and the younger, unconsolidated sedimentary lithologies of the

Atlantic Coastal Plain province. On the generalized geologic map of South Carolina (Figure 3-1), the fall line is coincident with the northwesternmost extent of the Coastal Plain map units and passes through the Columbia metropolitan area. Coastal Plain sediments occur as permeable units of gravels, sands, and crystalline carbonate sediments with intervening low-permeability units of silts and clays. The unconsolidated sediments form a wedge, thickening toward the ocean, that unconformably overlies the consolidated Paleozoic and Triassic rocks (Campbell and Coes 2010-TN6672). In South Carolina, the thickness of the Coastal Plain sediments is 0 m (0 feet [ft]) at the fall line, more than 304.8 m (1,000 ft) at the coast adjacent to North Carolina, and as much as 1,219.2 m (4,000 ft) along the coast at the Georgia border (Campbell and Coes 2010-TN6672). The age of the Coastal Plain sediments varies from the Late Cretaceous (100 million years before present [mbp]) to the Holocene (recent).

The South Carolina Coastal Plain is divided into three physiographic sub-provinces based on topography and surficial geology. These are referred to as the Upper, Middle and Lower Coastal Plain, or as the Sand Hill, Inner Coastal Plain, and Outer Coastal Plain, respectively. The topography is characterized by terraces at specific elevations and separated from each other by an erosional escarpment (or scarp). The escarpment to the abutting higher terrace reflects the extent of erosion of the higher (older) terrace during the deposition of that terrace. The Coastal Plain sub-provinces are roughly demarcated by the Orangeburg and Surry scarps, shown in Figure 3-1.

The occurrence of geologic formations within the Coastal Plain reflects the deposition of material at different sea level elevations as the ocean rose or fell during the geologic history of the region. Formations may or may not be found in any specific location of the Coastal Plain province due to the nature of the depositional environment. In general, Cretaceous sediments are found throughout the province, Tertiary sediments extend to the fall line only in the southwestern part of the region, and the Quaternary sediments occur within about 80.5 km (50 mi) of the coast and along the courses of the present-day rivers (including the Congaree River), as can be seen in Figure 3-1. If found in the subsurface, each formation unconformably underlies or overlies the abutting formations.

The fall line marks the division between the older, more-resistant crystalline or metamorphic rocks of the Piedmont and Blue Ridge physiographic provinces and the younger, unconsolidated sedimentary lithologies of the Atlantic Coastal Plain province.

The hydrogeologic framework relates the geologic formations to their hydrologic functions as aquifers and confining units. They evolve over time as data are reinterpreted and new data are obtained. The South Carolina Department of Natural Resources (SCDNR) recently adopted the newer hydrogeologic framework presented by Campbell and Coes (2010-TN6672) for their assessments of groundwater in South Carolina (Wachob et al. 2017-TN6712), and this newer framework will be used in this EIS.

The confining unit is a layer of rock that is less permeable than those above or below it, and which prevents or restricts the vertical movement of water and pressure.

When evaluating the occurrence and flow of groundwater, the regional geologic setting is commonly discussed in terms of a hydrogeologic framework, which relates the geologic formations to their hydrologic functions as aquifers and confining units. Hydrogeologic frameworks evolve over time as data are reinterpreted and new data are obtained. The hydrogeologic description of the CFFF site presented in the ER (WEC 2019-TN6510) and recent CA-related remedial investigation documents (e.g., *Final Interim Remedial Investigation Data Summary Report*, July 2020, WEC 2020-TN6526) appears to be based on a combination of the older frameworks of Colquhoun et al. (1983-TN6711) and Aucott et al. (1987-TN6674).

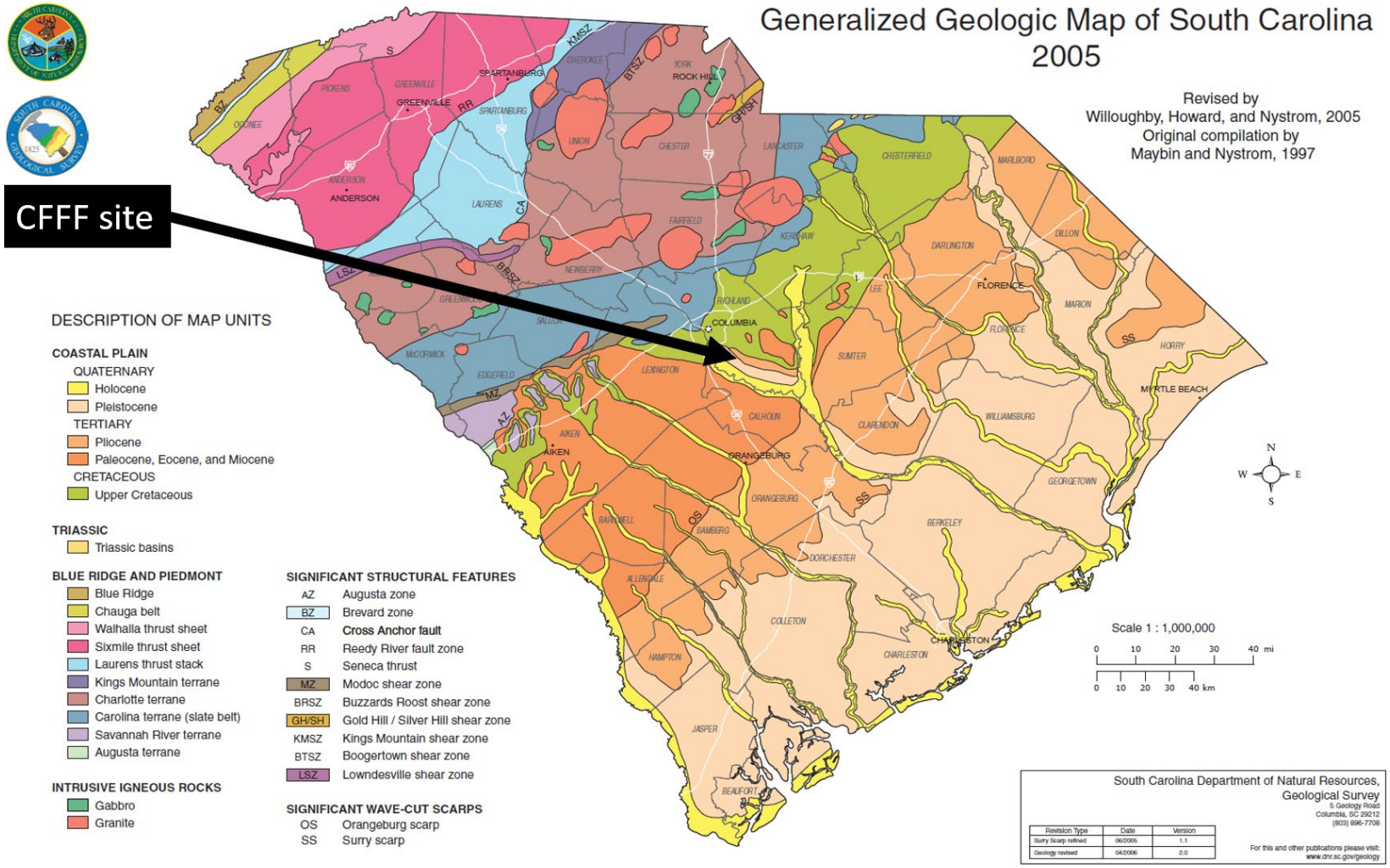

Figure 3-1 Generalized Geologic Map of South Carolina (Source: Willoughby et al. 2005-TN6717)

The South Carolina Department of Natural Resources (SCDNR) recently adopted the newer hydrogeologic framework presented by Campbell and Coes (2010-TN6672) for their assessments of groundwater in South Carolina (Wachob et al. 2017-TN6712), and this newer framework will be used in this EIS. The stratigraphic correlations of geologic formations and regional hydrogeologic units for South Carolina are shown in Figure 3-2. Additional discussion of groundwater in the region can be found in Section 3.4, Groundwater Resources, in this EIS.

3.2.2 Site-Specific Geology and Impacts

The WEC site is located approximately 18 km (11 mi) southeast of the fall line within the Upper (or Inner) Coastal Plain Province. The site is located at the southeastern edge of the Fort Jackson South quadrangle, as seen in Figure 3-3, which shows the surface geology of the area (Meitzen 2011-TN6678). Surface geology at the site comprises river terrace and floodplain deposits, separated by a bluff (a.k.a., escarpment). The Pleistocene-age terrace deposits are found in the northeastern portion of the site at elevations between 41 and 44 m mean sea level (MSL) (136 and 144 ft MSL); this area contains the CFFF operations and other undeveloped areas. Terrace sediments are described by Meitzen (2011-TN6678) as poorly sorted silty, fine to very coarse sand with some gravel containing remnants of preserved channel morphologies and other landform scars. The Holocene-age floodplain deposits are found in the southern portion of the site at elevations between 34 and 35 m MSL (112 and 115 ft MSL). These alluvial sediments of the Congaree River floodplain are described by Meitzen (2011-TN6678) as multiple sequences of channel-fill and overbank deposits, coarser at the base and fining upward clayey, silty, and fine- to coarse-grained sand. The fining upward sequence may be interrupted by coarser channel-fill sequences. Alluvial tributary valley deposits along streams such as Mill Creek contain coarse to fine sediments weathered from the Congaree River terraces. Deposition of the floodplain sediments effectively cut into and completely removed the older river terrace sediments (WEC 2019-TN6510), as illustrated in the cross section shown in Figure 3-3 (at the end of this section).

Based on its ongoing site remedial investigation, the WEC states that the surficial sediments at the CFFF site are 9.1 m to 12.2 m (30 to 40 ft) thick above and below the bluff, and consist of clay, silt, or silty sand at the surface, coarsening downward to coarse sand or gravel above an underlying low-permeability formation (WEC 2020-TN6707). Cross sections provided with the WEC's CSM show the occurrence of clay and silt lenses in the terrace deposits with more continuous layers of clay and silt in the floodplain deposits (WEC 2020-TN6707). Described as an anomaly, 15.2 m (80 ft) of surficial sediments were observed in one of the boreholes drilled in the floodplain (borehole L-1, at the location of well W-95; WEC 2020-TN6707).

Undifferentiated Tertiary sediments are present in the Congaree River valley beneath the floodplain deposits, as shown in Figure 3-2 and Figure 3-3. The Tertiary sediments are bedded sands varying from loose to clayey and compact, said to be thickest in the upper Congaree River valley and thinning toward the lower valley (Meitzen 2011-TN6678). The Tertiary sediments are absent beneath the floodplain and terrace deposits in geologic cross sections provided for the Saylors Lake quadrangle (where the southern portion of the CFFF site is located) (Shelley 2007-TN6889) and through the northern part of Congaree National Park, as shown by Graham (2014-TN6675).

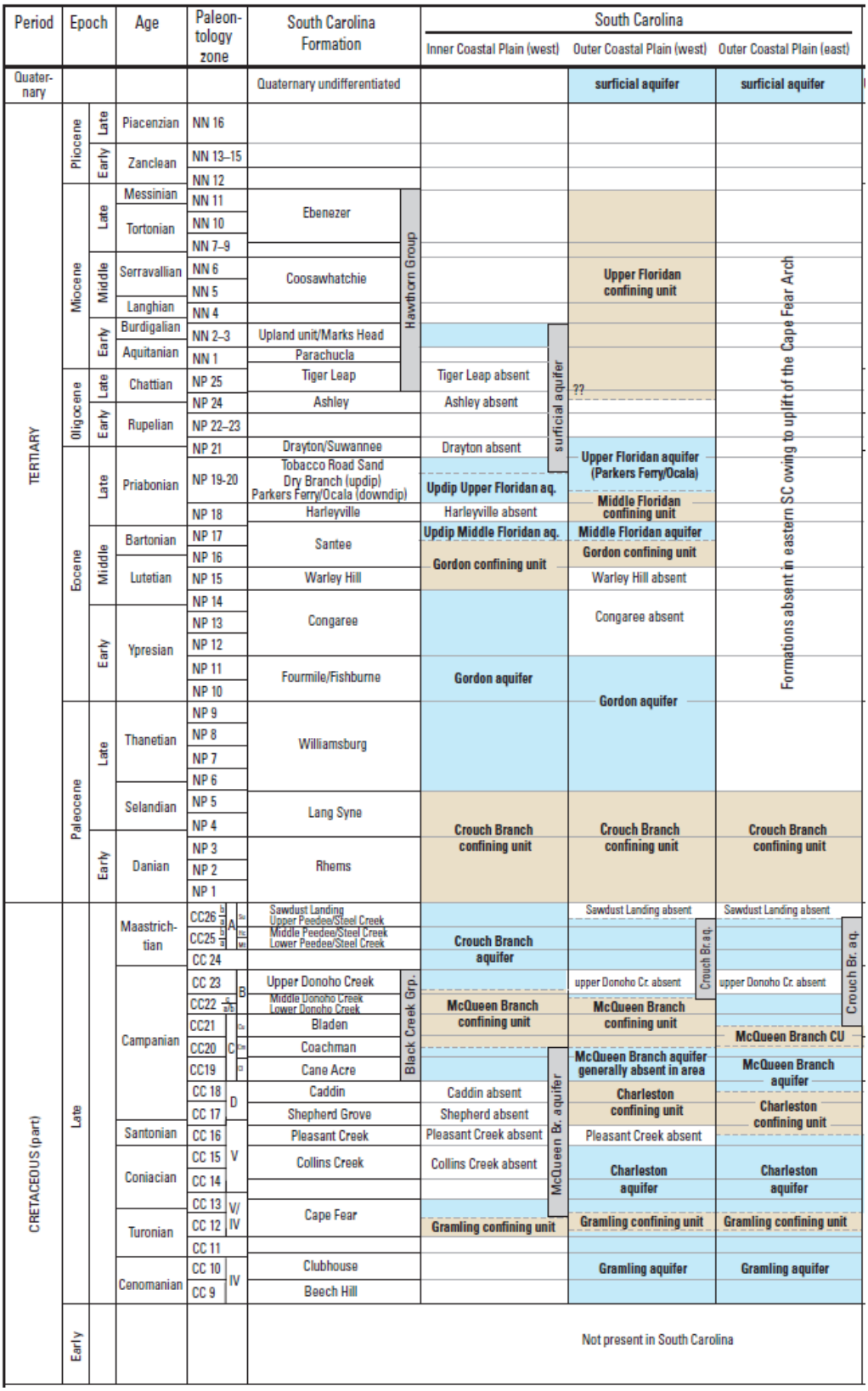

Figure 3-2 Stratigraphic Correlations of Hydrogeologic Units in South Carolina (Source: Campbell and Coes 2010-TN6672)

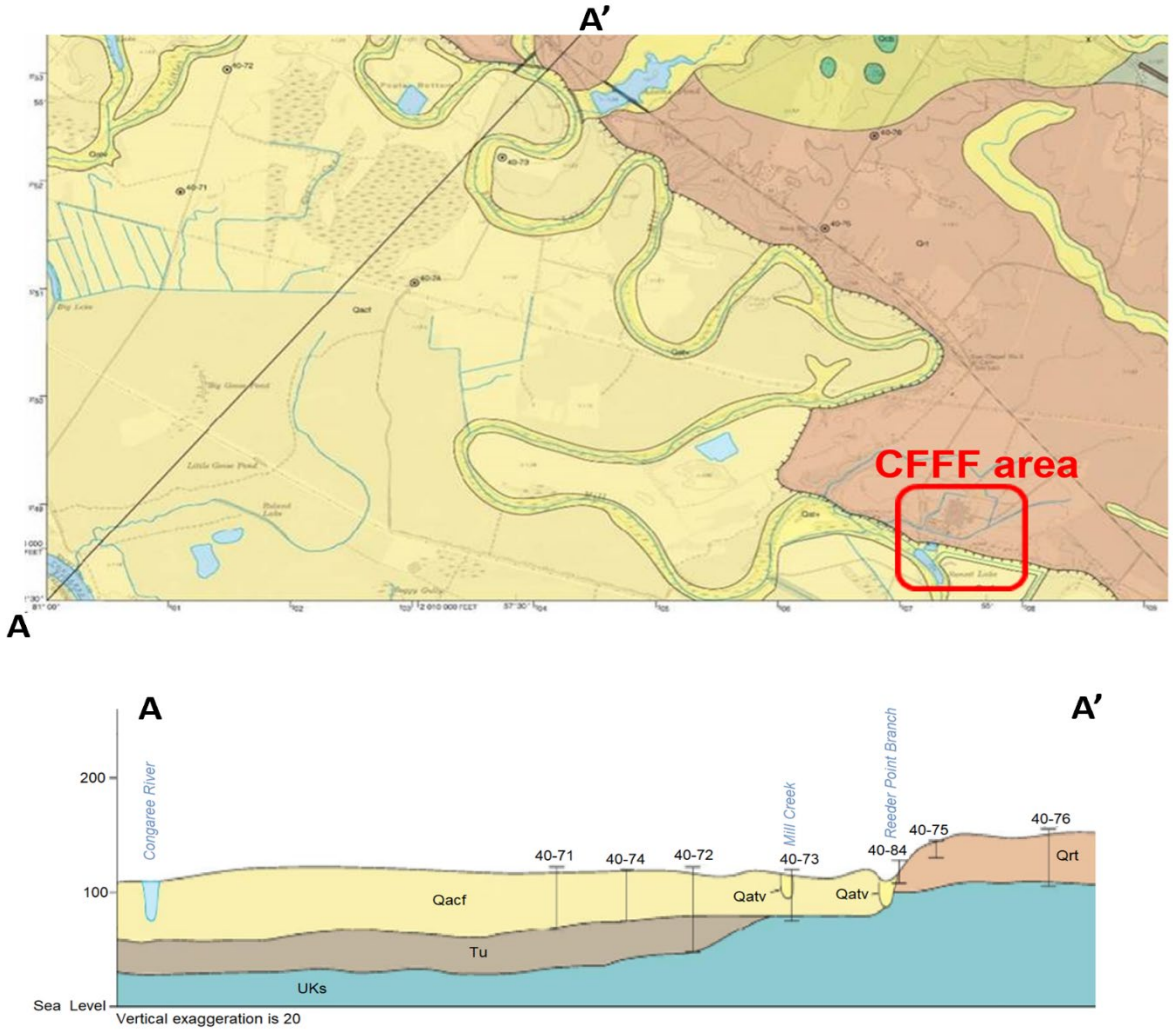

Figure 3-3 Surficial Geology of the CFFF Region: Plan View (top) and Cross Section (bottom). Note that "A" and "A'" markings are used on both maps to show where the cross section occurs on the top map. (Source: Meitzen 2011-TN6678)

Sediments at the CFFF site beneath the surficial deposits are interpreted in the WEC's CSM as being units of the Tertiary-age Black Mingo Formation, consisting of the Black Mingo (clay) confining unit and the underlying Black Mingo aquifer, both of which are stated to be continuous across the site (WEC 2019-TN6510, WEC 2020-TN6707). The thickness of the two units of the Black Mingo Formation beneath the CFFF site was previously estimated to vary between 23 and 35.5 m (75 and 100 ft) (AECOM 2013-TN5508). However, no wells or boreholes at the CFFF site penetrate to the base of this formation. Based on borehole logs from the four CFFF site wells installed in the upper part of what is referred to as the Black Mingo aquifer, the Black Mingo confining unit was stated to be 12 to 25 m (39 to 83 ft) thick at the CFFF site (WEC 2020-TN6707). However, the depth of the surficial sediments at borehole L-1 suggest that the confining unit has been eroded in this area and that the minimum confining unit thickness is less than 12 m (39 ft) at that location (WEC 2020-TN6917).

Underlying the Tertiary sediments in the area of the CFFF site are Upper Cretaceous sediments described as a cohesive matrix of clayey, silty, fine- to very coarse-grained sand by Meitzen (2011-TN6678). The basal and upper surfaces of these sediments are stated to be irregular and undulating. The Cretaceous sediments at the CFFF site are interpreted in the WEC's CSM as units of the Middendorf Formation, described as clay interbedded with fine- to coarse-grained sand, including the water-bearing Middendorf aquifer (WEC 2020-TN6707). There is usually not an apparent boundary between the Middendorf and Black Mingo Formations (AECOM 2013-TN5508). The WEC states that the Middendorf aquifer is unconformably underlain by bedrock (WEC 2020-TN6707). No wells or boreholes at the CFFF site have penetrated the Middendorf Formation sediments, although the thickness of the Cretaceous sediments at the CFFF site was reported to range from 38 to 44 m (125 to 145 ft) (WEC 2019-TN6510).

The Black Mingo Group includes the Rehms, Lang Syne, and Williamsburg formations shown in Figure 3-2, but they are eroded in the area of the Congaree River floodplain deposits according to Colquhoun (1983-TN6711). This is consistent with Graham (2014-TN6675), who showed the Lang Syne, and Congaree formations to be exposed in the southern bluffs (south of the Congaree River), but absent in the floodplain. The Tertiary-age Crouch Branch confining unit (see Figure 3-2) is shown extending into southern Richland County by Campbell and Coes (2010-TN6672) and as locally present (not continuous) in the CFFF site area by Wachob et al. (2017-TN6712). Units of the McQueen Branch and Crouch Branch aquifers are interpreted to be present in the CFFF site area by Wachob et al. (2017-TN6712), with the intervening McQueen Branch confining unit said to be thin and sandy such that the aquifers may be connected (Wachob et al. 2017-TN6712). Sediments of the Gramling confining unit overlie bedrock in the area of the CFFF site (Campbell and Coes 2010-TN6672; Wachob et al. 2017-TN6712). The elevation of the top of bedrock at the CFFF site is about 45.7 m MSL (150 ft MSL) (Newcome 2003-TN6706).

Based on the available literature and CFFF site information provided by the WEC, the NRC staff finds that the sediments identified at the CFFF site as the Black Mingo confining unit are likely to be correlated to the Crouch Branch confining unit in the hydrogeologic framework of Campbell and Coes (2010-TN6672). While this confining unit has been observed in all boreholes at the CFFF site, the lithologic characteristics and thickness of the confining unit vary, consistent with the description of these sediments in the literature. The NRC staff also finds that the underlying aquifers identified as the Black Mingo and Middendorf aquifers are correlated to the Crouch Branch and McQueen Branch aquifer units in the hydrogeologic framework of Campbell and Coes (2010-TN6672), and that these aquifers are likely to be connected with no significant confining unit separating them. The WEC will continue to refine the characterization of geologic

heterogeneities of the subsurface at the CFFF site as it continues to complete activities in the Phase II Remedial Investigation Work Plan (RIWP).

The proposed continued operation of the facility for an additional 40 years would cause no significant disturbance of the subsurface sediments at the CFFF site because the WEC is not proposing changes to its SNM-1107 license related to construction, and no offsite geological resources would be required. Therefore, the NRC staff concludes that direct and indirect impacts on geological resources resulting from the proposed action would be SMALL. In addition, because the proposed continued operation of the CFFF for an additional 40 years would not require the use of any offsite geological resources, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact from the proposed action (see Appendix B for additional information).

3.2.3 Seismology

Based on the U.S. Geological Survey (USGS) database (USGS 2021-TN6951), between 1900 and 2020, 389 historical earthquakes occurred in the South Carolina Region, which includes South Carolina and parts of North Carolina and Georgia (Figure 3-4). Of those, 384 earthquakes had a magnitude less than 3 on the Richter scale, 36 earthquakes had magnitudes between 3 and 4, and 11 earthquakes had magnitudes between 4 and 5 (Figure 3-5, USGS 2021-TN6951). The earthquake epicenter closest to the WEC site was located approximately 2 km (1.25 mi) south of the property. That earthquake occurred on May 24, 2007, at a depth of approximately 10 km (6 mi), and had a magnitude of 2.4 (USGS 2021-TN6951).

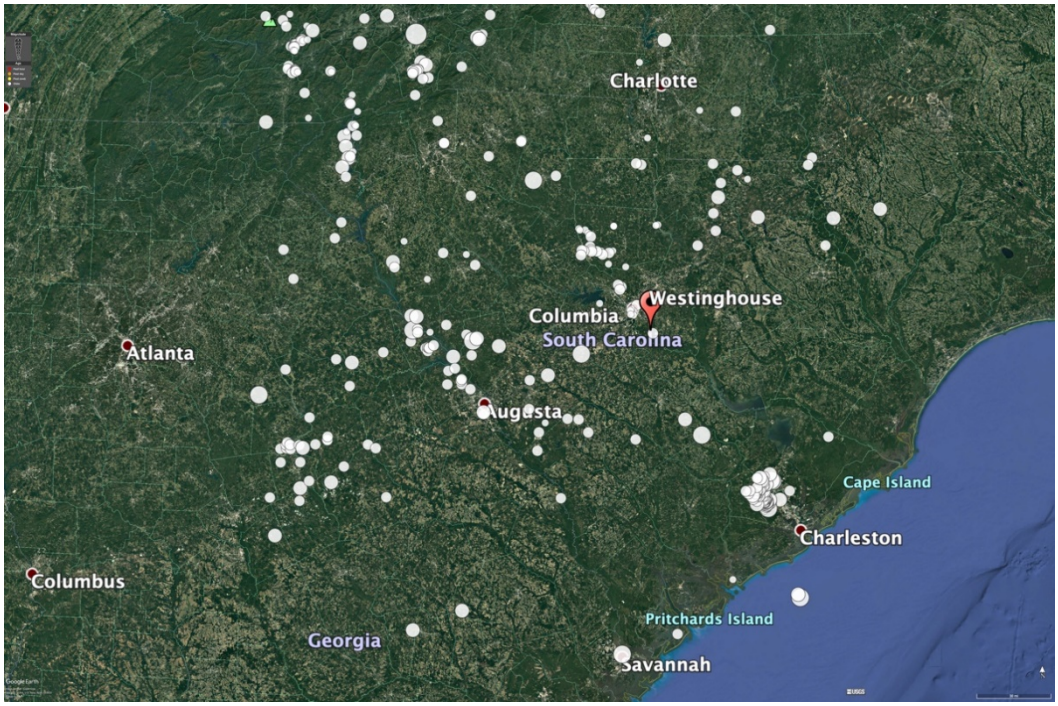

Figure 3-4 Location Map of Earthquake Epicenters for Earthquakes between 1900 and September 1, 2020, for the South Carolina Region (Source: USGS 2021-TN6951)

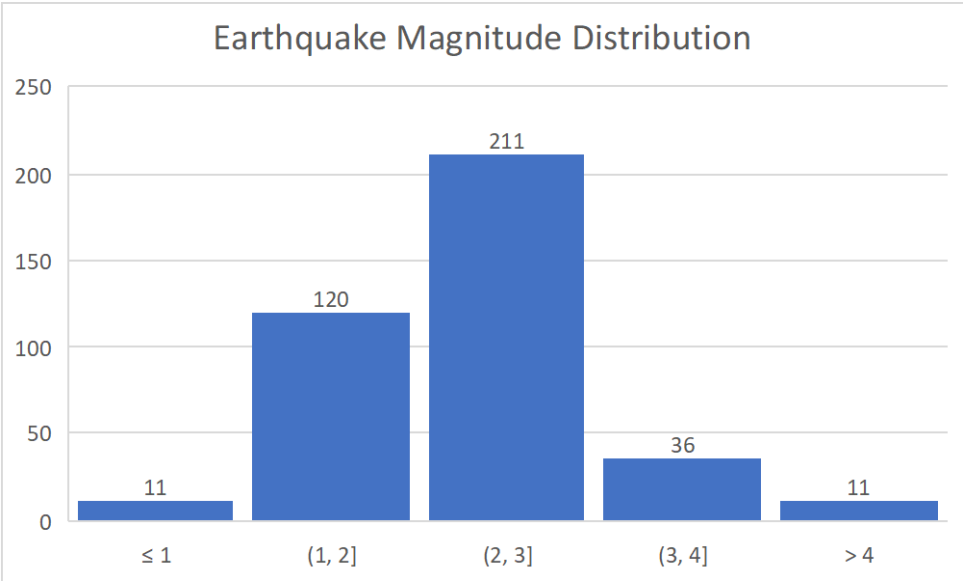

Figure 3-5 Magnitude Distribution for Earthquakes between 1900 and September 1, 2020, for the South Carolina Region (Source: USGS 2021-TN6951)

Earthquakes with magnitudes less than 3 are generally not felt by most people. Earthquakes with magnitudes between 3 and 5 are felt with negligible to slight damage (e.g., damaged chimneys). Generally, earthquakes with magnitudes greater than 6 result in considerable damage.

The NRC staff's research found that the region's largest magnitude earthquake occurred in the Charleston area prior to 1900, on August 31, 1886 (WEC 2019-TN6510; Greene and Gori 1982-TN6890; Bollinger 1972-TN6892). Based on the reported damage, the intensity near the epicenter is estimated to have been an intensity "X" on the Modified Mercalli Intensity Scale and an estimated magnitude between 7.1 and 7.3 by comparison to similarly intense earthquakes with measured magnitudes (Bollinger 1972-TN6892). It is thought that this earthquake was the largest along the eastern coast of North America during the recorded history timeframe. Extreme shaking would be felt for an earthquake of intensity "X," which would cause some well-built wooden structures to be destroyed and most masonry and frame structures to be destroyed, including foundations (USGS 2021-TN6933).

The intensity or peak ground acceleration reflect the greatest hazard associated with earthquakes. The peak horizontal acceleration is commonly used when estimating seismic hazards and developing building codes. Based on published USGS mapping, the estimated peak ground acceleration at the CFFF site with a 2 percent probability of exceedance in 50 years is 20 to 30 percent of gravity (USGS 2014-TN6891). Such a peak ground acceleration would correspond to an intensity of VII on the Modified Mercalli Intensity Scale for which very strong shaking would be felt and the potential for damage would be negligible for buildings constructed of good design and construction, slight to moderate for well-built ordinary structures, and considerable for poorly built structures (USGS 2021-TN6933).

3.2.4 Soils and Soils Impacts

Mapped soil series[2] on and around the CFFF site are shown in the Custom Soil Resource Report for Richland County report (NRCS 2021-TN6949). The soil series that have been directly affected by the CFFF itself, or that may be directly affected by operations (e.g., spills, releases), include the Orangeburg-Urban land complex and the Goldsboro sandy loam series. The Orangeburg-Urban land complex series reflects the artificial fill that was brought to the area to construct the facility. It is estimated that the maximum thickness of these soils is on the order of 1.2 m (4 ft). The Goldsboro loamy sand series is less likely to be affected because of the minimum development in the area west of the main facility. Approximately three-fourths of the area shown in Figure 3-6 is covered by soils classified as farmland. The Persanti very fine sandy loam unit composes the largest area of prime farmland (16.6% of the area shown). Other map units classified as prime farmland include the Orangeburg loamy sand, Goldsboro, Faceville sandy loam, and Dothan loamy sand units, which collectively occupy only 2% of the area shown in Figure 3-6. The Congaree, Chewacla, and Toccoa loam units (collectively 38.8% of the area shown) are classified as prime farmland if drained and either protected from flooding or not frequently flooded during the growing season. The Smithboro loam, Cantey loam, and Coxville fine sandy loam units are classified as farmland of statewide importance. These units are collectively 15.7% of the area shown in Figure 3-6.

Biannual soil sampling conducted as part of the environmental monitoring program shows low radionuclide levels around the site (see Figure 2-7 for soil-sampling locations under the license) (WEC 2019-TN6423). Total uranium activities at the four soil-sampling stations varied from 0.6 to 3.8 picocuries per gram (pCi/g) during the period from 2007 to 2018, below the 10 pCi/g investigation level (WEC 2019-TN6423). Concentration of gross alpha was less than about 30 pCi/g with the exception of two samples (39 pCi/g in 2013 and 37 pCi/g in 2017). Concentration of gross beta was less than about 40 pCi/g with the exception of one sample (68 pCi/g in 2013). No investigation levels were provided for gross alpha and beta concentrations. There were no apparent trends in any of the reported soil quality data during this time period (2007 to 2018) (WEC 2019-TN6423).

Historical operations at the facility have affected the subsoils, primarily within the Orangeburg-Urban land complex and underlying strata. The impacts on the subsurface from operations extend back to 1972 and include both radiological and nonradiological constituents (AECOM 2013-TN5508; WEC 2020-TN6526). Past NRC environmental reviews conducted for the previous WEC license renewals have determined that the impact on the subsurface was not significant (NRC 1977-TN6547, NRC 1985-TN5602, NRC 1995-TN5600, NRC 2007-TN5598). The historical constituents of concern (COCs) released to the soils or the subsurface are nitrate; fluoride; gross alpha (as a surrogate for uranium); gross beta (as a surrogate for technetium-99 [Tc-99]); volatile organic compounds (VOCs), primarily perchloroethylene (PCE), trichloroethene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), and vinyl chloride (VC) (WEC 2019-TN6510); and ammonia, which at least historically is related to the 1980 fish kill in Gator Pond (NRC 1985-TN5602). The findings for the previous NRC environmental reviews were based, in part, on low levels of COCs in soils outside of the building footprint and changes in facility operations that prevented or minimized releases (e.g., changes in the storage of materials containing contaminants).

[2] A soil series is a classification of soils with common properties, distinguishable from other soil series.

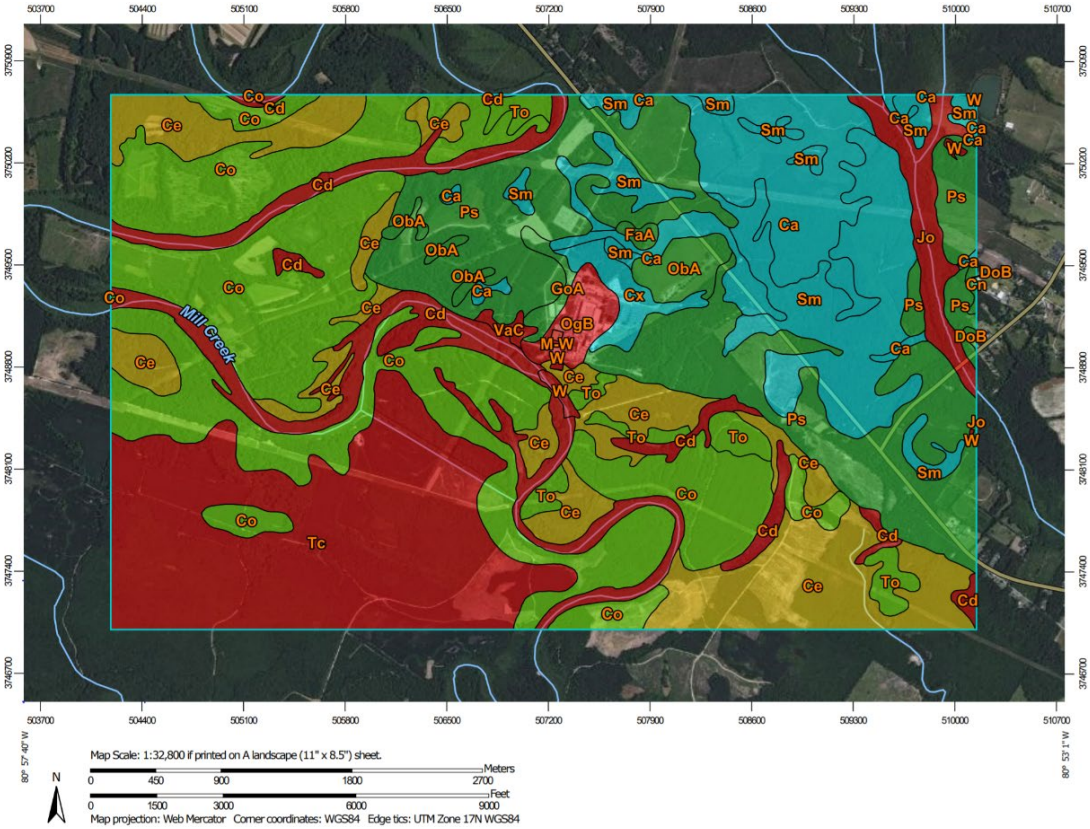

Figure 3-6 Mapped Soil Series in the Vicinity of the CFFF. Soil map unit symbols are Orangeburg-Urban land complex (OgB), Goldsboro sandy loam (GoA), Persanti very fine sandy loam (Ps), Orangeburg loamy sand (Oba), Faceville sandy loam (FaA), Dothan loamy sand (DoB), Congaree loam (Co), Chewacla loam (Ce), Toccoa loam (To), Smithboro loam (Sm), Cantey loam (Ca), and Coxville fine sandy loam (Cx). (Source: NRCS 2021-TN6949)

Since the last environmental assessment (EA) was prepared in 2007, several facility events have affected the existing soil quality or the quality of shallow sediments. Descriptions of these events are included in Section 2.1.3 of this EIS. These events include leaks from the contaminated wastewater (CWW) line, a cylinder recertification transfer line leak, the Hydrofluoric Acid Spiking Station (HFSS) #2 leak, and leaks from intermodal (sea-land) containers in the Southern Storage Area Operable Unit. These contaminant releases have all occurred at locations near or inside the plant. For these incidents, the WEC stated that soils that required immediate remediation based on their criteria were removed (WEC 2019-TN6510). The criteria for immediate remediation were based on impacts on workers or industrial standards and not necessarily NRC's unrestricted use regulations at 10 CFR 20.1402 (TN283). In addition, if access to the soils was limited (i.e., under the building or adjacent to underground piping), the WEC deferred remediation until decommissioning, which is acceptable to the NRC, provided adequate funding for that remediation is included in the Decommissioning Funding Plan (DFP).[3]

[3] The WEC submitted its 2019 DFP and updated it to reflect recent environmental investigations (WEC 2019-TN6926). The NRC considered the current state of site contamination and expected remediation that the WEC would implement when reviewing the DFP for approval. The NRC staff approved the revised plan in August 2020 and amended the license accordingly (NRC 2020-TN7002).

The WEC contends that deferring the cleanup of residual subsurface soil impacts does not pose a risk of offsite impacts based on contaminant levels observed in groundwater at the nearby wells and continued groundwater monitoring (WEC 2019-TN6510).

Data about the contaminants in the unsaturated sediments between the surface soils and the surficial aquifer are limited. Identified contamination incidents at the CFFF site have resulted in contaminants being released to the surface soils or to near-surface sediments. Contaminants that have reached the groundwater have clearly been transported through the unsaturated zone sediments. Any contaminants remaining in the unsaturated sediments provide a potential source for groundwater contamination. As part of the remedial investigation process under the CA, the WEC recently completed soil sampling around the CFFF site to evaluate the presence of potential Tc-99 sources (WEC 2020-TN6526). Samples were obtained from the surface to a depth of 2 m (7 ft) at 14 locations. One sample (21.6 pCi/g) exceeded the residential screening level (19 pCi/g) for Tc-99 activity. These results do not provide any indication of a significant Tc-99 source in the soils and shallow sediments at the CFFF site; however, the source of the Tc-99 contamination is unknown. The WEC is completing a shallow soil gas survey and soil sampling as part of the remedial investigation process to evaluate the continuing presence of a VOC source in the unsaturated sediments west of the main plant building and in the Western Groundwater Area of Concern (AOC) (WEC 2020-TN6707). Soil samples will be collected based on the results of the soil gas survey from the surface to depths up to 5.2 m (17 ft). Soil sampling is planned along the southern edges of the Sanitary and East Lagoons and will be evaluated for potential Tc-99 contamination (WEC 2020-TN6707).

The history of operations at the CFFF indicate that some soils near the plant buildings have been contaminated, and past and ongoing remediation efforts have been directed at removing soils contaminated above action levels. Soils away from the operational areas have been only minimally affected to date. The NRC staff expect that any potential future releases of contaminants would similarly affect soils near the plant. In addition, there would be no significant disturbance of the soils at the CFFF site from the proposed continued operation of the facility for an additional 40 years. Therefore, the NRC staff concludes that direct and indirect impacts on soil resources resulting from the proposed action would be SMALL. Additionally, because the proposed continued operation of the CFFF for an additional 40 years would not significantly affect onsite or offsite soils, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.2.5 Mitigation Measures

As described above, impacts on geology and soils resulting from the proposed action are expected to be SMALL and localized to those soils near the plant buildings. Soil sampling for radionuclide contamination is expected to continue under the CA with the SCDHEC and as part of the environmental monitoring program under the proposed license renewal. Remediation efforts under the CA are expected to disturb surface soils only near the plant buildings. No additional mitigation measures have been identified beyond the remedial investigations the WEC is conducting under the CA and the new license conditions (WEC 2021-TN7042). Under the new license, if renewed, the WEC would be required to submit its environmental sampling and monitoring program to the NRC for review and approval upon either SCDHEC's approval of the Remedial Investigation Report, as required by the CA (SCDHEC/WEC 2019-TN6554), or within 5 years of the license renewal (whichever comes first). The WEC would also be required to enter exceedances of Federal and State standards into its CAP. Additionally, the WEC has committed to submit the environmental monitoring and sampling program to the NRC for review

and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC (WEC 2021-TN7042). The WEC's additional commitments in its LRA address (i) the use of the CSM in informing decisions about the environmental monitoring program and maintaining the CSM (procedure RA-435); (ii) establishing and maintaining remediation procedure RA-433, which is used to prevent migration of licensed material and/or contamination off-site and inform decisions about remediation; and (iii) establishing and maintaining environmental data management procedure RA-434, which is used to manage the site's environmental data and assess potential trends within the environmental monitoring program (WEC 2021-TN7042).

3.3 Surface Water Resources

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on surface water resources from the proposed action.

The Congaree River is the principal surface water body draining the watershed in which the facility is located. At its closest point, the Congaree River is approximately 5 km (3 mi) southwest of the main manufacturing facility. The Congaree River is formed by the confluence of the Broad and Saluda Rivers upstream in Columbia, South Carolina. Flow in the Congaree River depends on inflows from the Broad and Saluda River Basins. Flow in the Broad River is regulated by the Parr Shoals Dam and Saluda River flow is regulated by the Lake Murray Dam (NRC 2007-TN5598). The annual average flow of the Congaree River at the Columbia gage (USGS 02169500) is 7,600 cubic feet per second (cfs) for the period from 1990 to 2019 (USGS 2020-TN6676). The average monthly flow varies throughout the year, from 12,000 cfs in March to 4,600 cfs in September, averaged over the period from 1990 to 2020. During the same period, the maximum monthly flow of 33,360 cfs occurred in March 2020 and the minimum monthly flow of 1,085 cfs occurred in October 2007.

The CFFF site is located within the flood basin of the Congaree River (see Figure 3-7). The flood stage for the Congaree River at the Carolina Eastman gauging station (located east of the CFFF site) is 35 m (115 ft) MSL. Flooding occurs when the river level rises above the flood stage and backs up water in the floodplains (WEC 2014-TN6420). Major flood stage at the Carolina Eastman gauge is 38 m (126 ft) NGVD29 (National Geodetic Vertical Datum of 1929), which has been exceeded five times since 1975, most recently in February 2020 (NWS 2020-TN6677). The southern, undeveloped portion of the CFFF site lies on Congaree River floodplain deposits at an elevation of about 34 m (110 ft) MSL and is within the designated flood zone. The developed portion of the CFFF site is above a bluff at an elevation of about 44 m (140 ft) MSL and lies on older terrace deposits (Meitzen 2011-TN6678). Flooding is possible at any time of the year, but on the Congaree River is most likely to occur from June through October due to tropical hurricanes (Richland County 2020-TN6679).

Other surface waters in the CFFF site area include Adams Pond, approximately 5 km (3 mi) to the northwest; Roundabout Lake, approximately 3 km (2 mi) south; Goose Pond, approximately 5 km (3 mi) to the southeast, and Myers Creek, approximately 3 km (2 mi) to the east (NRC 2007-TN5598).

Several surface water bodies within the CFFF site boundary are in the undeveloped portion of the site (Figure 3-8). Mill Creek meanders across the Congaree River floodplain and crosses the CFFF site below the bluff where it forms Sunset Lake as a result of dikes constructed across the creek. Downstream of the Sunset Lake dikes, Mill Creek continues to flow through the

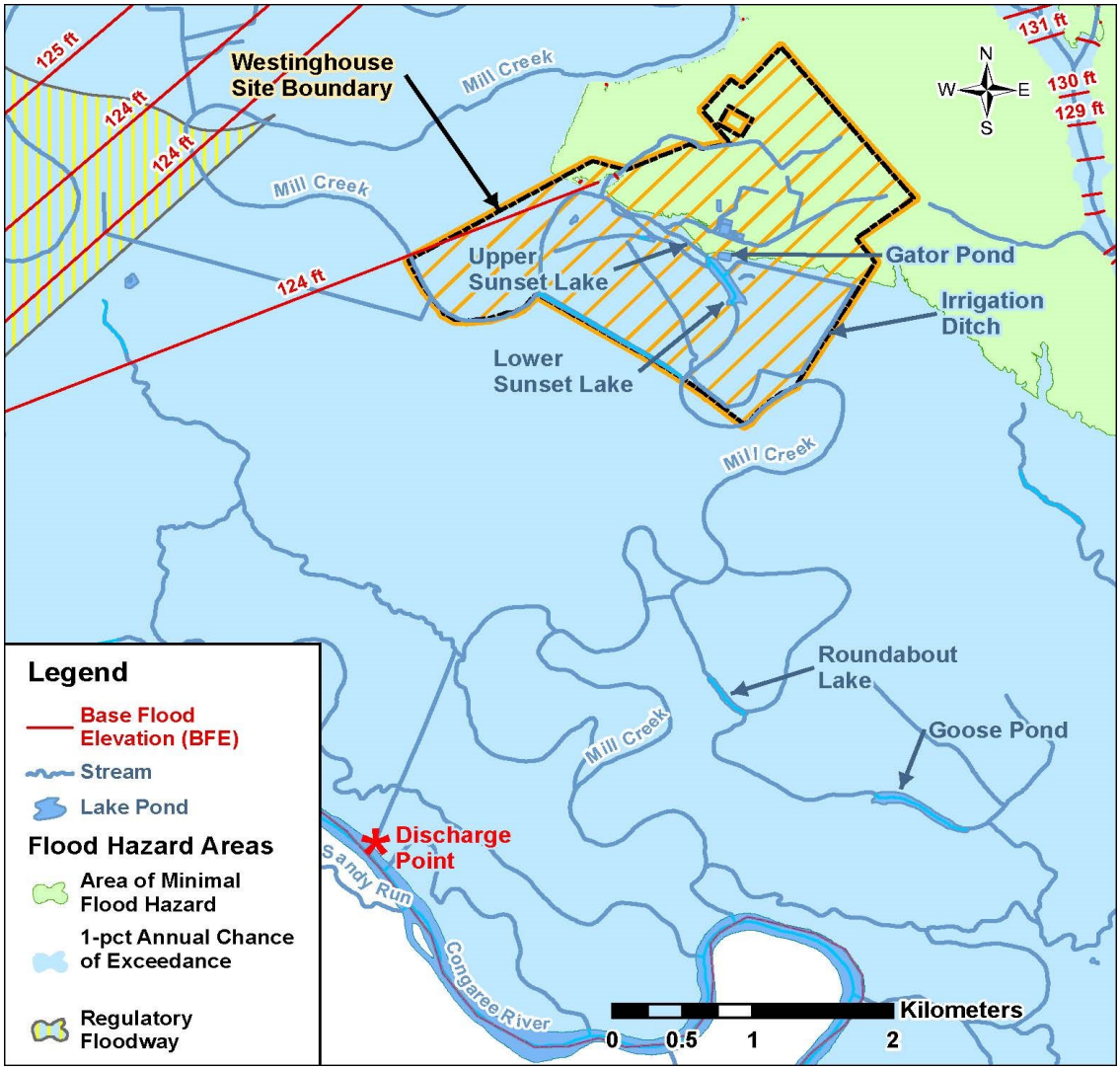

Figure 3-7 Congaree River Flood Hazard Areas (NRC 2019-TN6472)

Congaree floodplain, ultimately discharging to the Congaree River about 4.8 km (3 mi) south of the site (AECOM 2013-TN5508; NRC 2007-TN5598). A portion of Mill Creek flow is diverted at the point where it enters the CFFF site by a canal located along the southwestern site boundary (see Figure 3-8). Flow in the canal discharges to Mill Creek at the point where the creek leaves the CFFF site downstream of Sunset Lake and the exit dike (Figure 3-8). The presence of the canal reduces the flow of Mill Creek into Sunset Lake.

Sunset Lake is a shallow impoundment within the Mill Creek channel created by the pre-1950s construction of a man-made earthen berm across the channel. The upstream portion of this lake (Upper Sunset Lake) is now a swampy area; about 3.24 ha (8 ac) of the lower portion (Lower Sunset Lake) is still present as open water (WEC 2019-TN6510). Both lake portions were formed when dikes were placed across Mill Creek and are 1.5–2 m (5–6 ft) deep (WEC 2020-TN6526). Water from Lower Sunset Lake may have been diverted at one point to irrigate the area to the southeast of the plant site, where remnants of an irrigation ditch still exist today (WEC 2020-TN6707, Figure 2). The irrigation ditch rejoins Mill Creek near the point where the creek crosses the CFFF property line.

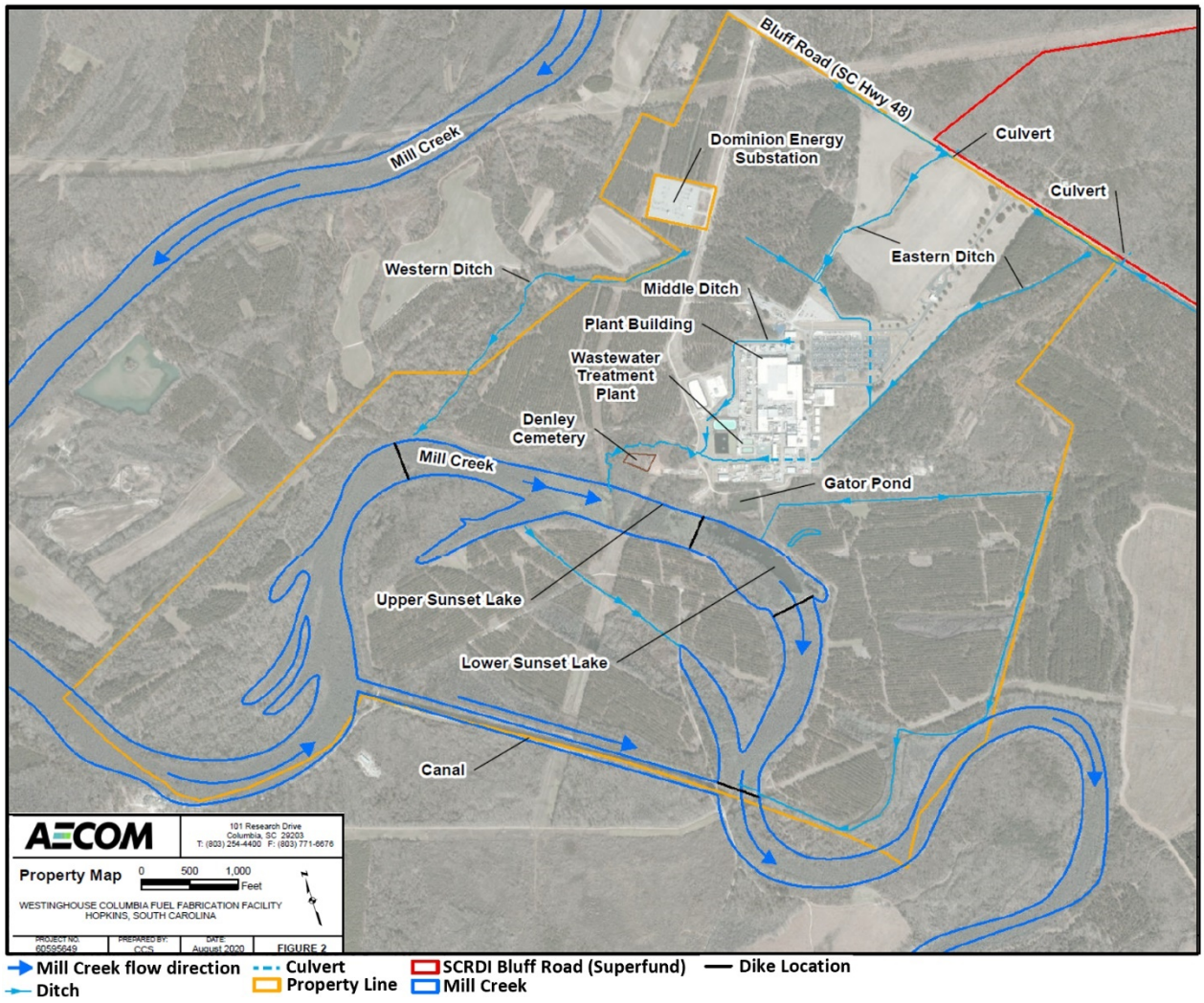

Figure 3-8 Onsite Surface Water Bodies (Source: modified from WEC 2020-TN6707)

A man-made pond (commonly referred to as Gator Pond) is located adjacent to the bluff, 152 m (500 ft) southwest of the wastewater treatment plant (WWTP). The elevation of the pond is about 37 m (120 ft) MSL, which is about 3 m (10 ft) above Sunset Lake lying immediately to the south (WEC 2020-TN6707). Gator Pond is fed by a natural spring, the source of which is likely the shallow groundwater directly beneath the plant site. The pond is about 2.6 m (8.5 ft) deep (WEC 2020-TN6526). Gator Pond discharges to groundwater or spills over into Lower Sunset Lake during periods of high precipitation (WEC 2020-TN6707). Gator Pond existed prior to construction of the CFFF (AECOM 2013-TN5508).

Surface runoff from the higher elevation portion of the CFFF site moves either through overland flow or through a stormwater drainage system of ditches and culverts that ultimately discharge into Sunset Lake (Figure 3-9, in Section 3.3.1.1). Drainage in the eastern and middle ditches converges west of the Sanitary Lagoon and then flows to the west, discharging through the single stormwater outfall (“C” valve) into the Upper Sunset Lake portion of Mill Creek. The stormwater drainage ditches may also interact with groundwater, discharging to the shallow groundwater where the elevation of the bottom of the ditch is above the water table and serves as a groundwater drain where (or when) the water table rises above the bottom of the ditch.

Other significant surface water and groundwater interaction may occur within the plant site (e.g., via seepage from the bluff face, and through potential seasonal variation of the groundwater table in the floodplain surrounding Sunset Lake and Mill Creek).

3.3.1 Surface Water Use and Quality

In 2015, 93 percent of the public water supply in Calhoun, Lexington, and Richland Counties was derived from surface water sources (Dieter et al. 2018-TN6681). Water for CFFF operations comes from the City of Columbia, which obtains water from Murray Lake on the Saluda River and from an intake on the Broad River near the confluence with the Saluda River that forms the Congaree River (SCDHEC 2020-TN6690). The CFFF consumes 4.4×10^7 gallons of water per year (about 0.12 million gallons per day [Mgd]) for potable and process uses, based on the average rates from 2014 to 2018 (WEC 2019-TN6510). Other major industrial water users within the Congaree watershed include DAK Americas (which withdraws water from the Congaree River upstream from the CFFF discharge), Nephron Pharmaceuticals, and Devro (WEC 2019-TN6510). Municipal users also include the City of Cayce and East Richland County Public Service District Gills Creek Plant. The CFFF does not use any water from Mill Creek, Sunset Lake, or Gator Pond.

The following subsections discuss the quality of the Congaree River and the surface water onsite based on recent sampling results. Section 2.2.2 describes the monitoring and sampling program the WEC has in place for surface water onsite and within the Congaree River. Water quality standards are defined in State regulations R.61-68, “Water Classifications and Standards” (SCDHEC 2014-TN6986). The Congaree River and Mill Creek are classified for freshwater uses in R.61-69, “Classified Waters” (SCDHEC 2012-TN6987). The section of the Congaree River from the confluence with Congaree Creek below Cayce, South Carolina, to the confluence with the Wateree River (below Congaree National Park) is listed in the Nationwide Rivers Inventory for its cultural, fish, geologic, historic, recreational, scenic, and wildlife values (NPS 2016-TN6705, NPS 2019-TN6579). The river is popular for recreational floating activities and as a fishery. Under the Wild and Scenic Rivers Act Section 5(d)(1) and related guidance, all Federal agencies must seek to avoid or mitigate actions that would adversely affect river segments listed in the Nationwide Rivers Inventory.

3.3.1.1 Congaree River

Section 2.2.2.1.1 describes the liquid effluents management program at the CFFF site. The CFFF discharges its liquid effluent directly into the Congaree River under its National Pollutant Discharge Elimination System (NPDES) permit (Permit No. SC0001848 [SCDHEC 2017-TN5607], currently in the renewal process). Average CFFF discharge was 378,541 liters per day (L/d) (100,000 gallons per day [gpd], or 0.15 cfs) during the period from 2007 to 2017 (WEC 2019-TN6510). This discharge rate is less than 0.015 percent of the minimum monthly Congaree River flow observed during the period from 1990 to 2020 (1,085 cfs in October 2007). A discharge that is a small fraction of river flow can be more easily diluted in the bulk flow of the river. There are no permitted withdrawals from the Congaree River downstream from the CFFF discharge (SCDHEC 2020-TN6690).

Within the Mill Creek portion of the Congaree River Basin, there are naturally low pH conditions, decreasing trends in total phosphorus concentrations, and upward trends for dissolved oxygen (SCDHEC 2011-TN6708). The portion of the Congaree River that flows through Columbia is impaired for recreational use due to reported *Escherichia coli* (*E. coli*) contamination and for fish consumption due to mercury contamination (SCDHEC 2018-TN6691). Downstream from the

CFFF discharge, the Congaree River is impaired for aquatic life use due to copper contamination (at the Devro-Teepak discharge outfall location) and for fish consumption due to mercury contamination (at U.S. Highway [Hwy] 601, downstream of Congaree National Park) (SCDHEC 2020-TN6690). Reeder Point Branch (a tributary to Mill Creek) is impaired for recreational use due to *E. coli* contamination at the Bluff Road (SC 48) location (SCDHEC 2018-TN6691).

As described in Section 2.2.2.2 of this EIS, the WEC has an NPDES permit from SCDHEC to discharge to the Congaree River, and the permit imposes effluent limitations and monitoring requirements upon the WEC. The WEC must ensure the CFFF's liquid discharge meets the NRC's 10 CFR Part 20 (TN283) effluent limits for radiological components. In 2020, the measured uranium released to the Congaree River was 3.8 millicuries with an average discharge since 2015 of 3.9 millicuries per year (mCi/yr). Since 2007, the amount of uranium released to the river has decreased (see Table 2-2 and Figure 3-9). The WEC began monitoring for Tc-99 in its liquid effluent starting in 2010, with detected levels generally decreasing over time, from 19.2 mCi in 2010 to 5.8 mCi in 2020, as shown in Figure 3-9. The average Tc-99 discharge since 2015 is 4.9 mCi/yr.

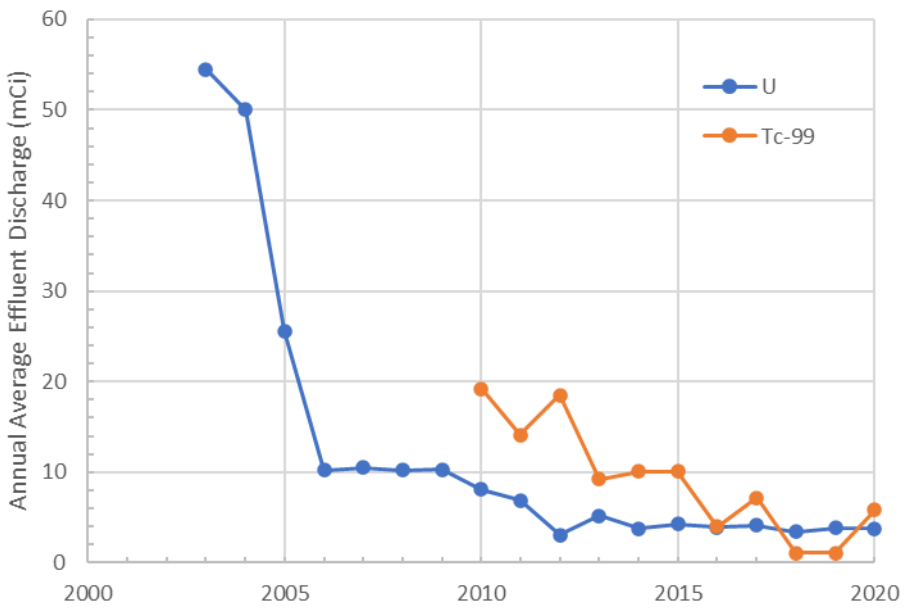

Figure 3-9 Annual Average Uranium and Technetium-99 Discharged to the Congaree River in CFFF Effluents (Sources: WEC 2019-TN6510, WEC 2020-TN6911, WEC 2020-TN6912, WEC 2021-TN6904)

Water samples collected from the Congaree River between 2010 and 2018, as part of the WEC's environmental monitoring program required by its NRC license, show gross alpha activities were less than 10 pCi/L, as shown in Figure 3-10 (WEC 2019-TN6423). These results are lower than the site's internal investigation level of 15 pCi/L, which initiates uranium speciation.

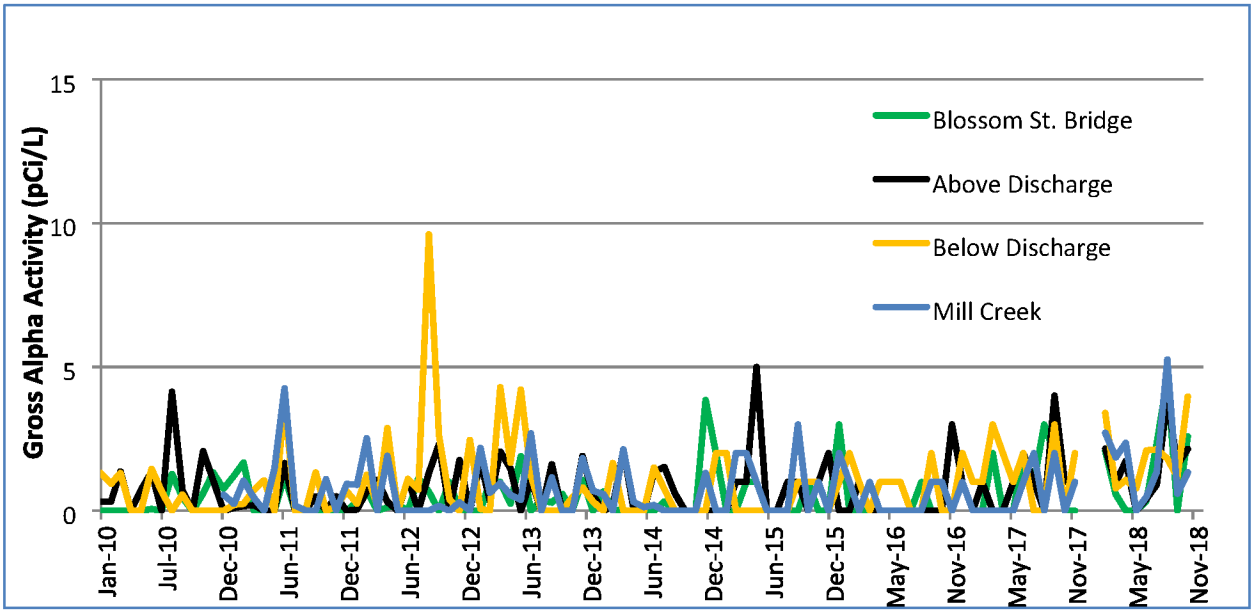

Figure 3-10 Gross Alpha Results for Congaree River Samples (Source: data from WEC 2019-TN6423)

Annual sediment samples taken from the Congaree River from 2007 to 2018 show uranium levels were below 4 pCi/g. During the same time period, gross alpha results ranged from 3 to 17 pCi/g, while gross beta results varied from 13 to 81 pCi/g (WEC 2019-TN6423). Tc-99 at a level greater than zero was measured in two sediment samples with a peak activity of 1.3 pCi/g (WEC 2019-TN6423). There are no regulatory limits for sediments, but these Congaree River sediment activities are less than the residential use screening level (RUSL) values for uranium isotopes (8 to 14 pCi/g) and Tc-99 (19 pCi/g).

Fish samples collected from 2007 to 2018 show uranium concentrations less than 1 pCi/g. During the same time period, gross alpha results in fish samples were less than 6 pCi/g, while gross beta counts in fish samples ranged from 8 to 65 pCi/g (WEC 2019-TN6423). Fish were not consistently analyzed for Tc-99 because they did not exceed the investigation level of 50 pCi/g. When Tc-99 was analyzed, the values ranged from 0.0 to 3.1 pCi/g (WEC 2019-TN6423). The results of a recent fish tissue study conducted near the Congaree River discharge location, described in more detail in Section 3.5.2.2, concluded that neither uranium nor fluoride were detected at levels of concern for fish consumption (SCDHEC 2020-TN6536).

3.3.1.2 Onsite Surface Water and Floodplains

The CFFF operates under a NPDES industrial stormwater general permit for stormwater discharges (Permit No. SCR003391), which requires implementation of a Storm Water Pollution Prevention Plan (WEC 2019-TN6510). Stormwater on the CFFF site is collected in a set of surface ditches that eventually discharge into the Upper Sunset Lake portion of Mill Creek (see Figure 3-8). Stormwater on the developed portion of the site is routed via the eastern and middle ditches to a common location (the “C” control valve location) at which stormwater is sampled monthly for radiological and chemical monitoring (WEC 2019-TN6510). No process wastewaters are discharged to storm drains (WEC 2019-TN6510).

Onsite surface water has been contaminated with radiological and nonradiological constituents: VOCs, gross alpha, gross beta, fluoride, nitrate, and ammonia. As described above, the shallow groundwater interacts with the ditches so that water may flow to or from the ditches depending on the relative elevations of the groundwater table and the bottom of the ditches. In the area near the bluff where the groundwater table is likely to intersect with the ditch, contaminants previously released into or retained in the shallow groundwater may discharge into the ditch and migrate through the ditch system, subsequently entering Sunset Lake. Similarly, Gator Pond is spring fed, and the source of the spring or seepage is through the bluff surface derived from the shallow groundwater. Therefore, contaminants found in Gator Pond could also be those previously released into or retained in the shallow aquifer (AECOM 2013-TN5508).

In December 2008 and March 2009, the WEC collected samples at 10 surface water locations within Upper and Lower Sunset Lakes, Gator Pond, and onsite drainage ditches as part of a site investigation (AECOM 2013-TN5508). Results from the Gator Pond sample location (SW-10) indicated levels of gross beta, fluoride, and nitrate above or at the respective MCLs. Gross alpha was observed to be above the 15 pCi/L investigation level in samples from the middle ditch (see Figure 3-8 for the location of the middle ditch). Fluoride was above the 4 mg/L MCL in the Upper and Lower Sunset Lakes samples and in drainage ditch samples collected between the “C” control valve location and Upper Sunset Lake. Nitrate exceeded the 10 mg/L MCL in Gator Pond (all results are from Table 4-6, AECOM 2013-TN5508).

Monthly surface water samples taken as part of the WEC’s environmental monitoring program between 2010 and 2018 were analyzed for gross alpha and gross beta. The results show that gross alpha was below the 15 pCi/L investigation level for all sampling locations except for some of the “roadway” samples collected at the drainage ditch connection (“C” valve) (11 samples in 2012 to 2014 and one sample in 2016 exceeded 15 pCi/L) and one sample in 2015 at the “exit” location on Mill Creek. During the period from 2010 to 2018, gross beta exceeded 50 pCi/L in one sample at the “roadway” location, one sample at the “exit” location, and two samples at Gator Pond. Gross beta levels in Gator Pond generally increased over this time period (see Figure 3-11), and are attributed primarily to the presence of Tc-99 (see Section 3.4.1.2.2). With the exception of the March 2015 sample, there was minimal difference between gross alpha and gross beta at the Mill Creek “exit” location and the values observed at the “entrance” location in Upper Sunset Lake (WEC 2019-TN6423). These gross alpha and beta monitoring data suggest that radionuclide releases from CFFF operations did not have a noticeable effect on Mill Creek water quality during the period 2010 to 2018.

More recent surface water quality results were reported by the WEC for samples obtained in 2019 at 12 locations on the CFFF site, including ditch locations, Sunset Lake locations (Upper and Lower lake areas), and Gator Pond (WEC 2020-TN6526). Analysis results for Tc-99, uranium isotopes, fluoride, nitrate, ammonia, antimony, and a set of VOCs were reported. MCLs were exceeded for fluoride in the Gator Pond sample and for TCE at two ditch locations below the drainage ditch connection (“C” valve) location. Uranium was detected in all but one sample and had a maximum concentration of less than 4 percent of the 30 μg/L MCL. The largest nitrate concentration (7.3 mg/L) was observed in Gator Pond. Tc-99 was not detected above the minimum detectable concentration (50 pCi/L) in any samples.

Onsite groundwater contamination is likely to be a source of contaminants detected in Gator Pond and in the lower elevation ditch locations. This indicates that onsite groundwater has the potential to more generally affect surface water quality in the wetlands and floodplain within and surrounding the western and southern portions of the CFFF site. As noted above, water may be exchanged between the surface water bodies and the groundwater depending on the relative

elevations of the shallow groundwater and the connected surface water bodies (wetlands, ponds, and creeks in the Congaree River floodplain). Additional discussion of these issues can be found in the groundwater resources section of this EIS (Section 3.4).

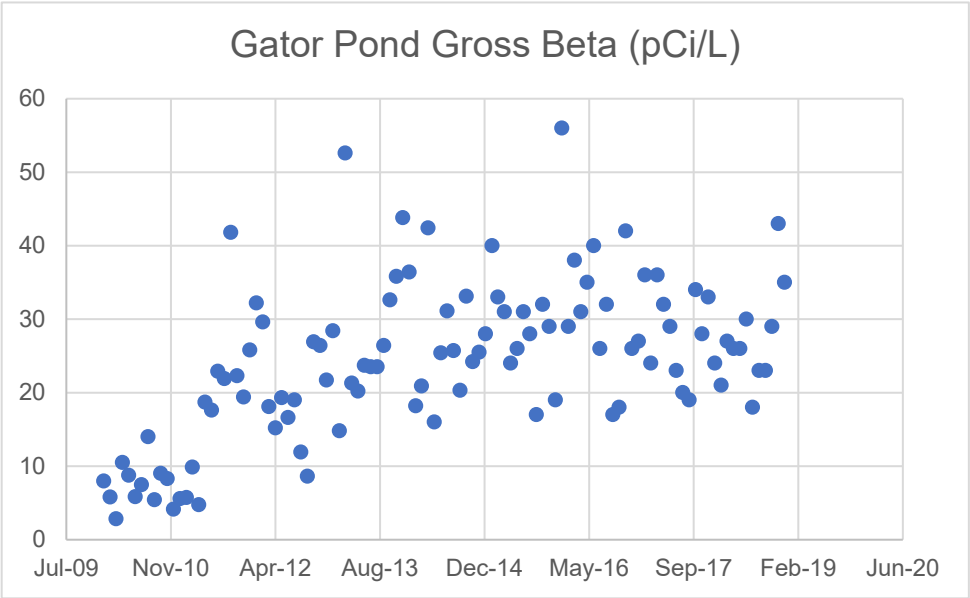

Figure 3-11 Gross Beta in Gator Pond Water Samples (Source: WEC 2019-TN6571)

Surface water quality at the CFFF site can be affected by precipitation events. In October 2015, the CFFF site received 35.5 cm (12.4 in.) of rainfall over a 4-day period. As a result, two process lagoons overflowed beyond containment—the sanitary lagoon spilled over into adjacent lagoons and the West II Lagoon overflowed but stayed within the bermed area. The WEC initiated an emergency discharge to the river, per procedures. The WEC staff conducted in-process sampling for fluoride, ammonia, pH, and total suspended solids and also took activity samples. There was one elevated total suspended solids reading and the highest activity readings were 100 and 10 pCi/L, which are below NRC effluent limits for uranium (WEC 2019-TN6510). Additionally, unknown levels of biological oxygen demand, fecal coliform, ammonia, calcium, fluoride, and nitrates could have been released from the lagoon overflow to the surrounding water bodies. The WEC notified SCDHEC of the event, and SCDHEC did not require any further action by the WEC (2016-TN5723). No supplemental sampling of environmental mediums was conducted during or immediately after the flooding event (NRC 2018-TN6549). During the rain event, the Congaree River rose to an elevation of 37.6 m (123.3 ft) above MSL in the area of the site (WEC 2019-TN6510); however, although depressions may have been locally flooded by the direct precipitation, the Congaree River did not overflow the bluff.

3.3.1.3 Sediment

There is limited data about onsite sediments because there was no requirement in the WEC's NRC-issued license for the WEC to conduct onsite sediment sampling. In July 2013, as part of a site investigation and based on communication with SCDHEC, the WEC collected sediment samples from 10 onsite locations (taken in the same locations as surface water samples) (AECOM 2013-TN5508). Two samples were collected adjacent to the dike between Upper and Lower Sunset Lake, seven samples were collected from the ditches draining the site, and one

sample was collected from Gator Pond. Samples were analyzed for PCE, fluoride, nitrate, gross alpha, and gross beta (among others). While there are no standards for contaminants in sediments, Table 3-1 summarizes the highest concentrations of some contaminants and their locations.

Table 3-1 Results of July 2013 Sediment Sampling Event (AECOM 2013-TN5508)

Contaminant	Concentration	Location[(a)]
Fluoride	220 mg/kg	Gator Pond
PCE	30 µg/kg	Ditch to the west of the WWTP
Gross alpha	377 pCi/g	Between the plant building and the West II Lagoon
Gross beta	295 pCi/g	Gator Pond

(a) Locations of sediment samples are noted on Figure 1-3 in the Remedial Investigation Report (AECOM 2013-TN5508).

Sediment samples were collected in 2019 as part of the remedial investigation under the CA for the CFFF site (WEC 2020-TN6526). Samples were collected in ditches, the Sanitary and East Lagoons, Gator Pond, and at a series of cross sections in Mill Creek from where the creek enters the CFFF site to where it exits, including within Sunset Lake (upper and lower sections). Samples were collected from surface sediments at all locations and from greater depths 15 to 30 cm and 30.5 cm to 40.6 cm (6 to 12 in. and 12 to 16 in.) at selected locations.

Uranium isotopes were detected in all of the samples and RUSLs were exceeded in a ditch location, Gator Pond, Sunset Lake, and the lagoons (WEC 2020-TN6526). One sample in the Sanitary Lagoon exceeded the industrial use screening level for U-235/236. During normal operations, this exceedance does not pose a risk to CFFF site workers because they are not exposed to lagoon sediments, but during closure and decommissioning of the lagoon, the WEC would follow requirements and procedures to avoid and minimize associated health risks to the workers. Excluding the lagoon samples, the largest activity observed was 117 pCi/g (for U-233/234) in a sample from Lower Sunset Lake. Tc-99 was above the detection level in a sample from the East Lagoon, and it exceeded the RUSL in the two Gator Pond samples, having a maximum value in pond sediments of 51 pCi/g. Tc-99 was below minimum detection levels in the remaining samples. RUSL values are based on a residential farming exposure scenario and a total effective dose equivalent of 25 mrem/yr (WEC 2020-TN6526).

Fluoride was detected in most of the sediment samples; the largest values outside the lagoons were observed in the Gator Pond samples (concentrations of 38 and 49 milligrams per kilogram [mg/kg]) (WEC 2020-TN6526). Maximum concentrations were 53 mg/kg in the Sanitary Lagoon and 171 mg/kg in the East Lagoon. Chlorinated VOCs were not detected in sediments with the exception of a single ditch sample that contained TCE (a duplicate sample from the same location was below the detection level). Other volatiles (acetone and 2-butanone) were reported in a number of sample locations, including background locations in the Eastern ditch near the site property line (see Figure 3-8) and in the upstream samples from Mill Creek. Nitrate was detected in about one-half of the samples at values exceeding 2 mg/kg in lower ditch locations. Ammonia exceeded 1,000 mg/kg in the lagoons and in some Upper Sunset Lake locations.

3.3.2 Surface Water Impacts

The NRC staff determined the impacts on surface water resources by evaluating the potential effects of CFFF's proposed continued operations of the CFFF for an additional 40 years on the

availability of the resources to support other uses and users. Surface water withdrawals and consumptive use of water for CFFF operations directly reduces the quantity of water available for other uses and users of the same resource. Degradation of water quality by the intentional or inadvertent release of contaminants to surface water bodies potentially renders the water resource unsuitable for other users and designated uses.

As noted in Section 3.3.1 of this EIS, the WEC does not use any onsite surface water for its CFFF operations. All water used at the CFFF site is supplied by the City of Columbia, which obtains its water from the Saluda and Broad Rivers that form the Congaree River. The WEC would continue to use this source of water for CFFF operations under the proposed action. The capacity of the city's supply is 160 Mgd, with average daily use of about 65 Mgd (CPD 2008-TN6894). The CFFF's average use of 0.12 Mgd is less than 0.2 percent of the city's current total use. The CFFF water use is also a negligible fraction of flow in the Congaree River, even during low-flow conditions. In addition, about 80 percent of water used at the CFFF is returned to the Congaree River via the plant's permitted discharge. The proposed renewal of the CFFF operating license for an additional 40 years does not involve changes in current operating practices that are expected to involve significant changes in water use.

Because CFFF water use is both a minor proportion of the total City of Columbia water supply and a negligible fraction of Congaree River flow, the NRC staff determined that the proposed continued operation of the CFFF for an additional 40 years would have negligible effects on Congaree River flows and minimal impacts on the availability of water for other users.

Operation of the CFFF has the potential to affect surface water quality through the direct discharge of plant effluents to the Congaree River and through the transport of inadvertently released contaminants to the onsite surface water bodies via runoff and groundwater discharge.

3.3.2.1 Congaree River

Potential impacts on the water quality of the Congaree River under the proposed action arise from the continued discharge of liquid effluents directly into the river. The WEC discharges its treated liquid effluent directly into the Congaree River in accordance with its NPDES permit. The discharge mixes with the much larger flow of the Congaree River and is diluted as it flows downstream. As described in Section 3.3.1 of this EIS, radiological contaminants are present in the effluent at low levels and have trended downward over the past 10 years, with no consistent effect on gross alpha activity resulting from the discharge (see Figure 3-10). In addition, the Congaree River is not impaired downstream of the CFFF discharge by any identified COPCs attributed to CFFF operations. There are also no surface water withdrawals on the Congaree River between the CFFF discharge and the confluence with the Wateree River.

The content and amount of regulated and permitted liquid effluent to be discharged into the Congaree River under the proposed action would be similar to recent and current discharges. CFFF releases would continue to be governed by its NPDES permit for discharge into the Congaree River and the NRC staff expects that the WEC would comply with the conditions set forth in that permit. The WEC has submitted a timely renewal application for its NPDES discharge permit, and SCDHEC currently is reviewing the application (WEC 2017-TN5621). The NPDES permit must be renewed every 5 years and, therefore, the conditions in the permit could be adjusted as needed. The NRC staff reasonably assumes that pollutant limitations and monitoring requirements under the current permit would be applied in a similar manner to discharges that would occur under the proposed action. The WEC discharges from the CFFF would also be expected to continue to comply with NRC regulatory limits and requirements for

liquid effluents. Additionally, the WEC will notify the NRC any time the NPDES permit is renewed, revoked, or revised, and if the WEC receives an NPDES Notice of Violation (WEC 2019-TN6423).

Because recent and current effluent discharges from CFFF have had a minor effect on the water quality of the Congaree River, and because discharge rates and pollutant releases will continue to be regulated and monitored under the NPDES permit and are not expected to change significantly, the NRC staff determined that the proposed continued operation of the CFFF for an additional 40 years would have minor effects on the water quality of the Congaree River and would not affect other users or uses of the river.

3.3.2.2 Onsite Surface Water

Onsite surface water bodies (Mill Creek, Sunset Lake, and Gator Pond), none of which are a source of drinking water, are described in Section 3.3 of this EIS. The water quality of these surface water bodies may be affected by the CFFF operations when contaminants that are spilled or leaked into the environment are subsequently transported to the water bodies by overland flow (stormwater runoff) or groundwater. The NPDES industrial stormwater general permit requires stormwater management, pollution prevention controls, and monitoring of water quality. As described in Section 3.3 of this EIS, surface runoff and stormwater drainage from the developed portion of the CFFF site are released through a single outfall to a ditch that flows to Upper Sunset Lake. Groundwater discharges to Gator Pond, which contributes water to Lower Sunset Lake by groundwater flow or via spill that occurs during periods of high precipitation. Groundwater may also discharge to site ditches, Sunset Lake, and Mill Creek, depending on groundwater levels in the surficial aquifer. Surface water movement on the CFFF site is attenuated by the Mill Creek and Sunset Lake dikes. Once offsite, Mill Creek meanders across the Congaree River floodplain before reaching the Congaree River.

As described in Section 3.3.1 of this EIS, surface water quality on the CFFF site has been noticeably affected by past plant activities. The WEC's surface water sampling conducted as part of its NRC license requirements has indicated elevated gross alpha and gross beta activities in CFFF site stormwater runoff sampled just before the control valve point of discharge to the drainage ditch (i.e., the Roadway sample location) and elevated gross beta in samples from the Gator Pond spring and the pond itself (WEC 2021-TN6920, WEC 2019-TN6423). Sampling conducted as part of the remediation investigation activities under the CA has shown VOC contamination in site runoff; fluoride contamination in site runoff, Gator Pond, and Sunset Lake; and nitrate contamination in site runoff and Gator Pond (AECOM 2013-TN5508; WEC 2020-TN6526). Recent sediment sampling provides additional evidence that the CFFF operations have contributed Tc-99 contamination in Gator Pond and potentially uranium contamination in Sunset Lake (WEC 2020-TN6526).

The principal means by which contaminated surface water could move beyond the CFFF site boundary is through flow in Mill Creek. Mill Creek is currently monitored as part of the NRC license requirements from the entrance at Upper Sunset Lake to the exit from the CFFF property. Results from this monitoring show minor differences in activities at the entrance and exit locations for both gross alpha and gross beta (WEC 2019-TN6423), indicating that radionuclide releases from CFFF operations have a minor effect on water quality in Mill Creek and are unlikely to move beyond the CFFF site boundary at noticeable. COPCs detected in Lower Sunset Lake during the most recent sampling completed under the CA were present at concentrations well below their MCLs: total uranium at 0.6% of the MCL and fluoride at 1% of the MCL (WEC 2020-TN6526). Contaminated Mill Creek sediments could be transported offsite

during flood events. Sediment samples obtained in 2019 from the Upper and Lower Sunset Lake sections of Mill Creek exceeded residential screening levels for uranium (WEC 2020-TN6526). Mill Creek sediment samples obtained between the Lower Sunset Lake dike and the exit dike contained uranium isotope activities below the residential screening levels (the largest activity was about one-half of the residential screening level) (WEC 2020-TN6526). Additional sediment sampling in Mill Creek and Sunset Lake is being conducted as part of the remedial investigation process under the CA (WEC 2020-TN6707).

Existing groundwater contamination is likely to continue to affect surface water quality in Gator Pond and Sunset Lake. The degree of interchange between site surface water bodies and groundwater is uncertain, as is the effect on groundwater quality of future remediation activities to be completed under the CA. The Phase II RIWP (WEC 2020-TN6707) describes additional investigations of the CFFF site that the WEC will perform to better understand migration pathways and connections between groundwater and surface water. The NRC staff expects the groundwater monitoring activities under the CA to continue as long as there is significant contamination at the site, and site investigation activities to continue to evolve in response to data obtained as part of the remedial investigation process (see Chapter 2.0 of the EIS for additional information about the CA).

The proposed continued operation of CFFF could result in additional inadvertent releases of contaminants. For example, future episodes of significant rainfall, such as the rain event in October 2015, could again cause the lagoons to overflow, possibly resulting in an uncontrolled release of their contents into groundwater or into nearby surface water bodies. However, the NRC staff expects that as happened during the October 2015 event, the WEC would notify SCDHEC of such an event, and necessary immediate corrective actions would be taken. The WEC would also inform the NRC within 30 days of any violations of their NPDES permit (WEC 2019-TN6423). The NRC staff also assume that monitoring of surface water quality, including Mill Creek water quality sediment contamination would continue as part of NRC license requirements.

The WEC is expected to continue to comply with its NPDES permit requirements for stormwater runoff as regulated by the SCDHEC. In addition, the WEC is expected to continue to follow its spill prevention control and countermeasures plan for minimizing the occurrence and effects of inadvertent spills. The WEC has an environmental monitoring and sampling program for surface water and sediments that can help identify potential migration pathways and indicate if there is an upward trend in existing contaminants. The NRC will continue to inspect the WEC's compliance with its NRC-licensed environmental monitoring program. The WEC's ongoing site remedial investigation under the CA will help fill data gaps in migration pathways and address the impacts of past leaks or spills on the surface water. Once either SCDHEC approves the WEC's final Remedial Investigation Report or within 5 years of the license renewal, whichever comes first, if the license is renewed, a new license condition would require the WEC to resubmit its environmental sampling and monitoring program for NRC review and approval. Additionally, the WEC has committed to submit the environmental monitoring and sampling program to the NRC for review and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC (WEC 2021-TN7042). The WEC has developed a CSM and procedures to inform decisions about changes to its monitoring protocols based on information learned from investigations and sampling data. Another new license condition would require the WEC to enter groundwater and surface water results above Federal and State limits into its CAP. The WEC has also established an environmental remediation procedure (RA-433) to be followed in the event of a release of contaminants to the ground surface or environmental mediums, the detection of

groundwater contamination above MCLs, or the discovery of a past release through soil sampling (WEC 2020-TN6853). The purpose of the remediation procedure is to prevent the migration of contaminants offsite and to minimize the impacts of contaminant releases on future decommissioning activities.

3.3.2.3 Surface Water Impacts Conclusion

Past operation of the CFFF has had a noticeable effect on the water quality of the onsite surface water bodies. The only contaminant derived from CFFF operations that is currently present (based on 2019 sampling) in onsite surface water bodies at a concentration above the MCL is fluoride in Gator Pond. However, uranium contamination in the upper and lower portions of Sunset Lake currently exceeds the residential use screening levels (based on 2019 sampling). Based on the existing data, the NRC staff expects that there is a low potential for significant contamination to move offsite via a surface water pathway and noticeably degrade water quality in Mill Creek downstream from the CFFF site boundary. The proposed continued operation of the CFFF for an additional 40 years could result in future inadvertent releases that may contribute additional contaminants to the onsite surface water bodies. However, the potential for significant impacts on these water bodies that might result in offsite movement of contaminants would be minimized by the existing inspection, monitoring, and reporting requirements currently in place at the CFFF site, and those activities and programs are expected to continue at the site under the proposed action. Contaminated sediments could be transported offsite during significant flooding events, but the large volume of water involved in such an event is expected to result in reduced contaminant concentrations when these sediments are redeposited. Therefore, the NRC staff determined that continued operation of the CFFF under the proposed action would have minor effects on the water quality of Mill Creek outside the CFFF boundary and would not affect other users or uses of the creek.

The NRC staff evaluated the effects of the proposed CFFF continued operation for an additional 40 years on the availability of the potentially affected water resources to support other uses and users. The NRC staff determined that continued withdrawal and consumptive use of Congaree River water for CFFF operations would have negligible effects on other uses/users of the Congaree River. The NRC staff determined that future discharges to the Congaree River in accordance with the NRC license and NPDES permit would have minor effects on water quality and that these discharges would not affect other users or uses of the Congaree River. Although the proposed continued operations could result in inadvertent releases of contaminants that may noticeably affect the water quality of the onsite water bodies, the NRC staff determined that there is a low potential for contaminants to move offsite because of the implementation of activities and programs to minimize the effects of releases on other users of the local surface water resources (e.g., spill prevention controls, the environmental sampling and monitoring program). Therefore, the NRC staff concludes that the impacts on surface water resources from continued operation of the CFFF for an additional 40 years would be SMALL.

Because the past operation of CFFF has had a noticeable effect on water quality of the onsite surface water bodies that continues to be observed in the most recent data, the NRC staff concludes that the cumulative impacts to surface water are MODERATE. However, because proposed continued operation of the CFFF for an additional 40 years would not affect other uses and users of the surface water resources, the SMALL incremental impact from the proposed action would not result in a significant contribution to the cumulative impacts (see Appendix B for additional information).

3.3.3 Mitigation Measures

As described above, the WEC currently monitors releases of stormwater runoff and plant effluents to conform with NPDES discharge permit requirements. Similar monitoring requirements are expected to be included in the NPDES permit renewal(s) applicable during the period of the proposed action. The WEC also carries out environmental monitoring of onsite sediments and surface water at both onsite and offsite locations under the terms of its NRC operating license and these would continue through the proposed license renewal period. Continued adherence to the terms of the NPDES permit, including monitoring of discharges to surface waters, and continued effective monitoring of onsite and offsite surface waters as conditions of the NRC license will serve to avoid and minimize impacts on surface water resources. The WEC is expected to continue to follow its spill prevention control and countermeasures plan for minimizing the occurrence and effects of inadvertent spills. In addition, the WEC is expected to follow its environmental remediation procedure to prevent the migration of contaminants offsite and to minimize the impacts of contaminant releases on future decommissioning activities. The NRC staff finds that sampling of fish tissue in Mill Creek could potentially further reduce the impacts of the proposed license renewal. This additional mitigation measure is not a requirement being imposed upon the licensee.

3.4 Groundwater Resources

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on groundwater resources from the proposed action.

The geology and hydrogeologic framework of South Carolina and of the CFFF site and surrounding region are described in Section 3.2 of this EIS. As noted in that section, this EIS uses the hydrogeologic framework of Campbell and Coes (2010-TN6672, Chapter B) adopted by SCDNR for their assessments of groundwater in South Carolina (Wachob et al. 2017-TN6712). The names of aquifers and confining units used in this framework differ from the names used in the ER (WEC 2019-TN6510) and recent remedial investigation documents (e.g., WEC 2020-TN6526). Correlations between the names used here and in the ER are explained below.

The CFFF site is located in the Atlantic Coastal Plain physiographic province. The principal aquifers in the province are the surficial aquifer system and the southeastern coastal plain aquifer system. The unconfined (water-table) surficial aquifer system in South Carolina generally consists of sandy terrace deposits of Quaternary age, commonly containing clay and silt (USGS 1990-TN6648). Groundwater elevations in the surficial aquifer typically mimic the ground surface. Recharge occurs primarily from infiltrated precipitation and flow occurring over relatively short distances before discharging to streams or other surface water bodies. The exchange of water between the surficial aquifer and deeper confined aquifers may also occur.

The coastal plain aquifer system in South Carolina consists of a sequence of aquifers and confining units extending from the fall line (located at Columbia in the region of the CFFF site) to the Atlantic Ocean, dipping and thickening toward the coast. The coastal plain aquifer system thickness is zero at the fall line and about 213 m (700 ft) at the far southeast corner of Richland County (Newcome 2003-TN6706). The base of the coastal plain sediments is at an elevation of about -46 m (-150 ft) MSL at the CFFF site (Newcome 2003-TN6706). The unconsolidated formations of the southeastern coastal plain aquifer system were deposited in fluvial, deltaic, and shallow-marine environments during the Cretaceous to late Tertiary periods (USGS 1990-TN6648). Aquifers consist mostly of fine to coarse sands with intervening confining units of silt

and clay. Aquifer units may outcrop in the updip (western) portion of their extent, becoming confined as they deepen to the east. Recharge occurs from precipitation in the outcrop areas and deeper groundwater movement occurs on long flowpaths and discharge to overlying aquifers or to surface water bodies. The most important aquifers in Richland County are the Cretaceous-age Black Creek and Middendorf aquifers (Newcome 2003-TN6706), which are correlated with the Crouch Branch and McQueen Branch aquifers in the hydrogeologic framework used in this EIS (Wachob et al. 2017-TN6712). As described in Section 3.2.2 of this EIS, the Crouch Branch confining unit extends into southern Richland County, but may be only locally present in the area of the CFFF site (Wachob et al. 2017-TN6712). The Tertiary-age Gordon aquifer (correlated to the Black Mingo aquifer) is reported to be absent in Richland County (Wachob et al. 2017-TN6712) or thin and of limited areal extent in the southern part of the county (Newcome 2003-TN6706).

Investigations of groundwater at the CFFF site between 1980 and early 2020 (including the activities conducted during Phase I of the remedial investigation process under the CA with SCDHEC) have resulted in the logging of more than 90 boreholes and the installation of more than 90 groundwater monitoring wells (AECOM 2013-TN5508; WEC 2019-TN6510; WEC 2020-TN6526). Data from these borings and monitoring wells have been used to identify the extent of groundwater contamination and to interpret the lithology, the occurrence of aquifers and confining units, the hydrogeologic properties, and the groundwater flow at the site, as represented in the WEC's CSM (WEC 2020-TN6707). Additional wells and borings are being completed as part of the Phase II remedial investigation process (WEC 2020-TN6707).

A description of the upper sediments in the CFFF site region is provided in Section 3.2.2 of this EIS. The surficial aquifer in the region occurs in the river terrace deposits above the bluff and in the alluvium of the Congaree River flood plain. The WEC's CSM interprets the river terrace and floodplain sediments at the CFFF site as being a hydrologically continuous unit, 9 to 12 m (30 to 40 ft) thick (WEC 2020-TN6707). The majority of the CFFF wells are installed in the surficial aquifer.

The top of the confining unit underlying the surficial aquifer is at an elevation of about 36 m (110 ft) MSL south of West Lagoon 2 and slopes downward in all directions, as interpreted from the CFFF borehole data (WEC 2020-TN6707, Figure A). This unit is referred to as the Black Mingo confining unit in CFFF reports, but is interpreted in the hydrogeologic framework used in this EIS as the Crouch Branch confining unit (see Section 3.2.2 of this EIS). The elevation of the confining unit in lithologic borehole L-1 (at the location of well W-95) was 10.7 m (31) ft MSL, about 15.2 m (50 ft) lower than the elevation observed at the nearest boreholes. These variations in the elevation of the confining unit may have implications for groundwater movement and contaminant transport in the surficial aquifer.

The unconfined surficial aquifer is recharged locally by infiltration from precipitation on the CFFF site and in the vicinity. The average depth to groundwater in the area of the CFFF site is about 4.6 m (15 ft), and a minimum depth of 0.9 m (3 ft) and a maximum depth of 13.7 m (45 ft) have been observed since 1971 (WEC 2019-TN6510). The elevation of the groundwater table generally is a subdued replica of the topography, except for locations below the plant buildings and facilities. As a result, groundwater in the surficial aquifer principally flows from areas of higher topography (e.g., in and around the main facility) to lower topography (e.g., the Mill Creek floodplain). Figure 3-12 shows groundwater elevations in the surficial aquifer during October 2019 and the inferred groundwater flow directions. Groundwater flow is generally to the south and southwest toward the Congaree River floodplain. As discussed in Section 3.3.2.2 of this EIS, groundwater discharges to the surface ditches, where groundwater elevation exceeds the

ditch bottom elevation (typically near the bluff), and to Gator Pond. Groundwater may also discharge to other springs or seeps along the bluff. Some exchange of water between the surficial aquifer and both Sunset Lake and Mill Creek is likely, and the rate of that exchange is governed by the relative water levels and the permeability of the lake and creek sediments. The surficial aquifer ultimately discharges to the Congaree River.

Groundwater head data show a hydraulic gradient in the plant building area that indicates downward flow from the surficial aquifer toward the underlying Crouch Branch and McQueen Branch aquifers (referred to as the Black Mingo and underlying Middendorf aquifers in the WEC's documents). The potential for significant downward flow through the confining unit was assessed to be negligible based on the low value of hydraulic conductivity estimated for the confining unit (10^{-7} cm/s) (WEC 2019-TN6510). It is not clear from the available data that the downward flow gradient from the surficial aquifer to the Crouch Branch aquifer exists throughout the CFFF site and vicinity. For example, groundwater head data suggest that the local hydraulic gradient is upward near Gator Pond and may be upward in the Sunset Lake area (WEC 2020-TN6526).

Groundwater flow velocities in the surficial aquifer terrace deposits were previously estimated to range from about 1 to 168 m/yr (4 to 550 ft/yr) with an average value of 47 m/yr (153 ft/yr) (AECOM 2013-TN5508). Saturated hydraulic conductivity values from recent testing in surficial aquifer wells in the terrace and floodplain deposits were reported as part of the remedial investigation under the CA with SCDHEC (WEC 2020-TN6526). Based on these reported values, the NRC staff estimated average saturated hydraulic conductivity values of 0.0022 cm/s (6.3 ft/d) for the terrace sediments and 0.011 cm/s (32 ft/d) for the floodplain sediments; conservative values[4] were estimated to be 0.0088 cm/s (24 ft/d) and 0.028 cm/s (79 ft/d), respectively. Based on Figure 3-12, the staff estimated horizontal hydraulic gradients in the surficial aquifer to be 0.01 to 0.02 ft/ft in the terrace sediments and 0.0005 to 0.001 ft/ft in the floodplain sediments. No porosity data for the surficial aquifer have been reported; the staff assumed a porosity range of 0.25 to 0.3 for the surficial aquifer, which is at the lower end of the range reported for unconsolidated sandy sediments (e.g., Freeze and Cherry 1979-TN3275). Using the data and assumptions above, the NRC staff estimated average groundwater velocities of 23 to 47 m/yr (76 to 153 ft/yr) in the surficial aquifer between the plant and the bluff, and 6 to 12 m/yr (20 to 40 ft/yr) in the floodplain; conservatively, groundwater velocities could be 108 to 216 m/yr (355 to 710 ft/yr) between the plant and the bluff and 18 to 35 m/yr (58 to 115 ft/yr) in the floodplain.

The confined Crouch Branch and McQueen Branch aquifers are of regional extent, and they are capable of providing large quantities of water for industrial and municipal uses, particularly in southern Richland County where these aquifers are thickest (Newcome 2003-TN6706). Recharge to these aquifers occurs regionally where they outcrop, generally northwest of the CFFF site. The limited data from the four CFFF wells completed in the confined aquifer suggest that groundwater in this aquifer flows to the southwest locally. Discharge may be to wells, to the Congaree River, or to other large regional sinks. In Richland County, flow in the Crouch Branch and McQueen Branch aquifers is primarily toward the Congaree and Wateree Rivers, based on potentiometric contours estimated from a limited set of well data (Wachob et al. 2017-TN6712; Czwartacki and Wachob 2020-TN6893). Movement of groundwater between aquifers can be

[4] Conservative estimates are expected to be greater than 80% of measured saturated hydraulic conductivity values.

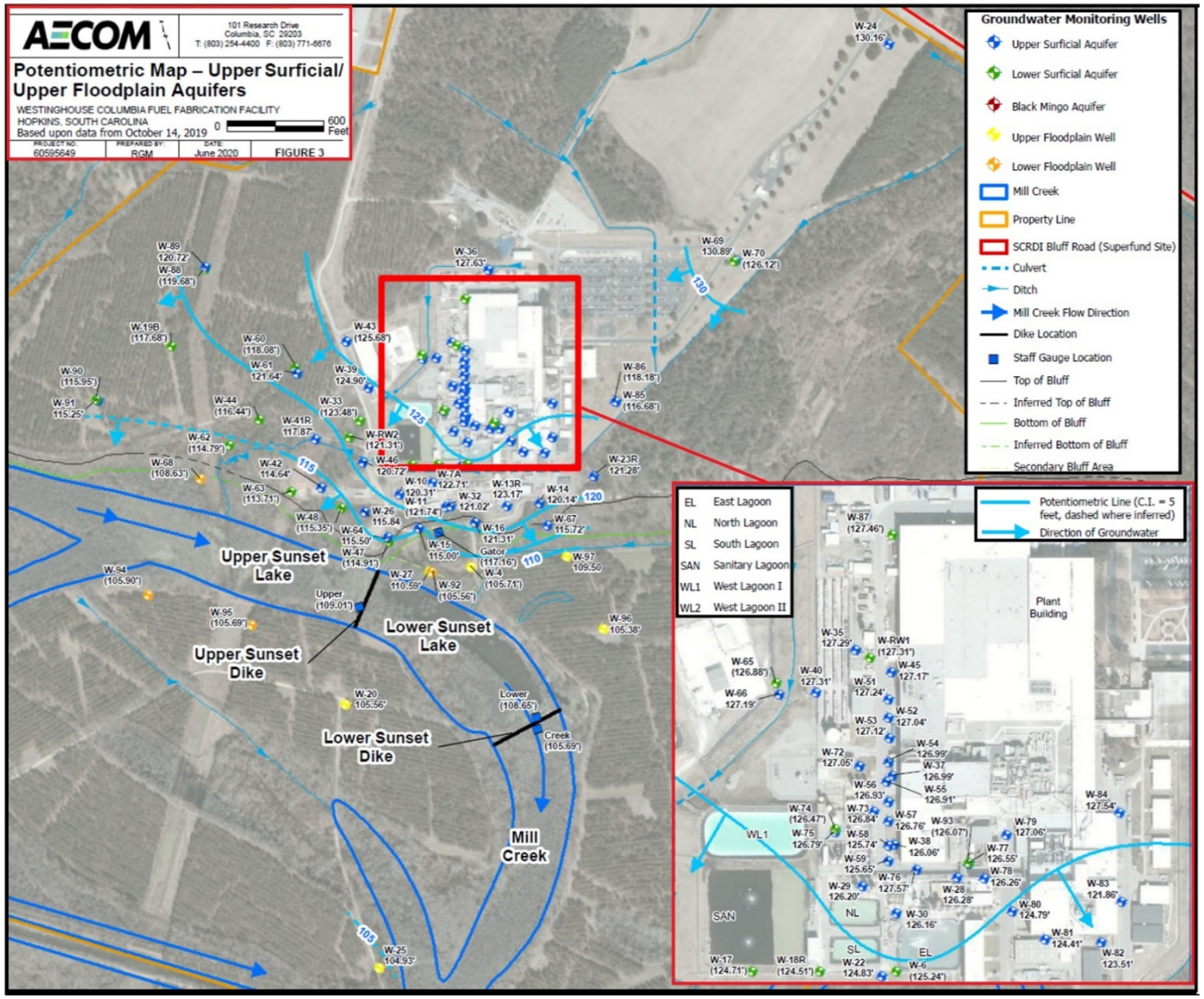

Figure 3-12 Groundwater Elevations in the Surficial Aquifer and Inferred Flow Directions (Source: WEC 2020-TN6526)

through either the intervening confining layers or, potentially, through open-hole or poorly sealed groundwater wells penetrating the confining layer (NRC 1985-TN5602). As described in Section 3.2.2 of this EIS, the Crouch Branch and McQueen Branch aquifers are likely to be connected with no significant confining unit separating them.

3.4.1 Groundwater Use and Quality

The WEC does not use groundwater for operations at the CFFF site. As noted in Section 3.3.1 of this EIS, service and potable water are provided by the City of Columbia, which gets its water from the Congaree River. Seven percent of public supply water use in Calhoun, Lexington, and Richland Counties is derived from groundwater (Dieter et al. 2018-TN6681), and the nearest public water supply wells are located about 1.6 km (1 mi) northeast (upgradient) of the CFFF site (SCDHEC 2020-TN6690). The closest public water supply wells within the Congaree River floodplain (nominally downgradient) are located about 10.5 km (6.5 mi) from the CFFF site at the Congaree National Park Harry Hampton Visitor Center (SCDHEC 2020-TN6690). The CFFF site is outside all designated public water supply well protection zones (SCDHEC 2020-TN6690). There are no designated sole source aquifers in South Carolina (EPA 2020-TN6709).

Domestic self-supplied water use is significant in Calhoun, Lexington, and Richland Counties (e.g., 6.24 Mgd in Richland County in 2015) and is entirely sourced from groundwater (Dieter et al. 2018-TN6681). As part of the CFFF site remedial investigation under the CA with SCDHEC, in 2019 the WEC completed a survey of private water supply wells within approximately 1 mi of the site (WEC 2020-TN6526). The WEC identified 25 wells located north of the CFFF site, to the east and west along Bluff Road. The closest of these wells is about 1,340 m (4,400 ft) north of the known extent of any COPCs derived from the CFFF site operations. Based on the head data from the CFFF site wells, the private water supply wells to the north of the site are upgradient so that groundwater would not normally flow from the site to these water supply wells. The WEC identified four active private water supply wells located west, southwest, and south of the CFFF property and two inactive wells located near the CFFF site boundary to the northwest of the plant buildings (Figure 3-13). The active wells are downgradient from the CFFF site and have the potential to be affected by site contaminants; the nearest well (WSW-03 in Figure 3-13) is about 1,650 m (5,400 ft) from the known extent of current contamination. The four downgradient wells were sampled by the WEC as part of its survey (WEC 2020-TN6526). Low levels of alpha particles were detected in two wells and low-level beta particles were detected in one well. Uranium-238 (U-238) was detected at low levels (<1 μg/L) in three of the four wells. Fluoride, nitrate, ammonia, and antimony were detected in one or more wells at low levels. Other contaminants were below detection limits.

SCDHEC sampled the Hopkins Community Water System and 13 private drinking water wells in the Hopkins and Lower Richland area during August and September 2018. Well water samples were tested for uranium, radium, gross alpha, gross beta, fluoride, nitrate, metals, and VOCs, and all contaminants of potential concern were found to be below the MCLs or minimum detection limits (SCDHEC 2018-TN6713). Richland County sampled 62 wells in the same area (SCDHEC 2018-TN6713); all results were reported in February 2019 to be below the EPA's drinking water standard for uranium (Richland County Council 2019-TN6682).

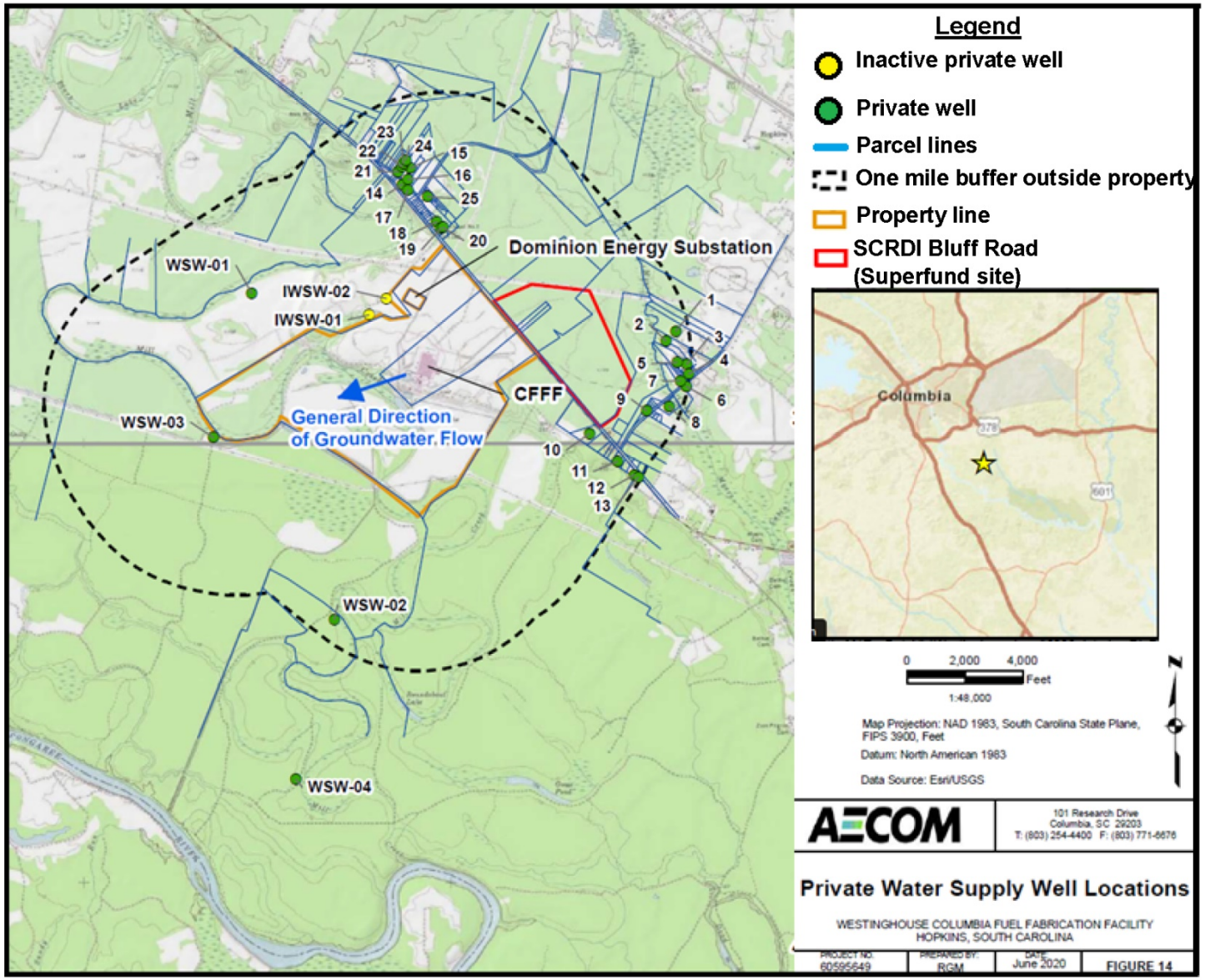

Figure 3-13 Private Water Supply Wells near CFFF Identified by the WEC (Source: WEC 2020-TN6526)

The SCDHEC classifies the groundwater at the CFFF site as “Class GB,” meaning the groundwater at the CFFF site meets the definition of underground sources of drinking water as defined by State regulations in R.61-68, “Water Classifications and Standards” (SCDHEC 2014-TN6986). The WEC had previously requested that SCDHEC reclassify the site as a groundwater mixing zone, as defined in R.61-68, but SCDHEC denied the request (AECOM 2013-TN5508). Therefore, groundwater at the CFFF site must meet the MCLs set forth in R.61-58, “State Primary Drinking Water Regulations” (SCDHEC 2014-TN6988).

Groundwater contamination was discovered at the CFFF site in the 1980s and has been the subject of ongoing investigations. The quality of the shallow groundwater has been affected by nonradioactive and radioactive contaminants from the CFFF operations. Contaminants that have been identified and are monitored as part of the remedial investigation under the CA with SCDHEC include VOCs, fluoride, nitrate, ammonia, gross alpha, gross beta, uranium, and Tc-99 (WEC 2020-TN6526, WEC 2020-TN6707). Investigations conducted by the WEC have identified the WWTP, CFFF operations, buried piping systems, and the former oil house as potential sources of contamination. The RIWPs identify data needs to address the sources and extent of groundwater contamination (WEC 2019-TN6553, WEC 2020-TN6707).

The majority of groundwater quality data has been obtained from the surficial aquifer, which has been directly affected by contaminant releases from the CFFF operations. The following summaries of the various COPCs found in the surficial aquifer are based on a review of data and analyses in the WEC’s 2013 Remedial Investigation Report (AECOM 2013-TN5508) and 2014 Baseline Risk Assessment Report (AECOM 2014-TN5511); the 2019 RIWP and addenda (WEC 2019-TN6553); the 2020 Final Interim Remedial Investigation Data Summary Report (WEC 2020-TN6526); the WEC’s 2020 Tc-99 Investigation Summary Report (WEC 2020-TN6538); annual groundwater reports submitted to SCDHEC (WEC 2019-TN6876, WEC 2020-TN6875); the WEC’s 2019 ER (WEC 2019-TN6510); and supplemental information submitted by the WEC to the NRC.

3.4.1.1 Nonradiological Contaminants

The groundwater at CFFF has been contaminated with chlorinated VOCs and inorganic contaminants from facility operations. Storage of petroleum products and solvents in the former oil house prior to 1980 contributed to the VOC contamination. The oil house has been removed. Studies conducted by the WEC since the assessment in 1994 indicated that the source area is near the West II Lagoon, although not the West II Lagoon itself (WEC 2019-TN6510). Effluents from the CFFF WWTP are suspected of being the source of the nonradiological contaminants—nitrate, fluoride, and ammonia. Four of the WWTP lagoons were relined between 2008 and 2012. The East Lagoon, which receives various waste streams (including radioactive elements) has been in service for almost 40 years and is currently being closed and cleaned (WEC 2020-TN6844). Sludge in the East lagoon contains elevated levels of fluoride and ammonia; the Sanitary Lagoon sludge contains elevated levels of fluoride, ammonia, and nitrate (WEC 2020-TN6526). The East and Sanitary Lagoons also contain elevated levels of uranium.

3.4.1.1.1 Volatile Organic Compounds

The VOC contaminants in the CFFF site groundwater that are of primary concern are the chlorinated compounds PCE and TCE, along with the products of their breakdown in the environment (cis-1,2-DCE and VC). The WEC installed an air sparging/soil vapor extraction

(AS/SVE) system in 1997 to remove the VOC contaminants from the groundwater. Operation of the AS/SVE system was discontinued in December 2010 because of reduced system efficiency in removing contaminants (WEC 2019-TN6510). While the AS/SVE system reduced PCE concentrations from their peak values, concentrations rebounded somewhat after the system was turned off and appear to have been relatively stable since 2013 (Figure 3-14).

The WEC completed groundwater screening for VOCs in 2016-2017 and installed additional groundwater monitoring wells in 2018. Beginning in late 2018, the WEC also started monitoring

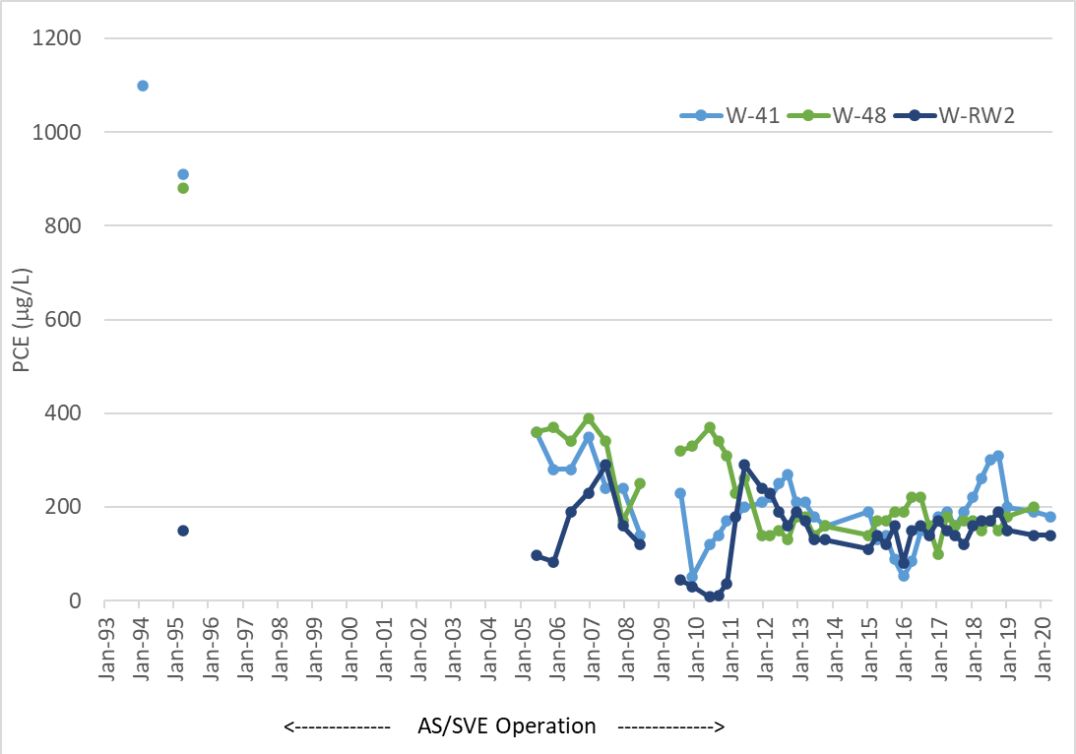

Figure 3-14 PCE Concentrations in the Surficial Aquifer. The AS/SVE System Operated from 1998 to 2010 (Sources: AECOM 2013-TN5508, AECOM 2017-TN5512; WEC 2019-TN6510, WEC 2020-TN6526, WEC 2020-TN6875)

VOCs at the site's existing wells (WEC 2019-TN6510). Results from early 2019 indicated that the PCE and TCE concentrations exceeded the 5 µg/L MCL in 15 and 7, respectively, of the 60 wells sampled (WEC 2019-TN6423). The WEC installed additional shallow and intermediate-depth wells as part of the Phase I remedial investigation process carried out under the CA to collect additional data about the occurrence and evolution of the VOC plumes (WEC 2019-TN6510; WEC 2020-TN6526). Concentrations of PCE and TCE were above the MCL at 18 and 10 wells, respectively, out of the 89 wells sampled in October 2019 (WEC 2020-TN6526). VOC concentration was greater than 50 µg/L in 10 wells. A shallow soil gas survey and soil sampling to evaluate potential chlorinated VOC source areas are part of the Phase II RIWP (WEC 2020-TN6707). Groundwater screening boreholes and additional groundwater monitoring wells are also being completed as part of the Phase II RIWP (WEC 2020-TN6707) to better define the extent of VOC contamination in the surficial aquifer.

The most recent CSM shows a large PCE plume (and smaller TCE plume) in the surficial aquifer extending southwest and south from the potential source areas near the former oil house and West Lagoon II (WEC 2020-TN6707). The upper portion of the plume is stated to be controlled by surface topography and flows into the ditch that traverses the area (WEC 2020-TN6707). The lower portion of the plume is stated to flow preferentially at the base of the surficial aquifer and is restricted from moving deeper by the confining unit present at the site (WEC 2020-TN6707). VOC contamination south of the WWTP, north and east of Gator Pond, occurs at concentrations above the MCL in the shallow surficial aquifer. This portion of the PCE plume may be the result of the spreading of the main plume or may have arisen from an independent, unidentified source. A second plume is identified in the CSM as occurring west of the main plume; this area is the subject of additional investigation as part of the Phase II remedial investigation activities.

3.4.1.1.2 Fluoride and Nitrate

Activities at the WWTP and plant operations are believed to be the source of fluoride and nitrate in groundwater. The fluoride and nitrate plumes are located in the vicinity of the WWTP lagoons, Gator Pond, and Sunset Lake. Concentrations of fluoride and nitrate in sampled wells continue to exceed EPA MCLs (4 mg/L for fluoride and 10 mg/L for nitrate) in the surficial aquifer between the plant buildings and Sunset Lake (WEC 2020-TN6526). Between 2004 and 2019, the highest concentrations of fluoride were around and above 15 mg/L and were found in the wells surrounding the WWTP, including wells W-7, W-18, W-22, W-28, W-30, W-77, and W-78 (AECOM 2013-TN5508; WEC 2019-TN6553, WEC 2020-TN6526). Concentrations of fluoride have gradually trended downward over time from the peak values. Surrounding the WWTP, the highest nitrate concentrations were often higher than 150 mg/L at wells W-18, W-30, W-32, W-29, and W-7 between 2004 and 2019 (AECOM 2013-TN5508; WEC 2019-TN6553, WEC 2020-TN6526). Well water samples with high nitrate concentrations were obtained from wells W-30 (peak value of 2,900 mg/L) and W-29 (peak value of 980 mg/L) between 2011 and 2013 (AECOM 2013-TN5508). The large concentrations may be related to leaks and subsequent liner replacement of the lagoons that took place between 2008 and 2012. Nitrate concentrations in well water from these two wells have decreased significantly from the peak values; recent values have been below the MCL (WEC 2020-TN6526). In contrast, nitrate concentrations in wells W-18 and W-7 have been trending up; recent observed values have been 770 mg/L and 390 mg/L, respectively. These two wells are located southwest of the WWTP and along the principal shallow groundwater flow direction. Nitrate concentrations have been elevated since at least 2011 at wells W-39 and W-41 located west of the lagoons (AECOM 2013-TN5508); recent values have been 73 and 65 mg/L, respectively (WEC 2020-TN6526). Concentrations at these wells may be influenced by the presence of a surface drainage ditch in this area. Nitrate concentrations above the MCL were also observed in several wells located near the bluff (W-47, W-64, and W-67). According to the CSM, potential nitrate sources other than the lagoons may be contributing to the concentrations in these areas (WEC 2020-TN6707).

Characterization efforts for the 2011 CWW pipe leak indicated fluoride in the soil and sludge samples—47 mg/kg and 85 mg/kg, respectively. Liquid collected from the well boring indicated nitrate levels to be approximately 2 mg/L. The contaminated soil and sludge will remain beneath the CFFF Uranium Recycling and Recovery Services (URRS) area until decommissioning, which would begin after the 40-year license renewal period ends, if the WEC does not request a license renewal. Therefore, the fluoride could leach through the contaminated soil into the groundwater. Fluoride and nitrate move with groundwater flow, although nitrate concentrations can be lowered through natural processes such as denitrification (AECOM 2013-TN5508). The WEC will continue to monitor for fluoride and nitrate and submit results to SCDHEC in its annual

groundwater report as part of its NPDES permit. Recent well water from the nine new wells along the CWW line suggest that fluoride concentrations were mostly below the MCL, and nitrate concentrations were mostly below the MCL except at wells W-58 and W-59 (WEC 2020-TN6875). The two wells are on the southwestern end of the CWW line, close to well W-29 and the WWTP lagoons. Nitrate in these wells may also be from other potential sources identified in the CSM (WEC 2020-TN6707). Nitrate concentrations in wells W-58 and W-59 ranged from 4.3 to 21 mg/L between 2018 and 2020 (WEC 2020-TN6875).

During the response to the 2018 HFSS leak, the WEC obtained fluoride concentrations up to 1,180 mg/kg from soil samples around and beneath the facility. Two of these samples also showed nitrate concentrations above 700 mg/kg. Sentinel wells installed along an east-west line at the southern end of the main plant buildings were monitored for releases, and fluoride (in wells W-77 and W-78) and nitrate (in well W-77) were detected at concentrations above the MCLs (WEC 2020-TN6526).

In addition to continued monitoring of existing wells, the Phase II RIWP describes additional wells to be installed to better determine the transport of fluoride and nitrate in the floodplain sediments (WEC 2020-TN6707).

3.4.1.1.3 Ammonia

Historic leaks near the WWTP and nearby product storage areas are believed to have caused the ammonia groundwater contamination. Ammonia was also identified as a COPC for the Chemical Area and Western Storage Area OUs (WEC 2019-TN6553). The 1985 EA indicated the highest concentration was 900 mg/L (at W-7) in 1981 (NRC 1985-TN5602). There is no established MCL for ammonia. Removal of ammonia from the environment occurs through natural processes, nitrification of ammonia to nitrite and/or nitrate and denitrification of nitrate to gaseous nitrogen. Recent ammonia concentrations are significantly lower than the earlier peak values; the maximum concentration was reported to be 126 mg/L in W-18 (WEC 2020-TN6526). Ammonia concentrations in wells W-32, W-22, and W-7 south of the WWTP appear to be relatively stable at around 50 to 60 mg/L. Recent groundwater monitoring results (WEC 2020-TN6526) show that wells with elevated ammonia concentrations (greater than 1 mg/L) generally have elevated nitrogen concentrations, with the notable exception of well W-27 located just south of Gator Pond. The amount of ammonia and nitrate in groundwater may be correlated when ammonia is being removed via the nitrification-denitrification process.

No activities proposed in the Phase II RIWP are specifically directed at additional characterization of ammonia sources or contamination.

3.4.1.2 Radiological Contaminants

Previous site investigations indicate that the WWTP lagoons contributed to gross alpha and gross beta contamination, and activities exceeded the screening levels (15 pCi/L for gross alpha, 50 pCi/L for gross beta) in groundwater samples from wells around and south of the lagoons (AECOM 2013-TN5508). Recent groundwater samples showed gross beta contamination remains above the screening level in this area, but gross alpha contamination was less than the screening level in all wells around the lagoons and downgradient, along the groundwater flow path (WEC 2020-TN6526). In the early 1980s, five lagoons (West, West II, East, North, and South) were lined with 36 mil Hypalon liners, and underdrain systems were installed to detect leaks from the lagoons (NRC 1985-TN5602). The WEC believes its process of removing solids from the bottom of the lagoons was damaging the liners, thereby creating a potential for leaks

(WEC 2017-TN5621). The WEC noticed an upward trend in groundwater contaminants, so it replaced four of the lagoon liners (all but the East Lagoon liner) between 2008 and 2012, this time with 80 mil high-density polyethylene (HDPE) liners (WEC 2017-TN5621). As described in Section 3.3.1.3 of this EIS, recent samples of sludge in the Sanitary and East Lagoons showed results exceeding the screening levels for uranium, confirming the presence of uranium in the lagoons with the potential to contaminate groundwater, if released (WEC 2020-TN6526). The lagoon sludge samples were below the detection limits for Tc-99. Following the appropriate approvals, the WEC intends to complete closure of the East Lagoon in 2021, including removing the East Lagoon and its liner and remediating the soil, if needed (WEC 2019-TN6555, WEC 2020-TN6707). The WEC intends to complete sampling of Sanitary Lagoon sludge, remove the sludge from the lagoon, and close the lagoon (WEC 2020-TN6707).

The current CSM recognizes that manufacturing operations in plant buildings are potential sources of groundwater contamination by radionuclides (WEC 2020-TN6707). Recent sampling results showed elevated gross alpha and gross beta contamination in the surficial aquifer next to the exterior CWW line on the western side of the manufacturing building (WEC 2020-TN6526). In 2018, the WEC discovered a leak at one of the HFSSs inside the plant. Soil samples taken beneath and around the spiking station footprint showed total uranium concentrations as high as 10,000 parts per million (ppm). The WEC subsequently completed remediation to remove affected soil below the spiking station to a depth of approximately 2.7 to 3.6 m (9 to 12 ft). Soil samples away from the footprint of the HFSS also showed high total uranium concentrations and indicated the impact of past WEC operations. Gross alpha and gross beta activities were both above screening levels in groundwater samples recently obtained from a well (W-77) downgradient from the HFSS release (WEC 2020-TN6526). In 2019, the WEC identified a roof leak on one of the intermodal (sea-land) containers south of the WWTP, which stores waste drums containing uranium-bearing materials. The WEC's inspection noted that the waste drums were degraded, and contaminants may have leaked to soils under the container. The WEC is implementing a work plan to remove waste and containers in the Southern Storage Area Operable Unit and to complete risk-based soil sampling in the areas of the containers. As described in Section 2.1.3.1, the WEC has removed 62 intermodal containers as of November 2020 (WEC 2020-TN6844), and has removed contaminated soil in accordance with its site remediation procedure. No groundwater contamination has been attributed to releases from the Southern Storage Area Operable Unit.

3.4.1.2.1 Gross Alpha and Uranium

Groundwater well sampling results from the WEC's ongoing environmental monitoring program show gross alpha activities have exceeded the 15 pCi/L screening level in a number of wells around the WWTP lagoons since 2004 (AECOM 2013-TN5508; NRC 2018-TN6549; WEC 2016-TN5723, WEC 2018-TN5722). From 2004 to 2019, gross alpha activity has consistently exceeded the screening level in wells W-18 and W-30, located to the southwest and northeast, respectively, of South Lagoon. From 2007 until the WEC started sampling all wells for uranium in 2018, there have been several instances of wells exceeding a gross alpha activity level of 15 pCi/L, which is the trigger for isotopic analysis. Of those samples for which the WEC completed isotopic analysis, the results showed uranium below the MCL/derived limit. Only one well, W-18 with a uranium activity of 101 pCi/L, was above the WEC-derived criterion of 84 pCi/L in 2007, and it had a relatively high gross alpha activity of 115 pCi/L (WEC 2019-TN6546). Gross alpha activities in wells located in the lagoon area and those located away from plant buildings have not exceeded 60 pCi/L since 2010. Beginning in late 2018, the WEC started evaluating isotopic uranium in all samples from the site's existing well network.

The CSM identifies several potential uranium sources that appear to have affected groundwater quality in the surficial aquifer near the main plant buildings (WEC 2020-TN6707). In 2008, a CWW line breach was discovered along the western side of the plant. Soil and water samples collected near the breach indicated radionuclides in the CWW line and the subsurface. While the CWW line was replaced, not all of the contaminated soil was removed (WEC 2019-TN6510). A 2011 pipe leak released uranium to the subsurface beneath the URRS floor. The total volume of material released into the subsurface is not clear. One liquid sample taken from beneath the URRS area had a total uranium concentration of approximately 98,000 pCi/L (NRC 2019-TN6472). Based on the isotopic analysis, the uranium is from the CFFF operations (mainly U-234). The 2018 HFSS leak (WEC 2019-TN6553) resulted in uranium contamination in soil underneath the concrete floor to a depth of 11 to 12 ft (WEC 2019-TN6510). Contaminated soil beneath the spiking station was removed; confirmatory soil sampling showed a maximum uranium concentration of 2,740 ppm. The WEC stated that uranium contamination in the soil below the concrete floor was observed in soils outside the immediate area of the spiking station that leaked; WEC concluded that the cause of these high uranium concentrations was previous plant operations (WEC 2019-TN6510, WEC 2019-TN6553).

The WEC added nine new wells (W-51 to W-59) along the west flank of the main manufacturing building in late 2018 (see Figure 3-15) to monitor potential groundwater contamination from the CWW line leaks and other potential releases identified in the CSM (WEC 2020-TN6707). The line of wells closely follows the buried CWW pipe. Isotopic uranium activities were above the derived level (84 pCi/L) and total uranium concentration was above the 30 μg/L MCL in three of the wells (W-55, W-56, and W-59) during 2018 (WEC 2019-TN6876). Therefore, it is not immediately clear whether the recent sampling results in 2018 and 2019 indicate that either or both of the CWW line leaks are the only sources of gross alpha and uranium levels. Well W-45, located at the north end of the line of wells along the west side of the building has not been routinely sampled, but has had gross alpha activity levels that slightly exceeded 15 pCi/L (AECOM 2013-TN5508; WEC 2018-TN5722). The most recent samples from W-45 have had total uranium concentrations less than one-tenth of the MCL (WEC 2019-TN6876, WEC 2020-TN6526).

Wells along the south and east sides of the Chemical Area OU (W-76 to W-84) were installed in 2019 to detect groundwater contamination resulting from past plant operations, including any potential impacts of the HFSS leak. Groundwater samples obtained from these wells in 2019 showed total uranium concentration significantly above the 30 μg/L MCL at well W-77 (247 μg/L) and low concentrations (<1 μg/L) at nearby wells (WEC 2020-TN6526).

3.4.1.2.2 Gross Beta and Technicium-99

Gross beta activity has been found in groundwater wells at the CFFF site since the early 1980s and has consistently exceeded the site action level of 50 pCi/L in wells around the lagoons and between the lagoons and the bluff, e.g., in wells W-7, W-10, W-13, W-15, W-17, W-18, and W-32 (AECOM 2013-TN5508). The gross beta action level was used to trigger analyses for Tc-99 (WEC 2019-TN6510). After sampling in 2010, the WEC determined that the gross beta in groundwater was primarily due to Tc-99 based on beta/gamma scans of the samples (WEC 2019-TN6510). Residual Tc-99 present in the enriched uranium received for processing at the CFFF has been postulated to be the source of the Tc-99 on the site (WEC 2020-TN6538). The WEC evaluated potential sources and mechanisms for Tc-99 releases to the environment and determined that a liquid release from the cylinder recertification building was the most likely

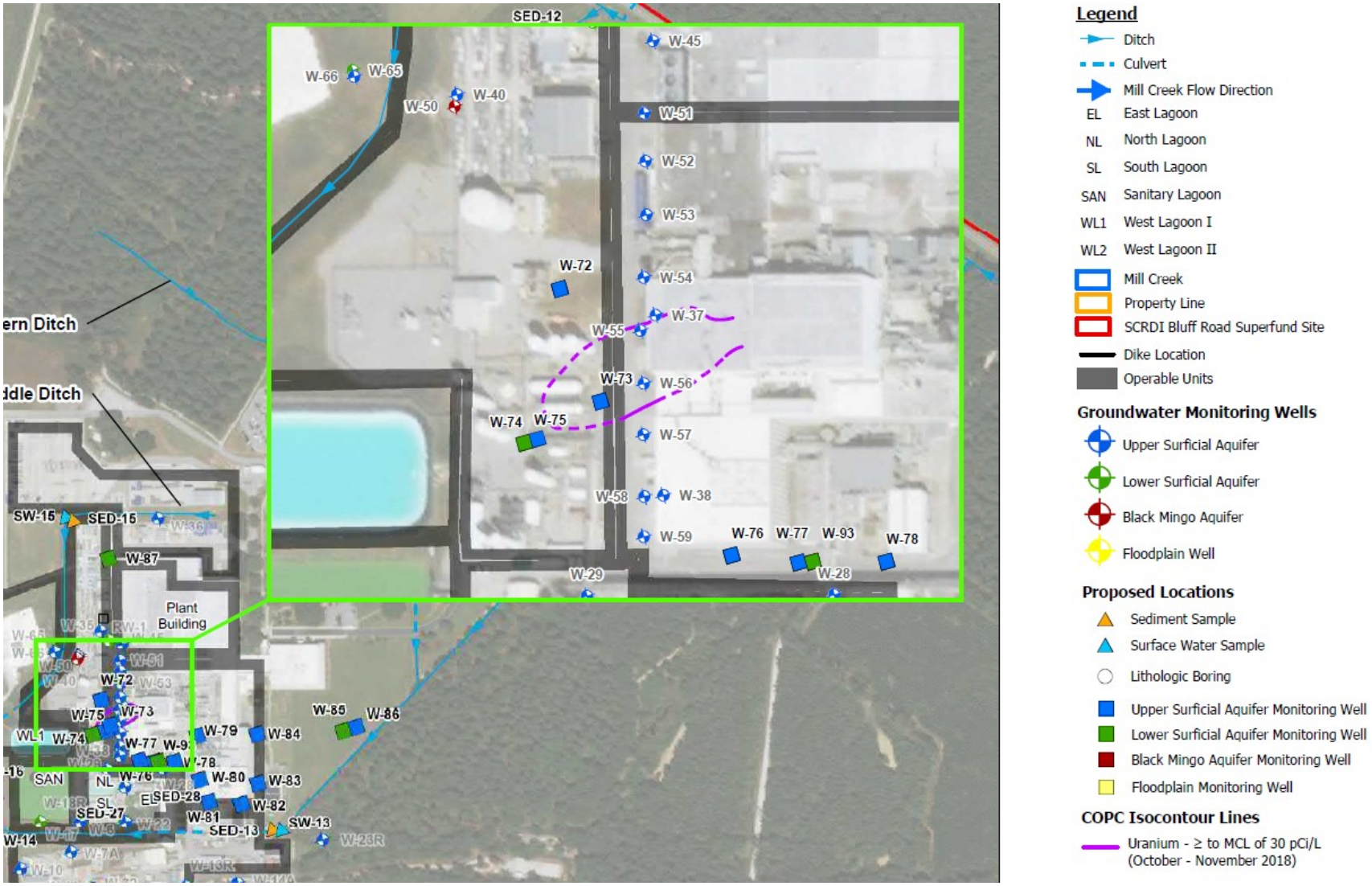

Figure 3-15 Uranium Groundwater Plume (Source: WEC 2019-TN6553, Adapted from Figure 12)

source of the Tc-99 releases (WEC 2019-TN6510). The CSM identifies three mechanisms for releases from the recertification building as potential sources for Tc-99 groundwater contamination (WEC 2020-TN6707). The WEC completed analysis of liquid and solid samples from various plant process streams (including East Lagoon sludge and adjacent soils) to evaluate potential sources of active Tc-99 releases, and concluded that current site operations do not have the potential for significant Tc-99 releases (WEC 2020-TN6538).

Sampling results for 2018 to 2020 indicate groundwater in the surficial aquifer continues to exceed the WEC's 50 pCi/L action level for gross beta (WEC 2020-TN6526, WEC 2020-TN6875). The WEC has evaluated all groundwater samples for Tc-99 activity since 2018. The MCL for Tc-99 (900 pCi/L) is derived from a calculated activity that will yield a dose of 4 mrem/yr to the total body or any critical organ (EPA 2015-TN6716); the Tc-99 MCL corresponds to a gross beta concentration much larger than the action level. While most Tc-99 activities at the CFFF site have been well below the MCL, measurements in two wells that were installed in 1980, but that were not sampled between 2004 and 2017, indicated Tc-99 activities above the MCL during the 2018 to 2020 sampling campaigns. These wells, W-6 and W-11, are screened in the surficial aquifer and located between the WWTP lagoons and Gator Pond. Gross beta activity since 2018 varied from 765 to 1,620 pCi/L at well W-6 and from 1,810 to 2,450 pCi/L at well W-11 (WEC 2020-TN6875). During the same period, Tc-99 activity varied from 861 to 2,450 pCi/L at well W-6 and from 2,660 to 4,200 pCi/L at well W-11 (WEC 2020-TN6875). Gross beta activity in Gator Pond (Figure 3-11) suggests that groundwater contaminated with Tc-99 has been discharging to the pond since routine measurements began in 2010. Groundwater monitoring data also show increasing Tc-99 activity at well W-47 (west of Gator Pond and downgradient from well W-11) and the presence of Tc-99 in wells W-13, W-67, and W-97 (east of Gator Pond), as well as at W-77 along the southern boundary of the Chemical Area OU. The WEC continues to assess the source of the Tc-99 contamination (WEC 2020-TN6707).

3.4.1.3 Confined Aquifer Contamination

As described earlier, only four wells at the CFFF site are screened in the confined aquifer (the Crouch Branch aquifer, referred to as the Black Mingo aquifer in CFFF documents)—wells designated as W-3A, W-49, W-50, and W-17 (WEC 2020-TN6526). The limited water quality data available from the confined aquifer wells show undetectable or very low levels of the monitored COPCs, and no indication that the confined aquifer has been contaminated as a result of CFFF operations.

3.4.2 Groundwater Impacts

The NRC staff determined the impacts on groundwater resources by evaluating the potential effects of the proposed CFFF's continued operations for an additional 40 years on the availability of the resources to support other uses and users. Groundwater withdrawals and consumptive use of water for CFFF operations would directly reduce the quantity of water available for other uses/users of the same resource. Degradation of groundwater quality by the inadvertent release of contaminants to the subsurface potentially renders the water resource unsuitable for other users and designated uses.

The WEC does not currently withdraw groundwater for any CFFF operational needs, and the WEC has not indicated that there are any plans to use groundwater for plant operations in the future (WEC 2019-TN6510). Therefore, the staff concludes that there are no potential impacts on groundwater resources from the withdrawal or consumptive use of groundwater for the proposed continued operation of the CFFF.

As described in Section 3.4.2 of this EIS, the groundwater at the CFFF site has been noticeably contaminated with VOCs, inorganics, uranium, and Tc-99 from inadvertent spills and leaks that have occurred during past operations. As noted previously, groundwater at the CFFF site is classified by South Carolina as an underground source of drinking water, even though the WEC is not currently using groundwater as a source of drinking water. As a result, the State's goal in remediating the site is for the groundwater to meet the applicable water quality standards established in the State's drinking water regulations (see Section 3.4.2 of the EIS).

When evaluating the potential impacts on groundwater quality from the proposed continued operation of the CFFF for an additional 40 years, the NRC staff considered the likelihood of future inadvertent releases of contaminants to the subsurface, the transport and fate of existing and potential future contaminants in the groundwater, and the potential effects of contaminated groundwater on other users of the groundwater resources.

3.4.2.1 Future Releases

The WWTP has been a source of groundwater contamination since before 1980 and likely will continue to be a potential source of contamination as long as it remains in operation. Actions taken by the WEC to reduce the likelihood of releases from the WWTP include the replacement of lagoon liners, the planned closure of East Lagoon in 2021, and the planned future closure of the Sanitary Lagoon. The NRC staff considers it likely that during the proposed 40-year license renewal period, the liners of the wastewater lagoons will need to be replaced again.

Several events involving leaks of contaminants from plant components have occurred since 2008. Actions taken by the WEC to reduce the environmental impacts of these events include remediation of contaminated soils, investigation of the extent of contamination, and expansion of the groundwater monitoring network to detect movement of contaminants and the occurrence of future leak events. Actions taken by the WEC to reduce the likelihood of future events that cause inadvertent leaks of contaminants include replacement of components (e.g., leaking pipes), removal of potential contaminant sources (e.g., the former oil house and southern storage area containers), and improved procedures (e.g., for materials handling, spill prevention, and inspection).

Investigations of subsurface contamination from past events have not been definitive in identifying the sources of contaminants, the initiation of contaminant releases, and the total amounts of contaminants released to the environment. For example, the source of VOC contamination in the Western Groundwater AOC is uncertain, as is the source of the Tc-99 contamination south of the plant. The NRC staff acknowledges that actions taken by the WEC in response to past contaminant releases have reduced the likelihood of future inadvertent releases with continued operation of the CFFF. With consideration of the history of the site, remaining uncertainties about past leaks, and the potential for the risk of leaks to increase with the age of plant components, the NRC staff concludes that future inadvertent releases of contaminants to the subsurface are reasonably foreseeable. Furthermore, the NRC staff expects that any future releases may result in groundwater contamination that exceeds MCLs, as has happened on multiple occasions in the past.

3.4.2.2 Transport and Fate of Contaminants

The WEC's best estimate of the current extent of the COPC contaminant plumes in groundwater, the potential sources of contamination, and the hydrologic and geological controls on the movement of the contaminants are embodied in the CSM (WEC 2020-TN6707). As

described in Section 3.4.2 of this EIS (and in the WEC's Phase II RIWP [WEC 2020-TN6707]), contaminants derived from CFFF operations that are currently present in groundwater at concentrations above their MCLs are the VOCs (PCE and TCE), nitrate, fluoride, uranium, and Tc-99.

VOCs contamination is widespread in the surficial aquifer on the CFFF site; recent concentrations exceed the MCL by more than an order of magnitude in wells screened in both the upper and lower portions of the aquifer (WEC 2020-TN6875). Although the existing data do not provide evidence that the VOC contaminants have been transported beyond Sunset Lake, the actual extent of VOC contamination is uncertain due to the relative sparsity of wells in the floodplain sediments. VOC biodegradation is expected to occur over time due to natural processes, but the current extent of contamination and the persistence of the contaminants over time indicate that VOC degradation has occurred at a rate too slow to prevent significant transport of contaminants by groundwater flow. The NRC staff expects these conditions to persist and additional transport of VOC contamination to occur in the future without remedial interventions.

Nitrate contamination is also widespread in the surficial aquifer; concentrations exceed the MCL by more than an order of magnitude in wells screened in both the upper and lower portions of the aquifer (WEC 2020-TN6875). Fluoride is less widespread in the groundwater; recent concentrations have been up to about three times the MCL. Both contaminants may have been transported in groundwater as far as Sunset Lake, although the actual extent of contamination is uncertain due to the relative sparsity of wells in the floodplain sediments. Although natural denitrification processes in groundwater may act to reduce nitrate concentrations, both contaminants are expected to be largely transported by groundwater flow, with any attenuation occurring through dispersive processes (including diffusion).

While uranium has been observed at concentrations above background levels at a number of wells screened in the surficial aquifer and located south of the main plant buildings, concentrations of uranium above the MCL have only been observed in relatively isolated locations close to the plant buildings (WEC 2020-TN6875). The isolated extent of uranium contamination in groundwater may arise from the size of the releases, which are unquantified, but is more likely due to the relatively low mobility of uranium in the subsurface. Uranium tends to adsorb to natural sediments under near-neutral pH conditions (Long et al. 2008-TN6947), such as those that exist at the CFFF site (WEC 2020-TN6875). In recent sampling, uranium concentration in groundwater exceeded the MCL by a factor of one to eight at three wells. The existing data are insufficient to conclude that uranium concentrations at these wells will not increase in the future because there could be uranium in the unsaturated sediments above the surficial aquifer. Due to the limited mobility of uranium, however, the NRC staff expects that the existing uranium contamination will move in groundwater more slowly than the other contaminants, and that the extent of uranium contamination above the MCL will remain relatively small in the absence of additional releases to the subsurface.

As described in Section 3.4.1.2.2 of this EIS, elevated levels of gross beta activity have been observed in the surficial aquifer at the CFFF site since the early 1980s; activities have consistently exceeded the action level of 50 pCi/L over the last 10 to 15 years in a number of wells south of the lagoons. Gross beta activity in the groundwater has been attributed to several potential past releases of Tc-99, and no estimate is available for the total quantity released (WEC 2019-TN6510). As described in Section 3.3.2.2 of the EIS, water quality measurements in Gator Pond have shown elevated gross beta activity since 2010, apparently a result of contaminated groundwater discharging to the pond via an associated spring. Annual

average gross beta activity in Gator Pond has been relatively constant since about 2014 (see Figure 3-11), suggesting a steady contribution of Tc-99 to the pond from the groundwater during this period, and the continuing presence of a Tc-99 groundwater plume.

Monitoring of two wells (W-6 and W-11) that had not been routinely sampled prior to 2018 has shown Tc-99 activity exceeding the MCL by a factor of about two in well W-6 and by a factor of three to four in well W-11 from 2018 to 2020. Shallower wells at these same locations (W-22 and W-32, respectively) have had Tc-99 activities below the MCL during the same monitoring period. The most recent groundwater monitoring results show the presence of Tc-99 in wells located hundreds of feet from W-6 and W-11 in all directions, as shown in Figure 3-16 (WEC 2020-TN6875). Tc-99 is expected to move in the surficial aquifer along with the groundwater flow; any attenuation of contaminant activities would largely occur through dispersive processes (including diffusion). With little information about the timing, location, duration, volume, and inventory of past Tc-99 releases, it is difficult to draw conclusions about the processes that have resulted in the observed Tc-99 behavior at the site. For example, it is unclear which processes might have influenced the observed Tc-99 activity at the co-located well pair, W-32 and W-11 (shown in Figure 3-17): the gross beta spike in 2004-2005, the steady, elevated activity in W-32 over a 15-year period, and the apparent significant vertical gradient in Tc-99 activities (the bottom of the W-32 well screen is at the same elevation as the top of the W-11 well screen). Similarly, with an estimated average groundwater velocity in the terrace sediments of between 75 and 150 ft/yr (see Section 3.4), any short-term release to groundwater should have been largely swept by advection from the region between the plant and the bluff.

The WEC states that the CSM is used to identify the fate and transport of contaminants (WEC 2019-TN6423. However, the CSM is currently mainly qualitative, and is currently limited to a hydrogeologic description of the site, the potential sources of contamination, and the extent of existing contamination. The NRC staff acknowledges that the CSM is currently investigatory and is intended to evolve as site investigation and remediation proceed and as new data are collected (WEC 2020-TN6526). The WEC intends to use the CSM as a decision-making tool throughout the life of the facility. However, there are currently a number of uncertainties associated with the fate and transport of contaminants during the period of the proposed action (40 years). For example, the degradation rate of VOCs, the role of the unsaturated zone as a reservoir of contaminants, and the effects of lithologic heterogeneities on groundwater flow and contaminant transport are currently undefined but may be needed to properly interpret existing observations and make inferences about future groundwater quality effects. The NRC staff finds that the current CSM is insufficient for evaluating the future movement and ultimate fate of contaminants in groundwater at the CFFF site that may occur as the result of future inadvertent releases. The WEC plans to enhance the CSM as the remedial investigation under the CA with SCDHEC is completed. Consistent with the RIWP, the WEC will document the results of all remedial investigation activities in a final Remedial Investigation Report that would also include a summary of the human health and ecological risks from the Baseline Risk Assessment that the WEC will perform after completing the remedial investigation activities. The remedial investigations and the Baseline Risk Assessment will inform the WEC's evaluation to determine whether additional assessments are necessary for further focused assessment activities and appropriate remedial alternatives, which will be part of a Feasibility Study. The Feasibility Study will be provided to SCDHEC within 90 days of SCDHEC's approval of the final Remedial Investigation Report.

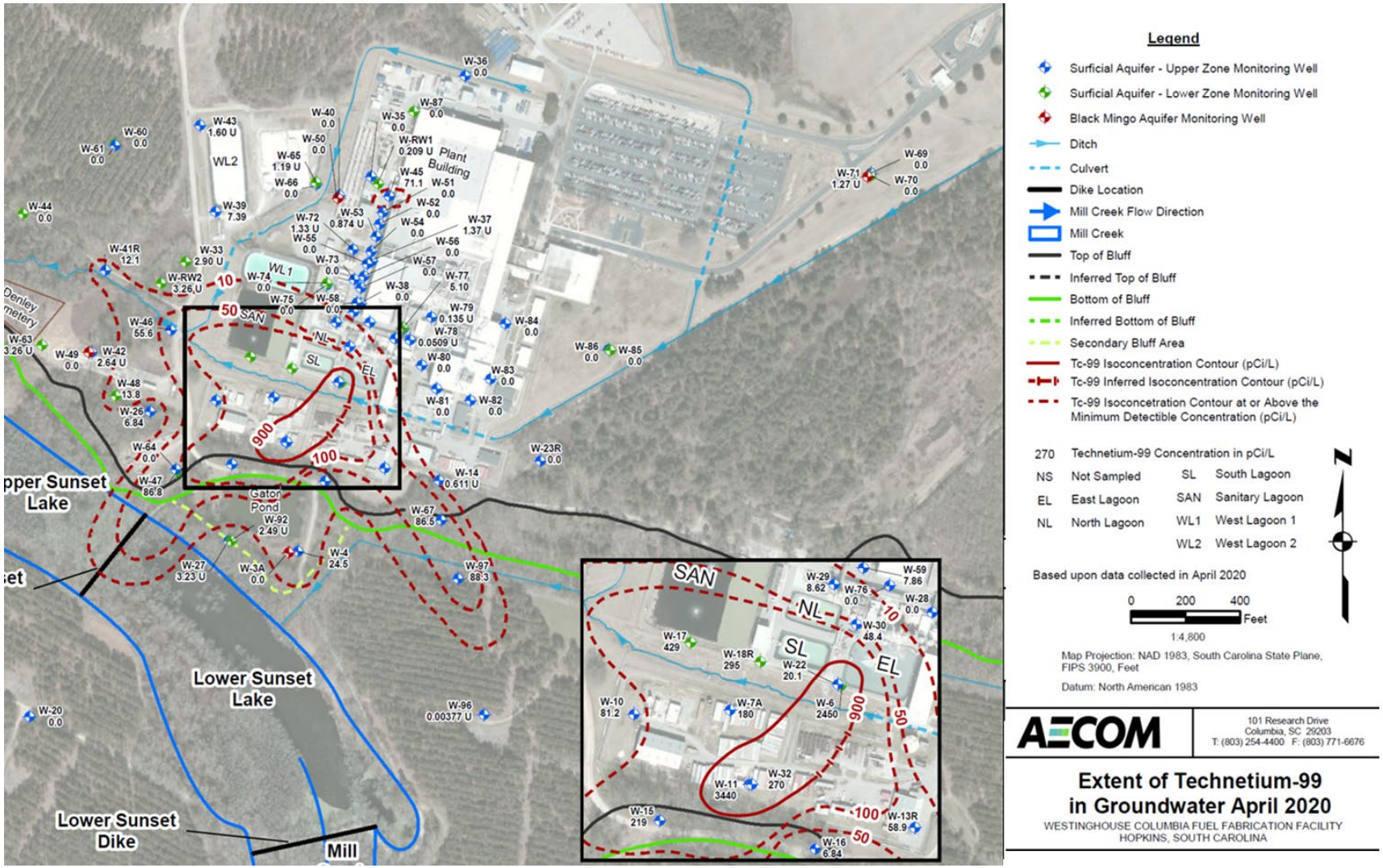

Figure 3-16 Tc-99 in the Surficial Aquifer, April 2020 (Source: WEC 2020-TN6875)

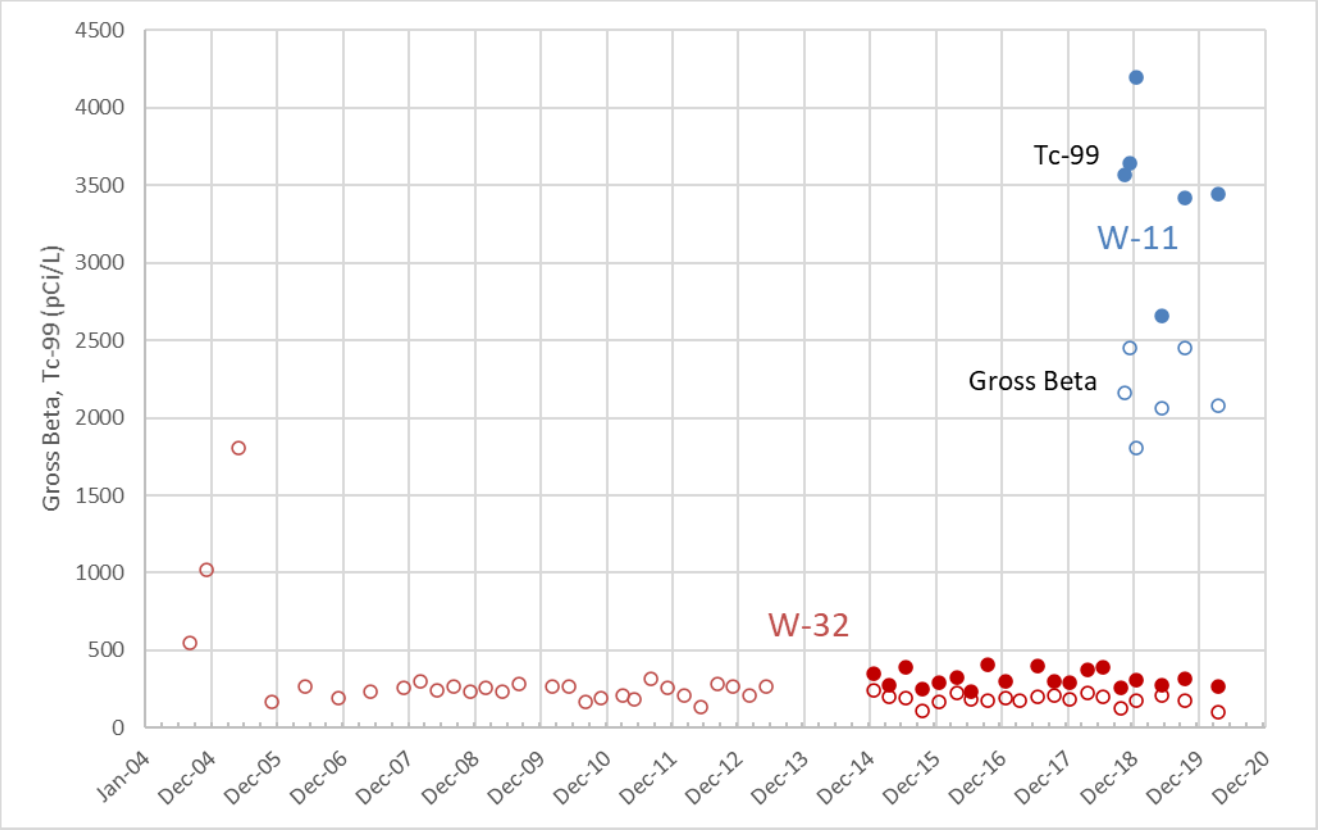

Figure 3-17 Gross Beta (open circles) and Tc-99 (filled circles) Activity at the Well Pair W-32 (red) and W-6 (blue) (Source: WEC 2020-TN6875)

3.4.2.3 Effects on Other Groundwater Users

The effects on other groundwater users from the existing or potential future degradation of groundwater quality due to the proposed continued CFFF operations for an additional 40 years are reduced by two factors: (1) the locations of the users with respect to the CFFF site, and (2) the results of the ongoing efforts of the WEC under the CA with SCDHEC to detect, monitor, and prevent or mitigate the movement of contaminants offsite (via the programs and procedures established by the WEC).

As described in Section 0 of this EIS, the majority of groundwater supply wells in the vicinity of the CFFF site are located to the north of the site along Bluff Road. The regional hydrogeologic information and the CFFF site-specific data to date indicate that groundwater in both the surficial and the confined aquifer flows generally southwestward, toward the Congaree River. Because groundwater beneath the CFFF site tends to flow away from Bluff Road, water quality in the water supply wells along Bluff Road is unlikely to be affected by the CFFF activities.

The offsite, private wells that were identified by the WEC (see Figure 3-13) are located in the general direction of groundwater flow from the CFFF site and could be affected by the existing and any potential future contamination from CFFF activities during the proposed license renewal period if contaminants were transported to these wells. The inactive wells, IWSW-01 and IWSW-02, and the active well WSW-01, all shown in Figure 3-12, are the least likely of the private wells to be affected by groundwater contamination from CFFF activities because they are located north of the CFFF site. As noted above, groundwater generally flows southwestward from the site, toward the Congaree River. The other active, private wells are located about 1.6 to 4 km (1 to 2.5 mi) from the existing groundwater contamination, while the Congaree River itself is about 5 km (3 mi) from the existing contamination. It is unknown whether the private wells are screened in the surficial aquifer or in the confined aquifer.

The existing groundwater sampling data from CFFF monitoring wells indicate that the contaminant plumes resulting from past activities at the CFFF site currently remain within the boundaries of the site property. With the exception of the VOC contamination in the Western Groundwater AOC (see Figure 2-4), detectable groundwater contamination occurs primarily around the WWTP and the Gator Pond and Sunset Lake areas. No significant contamination from COPCs has been observed in the floodplain wells located south of Sunset Lake. These CFFF floodplain wells are about 600 m (2,000 ft) from the downgradient property boundary.

As described in Section 3.4 of this EIS, average groundwater velocity in the floodplain sediments of the surficial aquifer was estimated by the NRC staff to be 6 to 12 m/yr (20 to 40 ft/yr). This is the velocity at which the center of mass of a non-reactive, non-decaying contaminant plume would travel. At this velocity, about 50 years would be required for the bulk of a contaminant plume to travel 600 m (2,000 ft). This could suggest that the existing groundwater contamination is not likely to travel beyond the CFFF site boundary during the period of the proposed action. However, there is significant uncertainty in the estimated groundwater velocities due to the limited data in the floodplain. Conservative estimates of groundwater velocities in the floodplain, discussed in Section 3.4 of this EIS, were 18 to 35 m/yr (58 to 115 ft/yr). These conservative estimates may be appropriate if the contaminants travel preferentially along higher-velocity flow paths within deposits of more permeable (sand, gravel) sediments. This could result in contaminants traveling offsite more quickly (e.g., with a travel time less than 20 years over a distance of 600 m) than suggested by the average groundwater velocity.

The identification of past releases of COPCs to the environment and the resulting contamination of water resources on the CFFF site, including the exceedance of water quality standards in site groundwater, led the SCDHEC and the WEC to enter into the CA (see Section 1.5.2.2.1). The NRC staff expects that the WEC will execute the activities laid out in the CA, including the remedial investigation, Baseline Risk Assessment, Feasibility Study, and subsequent remedial and corrective actions, if necessary, as required by SCDHEC. Through the remedial investigation process defined in the CA that is currently under way, the extent of onsite contamination and the potential for offsite movement of contaminants are being determined. Upon completion of the remedial investigation, the WEC will evaluate remedial alternatives for the site based on criteria that include compliance with applicable water quality standards. With respect to the groundwater resources at the site, the objective of the CA is to prevent the movement of contaminants off the CFFF property and to reduce groundwater contamination to below the MCLs. Because the WEC is currently in the investigatory phase of the CA, the methods by which the groundwater quality objectives of the CA will be met are unknown. The ultimate outcome of the remedial methods is also uncertain. Therefore, although groundwater contamination on the CFFF site currently exceeds water quality standards, the NRC staff does not expect the effects on offsite groundwater users to be significant, because the WEC is continuing to investigate the sources of contamination to monitor the extent and movement of existing contamination, and will take corrective actions as required by SCDHEC through the CA to prevent any significant offsite groundwater contamination.

In addition to the CA process, a groundwater monitoring program has been established at the CFFF site to provide ongoing monitoring of the site's groundwater quality under NPDES Permit No. SC0001848 (SCDHEC 2017-TN5607). The current NPDES permit requires semiannual groundwater level monitoring and water quality analyses for pH, specific conductance, nitrate, fluoride, VOCs, and radionuclides in a network of up to 20 existing wells. The NRC staff expects similar monitoring requirements under the NPDES permit will apply throughout the proposed continued operation of the CFFF. The draft NPDES permit is currently under renewal review by SCDHEC and also includes requirements for lagoon liner inspections. The WEC reports the groundwater monitoring results to SCDHEC annually, has committed to providing the same results to the NRC annually during the proposed license renewal period. Based on the results of the annual sampling or during a NPDES renewal review, SCDHEC could adjust monitoring requirements if deemed necessary, including requiring additional assessment of groundwater quality.

Groundwater monitoring of uranium isotopes and Tc-99 is also carried out as part of the environmental sampling and monitoring program for the CFFF's NRC license. Samples are obtained semiannually from 59 wells to monitor known contamination, to detect leaks, and to prevent offsite migration of contaminants. The wells monitored could change during the license renewal period based upon evaluations by the WEC, particularly the monitoring wells for existing or newly discovered plumes that will be used to delineate the boundary of the plumes and identify their center of mass. The NRC will continue to inspect WEC's compliance with its NRC-licensed environmental monitoring program. If the license is renewed, a new license condition would require the WEC to resubmit its environmental sampling and monitoring program for NRC review and approval upon either SCDHEC approval of the WEC's Remedial Investigation Report or within 5years of the license renewal, whichever comes first.

In response to environmental contamination from CFFF releases and pursuant to the CA with SCDHEC, WEC has developed a CSM and procedures concerning environmental data management and environmental remediation to help make informed decisions about data needs, changes to its environmental sampling and monitoring programs, and the remediation of

contaminant releases. The WEC has explained that the CSM will be used and maintained throughout the life of the facility. Additionally, if renewed a new license condition would require the WEC to enter groundwater and surface water results above Federal and State limits into its CAP. The WEC has also established an environmental remediation procedure (RA-433) to be followed in the event of a release of contaminants to the ground surface or environmental media, the detection of groundwater contamination above MCLs, or the discovery of a past release through soil sampling (WEC 2020-TN6853). The purpose of the remediation procedure is to prevent the migration of contaminants offsite and to minimize the impacts of contaminant releases on future decommissioning activities.

3.4.2.4 Groundwater Impacts Conclusion

Past operation of the CFFF has had a noticeable effect on the water quality of the onsite groundwater. Contaminants derived from the CFFF operations that are currently present in onsite groundwater at concentrations above their MCLs are the VOCs (PCE and TCE), nitrate, fluoride, uranium, and Tc-99. Based on the existing data and history of the site, the NRC staff expects future inadvertent releases of contaminants to the subsurface to be reasonably foreseeable, and that any future releases may result in groundwater contamination that exceeds the MCLs. With the exception of uranium, all of the contaminants currently present in groundwater at levels above their MCLs are expected to be mobile in groundwater. The existing groundwater sampling data indicate that the contaminant plumes resulting from past activities at the CFFF site currently remain within the boundaries of the site property and occur only in the surficial aquifer. Based on the existing estimates of average groundwater velocity, the current groundwater contamination is not likely to travel beyond the CFFF site boundary during the period of the proposed action. However, significant uncertainties affect the evaluation of fate and transport. These uncertainties include the location, timing, and magnitude of contaminant sources; explanations of large differences in observed Tc-99 activities in co-located well pairs; the effects of groundwater velocity variation in the heterogeneous sediments; and the ultimate outcome of the groundwater remediation that will occur under the CA process.

The NRC staff evaluated the effects of the proposed continued operation of CFFF on the availability of the affected groundwater resources to support other uses and users. There are no groundwater withdrawals or consumptive use of water for the CFFF operations and no planned discharges to groundwater. The NRC staff determined that the proposed continued operations could result in inadvertent releases of contaminants that may noticeably affect the quality of the onsite groundwater and exceed water quality standards. The NRC staff determined that there is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources (e.g., the environmental sampling and monitoring program). As described above, however, significant uncertainties remain about the ultimate fate and transport of groundwater contamination at the site. Therefore, the NRC staff concludes that the impacts on groundwater resources from continued operation of the CFFF for an additional 40 years would be SMALL to MODERATE.

Because the past operation of CFFF has had a noticeable effect on the water quality of the onsite groundwater that continues to be observed in the most recent data, the NRC staff concludes that the cumulative impacts to groundwater are MODERATE. In addition, although the proposed continued operation of the CFFF for an additional 40 years could noticeably alter onsite groundwater quality, the continued operation would not destabilize or significantly affect the groundwater resource because there is a low potential for contaminants to move offsite (for reasons explained above). Therefore, the SMALL to MODERATE incremental impact

contribution from the proposed action would not result in a collectively greater impact on groundwater resources (see Appendix B for additional information).

3.4.3 Mitigation Measures

As described above, the WEC currently monitors groundwater levels and water quality to conform with the NPDES discharge permit requirements. Similar monitoring requirements are expected to be included in the NPDES permit renewal(s) applicable during the period of the proposed action. The WEC also carries out environmental monitoring of groundwater under the terms of its NRC operating license and this would continue through the proposed license renewal period. Continued adherence to the groundwater monitoring requirements of the NPDES permit and NRC license will serve to avoid and minimize impacts on groundwater resources. The WEC is expected to continue to follow the RIWP, develop a Baseline Risk Assessment, Feasibility Study, and identify remediation as described in the CA with SCDHEC to limit health risks from the existing groundwater contamination and restore site groundwater to compliance with water quality standards. In addition, the WEC is expected to continue to follow its environmental remediation procedure throughout the proposed license renewal period to prevent the migration of contaminants offsite and to minimize the impacts of contaminant releases on future decommissioning activities. The WEC has also agreed to two new license conditions related to the WEC's environmental monitoring and sampling program. The first license condition would require the WEC to enter groundwater and surface water results exceeding Federal and State standards into its Corrective Action Program. The second condition would require the WEC to submit its environmental monitoring and sampling program to the NRC for review and approval upon either SCDHEC's approval of the final Remedial Investigation Report, as required by the CA, or within 5 years of the license renewal (whichever comes first). Additionally, the WEC has committed to submit the environmental monitoring and sampling program to the NRC for review and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC (WEC 2021-TN7042).

3.5 Ecological Resources

This section describes the ecological resources within the vicinity of the CFFF site and the potential impacts of the proposed continued operation of the CFFF for an additional 40 years.

3.5.1 Terrestrial and Aquatic Resources

3.5.1.1 Terrestrial Resources

The CFFF site is located within the Southeastern Plains (Level III Ecoregion 65) within the transitional area between two Level IV ecoregions: the Atlantic Southern Loam Plains (65l) and the Southeastern Floodplains and Low Terraces (65p) (EPA 2013-TN5033). The region is dominated by oak-hickory forests consisting of smaller tree and common shrub species.

The undeveloped portions of the site include wetlands, woodland areas, and hardwood forests. The area around the facility includes various grasses, rushes, sedges, and weedy herbs and is maintained by mowing, which limits vegetation height. Rodents, birds, reptiles, amphibians, and insects all potentially use the area as habitat based on surveys of the site that were last conducted in the 1970s (see Appendix B of the WEC's March 2019 ER [WEC 2019-TN6510] for a species list). However, wildlife diversity in the area is limited and is likely dominated by species tolerant of human activity because the area in and around the CFFF site has been used

as an industrial facility for decades and because vegetation in the area is of limited height and diversity (AECOM 2014-TN5511).

3.5.1.2 Aquatic Resources

The main aquatic habitats at the CFFF site include Mill Creek and Sunset Lake. Sunset Lake was created by a man-made impoundment of Mill Creek. A spill gate is used to discharge water from the dam at Sunset Lake back into Mill Creek, which then flows into the Congaree River approximately 10.5 river km (6.5 river mi) downriver from the CFFF site (AECOM 2013-TN5508; NRC 2007-TN5598, NRC 2019-TN6472). The species compositions of Sunset Lake and Mill Creek are unknown. The NRC staff identified no existing survey data about these aquatic features during its review. Small fish and invertebrates, however, likely inhabit onsite aquatic habitats. Organisms within the small creeks, drainage ditches, and floodplains are likely tolerant of extreme physical conditions given the lack of continuous connectivity with larger water bodies. Bathymetry surveys conducted by the WEC found that Sunset Lake is shallow— at 1.5 to 1.8 m (5 to 6 ft) deep (WEC 2020-TN6526) and could potentially provide suitable habitat for gamefish (e.g., bass, catfish, sunfish); however, fishing is currently prohibited (NRC 2019-TN6472). Gator Pond is located along the southern edge of the buildings at the CFFF site. This man-made pond does not drain into Mill Creek or Sunset Lake.

The Congaree River occurs outside of the CFFF site (approximately 5 to 6 km [3 to 4 mi] southwest at the closest), but it is part of the affected aquatic environment because (1) the CFFF site is within the Congaree River floodplain, (2) Mill Creek and Sunset Lake drain into the Congaree River, and (3) the CFFF discharges their treated wastewater directly into the Congaree River in accordance with a NPDES permit from SCDHEC (NRC 2019-TN6472).

The Congaree National Park is downriver from the CFFF site and is well recognized for having important scenic, cultural, ecological, scientific, and socioeconomic values as discussed by the National Parks Service (NPS 2020-TN6543). The park provides a diversity of riverine, wetland, and upland habitats that include more than 15,000 ac of protected wilderness area. The Congaree River is also known for providing scenic boating and fishing opportunities in a 72 km (45 mi) reach near the CFFF site and within the Congaree National Park.

Surveys within the Congaree National Park indicate that the Congaree River provides habitat to approximately 55 species of fish, 16 species of mussels, and 7 species of crayfish (Congaree Riverkeeper 2012-TN6895). Common recreationally important species include black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), bowfin (*Amia calva*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), redbreast sunfish (*Lepomis auritus*), striped bass (*Morone saxatilis*), and yellow perch (*Perca flavescens*) (NPS Undated-TN6992; NRC 2019-TN6472).

To gather additional data about fish populations near the CFFF site, the NRC staff reviewed survey data that were recorded in an online database, FishNet2 (2014-TN6991). This database is a collaborative effort by natural history museums and biodiversity institutions to compile fish survey data. The database included one fish survey in the vicinity of the CFFF site that was conducted in June 2002. However, the survey methodology, sampling protocols, and equipment were not specified. Therefore, a species may occur near the CFFF site but may not have been captured in the survey due to insufficient sampling effort and the various survey methods used. Table 3-2 lists fish species that were observed during the survey.

Table 3-2 Fish Species Collected Near the CFFF Site, 2002

Species	Common Name	Number of Organisms Captured
Carpiodes spp.	river carpsucker	20
Hypentelium nigricans	northern hogsucker	1
Moxostoma macrolepidotum	shorthead redhorse	6
Alosa sapidissima	American shad	1
Cyprinella nivea	whitefin shiner	2
Morone americana	white perch	1

Source: FishNet2 2014-TN6991: Survey conducted on June 19, 2002, on the Congaree River, from 1.6 to 2.4 km (1.0 to 1.5 mi) south of Interstate-77, about 8 air km (5.0 mi) south of the City of Columbia.

The stretch of the Congaree River adjacent to the CFFF site is also listed on the Wild and Scenic Rivers Act Nationwide Rivers Inventory, which is administered by the National Parks Service. In accordance with an executive memorandum (Office of the President 1979-TN7067), all agencies must "take care to avoid or mitigate adverse effects" on rivers identified in the Nationwide Rivers Inventory, and agencies should consider the potential impacts on outstandingly remarkable values (ORVs) (NPS 2019-TN6579, NPS 2020-TN6543). The proposed action could affect the ORVs related to deterioration of water quality, however chemical discharges are within health standards, as described in the section on aquatic impacts (Section 3.5.2.2 in this EIS). Continued operation of the CFFF could also potentially affect the ORV related to noise disturbance. However, minimal noise from the plant is expected to reach the Congaree River because the CFFF site is approximately 5–6 km (3–4 mi) away.

3.5.2 Terrestrial and Aquatic Resources Impacts

3.5.2.1 Terrestrial Resource Impacts

Potential sources of impacts on terrestrial resources include noise during daily operations, increased turbidity or introduction of pollutants from site runoff and discharges, and some minor land disturbances associated with the drilling of new groundwater monitoring wells per the CA with the SCDHEC.

The NRC and U.S. Fish and Wildlife Service (FWS) (NRC 2019-TN6473; FWS 2019-TN6429) expect the impacts on terrestrial species to be minor. In summary, the NRC staff and FWS determined that the proposed continued operation of the site for an additional 40 years is not likely to adversely affect federally listed terrestrial species because (1) the WEC is not proposing any new construction that would disturb terrestrial habitats; (2) although new groundwater monitoring wells will be drilled, the construction is temporary and only causes minimal land disturbance; and (3) wildlife is habituated to daily operating noises because the CFFF has been in operation for decades. While these findings were made for federally listed species, the NRC staff has determined, based on its review, that they apply more broadly to all terrestrial species.

Terrestrial species can also be affected by CFFF actions that affect water quality and aquatic habitats (e.g., Congaree River). Public comment requests in response to the draft 2019 EA (NRC 2019-TN6472) requested evaluation of the aquatic linkages to terrestrial resources, which are analyzed in the aquatic impacts section (Section 3.5.2.2 of this EIS). The proposed action is

expected to result in low impacts on terrestrial resources because the surface waters, where organisms live and drink, would continue to be monitored to ensure compliance with regulatory limits. This includes the treated effluent from fuel processing and for sanitary purposes that is directly discharged into the Congaree River. It also includes the known contaminations (e.g., uranium, Tc-99, PCE, and TCE) that were discovered in surface waters onsite (e.g., Sunset Lake) and are being further evaluated and addressed by the WEC through the CA with SCDHEC.

The proposed action could also benefit wildlife. The WEC volunteered to participate in the Wildlife and Industry Together program, which is sponsored by the South Carolina Wildlife Federation (SCWF 2017-TN6993). Members of the program establish conservation and education goals to improve wildlife health (WEC 2014-TN6421). To become certified by the South Carolina Wildlife Federation, the WEC agreed to conduct wildlife enhancement projects on or near the CFFF site, provide environmental education for employees, and community outreach (NRC 2019-TN6472). For instance, the WEC participated in a special project with the South Carolina Wildlife Federation in 2019 to build and install 25 nesting boxes on the CFFF site for prothonotary warblers (*Protonotaria citrea*).

3.5.2.2 Aquatic Resource Impacts

A primary potential impact on aquatic resources is that associated with the direct discharge of treated wastewater into the Congaree River. Although continued discharges could result in some minor degradation of aquatic habitats, the WEC would be required to comply with the chemical and quantity limits specified in its NPDES permit. Additionally, the volume of discharged effluent would be a small percentage of the overall flow of the Congaree River and, therefore, the concentration of discharged effluent would be quickly diluted. Mobile biota could likely swim around the effluent plume to avoid contact with chemical and other pollutants. A small portion of drifting or weakly swimming biota (e.g., fish eggs and larvae) could be exposed to the effluent plume, but exposure times would be limited because of the relatively small discharge rate compared to the flow rate of the river. Additional direct impacts on aquatic biota and habitats would be limited given that the WEC would not directly obtain water from surface water bodies.

The potential impacts of the CFFF discharge into the Congaree River were considered by NRC staff and NMFS (NRC 2018-TN5588), and both determined that continued operation of the CFFF is not likely to adversely affect listed sturgeons species because (1) pollutant levels from the discharge pipe are monitored and regulated by NPDES permits; (2) pollutant releases to water bodies outside the CFFF site are below the regulatory limits set by the SCDHEC and also within U.S. Department of Energy (DOE) guidelines to protect aquatic and terrestrial life (NRC 2018-TN6428); (3) uranium levels in water samples (below drinking water health limits) and sediment samples (below average U.S. soil levels) are low, and observed levels in fish tissue samples (<1 pCi/g) outside the CFFF site are minimal; (4) dissolved oxygen levels are supportive of aquatic life in the area; and (5) the effluent discharges to the Congaree River are minor (i.e., <001% of average river discharge), quickly dispersed, and are released at ambient temperatures. While these findings concern sturgeon, the same rationale applies to all aquatic species.

A second potential impact on aquatic habitats and biota concerns runoff that may contain sediments, contaminants from road and parking surfaces, or herbicides. Impacts of runoff on aquatic resources are expected to be minimal because of the distance to the Congaree River and site-specific programs to prevent pollution from stormwater runoff. The WEC's continued

compliance with its NPDES permit for stormwater runoff would ensure that the effects of runoff on aquatic resources are minimized.

A third potential aquatic concern is that Tc-99, uranium, and TCE were detected in surface water samples taken at the CFFF site in 2019 (WEC 2020-TN6526). However, contamination levels were below MCL levels in Sunset Lake and will continue to be addressed via the CA with the SCDHEC. Regarding uranium, all samples from Sunset Lake were less than 7% of the MCL (i.e., <2 ug/L of the 30 ug/L MCL [Table 4 in WEC 2020-TN6526]). Similarly, all Tc-99 samples were also less than 7% of the MCL (i.e., <50 pci/L of the 900 pci/L MCL) in Sunset Lake and there is a low potential for contaminants to move offsite (see Section 3.4 of this EIS). Regarding TCE, high levels were found in the drainage ditch between the CFFF buildings and Sunset Lake (i.e., 14 and 16 ug/L compared to the 5 ug/L MCL); however, TCE volatizes rapidly in surface water (ATSDR 2019-TN6948) and that may explain why all of the samples taken in Sunset Lake were <21% of the MCL 5 ug/L (WEC 2020-TN6526).

A fourth potential concern is the accumulation of uranium and fluoride in fish consumed by recreational anglers. However, observed contamination levels in fish tissue samples have remained well within health standards. As part of its environmental monitoring program, the WEC collects one fish each year from a location near or at the diffuser discharge into the Congaree River. Uranium samples in these fish tissue samples have consistently remained below 0.6 pCi/g, which is barely above the minimum detection level of 0.5 pCi/g (WEC 2019-TN6423). Further, the SCDHEC conducted additional tissue sampling in August 2019 of27 bluegill (*Lepomis macrochirus*) and redbreast sunfish (*Lepomis auratus*) around the discharge pipe and concluded that both uranium (not detected in fillets) and fluoride (<0.25 mg/kg-day limit) are not at levels that would cause fish consumption concerns (SCDHEC 2020-TN6536). Bluegill and redbreast sunfish were chosen because they primarily consume invertebrates, which makes them more susceptible to uranium uptake. Although the WEC does not collect any biota samples from onsite surface water bodies, such as Sunset Lake or Mill Creek, there is also currently no public access to those water bodies for fishing or recreation.

3.5.2.3 Terrestrial and Aquatic Ecology Impact Conclusions

Any radiological materials potentially released from the CFFF into the environment would be transported through terrestrial or aquatic habitat or wildlife in a variety of ways and could result in biota exposure and public exposure through the food chain. The NRCs radiation protection regulations, by protecting members of the public, also protect nonhuman biota (NRC 2004-TN6431, NRC 2006-TN6430, NRC 2008-TN6432, NRC 2005-TN6649, NRC 2005-TN6650, NRC 2009-TN6651). See Section 3.12 of this EIS for further discussion of the potential for public exposure from radiological materials through both internal and external exposure pathways.

In conclusion, no significant impacts on aquatic or terrestrial resources are expected from the proposed action because the contamination levels in surface waters, where organisms live and drink, are within health standards. This includes impacts related to the discharge of treated wastewater directly into the Congaree River and from recently identified onsite contamination, which are being further investigated by the WEC's Phase II RIWP (WEC 2020-TN6707) under the CA with SCDHEC. Mitigation responses, if needed, would also be under the governance of the CA with SCDHEC.

Given that habitat disturbances during operations would be negligible, any disturbed wildlife could find similar habitat in the vicinity, and direct and indirect impacts on aquatic habitats and

biota would be minimal, the NRC staff concludes that impacts on ecological resources during the proposed continued operations of the CFFF for an additional 40 years would be SMALL. Based on these minor impacts, the SMALL incremental impact contribution to ecological resources from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.5.2.4 Terrestrial and Aquatic Ecology Mitigation Measures

The proposed action would result in SMALL impacts on terrestrial resources because (1) WEC is not proposing any new construction that would disturb terrestrial habitats; (2) although new groundwater monitoring wells will be drilled, the construction is temporary and only causes minimal land disturbance; and (3) wildlife is habituated to daily operating noises because the CFFF has been in operation for decades. No additional mitigation measures beyond those described in Section 3.4.3 are identified for terrestrial species.

Similarly, the proposed action would result in SMALL impacts on aquatic resources because discharges to the Congaree River are anticipated to be implemented in accordance with the NPDES permit; there is a low potential for significant contamination to move offsite via a surface water pathway and noticeably degrade water quality in Mill Creek; WEC has established remediation procedures for detecting groundwater contamination above the MCLs, discovering a past release through soil sampling (WEC 2020-TN6853), and preventing migration of contaminants offsite. No additional mitigation measures beyond those described in Sections 3.3.3 and 3.4.3 are identified for aquatic species.

3.6 Protected Species and Habitat

This section discusses the impacts of the proposed action to renew the CFFF operating license for an additional 40 years on protected ecological resources protected under the Federal Endangered Species Act (ESA) of 1973, the Migratory Bird Treaty Act of 1918 (MBTA; 16 U.S.C. § 703 *et seq.*; TN3331), and the Bald and Golden Eagle Protection Act of 1972 (16 U.S.C. § 668-668d *et seq.*; TN1447), all as amended. Impacts on State-listed species are also included.

Section 7 of the ESA requires Federal agencies to consult with the FWS or the NMFS regarding actions that may affect listed species or designated critical habitats. Chapter 1 and Appendix A describe the Section 7 ESA consultations that led both the FWS and NMFS to conclude that the proposed action is not likely to adversely affect listed species or critical habitats under either Service's jurisdiction.

3.6.1 State-Listed Species

Table 3-3 identifies the State-listed species that have the potential to exist on and near the CFFF site. The NRC staff compiled this table from the SCDNR's database (SCDNR 2014-TN6994) and ecological studies conducted on and near the CFFF site (WEC 2019-TN6510). The last ecological surveys at the CFFF site were conducted in 1975. Based on those surveys, the WEC (2019-TN6510) concluded that the southern bald eagle (*Haliaeetus leucocephalus*) and the red-cockaded woodpecker (*Dendrocopus borealis*) may occur on or near the CFFF site (WEC 2019-TN6510).

Table 3-3 State-Listed Species with the Potential to Occur in the Vicinity of the CFFF Site

Common Name	Scientific Name	State Status[(a)]	Habitat
pine barens treefrog	*Hyla andersonii*	T	Occurs in South Carolina in herb shrub bogs (a.k.a., shrub pocosins) in the sandhills. Colonies are known to exist along power lines and gas line right-of ways (SCDNR 2006-TN6898)
bald eagle	*Haliaeetus leucoephalus*	T	Occurs in large trees with open views for nesting. Prefers perch and roost sites with minimal disturbance and fresh and brackish marine habitats suitable for foraging (SCDNR 2020-TN6897)
red-cockaded woodpecker[(b)]	*Picoides borealis*	E	Occurs in mature pine forests; excavates cavities in living pine trees (SCDNR 2006-TN6899)
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	E	Occurs in coastal plain habitat; roosts in dilapidated buildings or tree cavities near water (SCDNR 2006-TN6896)

(a) T = State threatened; E = State endangered.
(b) This species is also federally listed under the ESA.
Source: NRC 2019-TN6472

3.6.2 Federally Protected Species and Habitats

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 402.02; TN4312). The action area remains the same as that described in the 2019 draft EA (NRC 2019-TN6472): the 469 ha (1,151 ac) CFFF site, the surrounding area where operations noise can be audible to wildlife, and the area where runoff and effluent discharges drain (i.e., 3.2 km [2 mi] downstream of the discharge pipe in the Congaree River).

Consideration is given to all direct and indirect effects of the proposed action, to species that migrate through the area, and to species that could colonize the area in the future. For instance, NMFS included the Atlantic sturgeon in their determination because this species could colonize the area in the future if downriver migration routes are established (i.e., via removal of dams or addition of fish passages).

The eight federally listed species that could potentially exist within the CFFF action area remain the same as those identified during development of the 2019 draft EA (NRC 2019-TN6472; Table 3-4). This species list was developed based on ecological surveys of the site, searches of State and Federal ecological databases and interactive maps, and NRC consultations with the FWS and NMFS (NRC 2019-TN6472; WEC 2019-TN6510; FWS 2017-TN5578; FWS 2019-TN6426; NRC 2018-TN5588). The NRC staff did not identify any candidate species, proposed species, or designated or proposed critical habitat within the action area (FWS 2017-TN5578).

Table 3-4 Federally Listed Species with Potential to Occur within the CFFF Action Area

Common Name	Scientific Name	Federal Status[(a)]	Habitat
red-cockaded woodpecker	*Picoides borealis*	E	Mature pine forests; excavates cavities in living pine trees.
wood stork	*Mycteria Americana*	T	Freshwater and estuarine wetlands; foraging habitat includes freshwater marshes, narrow tidal creeks, or flooded tidal pools.
shortnose sturgeon	*Acipenser brevirostrum*	E	Spawns in coastal rivers, and forages along riverbeds or other bottom habitats.
Atlantic sturgeon	*Acipenser oxyrinchus*	E	Spawns in coastal river and resides in the Atlantic Ocean as juveniles and adults; CFFF is not within its critical habitat, but the species could colonize the area in the future if migration routes are restored.
Caroline heelsplitter	*Lasmigona decorate*	E	Cool, silt-free, well-oxygenated stream bottoms; pollution-intolerant and generally occur in areas with well-vegetated stream banks.
Canby's dropwort	*Oxypolis canbyi*	E	Coastal plain habitats, including natural ponds with a high proportion of pond cypress, Carolina bays dominated by grass-sedges, wet pine savannas, shallow pineland ponds, and cypress-pine swamps or sloughs.
rough-leaved loofstrife	*Lysimachia aperulaefolia*	E	Areas in between longleaf pine uplands and bogs of pond pines (pine pocosins) on moist to seasonally saturated sands and on shallow organic soils overlaying sand.
smooth coneflower	*Echinacea laevigata*	E	Magnesium- and calcium-rich soils in open woods, glades, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line right-of-ways.

(a) E = federally endangered; T = federally threatened.
Source: NRC 2019-TN6472

3.6.2.1 Federally Listed Species and Critical Habitats Under NMFS Jurisdiction

On March 11, 1967, the shortnose sturgeon was listed as endangered under the ESA, and the species has remained a listed endangered species since the enactment of the ESA in 1973. Construction of dams during the period of U.S. industrial growth; pollution of many large northeastern river systems; habitat alterations from discharges, dredging, or disposal of material into rivers; and development activities involving estuarine and riverine mudflats and marshes are the primary factors that have contributed to this species' decline (NOAA Fisheries 2021-TN6995).

Based on the available information, the NRC staff concluded that shortnose sturgeon likely occur within the CFFF action area. In its 2017 biological evaluation (NRC 2017-TN5603), the NRC staff evaluated the shortnose sturgeon and began the consultation process with NMFS. During the discussion of shortnose sturgeon, NMFS also recommended that the NRC consider impacts on the Atlantic sturgeon (NMFS 2018-TN5588). Although Atlantic sturgeon are not currently present in the Congaree River, they could be within the next 40 years if downriver migratory routes are re-established (NMFS 2018-TN5588). The NRC staff hereby incorporates by reference its 2017 biological evaluation into this EIS.

See Section 1.5.1.2 of this EIS and Appendix A for a list of documents related to the NRC's ESA consultation with NMFS about shortnose and Atlantic sturgeon. To summarize, the NRC staff requested informal consultation in 2017 with NMFS during the development of the 2018 EA and finding of no significant impact (FONSI) (NRC 2017-TN5603). After several information exchanges with the NRC staff to understand potential impacts of uranium, ammonia, and fluoride, on April 12, 2018, in their biological opinion NMFS concurred with the NRC staff's determination that the proposed action is not likely to adversely affect shortnose, Atlantic sturgeon, and their critical habitats (NRC 2018-TN5588). Regarding uranium, NMFS noted that "sturgeon may be harmed by eating prey that contains high levels of uranium; however, this effect is insignificant because uranium concentrations in sediment samples near the site are below average U.S. soil levels, water concentrations are below drinking water standards, and because fish tissue samples yielded no uranium (NRC 2018-TN5588)." Regarding, ammonia and fluoride, NMFS stated that the discharges are below the levels in their permit and also below levels found in research studies that could inhibit growth or cause mortality of sturgeons (NRC 2018-TN5588). NMFS also addressed potential concerns about low dissolved oxygen and determined that the permit requires that the effluent does not fall below South Carolina standards and the dissolved oxygen levels near the site are protective of sturgeon survival and growth for all stages (NRC 2018-TN5588).

The NRC staff requested that NMFS re-concur on its determination in light of the new information contained in the October 2019 draft EA (NRC 2019-TN6419). The NMFS confirmed its position that its previous concurrence remained valid, and that reinitiation of consultation was not required. The NRC staff has identified no information related to the proposed action during the preparation of this EIS that would require the NRC to reinitiate consultation with NMFS.

3.6.2.2 Federally Listed Species and Critical Habitats Under FWS Jurisdiction

In its license renewal application, WEC is not proposing to construct any new sites on undistributed grounds. Therefore, the NRC staff concluded that potential impacts on federally listed species or critical habitats would be similar to those determined during the 2006 license renewal review, in which the FWS determined that the action would not result in adverse effects (FWS 2006-TN6427).

In summary, the NRC requested concurrence of FWS on their not likely to adversely affect determination on May 12, 2015 (NRC 2015-TN5594). On May 20, 2015, the FWS agreed with the NRC staff's rationale and provided its concurrence that the proposed 40-year license renewal is not likely to adversely affect federally listed species under its jurisdiction (FWS 2015-TN5579). On June 25, 2019, the NRC staff informed the FWS that new contamination leaks had been identified in 2018 and that new groundwater wells would be drilled onsite to better monitor contamination (NRC 2019-TN6473). Both the NRC and FWS agreed that these new groundwater wells would only cause minimal land disturbances, and the FWS confirmed its previous not likely to adversely affect determination remained valid (NRC 2019-TN6473; FWS 2019-TN6429). After reviewing the October 2019 draft EA, the FWS again confirmed that the proposed action is not likely to adversely affect federally listed species under its jurisdiction (FWS 2019-TN6426). See Section 1.5.1.2 of this EIS and Appendix A for a list of documents related to the NRC's ESA consultation with FWS. The NRC staff has identified no information related to the proposed action during the preparation of this EIS that would require the NRC to reinitiate consultation with the FWS.

3.6.3 Migratory Birds

The MBTA protects a total of 1,007 migratory bird species (75 FR 9282-TN5498). The FWS (2017-TN5578) identified 22 species under the MBTA that may occur in or near the action area (Table 3-5). The FWS administers the MBTA to prevent the take, harassment, harm, or collection of migratory birds and/or their eggs and nests (see 50 CFR 10.12; TN5490). The CFFF site includes grasslands, forests, and wetlands that provide habitat for important life history functions of migratory birds (NRC 2019-TN6472). Near the site, migratory birds rely on riparian, forested, grassland, and wetlands areas for foraging, resting, and avoiding predators. Some species also breed near the site.

The WEC actively participates in efforts to protect and enhance the habitat of migratory birds on and near the CFFF site. For instance, in 2019, the WEC (2019-TN7032) partnered with the South Carolina Wildlife Federation to create and install 25 prothonotary warbler (*Protonotaria citrea*) nesting boxes on the CFFF property. Because the WEC is not proposing to construct any new sites on undistributed grounds, the NRC staff concludes that potential impacts on migratory birds would be similar to those experienced throughout the operation of the CFFF site, which have not been significant.

Table 3-5 Migratory Birds That May Occur Near the CFFF Site

Common Name	Scientific Name	Occurrence in Project Area
American bittern	*Botaurus lentiginosus*	Wintering
American Kestrel	*Falco sparverius Paulus*	Year-round
Bachman's sparrow	*Aimophila aestivalis*	Year-round
bald eagle	*Haliaeetus leucocephalus*	Year-round
brown-headed nuthatch	*Sitta pusilla*	Year-round
Chuck-will's-widow	*Caprimulgus carolinensis*	Breeding
fox sparrow	*Passerella iliaca*	Wintering
Kentucky warbler	*Oporornis formosus*	Breeding
least bittern	*Ixobrychus exilis*	Breeding
loggerhead shrike	*Lanius ludovicianus*	Year-round
Mississippi kite	*Ictinia mississippiensis*	Breeding
painted bunting	*Passerina ciris*	Breeding
peregrine falcon	*Falco peregrinus*	Wintering
prairie warbler	*Dendroica discolor*	Breeding
prothonotary warbler	*Protonotaria citrea*	Breeding
red-headed woodpecker	*Melanerpes erythrocephalus*	Year-round
rusty blackbird	*Euphagus carolinus*	Wintering
sedge wren	*Cistothorus platensis*	Migrating
short-eared owl	*Asio flammeus*	Wintering
Swainson's warbler	*Limnothlypis swainsonii*	Breeding
wood thrush	*Hylocichla mustelina*	Breeding
worm eating wobbler	*Helmitheros vermivorum*	Breeding

Source: NRC 2019-TN6472

3.6.4 Bald Eagles

The take of bald eagles is prohibited under both the MBTA and the Bald and Golden Eagle Protection Act of 1940, as amended (50 CFR Part 22-TN6580). The latter Federal Act prohibits anyone from taking or disturbing bald eagles or golden eagles (*Aquila chrysaetos*), including their nests or eggs, without an FWS-issued permit. The bald eagle is also a State-listed threatened species. The WEC concluded that bald eagles could occur on the site based on ecological surveys from the 1970s and because suitable habitat for the bald eagle occurs within the CFFF site, but no bald eagles have been observed on the site (FWS 2017-TN5578; WEC 2019-TN6510). Therefore, the NRC staff concludes that potential impacts would not be significant.

3.6.5 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA), as amended, requires Federal agencies to consult with NMFS on actions that may adversely affect essential fish habitat. There is no essential fish habitat near the CFFF site for marine and anadromous fishes that are federally managed by NMFS and the regional fishery management councils based on evaluation of NMFS's online Essential Fish Habitat Mapper; therefore, no consultation with NMFS is necessary (NRC 2017-TN5606, NRC 2019-TN6472).

3.6.6 Protected Species and Habitat Impacts

3.6.6.1 Section 7 ESA Consultation Findings

Eight federally listed species may occur near the CFFF site (see Section 3.6.2 of this EIS). Six of the species are under FWS's jurisdiction. On May 12, 2015, the NRC staff sent a letter to the FWS describing the proposed action and requested FWS's concurrence with the NRC staff's determination that impacts on federally listed species resulting from the proposed action site were unlikely (NRC 2015-TN5594). In a letter dated May 20, 2015, the FWS concurred with the NRC staff's determination that the proposed activity is not likely to adversely affect federally listed species under FWS's jurisdiction (FWS 2015-TN5579).

On June 25, 2019, the NRC staff informed FWS of the additional site investigation activities (NRC 2019-TN6473), including installation of groundwater wells, and stated that those activities were short-term and involved minimal land disturbance. The NRC staff also confirmed that the list of species remained the same (see Table 3-4). The FWS responded that they had no objections to the NRC staff's finding on June 27, 2019 (FWS 2019-TN6429). After the NRC's issuance of the 2019 draft EA, the NRC transmitted a copy of the draft EA to the FWS on October 28, 2019 (NRC 2019-TN6424).

In correspondence dated October 29, 2019, the FWS confirmed that its previous not likely to adversely affect determination still applies to the proposed action (FWS 2019-TN6426). The FWS also requested that they be notified if any new information becomes available regarding adverse impacts on listed species or critical habitat (FWS 2019-TN6426). The impacts on all terrestrial species and habitats, including ESA-listed species under FWS jurisdiction, for this EIS remain the same as previously disclosed to the FWS in the 2019 draft EA (see Section 3.6.2 of this EIS).

On July 31, 2020, the NRC staff notified the FWS of the NRC's intent to prepare an EIS for the WEC's LRA and invited them to participate in the scoping process (NRC 2020-TN6556).

Two of the federally listed species—the shortnose and Atlantic sturgeon—are under NMFS jurisdiction. On August 16, 2017, the NRC staff submitted a biological evaluation to the Southeast Regional Office of NMFS (NRC 2017-TN5603). In its evaluation, the NRC staff determined that the potential impacts would be insignificant and therefore concluded that the proposed action may affect, but is not likely to adversely affect, the shortnose sturgeon. The NMFS (2017-TN5577, NMFS 2017-TN5589) submitted several questions to the NRC staff concerning the WEC's LRA and its potential impacts on the shortnose sturgeon after their review of the NRC evaluation, and the NRC staff provided NMFS with the supplemental information it requested NRC 2018-TN5730, NRC 2017-TN5606, NRC 2017-TN5605, NRC 2017-TN5611). Included in NRC staff's responses was the NRC staff's no effect determination for the Atlantic sturgeon because this species and its critical habitat do not occur in the CFFF action area (NRC 2017-TN5611). The NMFS concurred on April 12, 2018 (NMFS 2018-TN5588) that the proposed action was not likely to adversely affect Atlantic sturgeon.

On July 10, 2019, the NRC staff informed NMFS of the WEC's additional site investigation activities under the CA with SCDHEC (NRC 2019-TN6419). The NMFS confirmed that its previous determination remained valid, and that reinitiation of consultation was not required.

On July 31, 2020, the NRC staff notified the NMFS of the NRC's intent to prepare an EIS for the WEC's LRA and invited them to participate in the scoping process (NRC 2020-TN6520).

This EIS analyzes the impacts on all aquatic species in Section 3.5.2.2, which includes ESA-listed sturgeons. In summary, there are no new adverse impacts to report in this EIS because: (1) impacts from wastewater discharges into the Congaree River remain low, are conducted in accordance with NPDES permit standards, and are the same as those previously analyzed during the 2019 draft EA; (2) onsite contaminations of Sunset Lake (i.e., uranium, Tc-99, TCE) during the 2019 site investigation have been below the MCLs (<7%) and continue to be addressed via the CA with the SCDHEC; and (3) the 2019 survey conducted by the SCDHEC to evaluate uranium (and fluoride) in fish tissue samples of bluegill and sunfish in the Congaree River resulted in levels below minimum detection amounts. Bluegills and sunfish were chosen for this study because they primarily consume invertebrates, and this makes them more susceptible to uranium uptakes. Because shortnose sturgeon also primarily consume invertebrates (NOAA Fisheries 2021-TN6995) and discharges of uranium are regulated, there are no new uranium concerns.

3.6.6.2 Protected Species and Habitats Mitigation Measures

Section 3.5.2.3 of this EIS also describes why no additional mitigation measures are identified beyond those described in Sections 3.3.3 and 3.4.3 for all terrestrial and aquatic ecology resources, respectively, including protected species. For terrestrial species, only minor and temporary land disturbances will be caused by the new groundwater monitoring wells, and wildlife is habituated to CFFF's noises. For aquatic species, onsite surface water contamination is within MCL health limits, and is being further investigated and subject to potential mitigation by the WEC via their CA with SCDHEC and associated CSM, RIWP, and remediation procedure with the WEC.

3.7 Climatology, Meteorology, and Air Quality

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on air quality of the proposed action.

3.7.1 Climatology and Meteorology

Richland County has a humid subtropical climate, characterized by moderate rainfall, high relative humidity, and moderate winds. The county experiences four distinct seasons—Spring, Summer, Autumn, and Winter—because of its mid-latitude location. The average annual mean temperature is 19.3°C (66.7°F); mild winters and freezing temperatures (≤0°C [32°F]) occur 77 days per year from November through March. Richland County experiences severe weather events such as thunderstorms, hail, and floods and occasional tornadoes. Winter precipitation, such as snow and freezing rain, occurs one to three time per year from November through March. Meteorological data from the National Weather Service station at Columbia Metropolitan Airport, located 19 km (12 mi) west-northwest of the site, were used to characterize the site in the WEC's ER (WEC 2019-TN6510). An overall summary of the climatological data for Richland County is provided in the March 2019 ER (WEC 2019-TN6510).

3.7.1.1 Temperature

Annual average temperature for the period of 1950 to 2019 ranged from a minimum of 16.1°C (60.9°F) during 1966 to a maximum of 18.6°C (65.5°F) during 1990. Table 3-6 shows the monthly average temperature during the period from 1950 to 2019. The average temperature is highest during July (27.1°C [80.8°F]) and lowest during January (6.9°C [44.4°F]) (NOAA NCEI 2021-TN6903). The highest maximum temperature of 45°C (113°F) was observed in Richland County on June 29, 2012, and the lowest minimum temperature of -20°C (-5°F) was recorded during January 16, 1994 (WEC 2019-TN6510).

Table 3-6 Average Temperature and Precipitation by Month for Richland County, South Carolina for the Period of 1950–2019 (Source: NOAA NCEI 2021-TN6903)

Average Temperature (°C [°F])												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
6.9	8.7	12.5	17.2	21.6	25.4	27.1	26.4	23.3	17.5	12.1	8.1	17.2
[44.4]	[47.7]	[54.4]	[63.0]	[70.9]	[77.6]	[80.7]	[79.5]	[74.0]	[63.5]	[53.8]	[46.7]	[63.0]
Average Precipitation (cm [in.])												
9.7	9.0	10.6	7.9	8.6	11.4	12.5	12.1	9.7	7.8	6.9	8.9	115.1
[3.8]	[3.6]	[4.2]	[3.1]	[3.4]	[4.5]	[4.9]	[4.8]	[3.8]	[3.1]	[2.7]	[3.5]	[45.3]

3.7.1.2 Precipitation

Precipitation occurs in the Richland County area in the form of rain, snow, and sleet, and occasional instances of hail. The average annual rainfall was 115.1 cm (45.3 in.) for the period from1950 to 2019 (NOAA NCEI 2021-TN6902). Annual rainfall was recorded as 161.3 cm (63.5 in.) in 1959, 171.8 cm (67.6 in.) in 1964, and 161.2 cm (63.5 in.) in 2015 over this period. The lowest annual rainfall was recorded as 66.7 cm (26.3 in.) in 1954. The highest daily rainfall was recorded as 21.2 cm (8.4 in.) at the Columbia Owens airport in 2014. The average monthly precipitation is shown in Table 3-6 for the period of 1950–2019.

Richland County experienced an average annual snowfall of 3 cm (1.2 in.); the maximum daily snowfall was recorded as 41 cm (16 in.) in February 1973. Detailed information about the winter precipitation is provided in the ER (WEC 2019-TN6510).

3.7.1.3 Winds

Due to the influence of the Appalachian Mountains, winds are predominantly from the southwest, but change seasonally; winds are from the northeast in fall and winter. Average wind speeds ranges from 2.4 m/s (5.4 mph) to 3.5 m/s (7.8 mph), and high winds occur from November to April. Figure 3-18 shows a windrose diagram at the Columbia Metropolitan airport.

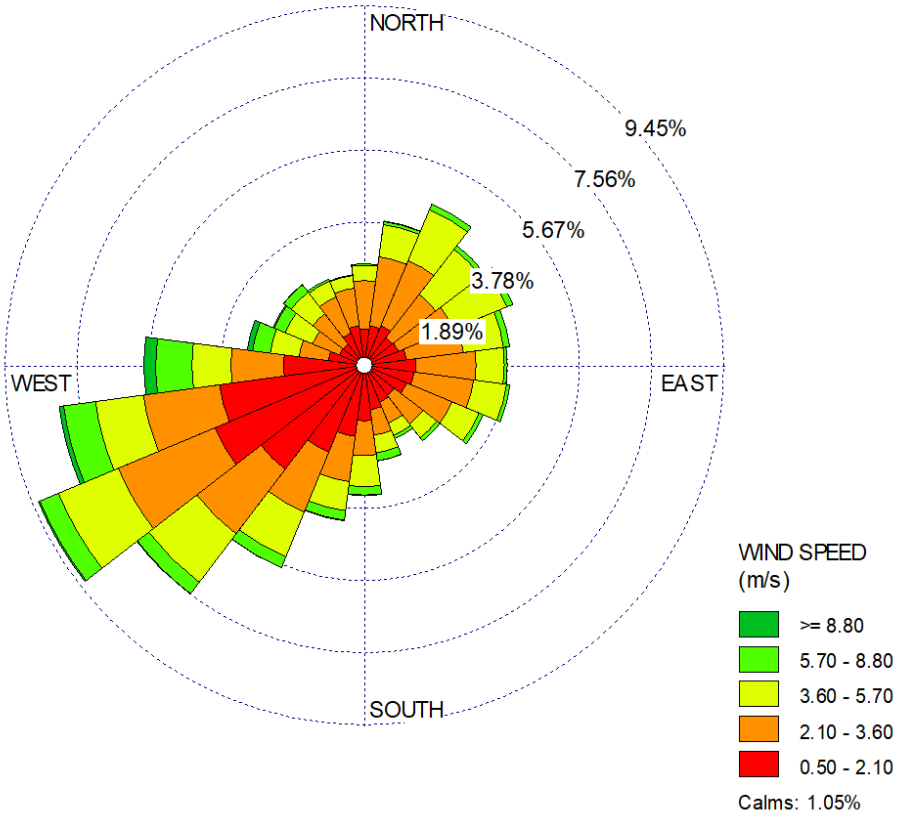

Figure 3-18 Windrose Diagram at Columbia Metropolitan Airport during the Period of 2012–2016 (Source: SCDHEC 2021-TN6909)

3.7.1.4 Severe Weather

Severe weather in Richland County occurs mostly as thunderstorms, commonly occurring during summer months. A total of 615 thunderstorm wind events (wind gusts ≥50 knots) occurred during the period from 1955 to 2019; 54% of them occurred during June and July (NOAA NCEI 2021-TN6908). A total of 3.4 million dollars was estimated for property damage related to thunderstorm events along with 3 deaths and 11 injuries. The highest number of events (19 days) were observed during 2011 with property damage totaling 1.2 million dollars. Only 15 high wind events were recorded with wind gusts ≥70 knots. About 95% of the thunderstorm wind events were recorded with wind gusts below 61 knots. Twelve events of lightning occurred during thunderstorms and resulted in 8 injuries and 3.8 million dollars of property damage. Hail, with a diameter ≥2.5 cm (1 in.), occurred 112 times from 1959 to 2019 with no reported death or injury.

South Carolina ranks twenty-third in the United States for annual tornado frequency and experienced an average of about 24 tornadoes each year between 2000 and 2014 (Runkle et al. 2017-TN6689). A total of 38 tornadoes occurred in Richland County between 1950 and 2019, causing 1 death, 20 injuries, and overall property damage of 12 million dollars (NOAA NCEI 2021-TN6906). Tornadoes are rated on a Fujita (F) or Enhanced Fujita (EF) scale in the United States based on their intensity and wind speed. The weakest tornado has a scale of EF0 (or F0) while a strongest tornado is scaled with an EF5 (or F5) grading. Currently, the EF scale is implemented as a more accurate grading system than the F scale. Sixteen of the tornadoes that occurred in Richland County had a tornado rating of EF0 (105 to 137 km/hr [65 to 85 mph]) or F0 (<117 km/hr [73 mph]) for light damage potential, and 15 of the tornado events were rated as EF1 (138 to 177 km/hr [86 to 110 mph]) or F1 (117 to 180 [73 to 112 mph]). Seven tornadoes were rated as F2 (182 to 253 [113 to 157 mph]) that can cause considerable damage.

Hurricanes commonly occur off the coast in the Atlantic Ocean, but hurricane-force winds typically dissipate before reaching the inland location of the site, becoming tropical storms. Hurricanes affect the State of South Carolina at a rate of approximately one every 2 years. Most affect only the coastal areas. Those that do come inland decrease in intensity by the time they reach the Columbia area, becoming tropical storms. In the period from 1851 to 2016, only 38 tropical cyclones have made landfall on the South Carolina coast (24 hurricanes, 9 tropical/subtropical storms, 5 tropical depressions). Among these, only two tropical storm events (63 to 117 km/hr [39 to 73 mph] surface winds) affected Richland County during 2018, causing one injury and no reported damage. In 1999, Hurricane Floyd made landfall near Cape Fear, North Carolina, causing mandatory coastal evacuations for South Carolina residents and more than 38 cm (15 in.) of rain in Horry County; it resulted in a one-month flooding of the Waccamaw River in and around the city of Conway, South Carolina. Since 1930, Richland County has experienced three tropical storms and two Category 1 hurricanes (NRC 2019-TN6472).

There were 81 days of flash flood events in Richland County from 1950 to 2019, which involved a total property damage of 30.5 million dollars, 9 deaths, and 30 injuries (NOAA NCEI 2021-TN6907). A historic flooding event occurred over a 4-day period in October 2015; it accounted for about 28 million dollars of property damage in Richland County and the maximum damage occurred in Woodland Terrace and Myron Manor (NOAA NCEI 2021-TN6907).

During October 2005 flooding event, Columbia received a total of 31.5 cm (12.4 in.) of rain, which caused flooding of low-lying areas near the site. Roads to the CFFF were closed, and the city water supply was interrupted, leading to a 3-day closure of the CFFF. The main manufacturing building was not affected by the flood, and there were no safety issues caused by the flooding (WEC 2019-TN6510). As a result of the flood, two process lagoons overfilled beyond containment during the early morning of October 3, 2015. The Sanitary Lagoon overflowed out of the chlorine contact chamber and flowed into the adjacent North and South Lagoons. The West II Lagoon was measured at approximately 38 cm (15 in.) beyond the liner onto the surrounding ground but remained within the berm. On October 3, 2015, an emergency discharge to the river was initiated per procedure, which allowed the levels to be decreased at a faster rate. In-process sampling for fluoride, ammonia, pH, total suspended solids (TSS), and radioactivity was conducted during the flood period for the following lagoons: North, South, West I, West II, and Weir Box. Only one elevated reading for TSS was recorded on October 4, taken from the Round Tank Weir Box. Activity samples that were taken yielded less than detectable levels in some areas and the remaining areas yielded maximum measurements of 10-07 and 10-08 µCi/ml, values consistent with background activity levels. There are no

anticipated long-term impacts on groundwater wells within the existing monitoring well network and the water table on the bluff, because the majority of the rainfall left the site via overland flow in the CFFF's network of stormwater ditches (WEC 2019-TN6510).

Table 3-7 summarizes the severe weather events discussed above.

Table 3-7 Summary of Severe Weather Events in Richland County (Sources: NOAA NCEI 2021-TN6908, NOAA NCEI 2021-TN6907, NOAA NCEI 2021-TN6906)

Severe Weather Events	Date Range	Events	Injuries	Deaths
Tornadoes	1950-2019	38	20	1
Thunderstorm winds	1955-2019	615	11	3
Hail (diameter ≥ 2.5 cm [1 in.])	1959-2019	112	--	--
Flash flood	1950-2019	157	30	9

3.7.1.5 Atmospheric Dispersion

Onsite meteorological data for the period of August 1, 1972, through July 31, 1973, were used to generate the joint frequency distribution (JFD) for wind speed, wind direction, and atmosphere stability and reported in the March 2019 ER (WEC 2019-TN6510). The March 2019 ER report indicates that the atmospheric stability classifications using this data set with stable conditions 47% of the time, neutral conditions 43%, and unstable conditions only 10% of the time (WEC 2019-TN6510). The stable and neutral atmospheric conditions at the site could be conducive to buildup of pollutant concentrations.

The atmospheric dispersion factors (χ/Q) were estimated annually at downwind distances up to 80 km (50 mi) in 16 compass directions at the 15 m (50 ft) level using the JFD data set, as provided in Table 3.6-5 of the March 2019 ER (WEC 2019-TN6510). These factors were calculated using the Gaussian plume model and diffusion coefficients based on Pasquill-Gilford stability classification along with building wake effects for turbulence. Because the CFFF effluent discharge points are generally lower than 2.5 times the height of adjacent solid structures, the discharge was conservatively assumed to occur at ground level. The annual average χ/Q was computed as 7.67×10^{-6} s/m^3 at the nearest residence (1,000 m [3,300 ft] northeast) and as 1.54×10^{-5} s/m^3 at the nearest site boundary (550 m [1,800 ft] north-northwest) (WEC 2019-TN6510; NRC 1985-TN5602).

Additional χ /Q values were generated for the year of 1990 using the XOQDOQ model (NUREG/CR-2919; Sagendorf et al. 1982-TN280) with input of STAR meteorological data at the Columbia Metropolitan Station. The ranges of the χ/Q values for 1990 were similar to those provided by the WEC in the ER (WEC 2019-TN6510) that were based on 1972–1973 meteorological data. The maximum annual average χ/Q value during 1990 was 1.7×10^{-5} s/m^3 at 800 m (2,625 ft) in the northeast direction. Figure 3-19 shows the distribution of these χ/Q values along different directions and downwind distances. These XOQDOQ-simulated χ/Q data during 1990 were used for dose assessment, as shown in Section 3.12 of this EIS.

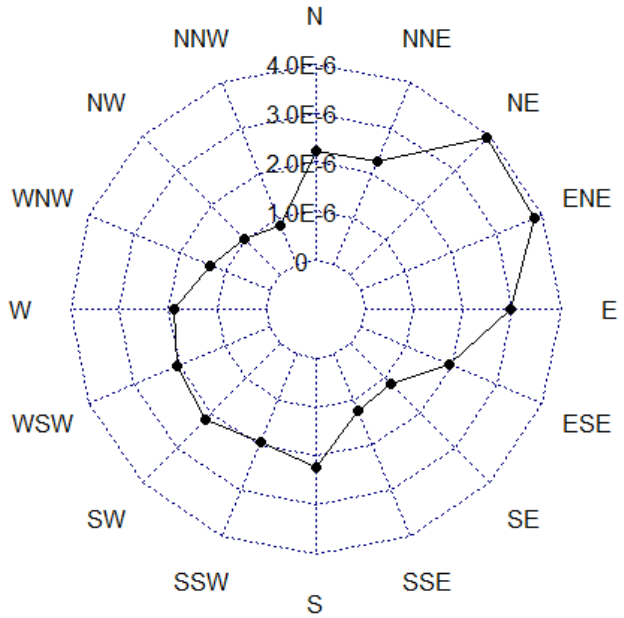

Figure 3-19 Radar Plot of χ/Q Values at 1 Mile from the Site Boundary

3.7.1.6 Climate Change

Temperature and precipitation are two parameters that can be used to characterize climate change. Average annual temperatures increased by 1.0°C (1.8°F) for the contiguous United States over the time period 1901 to 2016, and temperatures are expected to continue to rise (GCRP 2017-TN5848). Average temperature for South Carolina increased about 0.28°C (0.5°F) since the early 20th century (Runkle et al. 2017-TN6689). Columbia experienced an annual average of 3.5 days with temperatures exceeding 38°C (100°F) during the time period of 1984–2014, compared to an average of 2.3 days during time period of 1953–1983. More warming is projected by 2100, based on a high emissions scenario, with hottest years being about 10°F warmer than hottest historical years. There has been no significant trend for precipitation in South Carolina since the beginning of the 20th century. Between 2000 and 2014, 12 years have been characterized by warm season drought conditions in South Carolina (Runkle et al. 2017-TN6689). Sea levels have risen by 3.3 cm (1.3 in.) per decade at Charleston since 1921, which is double the global rise in sea level (1.8 cm [0.7 in.] per decade). Global sea level is forecasted to rise another 0.3 to 1.2 m (1 to 4 ft) by 2100; hence, greater rises are possible for sea levels near South Carolina (Runkle et al. 2017-TN6689). This would also lead to a substantial increase in tidal floods up to 350 days per year in South Carolina.

The 2018 Fourth National Climate Assessment (GCRP 2018-TN5847) also noted increasing daily average temperature and precipitation in the U.S. Southeast. This report highlighted the greater risks of metropolitan cities to be affected by poor air quality, vector-borne diseases, extreme weather events, and damage to infrastructure due to climate change. Extreme rainfall events have increased in frequency and intensity in the Southeast and will continue to increase in the future. Natural resources, industry, the local economy, and the population of the region are at increasing risk to these extreme events (GCRP 2018-TN5847).

3.7.2 Air Quality Impacts

3.7.2.1 Affected Air Quality

Under the federal Clean Air Act Amendments of 1990 (42 U.S.C. § 7401 *et seq.* Public Law 101-549, as amended; TN4539), the EPA established National Ambient Air Quality Standards (NAAQSs), which define the acceptable levels for six criteria pollutants: nitrogen oxides (NO_X), ozone (O_3), sulfur oxides, carbon monoxide, lead, and total suspended particles (shown in Table 3-8). Compliance is attained for a region when pollutant concentration levels are lower than the established NAAQSs. EPA categorizes areas using these three designations:

- attainment, which means the area meets the standards;
- nonattainment, which means the area doesn't meet the standards; and
- unclassifiable, which means there aren't enough data to classify the area under the new or revised standard.

Table 3-8 National Ambient Air Quality Standards for Criteria Pollutants (Source: 40 CFR Part 50-TN1089)

Pollutant		Averaging Time	NAAQS
Carbon Monoxide (CO)		8 hours	9 ppm
		1 hour	35 ppm
Nitrogen Dioxide (NO_2)		1 hour	100 ppb
		1 year	53 ppb
Ozone (O_3)		8 hours	0.070 ppm
Particle Pollution (PM)	$PM_{2.5}$	1 year	12.0 μg/m^3
		24 hours	35 μg/m^3
	PM_{10}	24 hours	150 μg/m^3
Sulfur Dioxide (SO_2)		1 hour	75 ppb

Currently, all of South Carolina, including Richland County, is in attainment for all criteria pollutants (40 CFR 81.341 [TN255]). Table 3-9 provides the annual total emissions of criteria pollutants in Richland County as estimated in the 2014 National Emission Inventory (EPA 2021-TN6996). The annual design values of ozone and nitrogen oxides at an air quality monitoring station in Columbia, South Carolina are provided in Table 3-10. These design values clearly demonstrate attainment in compliance with NAAQSs in the region.

Table 3-9 Annual Air Pollutant Emissions in Metric Tons for Richland County. (Source: EPA 2021-TN6996)

Pollutant	NH_3	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Emissions (T/yr)	502	6,7524	13,069	6,101	2,758	10,111	34,234

Table 3-10 Annual Design Values for Ozone and Nitrogen Dioxide at Sandhill Experimental Station in Columbia, South Carolina. (Source: SCDHEC 2021-TN7033)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
O_3 (ppb)	75	71	73	73	69	64	62	65	64
NO_x (ppb)	40	40	40	40	38	37	35	38	38

Section 111 of the Clean Air Act (40 CFR Part 60-TN1020) directs EPA to establish New Source Performance Standards (NSPSs) that requires new, modified, or reconstructed facilities to demonstrate continuous compliance. The National Emissions Standards for Hazardous Air Pollutants (NESHAPs) regulate hazardous chemicals, which are usually associated with specific industrial sources or activities (40 CFR Part 63-TN1403).

In addition to Federal regulations, the Bureau of Air Quality (BAQ) within the SCDHEC regulates the operation and construction of new emission sources in compliance with SCDHEC Regulations 61-61.1 through 61-62.99.

The SCDHEC BAQ issued an air permit for CFFF operations in May 2003, documenting that the CFFF is neither a "major" source nor a "significant minor" source of criteria pollutant emissions. The CFFF is classified as a minor-source operator by the State (WEC 2019-TN6510). The WEC's air permit addresses NAAQS pollutants, nitric acid, and opacity. The WEC's operating permit limits are based on process throughputs at rated capacities as outlined by SCDHEC in South Carolina Air Quality Control Regulation 61-62 (SCDHEC 2019-TN6997). Emission rates are calculated based on these throughputs because the permit does not require monitoring for any of the six criteria pollutants under the NAAQSs (WEC 2019-TN6510). The WEC has applied for renewal of the air permit and is awaiting approval from SCDHEC (WEC 2019-TN6777.

3.7.2.2 Air Quality Impact of Proposed Action

Under the proposed action, there would be no significant changes in operations. The WEC is required to continue to comply with permit limits for criteria pollutants, nitric acid, and opacity set by SCDHEC. The CFFF is located within an attainment area for the NAAQSs. The proposed action does not involve changes to equipment operations, workforce size, or truck shipments.

A construction permit application for the replacement of three existing boilers with two new natural gas-fired Cleaver Brooks boilers (each with 24.5 metric million British thermal units [MMBTU]/hr capacity), was submitted by the WEC on June 11, 2018, and approved by SCDHEC BAQ (WEC 2019-TN6777). The WEC's CFFF is classified as a minor source and does not require South Carolina Prevention of Significant Deterioration (PSD) standard evaluation. However, it is required to quantify emissions and perform modeling in compliance with the South Carolina Standards No. 2 and No. 8. Table 3-11 shows the yearly total emissions estimates for some of the major pollutants from the WEC facility as provided in the air permit renewal application (WEC 2019-TN6777). Emission rates are calculated based on process throughputs because the permit does not require monitoring of any air pollutant. More details about the emission inventory and the estimation methods are provided in the air permit renewal application.

Table 3-11 Annual Potential Emission Estimates for WEC CFFF as Reported in Permit Renewal Application (Source: WEC 2019-TN6777)

Pollutant	PM_{10}	SO_2	CO	NO_x	VOC	CO_2	HF	HNO_3
Emissions (T/yr)	8.8	3	16	45	4.1	35087	0.3	2.6

Air dispersion modeling for the site was performed as part of these permit applications to demonstrate compliance with South Carolina Standard No. 2. Dispersion modeling showed that the modeled NO_x air concentration at the property boundary of 675 m (2,215 ft) (in addition to background concentrations) is below the permissible limit that demonstrates the WEC facility is

in compliance with Standard No. 2, as provided in Table 3-12 below. In addition, dispersion modeling of toxic air pollutants, including hydrogen fluoride, showed air concentrations below the permissible limits and in compliance with Standard No. 8.

Table 3-12 Modeled NOx Concentrations from WEC CFFF as Provided in Permit Renewal Application (Source: WEC 2019-TN6777)

Pollutant	Averaging Period (μg/m³)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	Allowable Concentration (μg/m³)	Facility in Compliance
NO_x	1-hour	86.8	69.6	156.4	188	Yes
	Annual	2.1	7.7	9.8	100	Yes

The stack emissions from the CFFF are nominal; the site contributors are two boilers, five calciners, and six process scrubbers. For example, the NO_x emissions only account for 0.34% of the total emissions in Richland County. Additionally, the air dispersion modeling in the air permit applications clearly showed that the CFFF complies with the current air pollution standards in South Carolina. The incremental impact of the stack emissions is expected to be minimal to the region because it is already in compliance with the air quality regulations. The WEC would also continue its sampling and monitoring program to ensure radiological emissions meet 10 CFR Part 20 (TN283) limits. The program includes 47 stacks as well as 4 onsite locations monitored for the presence of radioactive material.

3.7.2.3 Greenhouse Gases

On September 22, 2009, the EPA issued a final rule for mandatory greenhouse gas (GHG) reporting from large GHG emission sources in the United States (40 CFR Part 98-TN2170). In general, the threshold for reporting is 25,000 tons (T) of carbon dioxide equivalent (CO_2 eq) emissions per year and/or an aggregate maximum heat input capacity greater than 30 MMBtu/hr. The potential GHG emissions of 35,507 CO_{2eq} were estimated by the WEC in the air permit renewal application (WEC 2019-TN6777). However, the actual CO_2eq emissions from the WEC boilers in 2020 are estimated to have been 7,224 T/yr based on combustion of 112 million cubic feet (MCF) of natural gas and 4.13 million liters (1.09 million gallons) of diesel fuel (WEC 2021-TN7048). The actual 2020 emissions are much lower than the 25,000 T threshold and the WEC is currently not required to report to EPA. The WEC is a minor source and has not previously been subject to PSD permitting (WEC 2019-TN6777), and the estimated GHG emissions are also below the 75,000 T/yr CO_2eq threshold in the GHG Tailoring Rule for major source provisions requiring best available control technology (BACT). EPA issued a GHG Tailoring Rule in May 2010 that required large stationary emission sources (GHG emissions >75,0000 T/yr) to comply with the PSD and Title V operating permit program and reduce GHG emissions by BACT (EPA 2019-TN7051). However, in June 2014, the U.S. Supreme Court restricted the Tailoring Rule requirement to only for sources that need to comply with the PSD permit program based on their exceedance of limits for other criteria pollutants (EPA 2012-TN7069, EPA 2019-TN7051). Thus, a new or existing source does not need to comply with the GHG Tailoring Rule only on the basis of GHG emissions exceeding 75,000 T/yr. GHG emissions from proposed continued operation of the CFFF would not be significant and should be below the criteria of the GHG Tailoring Rule.

Increasing temperatures and stagnant air masses due to climate change may produce conducive atmosphere for ozone (smog) formation. However, the regional monitors show O_3 values much lower than the current NAAQS (70 ppb) and therefore, the nominal NO_x emissions

from the continued operation of the CFFF are not expected to significantly increase regional O_3 concentrations. Nearby operation of the Dominion natural gas pipeline is expected to generate fugitive methane emissions of 28,312 CO_2eq T/yr (FERC 2016-TN6901). Similarly, a fiberglass manufacturing plant is currently operational and estimated to emit 126 T/yr of PM_{10}, 1,194 tons/yr of SO_2, 323 T/yr of NO_x, and 238 Tons/yr of fluorides (SCDHEC 2016-TN6900). The CFFF stack emissions along with such nearby major and minor operations (e.g., construction, logging) could slightly increase the air pollutants and GHG emissions in the region. Such future activities in combination with CFFF operations could lead to slightly poor air quality intermittently. However, their combined contribution should not affect the environment and climate significantly.

Based on these analyses, the NRC staff expects that the direct and indirect impacts on air quality from proposed continued operation of the CFFF for an additional 40 years would be SMALL. Based on these minor impacts, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.7.3 Mitigation Measures

The WEC monitors radiological gaseous emissions from 47 stacks. The stacks are outfitted with scrubbers, or high-efficiency particulate air (HEPA) filters, or both to minimize the discharge of gaseous effluents. Ambient air also is monitored at four onsite locations for the presence of radioactive material. The impacts on air quality can be further reduced by maintenance and best management practices relative to stacks and scrubbers (e.g., continuous monitoring and inspection of air flow, water flow, differential pressure and uranium buildup in scrubbers, differential pressure monitoring and regular maintenance of HEPA filters, record keeping, catalytic reduction of NO_x) through the proposed additional 40 years of operation. The WEC is also required to report any changes in the stack and scrubber configuration to SCDHEC (WEC 2019-TN6777).

3.8 Noise

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts of noise caused by the proposed action.

3.8.1 Noise Guidelines

Exposure to loud noise damages nerve endings in the inner ear, causing permanent hearing loss. Occupational workers at manufacturing facilities, like the CFFF, are exposed to noise from various industrial machines and equipment. Members of the public may also be exposed to noise if they are located close to such facilities.

Noise to members of the public is regulated in the State of South Carolina by local or county government. There are no Federal regulations for public exposure to noise. Congress passed the Noise Control Act of 1972 (42 U.S.C. § 4901 *et seq.*; TN4294); however, in 1982 Federal noise control policy transferred the responsibility to State and local governments (EPA 2020-TN7070). Noise to workers is subject to threshold values from the National Institute for Occupational Safety and Health (NIOSH) under the Occupational Safety and Health Act of 1970 (Public Law 91-596; 29 U.S.C. § 651 *et seq.*; TN4453). The NIOSH's Recommended Exposure Limit for occupational noise exposure is 85 A-weighted decibels (a weighted measure used to

approximate the noise response of the human ear), as an 8-hour time-weighted average using a 3-decibel exchange rate (CDC 2018-TN6998). The Occupational Safety and Health Administration (OSHA) permissible exposure limit states that a worker cannot be exposed to more than a 90-decibel (A-weighted) average for an 8-hour shift (29 CFR 1910.95 [TN654]).

Richland County, South Carolina, has promulgated noise standards in Section 18-3, "Noise," of its Code of Ordinances (Richland County 2019-TN6704). These standards deem it "… unlawful for any person to make, continue, or cause to be continued, any loud, excessive, unnecessary, or disturbing noise, or any noise which either annoys, disturbs, injures, or endangers the comfort, repose, health, peace or safety of others, within the limits of the unincorporated area of the county, except where the activity generating the noise is permitted by lawful authority (e.g., a permitted event)." However, the standard further states that these noise level limits do not apply to construction, industrial, or manufacturing noise.

The EPA recommends an equivalent continuous outdoor noise level (24 hour) of 70 decibels or less as adequate to protect against hearing loss over a lifetime and a day-night average sound level outdoors of 55 decibels or less to be adequate to protect against activity interference and annoyance (EPA 1974-TN3941; Table 1). The EPA identifies noise at/or greater than 55 A-weighted decibels, with a margin of safety determined to protect hearing, as causing outdoor-activity interference and annoyance. The U.S. Department of Housing and Urban Development's exterior noise standard states that noise levels are acceptable if the day-night average sound level outside a residence is less than 65 A-weighted decibels (24 CFR 51.101(a)(8) [TN1016]). As points of comparison, heavy highway traffic at 91 m (300 ft) has a noise level of 60 A-weighted decibels and a gas-powered lawn mower at 30 m (100 ft) has a noise level of 70 A-weighted decibels. Noise levels decrease with increasing distance from the source.

3.8.2 Existing Noise Levels at the CFFF Site and Impacts

Noise generated at the CFFF is associated with operations of a large manufacturing facility. Sources of noise at CFFF include various industrial machines and equipment such as materials handling equipment, paging and alarm systems, engines, and vehicular traffic. All noise-making activities would be performed in compliance with OSHA standards, best management practices, and other applicable regulatory requirements.

Under the proposed action, the WEC did not request changes to its license related to construction of new buildings or any changes to the CFFF operations. However, the East Lagoon and Sanitary Lagoon are being removed under the CA, which would necessitate the use of large earth-moving equipment and heavy trucks. Noise levels to workers are anticipated to continue during the proposed 40 years of CFFF operations and are not anticipated to change significantly during the proposed action.

The primary source of noise at the site boundary is vehicular traffic from Bluff Road, which bounds the site to the north (WEC 2019-TN6510). The NRC staff is not aware of any noise surveys that have been conducted at the CFFF site. Transportation impacts, such as worker and shipment traffic, are discussed in Section 3.13 of this EIS. The WEC stated that noise from the CFFF is not detectable at the site boundary (WEC 2019-TN6510). The manufacturing building for CFFF is located approximately 760 m (2,500 ft) from Bluff Road (WEC 2019-TN6510). The nearest resident is approximately 1,000 m (3,281 ft) to the northwest from the center point of the facility (see Figure 3-20 in Section 3.9). Eight individuals live and one church is located within 1.6 km (1 mi) of the CFFF site (WEC 2019-TN6510). There are no other noise-

sensitive receptors (e.g., schools, hospitals, etc.) in nearby. The potential impacts of noise on ecological resources from continued operation of the CFFF are addressed in Section 3.5.1 of this EIS.

Given the distance of the CFFF from the site boundary, and compliance with applicable noise regulations, the NRC staff expects that direct and indirect impacts on human health due to noise as a result of the proposed continued operation of the CFFF for an additional 40 years would be SMALL. Based on these minor impacts, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.8.3 Mitigation Measures

The proposed action is not expected to result in new noise effects. Current practices to mitigate manufacturing noise to occupational workers at similar facilities would include the use of engineering and administrative controls (OSHA 2020-TN6576). Examples of these controls would include providing distance between receptors and the noise activity, shielding, using personal protective equipment, and maintaining equipment and vehicles in proper working condition. The controls reduce the propagation of noise to onsite and offsite receptors. Additional mitigation measures are not identified.

3.9 Historic and Cultural Resources

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on historic and cultural resources from the proposed action.

Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to the district, site, building, structure, or object. The criteria for eligibility are listed in 36 CFR 60.4 (TN1682) and include (1) association with events that have made a significant contribution to our broad patterns of history; (2) association with the lives of persons significant in our past; (3) embodiment of distinctive characteristics of type, period, or methods of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (4) resources that have yielded or are likely to yield information important in prehistory or history (ACHP 2012-TN6999). The property must also have integrity, or the ability to convey its significance, to be listed or eligible for listing in the NRHP. The historic preservation review process, Section 106 of the National Historic Preservation Act (NHPA), is outlined in regulations at 36 CFR Part 800 (TN513). As allowed under 36 CFR 800.8, the NRC staff is conducting the Section 106 review process in coordination with the NEPA review for this proposed CFFF license renewal.

As discussed in section 2.1.1 of this EIS, the CFFF site is located on an approximately 469 ha (1,151 ac) in Richland County, SC. Approximately 28 ha (68 ac) of the property area are used for facility operations and support activities (see Figure 3-20). In developing this EIS, the NRC staff evaluated potential impacts to historic properties, assuming these are present, within the CFFF's license area boundary or area of potential effects (APE). As part of this impact evaluation, the NRC staff considered areas within the license area boundary that have been undisturbed and have been previously disturbed by the construction and operation of the CFFF site and the licensed activities anticipated to occur during the proposed license renewal term.

There are areas within the CFFF site that have also been previously disturbed by activities other than the construction and operation of the CFFF. For example, forested areas are used for timber production and hay fields are harvested. There is also an electrical substation, owned by South Carolina Electric and Gas, on approximately 2.8 ha (7 ac) of the CFFF site near Bluff Road. These activities are not licensed by the NRC and thus considered outside the scope of the undertaking (i.e., the NRC's decision whether to renew the NRC license for the CFFF to continue to operate for an additional 40 years).

The NRC staff consulted cultural resource reports and historic context information available at the South Carolina Department of Archaeology and Historic Preservation (SCDAH), the South Carolina Institute of Archaeology and Anthropology (SCIAA), and through the October 2019 draft EA public comment period and this EIS scoping process to compile a brief historic and cultural overview of the history of human land use in and around the CFFF site and its vicinity. Historic and cultural overviews provide historic context for understanding the potential significance of and period of significance associated with historic and cultural resources that may be present within the APE. The following high-level overview is derived from historic and cultural resource survey reports completed on portions of the CFFF site or nearby (Reid 2004-TN6886; Jaeger 1993-TN6877; Legacy Research Associates 2005-TN6885).

There is archaeological evidence of American Indian precontact use in the South Carolina Midlands area as early as 10,000 to 15,000 years ago. The cultural chronology for American Indian precontact use in the South Carolina Midlands area is divided into the following periods: Paleo-Indian (B.C. 10,000 to 8000); Archaic (B.C. 8000 to 500), Woodland (B.C. 500 to 1000) and Mississippian (AD 1000 to 1543) (Reid 2004-TN6886). The Archaic and Woodland Periods are further subdivided into Early, Middle, and Late Periods. Each period is characterized by changing material culture including stone tool technologies and pottery types, which first emerge during the Late Archaic Period (B.C. 2000 to 500), as well as changing settlement and resource procurement patterns. During the Paleo-Indian Period, mobile groups relied on hunting, fishing, and some plant resources for subsistence (Legacy Research Associates 2005-TN6885). During the Early Archaic Period, subsistence focused on foraging, and settlement patterns consisted mostly of base camps situated along rivers and streams, and smaller upland foraging sites (Legacy Research Associates 2005-TN6885).

By the Late Archaic Period, ceramics were introduced, stone tool technology became more diverse, and settlement patterns became more sedentary (Legacy Research Associates 2005-TN6885). Significant cultural changes occurred during the Woodland Period including the advent of the bow and arrow, burial mound construction, and an increase in permanent settlements (Legacy Research Associates 2005-TN6885). The Mississippian Period is characterized by large ceremonial centers situated along major river drainages including the Congaree River (Legacy Research Associates 2005-TN6885). Green Hill Mound (site 38RD4), located within 8 km (5 mi) of the CFFF site boundary near the Congaree River is an example of a Mississippian-era mortuary center, although its function may be more complex (Mitchie 1980-TN7019; Stephenson 1972-TN7018). Archaeological evidence indicates that these societies relied on agricultural practices as a key part of their subsistence strategy (Legacy Research Associates 2005-TN6885).

In the mid-16th century, Spanish explorer Hernando De Soto encountered the Congaree Indians when traveling through the region. The Congaree and Wateree people occupied what is now Richland County until the 1700s when they merged with the Catawba Indian Tribe (Jaeger 1993-TN6877). Trading posts were established, including Old Fort Congaree located on the West bank of the Congaree River that was established in 1718 (Legacy Research Associates 2005-TN6885).

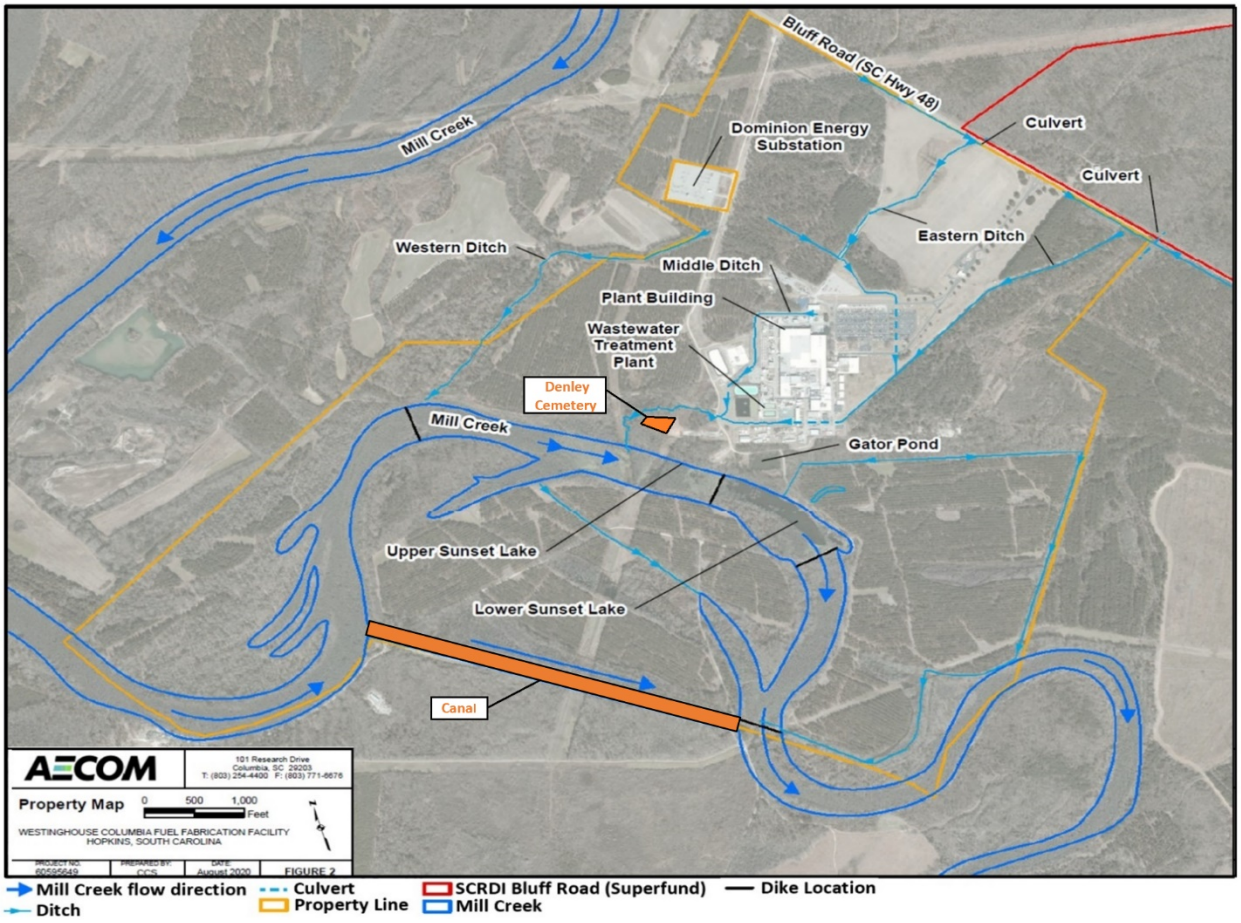

Figure 3-20 Area of Potential Effect CFFF Property Boundary. Denley Cemetery and Historic Canal are also depicted. (Source: WEC 2020-TN6707)

By the mid-1700s the lands in and around the CFFF site consisted of small family farms and large plantations (Reid 2004-TN6886). According to the Jaeger Company (1993-TN6877), the emergence of these large plantations resulted in a slave/plantation economy and an increase in the slave population in the lower Richland County area. Among these early plantation landowners was Thomas Howell. Archaeological site 38RD397, which is located adjacent to but outside the CFFF site license boundary, contains the structural remains of this plantation (Reid 2004-TN6886). Indigo, cotton, and tobacco were the primary crops grown in the region (Jaeger 1993-TN6877). Cotton became the primary crop as a result of Eli Whitney's invention of the cotton gin in the late 1700s (Jaeger 1993-TN6877) and by the mid-19th century was South Carolina's primary cash crop.

During the American Revolution, American forces were defeated in 1780 at Camden, which is located northwest of the CFFF site and the City of Columbia (Reid 2004-TN6886). The City of Columbia, established in the mid-1780s, replaced Charleston as the state capital and later became a hub of activity during the Civil War (Reid 2004-TN6886; Legacy Research Associates 2005-TN6885). After the Civil War, there was an overall decline in agricultural production in the region. The South Carolina Land Commission, established in 1869, purchased approximately 9,000 ac of land in Richland County for the purposes of redistributing the land to poor white men and to freedmen (Jaeger 1993-TN6877).

The NRHP-listed Barber House is located within 8 km (5 mi) of the CFFF site. It was constructed in 1880 and is situated on land acquired by Samuel Barber, a former slave, in 1872 as part of the South Carolina Land Commission efforts.[5] The Barber House has remained in the same family since 1872. During the early 20th century, the number of farms and farm sizes in the region decreased. Fort Jackson, which is located within 8 km (5 mi) of the CFFF site, opened in 1917 and the City of Columbia continued to grow. The region around and at the CFFF site has become more industrialized since the opening of the CFFF in 1969.

3.9.1 Historic and Cultural Resources at the CFFF Site

The SCDAH has indicated that the CFFF site has a high probability of significant archaeological resources (SCDAH 2006-TN6700, SCAHC 2015-TN5608, SCDAH 2019-TN6701). Scoping comments received from external stakeholders (Catawba Indian Nation 2020-TN6534; Waccamaw Indian People 2020-TN6532; Pine Hill Indian Tribe 2020-TN6535; COSCAPA 2020-TN6540; NPS 2020-TN6543; Friends of Congaree Swamp 2020-TN6703; Hayden 2020-TN6702; Judge 2020-TN6879, Judge 2020-TN6878) have also indicated that the area where the CFFF site is located and the nearby surrounding area, particularly along the nearby Congaree River and Congaree National Park, is important historically and archaeologically (NRC 2021-TN6934).

The NRC staff also consulted the following databases to identify cultural resource investigations that have occurred within the APE and to determine if any historic and cultural resources are located within the APE:

- non-public view of SCIAA's ArchSite
- NRHP database
- SCDAH National Register of Historic Places.

According to SCIAA's ArchSite, two cultural resource investigations have occurred at the CFFF site, resulting in the identification of one aboveground resource, site # 171-3577. In 1993, a historical and architectural survey was completed by the Jaeger Company of lower Richland County (Jaeger 1993-TN6877), which covered the CFFF site. Additionally, in 2004 an archaeological inventory was completed of a small portion (8 ac) of the CFFF site for the Hopkins Transmission Line and Substation (Reid 2004-TN6886). The Jaeger Company first identified site # 171-3577 in 1993, describing it as an "unknown canal" and recommended the site as being potentially eligible for NRHP listing and worthy of further research to understand its historic function and age (Jaeger 1993-TN6877). The 2004 archaeological field investigation consisted of a surface inventory and subsurface shovel testing, which did not locate any archaeological resources but did relocate site # 171-3577 (Reid 2004-TN6886). Site # 171-3577 is depicted as a linear canal feature on the USGS topographic map included in the report and is described as an excavated canal feature that links two portions of Mill Creek (Reid 2004-TN6886). Based on discussions the author had with the then South Carolina Electric and Gas (SCE&G) project manager of the WEC CFFF, Reid (2004-TN6886) learned that the canal was excavated by the property owners (Burnside family) in the 1960s to address flooding of the Mill Creek and to enhance hunting conditions. Based on this information, Reid (2004-TN6886), recommended that site # 171-3577 did not meet NRHP eligibility requirements, but may have research value to future researchers as an engineering feature. Site #171-3577 has not been formally evaluated for NRHP eligibility but is identified in ArchSite as being potentially eligible. While not listed in ArchSite, the Denley Cemetery was discovered on the CFFF site in 2003 and

[5] http://www.nationalregister.sc.gov/richland/S10817740093/index.htm

fenced off by the WEC (2019-TN6510; SCDAH 2008-TN6641). The cemetery is located southeast of the main CFFF building, and its footprint is approximately 24 × 49 m (80 × 160 ft) (WEC 2019-TN6510). The cemetery operated from approximately 1890 to 1940, contains more than 100 graves of African Americans, and has historical ties to the Denley Plantation (WEC 2019-TN6510). Members of the Denley and Washington families of Lower Richland are buried there (SCDAH 2008-TN6641). The WEC continues to maintain the fenced area (WEC 2019-TN6510). Figure 3-20 (above) indicates the location of the canal and the Denley Cemetery (depicted in Figure 3-21).

Figure 3-21 Denley Cemetery (Photo provided by the WEC)

A review of ArchSite indicates that there are 58 archaeological sites located within 8 km (5 mi) of the CFFF site boundary. Eight archaeological resources are located within 1.6 km (1 mi) of and adjacent to the north and west boundary of the CFFF site and were recorded in 1990 by Mark Groover as part of his Master's thesis research (Reid 2004-TN6886). These resources include five artifact scatters predominantly associated with the 19th century (site numbers: 38RD391, 38RD394, 38RD395, 38RD396, and 38RD398), two multicomponent[6] sites containing 19th century and Archaic/Woodland artifact scatters (site number 38RD392, and 3RD393), and the remains of the mid-18th century Thomas Howell Plantation (site number 38RD397). While none of these sites has been formally evaluated for NRHP eligibility, excavations completed at the Thomas Howell Plantation and published research (Groover and Brooks 2003-TN6642; Stine et al. 1996-TN6643) indicate that this site likely qualifies for NRHP eligibility and listing.

ArchSite indicates that there are 60 aboveground resources located within 8 km (5 mi) of the CFFF site boundary. Two aboveground resources are located within 1.6 km (1 mi) of the CFFF site boundary and were recorded by the Jaeger Company in 1993. One resource is a cemetery (site # 171-3586), which the Jaeger Company described as being associated with Black residents in the community (Jaeger 1993-TN6877). Because of limited access to this cemetery during the 1993 survey, field investigations were not completed at that time. The Jaeger

[6] Multicomponent archaeological sites contain both historic and precontact era artifacts and features.

Company identified site # 171-3586 as being worthy of further investigation and recommended that it be formally evaluated for NRHP eligibility in the future (SCIAA 2021-TN6916).[7] The Chicora Foundation completed a comprehensive inventory and research of cemeteries in Richland County, and the Denley Cemetery was recorded and included in that inventory as "Denley's Graveyard" (Trinkley and Hacker 2013-TN7000). The second resource is an unidentified house (site # 463-3674) that is identified on ArchSite as being potentially eligible for inclusion in the NRHP. The Jaeger Company also recommended that site # 463-3674, which was also inaccessible at the time, was worthy of further investigation and that it too should be formally evaluated for NRHP eligibility in the future (Jaeger 1993-TN6877).

ArchSite also indicates that there are 5 NRHP-listed aboveground resources within 8 km (5 mi) of the CFFF site boundary; they include the Hopkins Graded School, Barber House, Hopkins Presbyterian Church, Hopkins Family Cemetery, and the Northwest Boundary Dike.[8] None of these resources are located within 1.6 km (1 mi) of the CFFF site boundary.

3.9.2 Historic and Cultural Resources Impacts

As discussed in Section 2.1 of this EIS, the NRC's proposed action is to determine whether to renew the CFFF's current operating license for an additional 40 years. The NRC staff's impact evaluation considered effects from ground disturbing activities within the CFFF site anticipated to occur during the proposed license renewal term from the continued operation of the CFFF. Indirect effects considered in this EIS within the CFFF site and adjacent areas would consists of atmospheric, auditory, and visual effects that could diminish the integrity of historic and cultural resources from the proposed continued operation of the CFFF for an additional 40 years were also considered.

In its LRA, the WEC has not requested changes to its license that would result in significant land disturbances. It is possible that over the course of the proposed 40-year renewal license term that the WEC would need to conduct ground-disturbing activities under the purview of the NRC license. Some of these activities might require a license amendment, in which case the NRC staff would then evaluate the potential environmental impacts of that action at that time. For instance, in December 2018 the WEC described plans to remodel its administration building, which they anticipated would require a license amendment request (NRC 2018-TN6925). The WEC, however, has since stated it does not plan to request those changes at this time (NRC 2019-TN6474).

The WEC has been installing new monitoring wells and borings (which involve ground-disturbing activities) in support of the remedial investigations being conducted as part of the implementation of the CA that was executed with SCDHEC to address known onsite groundwater, surface water, and soil contamination from COPCs (SCDHEC/WEC 2019-TN6554). The installation of these monitoring wells and borings is occurring under current CFFF operating license, which expires in 2027. See Section 1.5.2.2.1 of this EIS for additional information about the CA. Installation of these wells is anticipated to be short-term and involve

[7] ArchSite (SCIAA 2021-TN6916) identifies site # 171-3586 as not eligible for inclusion in the NRHP, while the Jaeger Company 1993 report does (Jaeger 1993-TN6877). The NRC staff reached out to SCDAH to clarify the status and received a reply by e-mail on October 12, 2020, stating that the site has not been formally evaluated for NRHP eligibility and to "rely on the language at the end of the survey report that says further research and evaluation of the site is needed since it was not evaluated in the field in 1993" (SCDAH 2020-TN6887).

[8] NRHP documentation for these resources can be found on the SCDAH's SHPO NRHP database located at http://www.nationalregister.sc.gov/richland/nrrichland.htm.

minimal land disturbance as noted in the NRC staff's July 2019 communication to the South Carolina SHPO.

In November 2020, SCDHEC approved a Phase II RIWP (WEC 2020-TN6871) submitted by the WEC to completely characterize the "source, nature and extent of COPCs from historic operations" (WEC 2020-TN6844). Accordingly, the WEC continues to conduct investigations that involve collecting soil gas and sediment samples and installing monitoring wells to assess contamination levels of COPCs (WEC 2020-TN6844, WEC 2020-TN6871). Remediation of contaminated soils has also been conducted in certain areas of the CFFF site and future remediation could be completed as part of the WEC's implementation of the CA.

Limited cultural resource investigations have been completed on the CFFF site. Known historic and cultural resources located within the CFFF site boundary include the Denley Cemetery and a historic canal (site # 171-3577), which has not been formally evaluated for NRHP eligibility or listing. The Denley Cemetery is currently maintained by the WEC and they have indicated they will continue its upkeep (WEC 2019-TN6510). Additionally, the WEC must follow State laws such as S.C. Code of Laws, Section 16-17-600, regarding burial sites and cemeteries.

The NRC staff has not identified activities being conducted under the WEC's CA with SCDHEC or ongoing licensed operational activities that would continue through the proposed license renewal term that would affect the Denley Cemetery or historic canal (site # 173-3577) (WEC 2020-TN6844, WEC 2020-TN6871). The WEC has proposed installation of a permanent monitoring well (W-98) "near but outside the southern edge of the Denley Cemetery," but no investigations are planned to occur within the fenced area (WEC 2020-TN6871). A review of maps provided in the Phase II RIWP and based on the WEC's responses to the NRC staff's request for additional information dated November 3, 2020, current ground-disturbing activities planned by the WEC as part of the implementation of the CA would also avoid impacts on the historic canal (site # 173-3577) (WEC 2020-TN6844, WEC 2020-TN6871).

Ground-disturbing activities currently associated with the installation of monitoring wells and borings under the CA as well as future remediation activities would have the potential to affect previously unidentified archaeological resources located on the CFFF site. While current and future ground-disturbing activities (e.g., well installations, and contaminated soil remediation) would occur within disturbed areas of the CFFF site, soils in these areas have been extensively disturbed by past construction and operation of the CFFF. Potential impacts on historic and cultural resources are unlikely given the low potential for previously unidentified intact archaeological resources to be present in these areas.

Current and future ground-disturbing activities associated with the WEC's implementation of the CA are also occurring in previously undisturbed areas and are currently limited to the installation of groundwater monitoring wells and collection of soil samples (WEC 2020-TN6871). Because only a small portion of lands (~ 8 ac) within the APE have been inventoried for archaeological resources, there is a high potential for previously unrecorded archaeological resources to be present within areas of the CFFF site that have not been extensively altered by past construction and operation of CFFF facilities. The WEC has established procedures and provisions with the goal of avoiding and minimizing impacts on historic and cultural resources in the conduct of all ground-disturbing activities including those being conducted as part of the implementation of the CA (WEC 2021-TN7048).

One WEC-developed procedure to manage the discovery of previously unrecorded cultural resources or human remains during the implementation of ground-disturbing activities

associated with the implementation of the RIWP (WEC 2020-TN6707). This procedure was provided in Appendix C of the Phase II RIWP and is entitled "Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains" (unanticipated discovery procedure or UDP) (WEC 2020-TN6871). This procedure has been incorporated into a new WEC procedure, RA-432 (WEC 2021-TN7060), which will be used prior to and during all ground-disturbing activities that would occur in previously undisturbed[9] areas of the CFFF site and during any unanticipated discovery made in either previously disturbed or undisturbed areas of the CFFF site. The UDP was informed by S.C. Code of Laws, Section 16-17-600 (SC Code 16-17-TN6883). The UDP includes stop work procedures and notification to the South Carolina State Historic Preservation Office (SHPO) in the event of an unanticipated discovery of cultural resources or human remains (WEC 2020-TN6871). Additionally, the UDP requires that a qualified professional archaeologist investigate any finds to determine the potential significance of the find and to consult with the South Carolina SHPO on additional actions, which may include further archaeological investigations or consultation with Indian Tribes. If human remains are determined to be of Indian Tribes, the remains will be left in place and the South Carolina SHPO and appropriate Indian Tribes will be consulted to develop a plan that is consistent with S.C. Code of Laws, Section 16-17-600 (SC Code 16-17-TN6883) guidance (WEC 2020-TN6871).

In addition to the UDP, the WEC has several provisions in place that provide comprehensive sitewide procedural cultural resource protections during ground-disturbing activities occurring on the CFFF site (WEC 2020-TN6844, WEC 2020-TN6872, WEC 2020-TN6873, WEC 2021-TN7048). These include RAF-104-5, "Environmental Protection Guidelines and Checklist" (WEC 2020-TN6844, WEC 2020-TN6872), TAF-500-11, "10 CFR 70.72 Engineering Pre-screening Checklist" (WEC 2020-TN6844, WEC 2020-TN6873), RA-136, "Soil Sampling and Disposal" (WEC 2021-TN7062), SYP-233, "Excavation" (WEC 2021-TN7064), and RA-432, "Procedures Guiding the Unanticipated Discovery of Cultural Resources and Human Remains" (WEC 2021-TN7060), and a cultural resources training module, TRN-170 (AECOM Undated-TN7063).

RAF-104-5 is a checklist that considers whether a proposed activity occurring on the CFFF site would affect various aspects of the environment including impacts on archaeological or historical sites located on the WEC property or "if provisions have been made for protection or mitigation in the event of an archaeological or historical discovery onsite" (WEC 2021-TN7048). TAF-500-11 considers whether a proposed CFFF activity "involves land/soil disturbance or removal" (WEC 2020-TN6844, WEC 2020-TN6873). If the answer is yes for either of these procedures, "controls would be established" (WEC 2020-TN6844). Controls include, but are not limited to, completion of ground-penetrating radar (GPR) analysis prior to completing ground-disturbing activities on the CFFF site, stop work instructions and notification to the Environmental, Health, and Safety environmental engineering, at the WEC, to conduct additional evaluations (WEC 2021-TN7048).

RA-136 (WEC 2021-TN7062) is specific to soil-sampling activities and directs personnel to stop work and evaluate if any unknown anomaly is identified. SYP-233 (WEC 2021-TN7064) is specific to safe excavation and hand digging on the CFFF site and requires that subsurface anomalies be identified by GPR or other applicable alternate method, prior to any excavation

[9] According to procedure RA-432, a disturbed area "means an area that is altered as a result of clearing, grading and/or excavation," including areas disturbed by CFFF-related construction and past agricultural activities that occurred prior to CFFF construction. RA-432-1 includes a map showing disturbed and undisturbed areas on the CFFF site.

occurring in undisturbed areas to avoid impacting cultural resources and to follow stop work protocols if unknown anomalies are identified. RA-136 and SYP-233 refer to TRN-170, "Cultural Resources Training" for an overview of typical cultural resources that may be found on the CFFF site (AECOM Undated-TN7063).

RA-432 (WEC 2021-TN7060) applies to all ground-disturbing activities that would occur in previously undisturbed areas of the CFFF site and to any unanticipated discovery that is made as a result of any onsite project work occurring in both disturbed and undisturbed areas on the CFFF site. RA-432 directs personnel to conduct GPR or another applicable alternative method to identify potential subsurface cultural resource anomalies prior to starting any work in undisturbed areas of the CFFF site (WEC 2021-TN7060). RA-432 also requires the anomaly to be evaluated by a qualified archaeologist who would consult with the South Carolina SHPO to ascertain whether the find is of archaeological significance, and if so, additional notifications and consultations would be made (WEC 2021-TN7060). GPR is not required in disturbed areas for the purposes of identifying cultural resources; if cultural resources or human remains are identified in disturbed areas during the course of routine work, they would be treated as an unanticipated discovery and the corresponding protocol would be followed.

TRN-170 is a cultural resources training module prepared by a qualified archaeologist (i.e., a professional that meets the Secretary of Interior's qualification standards at 36 CFR Part 61) and provided to all employees and contractors conducting or supervising ground-disturbing activities (WEC 2021-TN7048 and AECOM Undated-TN7063). The training provides an overview of historic and cultural resource types found in the region and describes the types of "artifacts, cultural features, and soil deposits" that are "likely to be associated with these sites" (WEC 2021-TN7048 and AECOM Undated-TN7063). The training module also describes the procedures to be followed if archaeological remains are exposed (WEC 2021-TN7048 and AECOM Undated-TN7063).

Known contaminated soil has been identified in disturbed areas of the CFFF site (WEC 2020-TN6844; SCDHEC/WEC 2019-TN6554). Impacts from the presence of soil contamination to historic and cultural resources located in areas extensively disturbed by past CFFF construction and operation activities are unlikely given the low potential for previously unidentified intact archaeological resources to be present in these areas. Additionally, as discussed in Sections 3.2, 3.3, and 3.4 of this EIS, the NRC staff determined that there is a low potential for contaminants to move offsite because of the implementation of activities and programs to minimize the effects of releases on other users of the local surface water and groundwater resources (e.g., spill prevention controls, the environmental sampling and monitoring program). Additionally, both chemical and radioactive materials are present in the fuel fabrication operations at the CFFF. Subpart H of 10 CFR Part 70 (TN4883), requires certain fuel cycle facilities licensed under Part 70 to perform an Integrated Safety Analysis (ISA). As part of the LRA, the WEC submitted its ISA methodology for NRC's review and approval. The purpose of the NRC staff's review of the ISA summary is to establish reasonable assurance that applicants and licensees have conducted an adequate ISA. In the ISA, applicants and licensees identify and evaluate all credible events (accident sequences) internal to the facility (e.g., explosions, spills, fires) and credible external events that could result in facility induced consequences to workers, the public, or the environment that could exceed the performance requirements of 10 CFR Part 70 (TN4883). Engineered and administrative controls are identified to prevent or mitigate consequences. The WEC (2019-TN6510) evaluated several accidents that, although considered to have a low probability of occurrence, could result in the largest environmental consequences—criticality accident, a UN release, chemical releases from a UF_6 cylinder, and a major fire. These are discussed in Section 3.15 of this EIS. As discussed in Section 3.10 of the

EIS, the CFFF can be partially viewed at a distance from State Route 48 (Bluff Road), but otherwise is difficult to view from the forested landscape of the surrounding rural area. Therefore, indirect effects (atmospheric, auditory, and visual effects) to historic and cultural resources located in adjacent areas to the CFFF are not anticipated to be significant or adverse.

Although the WEC did not propose changes to its licensed operations or construction activities as part of the LRA, impacts from future NRC-licensed activities during the proposed license renewal term are possible because the potential for significant archaeological resources to be present in undisturbed areas is high. The South Carolina SHPO has determined that the WEC site as a whole has a high probability of significant archeological properties (SCAHC 2015-TN5608). Accordingly, the potential impact on archaeological resources from potential ground disturbance activities in previously undisturbed areas during the proposed license renewal term would be subject to a high degree of uncertainty. The WEC has proposed to conduct a cultural resource survey within the CFFF site to identify historic properties in a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). The cultural resource survey would be developed in coordination with the South Carolina SHPO. A qualified professional who meets the Secretary of Interior's qualification standards at 36 CFR Part 61 (TN4848) would perform the survey. Implementation of the historic and cultural resources procedures developed by the WEC (RA-432 [WEC 2021-TN7060], RAF-104-5 [WEC 2020-TN6872], TAF-500-11 [WEC 2020-TN6873], SYP-233 [WEC 2021-TN7064], and RA-136 [WEC 2021-TN7062]) and the historic and cultural resource identification training TRN-170 [AECOM Undated-TN7063] for employees and contractors conducting ground disturbing activities (WEC 2021-TN7048) would avoid or minimize potential impacts on historic and cultural resources.

In summary, in its LRA the WEC did not propose changes to its licensed operations or construction activities that would result in significant land disturbance activities. The WEC has proposed to conduct a cultural resource survey within the license area of the CFFF (WEC 2021-TN7077). The WEC has also developed and established cultural resources procedures and provisions with the goal of avoiding and minimizing impacts on historic and cultural resources in the conduct of all ground-disturbing activities, including procedures for unanticipated discoveries of cultural resources and human remains, and a training module for employees and contractors conducting ground disturbing activities. The WEC would continue the upkeep of the Denley Cemetery. Indirect effects on historic and cultural resources are not anticipated. Therefore, the NRC staff concludes that potential impacts on historic and cultural resources would be SMALL. Additionally, the NRC staff does not anticipate that historic properties would be affected. See Appendix A for additional discussion of past and ongoing NHPA Section 106 consultation activities for the proposed action.

Overall, when combined with other past, present, and reasonably foreseeable future actions, the proposed action would have a SMALL incremental impact contribution but would not result in a collectively greater cumulative impact on historic and cultural resources. That is, the proposed continued operation of the CFFF for an additional 40 years could noticeably alter previously unidentified cultural resources onsite but would not destabilize or significantly affect them because there is a low potential for contaminants to move offsite given the implementation of programs and procedures to minimize the effects of releases (e.g., spill prevention controls, the environmental sampling and monitoring program). In addition, as a result of the implementation of a cultural resources survey and WEC's procedures and provisions described in this section, potential impacts to historic and cultural resources would be avoided, minimized, or mitigated (see Appendix B for additional information).

3.9.3 Mitigation Measures

The WEC will follow its sitewide historic and cultural resource procedures and provision prior to conducting ground-disturbing activities on the CFFF site. These procedures include the UDP, which is specific to the WEC's implementation of the CA (WEC 2020-TN6707), and the WEC's sitewide historic and cultural resources protection procedures and provisions (Procedure RAF-104-5 [WEC 2020-TN6872], TAF-500-11 [WEC 2020-TN6873], SYP-233 [WEC 2021-TN7064], RA-136 [WEC 2021-TN7062], RA-432 [WEC 2021-TN7060], and TRN-170 [AECOM Undated-TN7063]). These procedures address stop work provisions and notification to the South Carolina SHPO and Indian Tribes, as appropriate, if cultural resources or human remains are inadvertently encountered during ground-disturbing activities. The sitewide protection procedures include the use of GPR and GPR analysis prior to conducting ground-disturbing activities and evaluation of any anomaly by a professional archaeologist (WEC 2021-TN7048). The WEC has also committed to provide historic and cultural resource identification training (see AECOM Undated-TN7063) for all employees and contractors conducting ground-disturbing activities on the CFFF site (WEC 2021-TN7048).

3.10 Visual and Scenic Resources

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on visual and scenic resources of the proposed action.

An aerial view of the CFFF is shown in Figure 3-22. The CFFF is an industrial complex located in a semi-rural area that is surrounded in part by forested lands (WEC 2019-TN6510). There are no nearby natural or man-made features that are considered distinct visual or scenic resources, such as views of mountains, surface water features, or monuments. The CFFF can be partially viewed at a distance from State Route (SR) 48 (Bluff Road) from the north from a clearing near the entrance, but otherwise is difficult to view from the forested landscape of the surrounding rural area. The CFFF is not visible from the Congaree National Park, located approximately 8 km (5 mi) to the southeast of the site, or the Congaree River Swamp within the park, which is a National Natural Landmark (NPS 2020-TN6973).

Figure 3-22 Aerial View of the CFFF Site and Facilities (WEC 2012-TN6697)

3.10.1 Visual and Scenic Resource Impacts

The WEC did not request changes to its NRC license related to construction of new facilities or operations, which would alter the existing visual character of the local landscape of the site (WEC 2019-TN6510). Additionally, any minor visual alterations would be difficult to detect from the existing available views of the CFFF site from public locations. Therefore, the NRC staff concludes that direct and indirect impacts on visual or scenic resources during continued operations of the CFFF for an additional 40 years would be SMALL. Because the proposed action will not alter the existing landscape, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.10.2 Mitigation Measures

The proposed action is not expected to result in significant impacts on visual and scenic resource and additional mitigation measures are not identified.

3.11 Socioeconomics

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct and indirect impact on socioeconomic resources of the proposed action. The following subsections summarize the affected socioeconomic environment for five primary topic areas: (1) demography (i.e., population characteristics), (2) employment structure and personal income, (3) housing availability and affordability, (4) tax structure and distribution, and (5) community services. These subsections include discussions of spatial (e.g., regional, vicinity, and proposed CFFF project area) and temporal considerations, where appropriate.

The NRC staff analyzed regional socioeconomic data provided by the U.S. Census Bureau (USCB), including 5-year estimates that the USCB collects for commuting workers by county of origin and county of destination. The CFFF is located in Richland County and the NRC staff considered the linkage between the labor force commuting to and from Richland County as the principal influencing factor for determining the appropriate socioeconomic region. Figure 3-23 illustrates this linkage. Richland County, with the economic center of Columbia, the state capital, employs more than 80 percent of its resident workforce in the county. Figure 3-23 illustrates that while commuting workers from Fairfield, Kershaw, Calhoun, and Newberry counties represent only minimal proportions of the Richland County workforce, these workers represent 10–36 percent of the working residents in these counties. This forges a strong economic linkage between these counties. Because of these linkages, a 32 km (20 mi) radius is used for demographic analysis to encompass the likely extent of commuting CFFF workers and related plant economic activity.

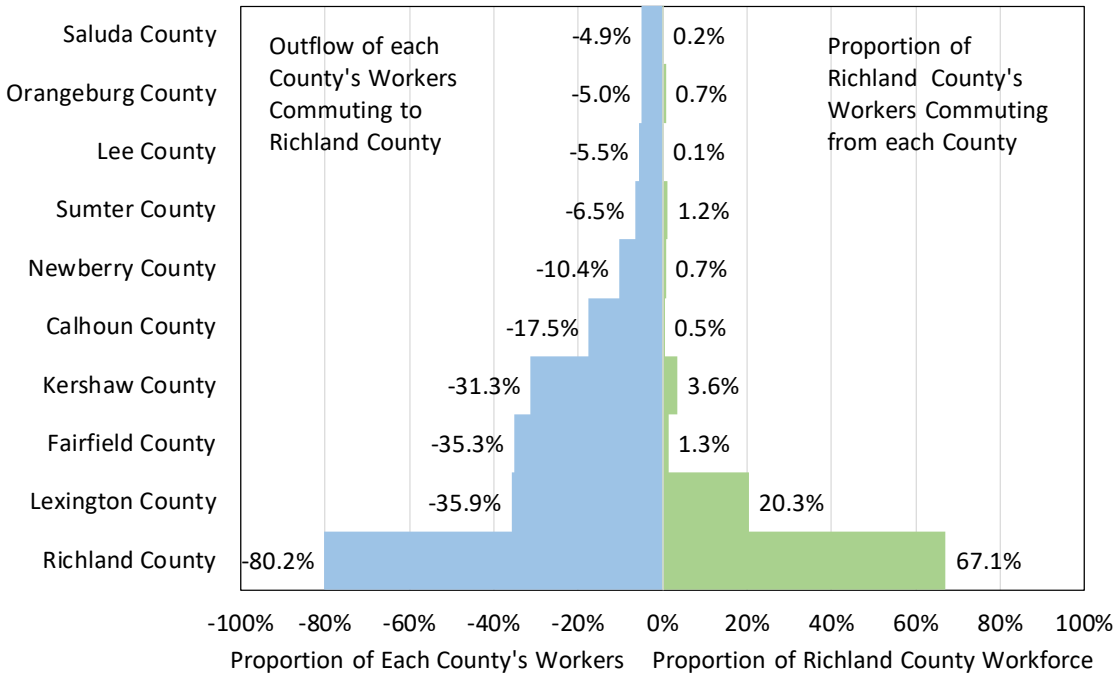

Figure 3-23 2015 County Workforce Commuting Flows (Source: USCB 2019-TN6977)

In addition to the census data about commuting patterns, the WEC provided the current distribution of the CFFF workforce by county of residence (WEC 2020-TN6844), which is summarized in Table 3-13. The WEC data indicate that 88.9 percent of the CFFF workforce resides in five South Carolina counties: Richland, Lexington, Kershaw, Orangeburg, and Sumter.

Table 3-13 CFFF Workforce by County of Residence (November 2020)

County of Residence	Workers	Percent
Richland	489	43.0%
Lexington	369	32.4%
Kershaw	92	8.1%
Orangeburg	39	3.4%
Sumter	23	2.0%
All Other South Carolina	84	7.4%
Outside South Carolina	42	3.7%
Total	1,138	100%

Source: WEC 2020-TN6844

3.11.1 Demography

3.11.1.1 Population Distribution in the Socioeconomic Region

The CFFF is located in unincorporated Richland County, near the community of Hopkins. Table 3-14 provides demographic information about the population (current and projected) in these counties, within the 32 km (20 mi) radius from the CFFF. Table 3-15 provides demographic characteristics of the socioeconomic region.

Table 3-14 County Population Estimates and Projections for the Socioeconomic Region

County	2000	2010	2020	Annual 00-20	2025	2035	Annual 20-35
Calhoun	15,192	15,094	14,290	-0.3%	13,655	12,345	-0.9%
Kershaw	52,851	61,706	66,685	1.3%	69,340	74,145	0.7%
Lexington	216,873	263,334	303,605	2.0%	324,860	365,575	1.4%
Richland	321,981	385,757	420,845	1.5%	436,420	463,530	0.7%
Orangeburg	91,524	92,320	85,250	-0.3%	80,950	71,710	-1.1%
Sumter	104,802	107,612	105,740	0.0%	103,570	97,690	-0.5%
Region	803,223	925,823	996,415	1.2%	1,028,795	1,084,995	0.6%
South Carolina	4,024,223	4,635,656	5,213,370	1.5%	5,542,140	6,223,085	1.3%

Source: South Carolina Department of Revenue and Fiscal Affairs (SCDRFA 2019-TN6698)

The five-county region has been growing at a slightly slower rate than South Carolina as a whole and is projected to grow at less than half of the annual rate of the State through 2035. Several rural counties are shrinking and are projected to continue shrinking in population. Growth is largely confined to Lexington County, making up suburban Columbia. The five-county region makes up nearly 20 percent of the South Carolina population. The five-county region has a substantially higher proportion of minority residents than South Carolina as a whole, and nearly half of the population comprises racial or ethnic minorities. African Americans and Hispanics/Latinos make up the largest individual minority groups.

Median family incomes vary widely by county, reflecting the combination of urban and rural counties in the region. The weighted average median family income for the five-county region is slightly higher than the State median income. Orangeburg County has the lowest median family income and the highest proportion of individuals living at or below the Federal poverty level. The socioeconomic region's proportion of individuals living in poverty closely matches the State proportion of about 16 percent.

3.11.2 Economic Characteristics

Economic characteristics include the local employment situation and the housing market conditions. These factors become important for context if the CFFF were to change employment levels significantly during the proposed license renewal period. Unemployment rates in the five-county region reflect trends that have been observed across the nation since the mid-2000s. Unemployment was relatively low prior to the Great Recession of 2008–2010, then doubled in most areas between 2008 and 2010. Prior to the COVID-19 public health emergency (PHE), unemployment levels had been reduced to levels lower than pre-recession levels of the mid-2000s. Estimated 2020 unemployment across all counties in the region shows a 1-year doubling due principally to the economic effects of the COVID-19 PHE. However, as seen in Table 3-16, current unemployment has not approached levels seen during the recession period in 2010.

Industry employment is summarized at the metropolitan area scale by the Bureau of Economic Analysis. As shown in Table 3-17, the 2015–2018 period exhibits a diverse and growing employment base in several major industries including construction, manufacturing, trade, healthcare, financial services, and other service sector industries. Total employment was growing steadily prior to the COVID-19 PHE.

Table 3-15 Selected 2018 Demographic Characteristics of the Socioeconomic Region

Demographic	Sumter County	Lexington County	Kershaw County	Orangeburg County	Richland County	Region	South Carolina
Population reporting race/ethnicity	106,995	286,316	64,361	88,454	408,263	954,389	4,955,925
White alone	48,574	215,302	44,372	29,404	174,911	512,563	3,156,973
African American alone	50,218	41,302	15,253	54,253	188,510	349,536	1,328,352
Native American alone	272	742	147	289	660	2,110	14,187
Asian alone	1,328	5,019	253	735	11,416	18,751	74,278
Pacific Islander alone	38	275	-	83	477	873	2,812
Other race alone	100	363	157	122	1,267	2,009	8,584
Multiracial alone	2,318	6,315	1,489	1,651	10,289	22,062	95,054
Hispanic or Latino of any race	4,147	16,998	2,690	1,917	20,733	46,485	275,685
Aggregate Minority	58,421	71,014	19,989	59,050	233,352	441,826	838,833
Aggregate Minority Percentage	54.6%	24.8%	31.1%	66.8%	57.2%	46.3%	16.9%
Population reporting Poverty Status	104,409	282,695	63,958	85,572	378,039	914,673	4,814,032
Individuals at or Below Federal Poverty Level	21,177	35,768	10,488	20,697	61,617	149,747	770,632
Poverty Level Percentage	20.3%	12.7%	16.4%	24.2%	16.3%	16.4%	16.0%
Families	3,849	17,371	75,479	20,033	27,915	144,647	1,249,795
Median Family Income (2018$)	$63,917	$57,866	$72,398	$47,002	$51,369	$62,852	$63,437

Sources: USCB 2019-TN6978, USCB 2019-TN6979, USCB 2019-TN6980

Table 3-16 County Unemployment Rates, 2007–2020

County	2007	2010	2015	2019	2020
Kershaw	5.4	11.5	6.0	3.5	5.6
Lexington	4.1	8.2	4.9	2.7	4.7
Orangeburg	8.1	15.9	10.9	5.3	10.1
Richland	5.2	9.4	5.7	3.2	6.8
Sumter	7.0	12.5	6.8	3.8	7.6
Region	5.4	10.1	6.0	3.3	6.4

Source: SCWorks 2020-TN6981

Table 3-17 Columbia, South Carolina, Metropolitan Area Employment by Industry, 2015–2018

Industry	2015	2016	2017	2018
Farm employment	3,920	3,893	3,942	3,701
Forestry, fishing, and related activities	2,491	2,537	2,524	2,595
Mining, quarrying, and oil and gas extraction	876	695	669	699
Utilities	(D)	(D)	4,323	3,883
Construction	22,168	23,915	27,450	25,673
Manufacturing	32,547	32,364	29,671	31,358
Wholesale trade	16,819	(D)	16,781	16,602
Retail trade	48,422	50,063	50,601	50,926
Transportation and warehousing	(D)	15,987	17,914	19,331
Information	(D)	(D)	(D)	6,959
Finance and insurance	27,704	28,421	28,958	29,238
Real estate and rental and leasing	(D)	(D)	21,493	22,070
Professional, scientific, and technical services	25,889	26,027	(D)	(D)
Management of companies and enterprises	(D)	(D)	(D)	(D)
Administrative and support and waste management and remediation services	(D)	(D)	38,188	38,551
Educational services	10,103	10,219	9,358	9,222
Health care and social assistance	43,810	45,092	45,804	46,474
Arts, entertainment, and recreation	(D)	(D)	(D)	(D)
Accommodation and food services	(D)	(D)	(D)	(D)
Other services (except government and government enterprises)	28,953	(D)	(D)	28,999
Federal civilian	10,235	10,276	10,366	10,413
Military	12,398	11,739	12,330	12,408
State government	34,970	35,370	35,309	34,826
Local government	37,903	38,011	38,262	38,537
Total employment (number of jobs)	489,418	498,376	505,636	512,470

(D): Disclosure withheld in source data for privacy reasons; totals include undisclosed employment.
Source: BEA 2020-TN6982

3.11.2.1 Housing

Housing statistics for the local five-county region are compiled in Table 3-18. Based on the Census American Community Survey (ACS) 2014-2018 5-year data on housing units by county, the local housing market, including single-family homes and rental properties, appear to have an adequate supply of available housing. Across the region, nearly 13 percent of the habitable housing stock is vacant of which over 7 percent are rental units. The market is tighter than the State average, based on vacancy rates, but would not be considered constrained currently. The weighted average median rent across the region is slightly less than the State average.

Table 3-18 2018 County Housing Statistics (USCB 2020-TN6983)

County	Housing Units	Owner-Occupied		Renter-Occupied		Vacant Units		Median Rent	Rental Vacancy Rate
		Number	Pct	Number	Pct	Number	Pct		
Kershaw	28,799	20,404	70.8%	4,429	15.4%	3,966	13.8%	$745	5.5%
Lexington	122,711	82,289	67.1%	28,976	23.6%	11,446	9.3%	$907	6.2%
Orangeburg	42,689	22,427	52.5%	10,539	24.7%	9,723	22.8%	$679	9.9%
Richland	171,000	88,450	51.7%	61,859	36.2%	20,691	12.1%	$952	7.8%
Sumter	47,837	26,608	55.6%	14,529	30.4%	6,700	14.0%	$776	5.9%
Region	413,036	240,178	58.1%	120,332	29.1%	52,526	12.7%	$854	7.3%
South Carolina	2,256,951	1,305,349	57.8%	589,362	26.1%	362,240	16.0%	$868	9.4%

3.11.2.2 Local Finance

The WEC as the owner of the CFFF and site property is subject to local property taxes or fees in lieu of taxes, corporate income taxes, local sales and use taxes, and CFFF employees pay income and property taxes, of which property taxes are the great majority affecting the local region (WEC 2020-TN6844).

The WEC paid $3.4 million in property taxes and fees in lieu of taxes in calendar year 2019. It is assumed that this is an appropriate estimate for continued annual payments over the course of the proposed 40-year renewed license period (WEC 2020-TN6844). In 2018, the WEC paid $2.8 million and Richland County indicates that the WEC ranked 8th of the County's largest tax payers (Richland County 2019-TN6930). The CFFF tax revenue is a minor fraction of the total annual Richland county property tax revenue of about $700 million.

3.11.3 Community Infrastructure and Services

This section provides baseline information regarding local services and infrastructure in close proximity to the CFFF site or which provide services to the site.

3.11.3.1 Education

Several schools are located in the Hopkins area to the north of the CFFF site and are listed in Table 3-19.

Table 3-19 Local Area Public Schools Information 2019-2020 School Year

School	Grades	Enrollment	Student Teacher Ratio
Hopkins Elementary	PK-5	270	11.84
Hopkins Middle School	6-8	472	11.51
Lower Richland High School	9-12	1,137	12.65
Mill Creek Elementary School	PK-5	357	11.52

Sources: National Center for Educational Statistics (NCES 2020-TN6931)

3.11.3.2 Hospitals

There are no hospitals within the 8 km (5 mi) radius of the CFFF site. There are several hospitals in the greater Columbia metropolitan area: Providence Hospital, Palmetto Richland Hospital, and Lexington Medical Center.

3.11.3.3 Fire and Police

Richland County is served by four fire departments including the Columbia-Richland County Fire Department, two Federal fire departments, and a State fire department. Richland County Emergency Services provides emergency medical and disaster relief services. The Alvin S. Glenn (Richland County) Detention Center is located 8 km (5 mi) north of the CFFF site, just off Bluff Road (SC 48) (WEC 2019-TN6510)

3.11.3.4 Transportation and Traffic

According to the WEC (2019-TN6510), Columbia and the surrounding area contain a well-developed and maintained system of interstate, regional, and local highways that provide easy year-round access. Three interstate highways serve Columbia. The CFFF site can be accessed by state highway S-48 (Bluff Road). Although CSX Transportation, Incorporated (CSX), operates two rail lines close to the CFFF site, there are no rail lines or spurs on the WEC property.

Currently, there are approximately 1,138 employees at the CFFF, working in one of three shifts. The annual average daily workforce is 859 workers resulting in approximately 1,700 vehicles on the road (WEC 2019-TN6510, WEC 2020-TN6844). Additional information about the transportation and traffic can be found in Section 3.13 of this EIS.

3.11.4 Socioeconomic Impacts

Socioeconomic impacts would be expected if the proposed continued operation of the CFFF for an additional 40 years would alter baseline socioeconomic conditions in some noticeable way. The current operations of the CFFF already contribute to the baseline conditions encountered in the five-county socioeconomic region. The proposed continued operation of the CFFF for an additional 40 years is not expected to noticeably change the employment level or mission of the CFFF. The CFFF would continue to be a significant employer in the Columbia metropolitan area and would continue to generate positive impacts such as tax revenue and personal income, which would benefit the local economy through a multiplier effect as plant employees spend their income and the plant makes local expenditures. Local traffic would continue and change to the baseline impacts on local roadways and other infrastructure would not be expected.

The NRC staff could not identify impacts on local property values connected to the known contamination in close proximity to the CFFF site. Property values are affected by many factors simultaneously and may have offsetting effects. Various studies have reviewed the recent evidence and found the body of studies to be inconclusive. For example, Bezdek and Wendling (2006-TN2748) found that various studies report no statistical effect of proximity to nuclear facilities, while other studies have found positive or negative effects. Property tax valuations also do not indicate any departure from local trends, indicating that property values in the area track with the wider Columbia metropolitan area.

Therefore, the staff concludes that the socioeconomic impacts of proposed continued operation of the CFFF over a 40-year license period would be SMALL. Because the NRC staff does not expect changes to baseline socioeconomic impacts, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.11.5 Mitigation Measures

NRC staff does not expect changes from the proposed action to result in changes to baseline socioeconomic impacts and additional mitigation measures are not identified beyond the remedial investigation the WEC is conducting under the CA with the SCDHEC

3.12 Public and Occupational Health

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on public and occupational health of the proposed action.

The proposed renewal of the CFFF operating license for an additional 40 years does not involve changes to current licensed operations. The radiological and nonradiological exposures to members of the public and workers would continue, and the WEC would continue to be bound by its license and regulatory requirements. This section describes the sources of radiation and chemical exposure, baseline health conditions, public and occupational health protection standards, and the potential direct and indirect impact of renewing the operating license. Additionally, Section 3.8 of this EIS discusses impacts from noise, and Section 3.13 discusses transportation impacts, such as workers commuting and shipment of materials. Section 3.15 of this EIS discusses accidents.

3.12.1 Sources and Pathways of Radiation and Chemical Exposure

Radiation doses to the general public occur from radioactive materials found in the Earth's soils, rocks, and minerals. Radon 18 (Rn-222) is a radioactive gas that escapes into ambient air from the decay of uranium (and its progeny, radium-226) found in most soils and rocks. Naturally occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of exposure and ionizing radiation dose. In addition to natural sources of radiation, there are artificial or man-made sources that contribute to the dose the general public receives. Medical diagnostic procedures using radioisotopes and x-rays are a primary man-made radiation source.

Based on the most recent National Council of Radiation Protection and Measurements (NCRP) Report No. 160, *Ionizing Radiation Exposure of the Population of the United States* (NCRP 2009-TN420), for a U.S. resident, the effective dose per individual from ubiquitous background

radiation is 311 mrem/yr (3.11 millisieverts [mSv]/yr). Because of the increase in medical imaging and nuclear medicine procedures, the annual average dose to the public from all sources (natural and human-made) is 620 mrem (6.2 mSv) (NCRP 2009-TN420). The sources of this exposure are naturally occurring radionuclides, anthropogenic radionuclides (human produced), external radiation, and internal radiation (radionuclides in the body) (NCRP 2009-TN420). This value is important for comparison to the estimated dose to a member of the public and to the occupational worker from CFFF operations.

The NRC noted in its 1985 environmental review for the license renewal for the CFFF that background radiation, expressed in terms of average gross alpha contamination, in the vicinity of the CFFF was 3.9×10^{-6} pCi/L in ambient air, 2.2 pCi/L in the Congaree River, and 1.0 pCi/L in offsite well water and drinking water (NRC 1985-TN5602). The radiological monitoring data for onsite soil resulted in a 3-year average of 0.23 to 0.65 pCi/g of total uranium. The sample locations are the same location as the ambient air monitors (NRC 1985-TN5602).

Chapter 2 of this EIS describes facility operations at CFFF. The following chemicals are kept in bulk to support manufacturing operations: aqueous ammonia, argon, calcium hydroxide, calcium oxide, fuel oil, gasoline, hydrofluoric acid, hydrogen, nitric acid, oxygen, sodium hydroxide, sodium silicate, sulfuric acid, triuranium octoxide, uranium dioxide, uranium hexafluoride and UN (WEC 2019-TN6510). Other hazardous materials include degreasing solvents, lubricating and cutting oils, and spent plating solutions (WEC 2019-TN6510).

Across the street from the CFFF on the northside of Bluff Road, there is a Superfund site known as the South Carolina Recycling and Disposal, Inc. site. It is a 1.6 ha (4 ac) site that was used for storage, recycling, and disposal operations until 1982. The migration of contaminated groundwater (mainly VOCs) from this site was stabilized and the contamination does not currently threaten people living and working near the site (EPA 2020-TN6522).

Additionally, Knight's Redi-Mix, Schneider Electric, and Devro all have manufacturing facilities within an 8 km (5 mi) radius of the CFFF. Amazon, Nephron Pharmaceuticals, and DAK Americas are located within a 16 km (10 mi) radius. Fort Jackson U.S. Army Base is 11 km (7 mi) to the north of the CFFF and McEntire Joint National Guard Station is 9.6 km (6 mi) northeast. These facilities have the potential to release liquid or gaseous effluents that may contribute to or interact with the CFFF effluents.

Historical incidents of interest to public and occupational health at the CFFF began in 1971 when a former wastewater lagoon leaked and released up to 1.5 million gallons of wastewater into Upper Sunset Lake (SCDHEC 2020-TN6842). As documented in a presentation by the SCDHEC (2019-TN6843), occupational and public health incidents noted in the 1980s included a fish kill in Gator Pond. A monitoring well network was established, and it was determined that the wastewater lagoons were leaking nitrates and fluoride to the groundwater. In 1995, solvent chemical contamination was noted in the groundwater and more monitoring wells were installed. Groundwater treatment to reduce the solvents in groundwater occurred between 1996 and 2011. Wastewater line leaks occurred in 2008 and 2011, and leaks from the HFSS #2 inside the facility were reported in 2018. The soil underneath the HFSS #2 was removed, remediated, and filled back in with concrete. In 2019, inspections by the WEC found a hole in the roof of a sea-land container (also referred to as intermodal container) being used to store materials containing uranium (2019-TN6843). As of November 2020, 62 intermodal containers had been removed. As the intermodal containers were removed, the WEC sampled the soil and removed contaminated soil in accordance with its site remediation procedure. The WEC has remediated soils in which the uranium levels were detected above the WEC-established residential cleanup

standard (WEC 2020-TN6844). A CA with the SCDHEC was executed on February 26, 2019, to establish communication protocols, and conduct investigations of past releases, response mechanisms for future releases, evaluation of cleanup alternatives, remedial design, and remedial action (SCDHEC/WEC 2019-TN6554) (see Section 1.5.2.2.1 for additional discussion). For more information regarding water sampling, see Sections 2.2.2, 3.3, and 3.4 of this EIS. Section 2.2.2.3 of this EIS describes the CA, and Section 2.2.2.3 describes monitoring for the CA.

The WEC also completed several environmental improvement programs in the 2019-2020 timeframe, including the addition of monitoring wells around the chemical manufacturing building, removal of obsolete air-handling equipment, completion of air emission testing to validate minor-source status for the CFFF air permit, elimination of nickel-plating room operations to eliminate the only chemical source in the mechanical manufacturing area, and elimination of PCE. Elimination of PCE means that there is no significant source of VOCs at the site. The WEC is actively pursuing closure and cleanup of the East Lagoon, disposal of other contaminated materials, such as calcium fluoride and obsolete cylinders, and analyzing sludge in the Sanitary Lagoon to support closure activities (WEC 2020-TN6844). For more information about waste management, see Section 3.14 of this EIS.

The radiological materials potentially released from the CFFF into the environment would be transported through the environment in a variety of ways and would expose the public through both internal and external exposure pathways. For the liquid exposure pathway, dose to the public would be through potential ingestion of aquatic food and exposure from recreational activities such as boating; there are no surface water withdrawals registered within the Saluda River Basin downstream of the WEC NPDES discharge (WEC 2021-TN7048). For the gaseous releases, the exposure pathways would include direct radiation from deposited radioactivity on the ground, inhalation of radioactive material in the air, and ingestion of crops and animal products that come in contact with radioactive material in the air.

The CFFF is bounded by private property owners to the east, south, and west. Manufacturing facilities are located about 0.5 km (0.3 mi) from the site boundary, at its nearest point. Farms, single-family dwellings, and light commercial activities are located chiefly along nearby highways. Within a 1.6 km (1 mi) radius of the CFFF site, agricultural use makes up 44 percent of the area (WEC 2019-TN6510). The remaining 56 percent is classified as “other” (WEC 2019-TN6510). Five farms are located within 8 km (5 mi) of the CFFF. These provide quail, strawberries, fish for pond stocking, and full-service equestrian services (WEC 2019-TN6510). Within the county there are a variety of farms producing vegetables, fruits, and animal products including herbs, leafy greens, corn, tomatoes, pork, and chicken (WEC 2021-TN7048).

To evaluate the dose to a member of the public the maximally exposed individual (MEI) is considered to be a potential person living adjacent to the CFFF site boundary full time and growing food and raising animals for both milk and meat on their property. Potential MEIs were modeled as being located approximately 1,000 m (1094 yd) to 2,900 m (3,173 yd) away from the center of the CFFF in the cardinal directions N, NNW, ENE, ESE, and WSW based on satellite imagery (Figure 3-24). The person is also expected to participate in recreational activities on the Congaree River and consume fish harvested from the Congaree. To be conservative, the MEI is also modeled as getting drinking water from the Congaree River, but this is not probable for a resident.

Figure 3-24 Map of Potential MEIs with an Approximation of the CFFF Site Boundary

The potential exists for accidents leading to a direct or indirect release of radioactive and chemical materials. The accidental release would likely be more concentrated over a shorter period of time. Concentrations and exposure rates help determine whether there will be acute effects or chronic effects. For radiation, acute dose usually refers to a large dose of radiation received in a short period of time, while chronic dose refers to the sum of small doses received repeatedly over a long period of time. See Section 3.15 of this EIS for information about radiological and nonradiological accidents.

Additionally, the NRC-approved Site Emergency and Physical Protection Plan minimizes the potential and severity of such accidents (WEC 2019-TN6510). The WEC coordinates with the DOE Savannah River Site in Aiken, South Carolina, and the U.S. Department of Homeland Security Federal Emergency Management in Atlanta, Georgia (WEC 2019-TN6510) with regard to emergency response coordination and facility security.

3.12.2 Protection Standards, Programs, and Permits

The NRC has statutory responsibility, pursuant to the Atomic Energy Act of 1954, as amended (42 U.S.C. § 2011 *et seq.*; TN663) to protect worker and public health and safety. The NRC's regulations in 10 CFR Part 20 (TN283) specify annual worker dose limits, including 0.05 Sv (5 rem) total effective dose equivalent (TEDE) and dose limits to members of the public, including 1 mSv (100 mrem) TEDE with no more than 0.02 mSv (2 mrem) in any 1-hour period from any external sources. Regulatory requirements in 10 CFR Part 72 (TN4884) include an annual public dose limit of 0.25 mSv (25 mrem) committed dose equivalent to the whole body. These public does limits from NRC-licensed activities are a fraction of background radiation dose, which is 6.2 mSv (620 mrem) from natural and man-made sources (NCRP 2009-TN420).

The WEC is required to meet the dose limits for individual members of the public as stated in 10 CFR 20.1301 (TN283) (see Table 3-20) and demonstrate compliance with the dose limits at the

site boundary as required in 10 CFR 20.1302 (TN283). In addition, the WEC uses guidance in Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities* to demonstrate the offsite doses are as low as reasonably achievable (ALARA) (NRC 1993-TN5601). The WEC conducts a radiological effluent monitoring program to meet the regulatory requirements in 10 CFR 70.59 (TN4883), "Effluent Monitoring Requirements." Data from this monitoring program are used by the WEC to perform annual assessments of dose to members of the public from liquid and gaseous effluents to ensure that limits to the public provided in 10 CFR 20.1301 (TN283) are met and are ALARA (WEC 2014-TN6421).

Table 3-20 Dose Limits for Individual Members of the Public

Annual Dose Limit from Licensed Operations	
Individual member of the public	0.1 rem/yr (1 mSv/yr)
Dose in any unrestricted area from external sources	0.002 rem/hr (0.02 mSv/hr)
ALARA constraint per 10 CFR 20.1101 (d)	0.01 rem/yr (0.1 mSv/yr) from emissions of airborne radioactive material, excluding radon

Exposure to radiation presents an additional risk of cancer. The annual dose limit set by the International Atomic Energy Agency (IAEA), and the NRC, to protect members of the public from the harmful effects of radiation is 1 mSv (100 mrem). The additional risk of fatal cancer associated with a dose of 1 mSv (100 mrem), calculated using the scientific methods of the International Commission on Radiological Protection (ICRP 2007-TN422) and applying a linear-no-threshold dose response assumption, is on the order of 1 in 20,000. This small increase in lifetime risk can be compared to the baseline lifetime risks of 1 in 2–3 for anyone developing a cancer and 1 in 5 for anyone developing a fatal cancer (ACS 2020-TN6932).

The OSHA General Industry Standards (29 CFR Part 1910-TN654) establish practices, procedures, exposure limits, and equipment specifications to preserve worker health and safety. Standards for occupational exposure to hazardous chemicals in laboratories are found at 29 CFR 1910.1450, while process safety management of highly hazardous chemicals are found at 29 CFR 1910.119, and personal protective equipment standards are found at 29 CFR 1910, Subpart I (TN654). The WEC is required to meet the occupational dose limits for workers as stated in 10 CFR 20.1201 (TN283) (see Table 3-21). Workers are monitored for radiation exposure to ensure the occupational doses limits are met and maintained ALARA. The WEC is also required to limit risk to workers from accident conditions in accordance with 10 CFR 70.61 (TN4883).

Table 3-21 Occupational Dose Limits for Adults Established by 10 CFR 20.1201(a) (TN283)

Tissue	Annual Dose Limit
Whole body or any individual organ or tissue other than the lens of the eye	More limiting of 5 rem/yr (0.05 Sv/yr) TEDE to whole body or 50 rem/yr (0.5 Sv/yr) sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye
Lens of the eye	15 rem/yr (0.15 Sv/yr) dose equivalent
Extremities, including skin	50 rem/yr (0.050 Sv/yr) shallow dose equivalent

Source: NRC 2019-TN6472

The SCDHEC and NRC have oversight of operations at the WEC site (SCDHEC 2020-TN6845). As noted previously, environmental investigations and monitoring have been conducted at the CFFF site since the 1980s. SCDHEC and the WEC signed a CA in February 2019 to define the sources and extent of contaminants throughout the CFFF site (SCDHEC 2018-TN6713). For the CFFF's air permit, the SCDHEC does not require the WEC to monitor for nonradiological pollutants because the CFFF is classified as a minor-source operator, but the WEC provides modeled emission rates that the SCDHEC uses to determine compliance (WEC 2019-TN6510). The WEC does monitor for nonradiological pollutants as part of the NPDES permitting process. The WEC also performs radiological ecological monitoring on soil, vegetation, and fish samples annually and samples vegetation for fluoride levels (WEC 2019-TN6510). The WEC is currently preparing a Remedial Investigation Report as part of the CA with SCDHEC, so monitoring requirements may change in the future based on the final Remedial Investigation Report. The CFFF Chemical Safety Program is designed to assure that all current and proposed chemical-use hazards are evaluated, and appropriate measures are taken to assure safe operations. For instance, use of anhydrous ammonia at the CFFF was eliminated in August 2011, and replaced by the use of aqueous ammonium hydroxide. This resulted in a reduction in chemical hazard risk (WEC 2019-TN6510). The WEC has programs in place to manage industrial hazards, hazardous materials, and radioactive materials. Industrial hazards for the CFFF are those considered typical for similar industrial facilities and include exposure to chemicals and accidents ranging from minor cuts to harm from industrial machinery (NRC 2007-TN5598).

The WEC holds an International Organization for Standardization (ISO) 9001 Certification of Approval. While the approval isn't required by NRC or OSHA regulations, the ISO process implements a quality assurance program by which safety requirements are met, hazards are identified, and risks are reduced. The facility also has a Clinical Laboratory Improvement Amendments Certification, Environmental Laboratory Certification, NPDES Permit, Air Quality Operating Permit, Infectious Waste Generator Registration, Radioactive Materials License, Radioactive Waste Transport Permit, and Registration for radiation-producing machines and other sources of ionizing radiation from the SCDHEC (WEC 2019-TN6510). These permits, certifications and licenses assist in maintaining public and occupational health. A list of permits held by the WEC can be found in Section 1.4 of this EIS.

3.12.3 Public Health Impacts

Potential public health impacts could result from release of radiological materials and nonradiological hazardous materials that are transported from the site through the air, surface water, or groundwater.

The WEC conducts a radiological effluent monitoring program to meet the regulatory requirements in 10 CFR 70.59 "Effluent Monitoring Requirements" (TN4883). Data from this monitoring program are used by the WEC to perform annual assessments of dose to members of public from liquid and gaseous effluents to ensure that public dose limits provided in 10 CFR 20.1301 (see Table 3-20 [TN283]) are met and are ALARA (WEC 2014-TN6421). Doses at the CFFF site have been below 1 mrem/yr (WEC 2021-TN6904, WEC 2020-TN6912, WEC 2020-TN7016, WEC 2019-TN6950, WEC 2019-TN6550, WEC 2018-TN7049). Offsite effluent releases are monitored at release points and reported to the NRC on a semiannual basis. In addition, doses to the public are estimated on an annual basis. The sources of radiation from the CFFF include both uranium and Tc-99 from operation activities (see Chapter 2 of this EIS for detailed information about the operational processes and points of release). The annual average discharge rate for uranium in gaseous effluents can be found in Table 2-1 of this EIS and the measured discharge to the Congaree River for uranium and Tc-99 can be found in

Table 2-2 of this EIS. For estimating a dose to the MEI, the gaseous release of uranium is assumed to be 470 µCi/yr (WEC 2019-TN6510) and the discharge of uranium and Tc-99 is assumed to be 13.4 mCi and 10.4 mCi, respectively (WEC 2019-TN6510).

Radiation doses to the public and nonhuman biota were evaluated using NRCDose3 (NRC 2021-TN7050) including XOQDOQ, GASPAR II, and LADTAP II. Potential doses to an MEI included exposure to gaseous effluents as well as liquid effluents releases to the Congaree River but did not include exposure to contaminants in the groundwater, because there is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources (e.g., the environmental sampling and monitoring program) (see Section 3.4 of this EIS for additional information). XOQDOQ was used to determine the gaseous dispersion of radiation (see Section 3.7 of this EIS). GASPAR was used to evaluate the doses to the potential MEI by evaluating dose to a potential resident living adjacent to the site boundary, including doses from external exposure to radiation on the ground and in the air as well as internal exposure to radionuclides inhaled or ingested through vegetables, meat, milk that is grown or raised at the residence. LADTAP was used to evaluate the dose to an MEI assuming that the MEI gets drinking water and fish for consumption from the Congaree River downstream from the effluent discharge point and participates in recreational activities including boating and shoreline exposure.

The highest radiation dose to a potential MEI from uranium released through gaseous in a year was found to be approximately 0.2 mrem/yr. Doses to the potential MEI from yearly liquid effluent releases of uranium and Tc-99 was found to be approximately 0.0001 mrem/yr. These doses are comparable to those calculated by the licensee in semiannual reports to the NRC (WEC 2020-TN6912, WEC 2020-TN7016, WEC 2019-TN6950, WEC 2019-TN6550, WEC 2018-TN7049). This is below the WEC's ALARA goal of a 1 mrem/yr dose to members of the public from gaseous and liquid effluents (WEC 2019-TN6510). If compared to the dose limit in 10 CFR 20.1301, this is less than 1 percent of the 100 mrem/yr (1 mSv/yr) limit. That dose also represents less than 10 percent of the 10 mrem/yr ALARA constraint from air emissions discussed in 10 CFR 20.1101. Compared to the ubiquitous background dose given in NCRP Report 160 of 311 mrem/yr (NCRP 2009-TN420), the 0.2 mrem/yr is only a small fraction of that amount. These doses to a potential MEI living at the site boundary are compliant with the regulatory limits set in 10 CFR Part 20 (TN283).

Liquid effluent from the CFFF includes sanitary waste and process liquid waste containing ammonia and fluorides. To comply with its NPDES permit requirements and 10 CFR Part 20 (TN283) regulatory limits, the WEC currently treats the sanitary waste and process liquid waste onsite prior to its being discharged into the Congaree River. According to the WEC, the average combined liquid effluent flows were 100,000 gpd over a 10-year period (WEC 2019-TN6510).

The CFFF is classified as a minor-source operator and operates under an air permit from SCDHEC (WEC 2019-TN6510). The WEC submitted an air permit renewal application to SCDHEC and the approval is pending. The WEC is required to comply with the emission limitations in Section II of the permit (WEC 2019-TN6510). There are 47 exhaust stacks that discharge gaseous emissions, such as uranium compounds, ammonia, and fluorides (WEC 2019-TN6510). Gaseous effluents are treated through HEPA filters and scrubbers prior to discharge to comply with 40 CFR Part 61 (TN252) and regulatory limits in 10 CFR Part 20 (TN283) (WEC 2019-TN6510). The facility also uses an incinerator, gas-fired boilers, gas-fired calciners, and oil-fired diesel generators, which release gaseous effluents (WEC 2019-TN6510).

The impacts of the proposed action could result in potential direct and indirect exposure to members of the public from releases of radiological and nonradiological hazardous materials. Based on this review, the continued requirements to meet NRC dose limits to the public, compliance with the NPDES permit and SCDHEC's air permit, the facility's environmental sampling and monitoring, and oversight by the SCDHEC and the NRC, the NRC staff considers direct and indirect impacts on members of the public from renewing the CFFF license for an additional 40 years to be SMALL. Based on the potential for cumulative impacts on public and occupational health from nearby actions and facilities, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.12.4 Occupational Health Impacts

During normal facility operations, occupational workers would be expected to be exposed to radiological and nonradiological hazardous materials that must be within regulatory limits. The WEC has a Chemical Safety Program and other occupational programs in place to minimize worker health impacts, including accidents, such as electrical shock and asphyxiation, while workers are engaged in activities such as facility maintenance and testing. Health impacts on the CFFF workers would also be through chronic exposure or improper handling of nonradiological materials including ammonia, nitric acid, nitrates, and hydrofluoric acid.

The WEC is required to meet the occupational dose limits for workers as stated in 10 CFR 20.1201 (TN283). Workers are monitored for radiation exposure to ensure the occupational doses limits are met and maintained ALARA. The WEC is also required to limit risk to workers from accident conditions in accordance with 10 CFR 70.61 (TN4883) and monitor workers for radiation exposure (WEC 2019-TN6510).

According to the March 2019 ER, no serious injuries or deaths have occurred at the CFFF site since operations began in 1969 (WEC 2019-TN6510). In 2019, the WEC reported to the NRC an event requiring three employees to be hospitalized as a result of maintenance work on hydrofluoric acid process equipment. The employees stayed at the hospital overnight and were released with no work restrictions. The incident was entered into the WEC's CAP (NRC 2020-TN6847). For 2017 and 2018, the CFFF total recordable incident rates were 0.83 and 2.10, respectively. The rate is defined as the number of OSHA-recordable injuries and illness versus the total number of man-hours worked. As noted by the U.S. Bureau of Labor Statistics, the 2019 average incident rate for chemical manufacturing facilities such as the CFFF is 1.9 (BLS 2020-TN6846).

The continued operation of the CFFF would result in the potential direct and indirect exposure from release of radiological and nonradiological hazardous materials resulting in potential occupational health impacts on workers. According to the WEC, from 2005 to 2011, the average annual total effective dose to a radiation worker ranged between 197 mrem (1.97 mSv) (0.197 rem) and 327 mrem (3.27 mSv) (0.327 rem) (WEC 2014-TN6421). In its revised ER (WEC 2019-TN6510), the WEC noted that the average annual total effective dose for a radiation worker from 2014 through 2018 was lower and ranged from 98 to 143 mrem (0.98 mSv to 1.43 mSv) (0.098 to 0.143 rem). These doses are less than 10 percent of the 5.0 rem (50 mSv) annual occupational dose limits in 10 CFR 20.1201 (WEC 2019-TN6510). The average worker dose (TEDE) at a fuel cycle facility (fuel fabrication, processing, uranium enrichment, and UF_6 production facilities) in 2017 was 90 mrem (0.9 mSv) (0.09 rem) (WEC 2019-TN6550). In 2017, there were 339 workers at the CFFF with measurable committed effective dose equivalent

(CEDE); the collective CEDE at the CFFF was 40.153 person-rem, the highest CEDE of the fuel fabrication facilities in 2017 (WEC 2019-TN6550).

The impacts of the proposed action would result in the potential direct and indirect exposure of occupational workers to the release of radiological and nonradiological hazardous materials. Worker radiological dose exposures would be expected to remain below 10 CFR Part 20 (TN283) regulatory limits, and the WEC is expected to continue to comply with OSHA regulations; therefore, the NRC staff considers direct and indirect impacts on occupational workers from the proposed renewal of the CFFF operating license for an additional 40 years to be SMALL. Based on the potential for cumulative impacts on public and occupational health from nearby actions and facilities, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.12.5 Mitigation Measures

The proposed action is not anticipated to result in significant public and occupational human health effects and additional mitigation measures are not identified beyond the remedial investigation the WEC is conducting under the CA with the SCDHEC and new license conditions agreed to by the WEC as part of the review of the LRA: (1) the WEC would be required to submit its environmental monitoring and sampling program to NRC for review and approval upon either SCDHEC's approval of the Remedial Investigation Report, as required by the CA (SCDHEC/WEC 2019-TN6554), or within 5 years of the license renewal (whichever comes first), and (2) the WEC would be required to enter exceedances of Federal and State standards into its CAP.

3.13 Transportation

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts on transportation from the proposed action.

The CFFF site is located in Richland County, South Carolina, and can be accessed by South Carolina highway S 48 (or Bluff Road). The major transportation corridors in the Columbia, South Carolina, area include Interstate highways I-20 (east-west), I-26 (northwest to southeast), and I-77 (north to south). Interstate 20 is approximately 22.4 km (14 mi) north of the CFFF site. Interstate 26 is slightly more than 12.8 km (8 mi) west of the CFFF site. Interstate 77 is approximately 9.6 km (6 mi) to the northwest. Other roads include US-21 (11.2 km [7 mi] west of the CFFF site), US-76/378 (about 9 km [5 mi] north of the CFFF site), and S 37 (about 2.4 km [1.5 mi] to the southeast of the CFFF) (see Figure 2-1).

CSX Railroad runs two train lines within 8 km (5 mi) of the CFFF site, but there are no rail lines or spurs on the site itself. The closest airport is the Columbia Metropolitan Airport, located 26 km (16 mi) away, northwest of the site. The Congaree River, which flows approximately 6.4 km (4 mi) southwest of the CFFF site, supports commercial barge traffic.

The South Carolina Department of Transportation (SCDOT) provides annual average daily traffic (AADT) counts by highway and highway segment. There are two traffic counting stations on S 48 on either side of the CFFF site entrance. The AADT counts in 2018 and 2019 for station #244, which is north of the CFFF site entrance and headed toward the City of Columbia, were 6,700 and 7,500, respectively (SCDOT 2019-TN6573, SCDOT 2020-TN6570). The AADT

counts in 2018 and 2019 for station #241, which is south of the CFFF site entrance and heading toward Gadsden, were 4,200 and 4,900, respectively (SCDOT 2019-TN6573, SCDOT 2020-TN6570).

The South Carolina Department of Public Safety (SCDPS) provides data about traffic accidents, injuries, and fatalities. In Richland County, 5,669 people were injured in traffic accidents and 52 traffic fatalities occurred in 2017, and 5,124 people were injured and 50 traffic fatalities occurred in 2018. Table 3-22 summarizes the traffic accident, injury, and fatality rates for Richland County for 2017 and 2018 (SCDPS 2018-TN6575, SCDPS 2019-TN6574).

Table 3-22 Richland County Traffic Accidents, Injuries, and Fatalities and Rates

Year	Vehicle Miles Traveled	Accidents	Accident Rate (per mile)	Injuries	Injury Rate (per mile)	Fatalities	Fatality Rate (per mile)
2017	4,120,696,522	13191	3.201E-06	5669	1.376E-06	52	1.262E-08
2018	4,300,003,041	13519	3.144E-06	5124	1.192E-06	50	1.163E-08

Source: SCDPS 2018-TN6575, SCDPS 2019-TN6574

There are approximately 1,250 employees at the CFFF, working in one of three shifts. The annual average daily workforce is 859 workers. Assuming one worker per vehicle (maximum traffic estimate), then the total number of worker vehicles on local roads would be 1,718 per day (i.e., = 2 x 859) (WEC 2019-TN6510).

The WEC has approximately 1,342 shipments of chemicals, radioactive material, and waste annually, which equates to approximately seven vehicles per day (WEC 2019-TN6510). Therefore, vehicles either carrying workers or shipments represent 23 to 35 percent of the AADT count for the two Bluff Road stations in 2019.

Completed fuel assemblies are shipped to customers in NRC-certified fissile material packages such as the Traveller (NRC 2019-TN6511). Figure 3-25 shows 10 Traveller unirradiated fuel transportation packages being transported on a truck. Low-level radioactive waste (LLRW) is shipped to NRC-licensed or NRC Agreement State-licensed LLRW disposal sites. The WEC must follow NRC, DOT, and SCDOT requirements for shipment of radioactive materials.

Figure 3-25 Ten Traveller Unirradiated Fuel Transportation Packages Being Transported on a Truck (Source: Photo provided by the WEC).

3.13.1 Transportation Impacts

The proposed action does not involve any increase in workforce size or a significant increase in material or waste shipments. All material shipments will be conducted in accordance with applicable regulations from NRC, DOT, and the State of South Carolina. Operational activities will remain at current staffing levels. Therefore, the NRC staff does not expect any significant transportation impacts as a result of the proposed continued operation of the CFFF for an additional 40 years. Accordingly, the NRC staff considers direct and indirect transportation impacts to be SMALL. Based on these minor impacts, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information).

3.13.2 Mitigation Measures

Transportation activities are a vital aspect of manufacturing that cannot be avoided, but negative impacts can be minimized by following established regulations. All shipments of nuclear materials, chemicals, and wastes would be carried out in conformance with NRC, DOT, and South Carolina requirements, including using truck placarding to identify contents and manifests. Trucks used for transport would be of the design and size deemed appropriate by the applicable regulations, and subject to the necessary inspections and maintenance to ensure safe transport. The proposed action is not expected to result in significant transportation impacts and additional mitigation measures are not identified.

3.14 Waste Generation and Management

This section describes the context of the proposed continued operation of the CFFF for an additional 40 years, and the potential direct or indirect impacts resulting from waste generation and management related to the proposed action. More specifically, this section describes the types of waste generated by the WEC and the disposition of the waste. Section 2.1.2 of this EIS describes the facility operations that generates solid, gaseous and liquid wastes; Section 2.2.1 discusses the gaseous and liquid effluents; and Section 2.2.2 discusses monitoring and mitigation of the effluents. The WEC manages these wastes using a combination of onsite processing, onsite storage, offsite disposal, incineration, and recycling. The WEC would continue to generate several types of wastes—gaseous, liquid, and solid—during the proposed continued operation of the CFFF for an additional 40 years.

3.14.1 Waste Generation and Management and Impacts

3.14.1.1 Gaseous Wastes

The gaseous effluents currently generated by the CFFF operations would continue under the proposed LRA. Sections 2.2.1.1 and 3.7.2 of this EIS discuss gaseous effluents that are monitored (uranium compounds, ammonia, and fluorides) and modeled (nonradiological gaseous pollutants, e.g., particulate matter, sulfur dioxide, No_x, carbon dioxide, VOCs). Gaseous effluents from the CFFF are normally treated by HEPA filters, scrubbers, or both prior to discharge from the 47 exhaust stacks. The WEC operates the CFFF in accordance with 40 CFR Part 50 (TN1089) and Part 61 (TN3289), and 10 CFR Part 20 (TN283) and Part 70 (TN4883). The CFFF is a minor-source operator and operates under an air permit with SCDHEC (1900-0050-R1; WEC 2019-TN6510), which is currently in timely renewal. The renewal air permit application with SCDHEC will include a new emissions calculation and the elimination of plating activities that occurred prior to 2020 (WEC 2020-TN6844). The CFFF has

been below all regulatory limits for gaseous radiological effluents and nonradiological effluents, except for sulfur dioxide. No actions by SCDHEC have been taken for sulfur dioxide emission rates to date (WEC 2019-TN6510).

3.14.1.2 Liquid Wastes

There are two types of liquid effluent streams from the CFFF operations: process liquid wastes and sanitary waste sewage. Section 2.2.1.2 and 3.3.2 of this EIS describe these effluents in more detail and the associated monitoring programs. Liquid discharges of radiological constituents (whether gross measurements or isotopic specific) and nonradiological parameters (e.g., water quality measurement, pH, or element, e.g., iron) must be in compliance with the dose to the public and protection of the environment, in accordance with 10 CFR Part 20 (TN283) and Part 70 (TN4883) and the facility's NPDES permit (SC0001848; SCDHEC 2017-TN5607). The NPDES permit for discharge to the Congaree River also requires groundwater monitoring, and the WEC provides groundwater monitoring results to SCDHEC annually (SCDHEC 2020-TN6984). The WEC is currently working with SCDHEC on a renewal of the NPDES permit (WEC 2020-TN6844). In addition, stormwater runoff from the site is in accordance with SCDHEC's general NPDES permit for Storm Waste Discharges Associated with Industrial Activities (General Permit Number SCR000000; WEC 2019-TN6510). Changes in operations and discharges are discussed in Section 2.1.3 and the new processes (e.g., operational changes based on closure of lagoons) are expected to continue under the proposed license renewal period.

3.14.1.3 Solid Wastes

The CFFF generates multiple types of solid waste: combustible, hazardous, mixed, nonhazardous, industrial, and radioactive wastes. The associated processes would continue under the proposed license renewal term.

Combustible wastes are generated through the manufacturing process. Combustible wastes containing uranium are either incinerated and leached to recover the uranium or shipped offsite to other licensed facilities for recovery. Noncombustible wastes and selected combustible wastes are packaged in compatible containers, compacted when appropriate, measured to verify the uranium content, and placed in storage to await shipment for further treatment, recovery, or disposal (WEC 2019-TN6510). The WEC stored drums of combustible waste, containing uranium waiting for uranium recovery via onsite incineration, in intermodal containers (sea-land containers) in an outdoor storage area. This practice of storing the waste in intermodal containers led to leakage and subsurface contamination and the WEC will remove the remaining containers by 2021 (see Section 2.1.3.1; WEC 2020-TN6844). The WEC also explained that procedures have been revised to prohibit future storage of uranium-containing materials in intermodal containers (WEC 2019-TN6552).

The WEC is a large-quantity generator of hazardous wastes that include degreasing solvents, lubricating and cutting oils, spent plating solutions, and zirconium-laden wastes. These wastes are regulated under 40 CFR Part 261 (TN5092), "Identification and Listing of Hazardous Waste;" 40 CFR Part 262 (TN5492), "Standards Applicable to Generators of Hazardous Waste;" and South Carolina Hazardous Waste Regulations R61-79.261 (SC Reg 61-79-TN6888). Hazardous wastes are stored at an onsite storage pad until being shipped for disposal offsite through permitted contractors. The rate of hazardous waste generated was approximately 92,360 kg (204,000 lb) annually from 2013 to 2018, except in 2017. In 2017, the WEC generated 105,607 kg (232,824 lb) of hazardous waste (WEC 2019-TN6510) based on an increase volume of waste from the plating process. The WEC stated that it believes the amount

of hazardous wastes at the CFFF will be similar over the proposed license renewal term to the averages from 2013 to 2018, excluding 2017 (NRC 2019-TN6474). The WEC provides Hazardous Waste Generation Reports quarterly to SCDHEC (NRC 2018-TN6416).

The CFFF operations produce a variety of LLRW, including used packaging, clothing, paper, and tools. After sorting, the LLRW is transferred to an onsite waste processing station, where radiation surveys are conducted. The waste may then be decontaminated for free release or reuse or shipped offsite for disposal at the Waste Control Specialists facility in Andrews, Texas. The LLRW is shipped offsite for disposal in 55-gallon drums or sea-land containers. The WEC stated that the amount shipped offsite between 2010 and 2018 has ranged from 12,000 ft^3 to 38,000 ft^3 (340 m^3 to 1,100 m^3) respectively, with an annual average of 24,000 ft^3 (680 m^3) (WEC 2019-TN6510).

The CFFF operations generate a limited amount of mixed waste. Mixed waste contains both hazardous and radioactive components and is regulated by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. § 6901 *et seq.;* TN1281) and the Atomic Energy Act of 1954 (42 U.S.C. § 2011 *et seq.*; TN663). Mixed waste from the CFFF operations consists of materials that cannot be free-released, and include batteries (dry cell, lead acid, lithium), polychlorinated biphenyl-containing light ballasts, contaminated lamps, and lead shielding (WEC 2019-TN6510). The WEC expects to generate 5 to 10 drums of mixed waste per year (NRC 2019-TN6474). Mixed waste is disposed of offsite through permitted contractors.

Nonhazardous waste from the CFFF operations consists of items from routine office and industrial activities. The nonhazardous waste includes batteries, computers, oil filters, rags, and trash from office areas and lunchrooms. Nonhazardous waste generation rates have increased from 4,218 kg/yr (9,300 lb/yr) in 2013 to 178,446 kg/yr (393,000 lb/yr) in 2017, as a result of changing recycling markets. Industrial trash waste from office areas and lunchrooms has decreased from 292 MT in 2013 to 201 MT in 2017. These wastes are stored on the onsite storage pad and disposed of offsite at a State-permitted landfill (WEC 2019-TN6510). In 2012, the WEC implemented a recycling program for wood, corrugated cardboard, and rigid plastics. The WEC also implemented a food composting program to reduce food waste from the site (NRC 2018-TN6549).

Calcium fluoride, a nonhazardous industrial waste, is removed from West Lagoon I and West Lagoon II, and is either recycled or disposed of offsite. Currently, calcium fluoride with less than 30 pCi/g of uranium is sent to an offsite concrete plant through a permitted recycling activity (WEC 2019-TN6510; NRC 2020-TN6935). Every 2 years the calcium fluoride is recovered by dewatering the lagoons, dredging, and then storing it nearby to dry the material. The average amount of calcium fluoride, based on data from 2014 to 2018, is 4,152 T (WEC 2019-TN6510). The calcium fluoride is sampled to ensure it meets the free release criterion (<30 pCi/g). If it does not meet the criterion, the WEC must either request a license exemption or ship it offsite for disposal as LLRW (WEC 2019-TN6510).

3.14.1.4 Impacts

The proposed action, if approved, would allow the CFFF to operate for another 40 years. The WEC did not propose changes to its licensed operations. The solid waste generation and management is expected to remain at annual levels similar to the current levels.

The WEC has seen an increase in its solid and hazardous waste streams over the last few years. The NRC staff expects that during the proposed license renewal term the WEC would continue to re-evaluate and assess its processes and waste streams, and thus the volume and types of waste changes could also change. The NRC staff also anticipates that the remediation

activities at the CFFF in response to the CA with SCDHEC will generate additional waste beyond the solid and hazardous waste streams from the operation of CFFF (SCDHEC/WEC 2019-TN6554).

The NRC staff expects that the WEC will follow all applicable State and Federal regulations, as indicated in the WEC LRA and March 2019 ER. The NRC staff expects that disposal capacity at offsite facilities will remain available for the anticipated volumes of nonhazardous and hazardous solid waste over the proposed license renewal period. There are no existing and reasonably foreseeable projects, activities, or actions in the vicinity waste disposal that would negatively affect the disposal capacity for the CFFF wastes. LLRW and mixed waste are shipped in DOT-approved packages, and shipments are made in compliance with applicable State and Federal regulations (WEC 2019-TN6510). The NRC staff recognizes the uncertainty regarding the long-term availability of commercial offsite storage of LLRW. While this uncertainty exists, the NRC staff finds it is reasonable to assume that sufficient LLRW capacity would be available during the proposed renewal term when needed. Historically, the demand for LLRW disposal capacity has been met by private industry and the NRC staff anticipates that this trend would continue in the future (NRC 2014-TN4117).

Decommissioning of the CFFF site will generate significant volumes of LLRW. The NRC staff expects that the WEC will work with private industry to prepare plans for the needed disposal capacity for decommissioning. Limitations in capacity at the four licensed LLRW facilities within the United States may pose challenges for the WEC.

The NRC staff expects that waste generation and management over the proposed license renewal period for the CFFF would be similar to current generation rates and management practices. Shipment and disposal of solid wastes would also follow State and Federal regulations. Therefore, the NRC staff does not expect any significant waste generation and waste management impacts as a result of the proposed continued operations of the CFFF for an additional 40 years, and any impacts on waste generation and management would be SMALL. Based on these minor impacts and because the NRC staff does not expect changes to waste management impacts, the SMALL incremental impact contribution from the proposed action would not result in a collectively significant impact (see Appendix B for additional information). Because there is uncertainty regarding the long-term availability of commercial offsite storage of LLRW in the U.S. during decommissioning of the CFFF, the NRC staff found that impacts as a result of decommissioning on waste management would be SMALL to MODERATE.

3.14.2 Mitigation Measures

Waste minimization actions can include reuse and recycling of nonradioactive materials, e.g., reuse of pallets and recycling of low-density plastic films as well as recovery of materials for reuse. For radioactive materials, the CFFF processes for recovery of uranium are either onsite or the materials are shipped to offsite licensed facilities (WEC 2019-TN6510). Uranium is recovered from combustible materials produced at CFFF through incineration, then chemical leaching the ash and clinker residue to form UN for recycle/reuse at the CFFF (WEC 2021-TN7048. The WEC eliminated the use of PCE in the solvent extraction process in 2020, and that change will continue to reduce the hazardous material in the liquid effluent streams and elimination of PCE degradation products in the solid mixed wastes (WEC 2020-TN6928). Noncombustible materials maybe decontaminated for reuse, recycle, or release from the plant. The WEC plans to continue waste minimization as a mitigation measure.

3.15 Accidents

The term "accident," as used in this section, refers to any abnormal event that results in a radiological and/or nonradiological release of materials into the environment. The focus of this review is on events that could lead to releases substantially in excess of permissible limits for normal operations. Normal release limits are specified in 10 CFR Part 20 (TN283), and regulations that apply to the control and management of radiological and nonradiological risks from accidents are also in 10 CFR Part 70 (TN4883).

Subpart H of 10 CFR Part 70 (TN4883), requires certain fuel cycle facilities licensed under Part 70 to perform an Integrated Safety Analysis (ISA). Subpart H of 10 CFR Part 70 applies to the WEC's CFFF. An ISA is defined in 10 CFR 70.4 as "… a systematic analysis to identify facility and external hazards and their potential for initiating accident sequences, the potential accident sequences, their likelihood and consequences, and the items relied on for safety." The ISA describes the licensee or applicant's compliance with the 10 CFR 70.61 performance requirements, which require that controls be implemented to make credible high-consequence events highly unlikely or the consequences less severe than those in 10 CFR 70.61(b)(1)–(4) and to make credible intermediate-consequence events unlikely or the consequences less severe than those in 10 CFR 70.61(c)(1)–(4). In addition, the risk of nuclear criticality accidents must be limited by assuring that all nuclear processes are subcritical and in compliance with 10 CFR 70.61(d). The engineered or administrative controls and measures necessary to meet these performance requirements are known as items relied on for safety (IROFS). The WEC performed an ISA and submitted a summary to the NRC. As part of the LRA, the WEC submitted its ISA methodology for NRC's review and approval. In addition, the WEC submits an updated ISA Summary to the NRC annually.

Radiological Risk Regulations

As noted in NUREG-1520 (NRC 2010-TN5597), the specific regulations related to radiological risk are as follows:

10 CFR 20.1101 *states that licensees shall apply procedures and engineering controls to achieve exposures to workers and the public that are ALARA.*

10 CFR 20.1406 *states that licensees shall design and develop procedures for operation that will minimize contamination of the facility and the environment, facilitate eventual decommissioning, and minimize the generation of radioactive waste.*

10 CFR 70.22(i)(1) *requires either an evaluation that the maximum dose to a member of the public resulting from a release of materials would not exceed 1 rem or 2 milligrams soluble uranium intake or the submission of an emergency plan for responding to the radiological hazards of a postulated accident.*

10 CFR Part 70, Subpart H*, contains requirements for performing ISAs, designating IROFS, and having management measures in place, both to ensure that IROFS are readily available and reliable in the context of the performance requirements and to provide facility change management and configuration control.*

The purpose of the NRC staff's review of the ISA summary is to establish reasonable assurance that the licensee has conducted an adequate ISA that meets 10 CFR 70.62(c)(1) and (2) requirements; for each applicable process, used methods and qualified staff adequate to achieve the requirements of 10 CFR 70.62; identified and evaluated all credible events (accident sequences) internal to the facility (e.g., explosions, spills, fires) and credible external events that could result in facility induced consequences to workers, the public, or the

environment, that could exceed the performance requirements of 10 CFR Part 70 (TN4883); and evaluated the designated engineered and administrative controls and IROFS for preventing or mitigating the applicable accident sequences, and applied management measures to provide reasonable assurance that the performance requirements of 10 CFR 70.61 are met. Neither the ISA nor the summary are incorporated into the license (NRC 2010-TN5597).

In Chapter 4 of its LRA (WEC 2019-TN6423), the WEC discussed its ISA methodology, including consideration of the effects on workers and members of the public from chemical hazards, fire hazards, criticality accidents, and radiological hazards. Table 3-23 describes the criteria the WEC identified for determining the severity of accident consequences to comply with the performance requirements in 10 CFR 70.61 (WEC 2019-TN6571). The NRC staff's safety review evaluates whether the ISA methodology provides reasonable assurance that the potential failures, hazards, accident sequences, and scenarios have been evaluated. The NRC staff, as part of its safety review of the LRA, determines whether the IROFSs will be available and reliable to reduce the likelihood of occurrence and consequences of the credible accident sequences to acceptable levels in accordance with the performance requirements of 10 CFR 70.61. Additionally, as part of the safety review, the NRC staff determines if the WEC has committed to an acceptable radiation protection program that meets requirements set forth in 10 CFR Part 19 (TN5491), Part 20 (TN283), and Part 70 (TN4883). Both chemical and radioactive materials are present in the fuel fabrication operations at the CFFF.

Table 3-23 Accident Sequence Consequences

Level	Worker	Public	Environment
High	Radiological dose greater than or equal to 1 Sv (100 rem) total effective dose equivalent 400 mg soluble uranium intake or greater Chemical exposure greater than or equal to ERPG-3 A nuclear criticality accident	Radiological dose greater than or equal to 0.25 Sv (25 rem) total effective dose equivalent 30 mg soluble uranium intake or greater Chemical exposure greater than or equal to ERPG-2	None.
Intermediate	Radiological dose greater than or equal to 0.25 Sv (25 rem) but less than 1 Sv (100 rem) total effective dose equivalent 150 mg soluble uranium intake or greater Chemical exposure greater than or equal to ERPG-2 but less than ERPG-3	Radiological dose greater than or equal to 0.05 Sv (5 rem) but less than 0.25 Sv (25 rem) total effective dose equivalent Chemical exposure greater than or equal to ERPG-1 but less than ERPG-2	A 24-hour averaged radioactive release outside the restricted area greater than 5,000 times Table 2 Appendix B of 10 CFR Part 20
Low	Accidents with radiological and/or chemical exposures to workers less than those above	Accidents with radiological and/or chemical exposures to the public less than those above	Radioactive releases to the environment producing effects less than those specified above

ERPG: Emergency Response Planning Guidelines
Source: WEC 2019-TN6423

In its March 2019 ER, the WEC (2019-TN6510) identified the bounding maximum consequence basis accidents for the CFFF.

- liquid system criticality
- dry system criticality
- soluble uranium release
- insoluble uranium release
- aqueous ammonia release
- hydrofluoric acid release
- nitric acid release
- chlorine release
- hydrogen explosion
- fuel oil fire
- natural phenomena hazards

Table 3-24 identifies a spectrum of potential accidents in different areas of the CFFF (e.g., tank farm, chemical and manufacturing areas) and the chemical and radiological materials (e.g., U, fluoride, nitrate, hydrogen fluoride) that could be released (WEC 2019-TN6510).

Table 3-24 Potential Accidents and Releases of Concern

Facility Area and Material Involved	Potential Accidents	Severity[(a)]	Releases of Concern
Tank farm • Ammonium hydroxide • Sodium hydroxide • Nitric acid	Pipeline or tank leak; rupture, spills, fire	1, 2	Ammonia Nitrate Caustic and acid solutions
Lagoons • Ammonium nitrate • Calcium fluoride • Uranium	Leak, massive dike/liner failure, flooding	1, 2	Ammonia Nitrate Fluoride Uranium
Outside-storage/inside-vaporization area • Uranium hexafluoride (solid, liquid, vapor) • Uranyl nitrate	Ruptured cylinder, vapor release Ruptured tank	1, 2, 3	Uranium Hydrogen fluoride Uranium Nitrate
Chemical and manufacturing areas • Uranium • Uranium dioxide • Ammonium diuranate • Hydrogen fluoride	Pipeline or container rupture, spills, explosions, fires, filter failure criticality	1, 2, 3	Uranium Ammonia Fluoride
• Hydrogen	Explosion		
Transportation	Container rupture, spills	1, 2	Uranium Miscellaneous chemicals

(a) Accident severity category:
Category 1 accidents – those most likely to occur during normal plant operations and have the least environmental impacts of the three categories.
Category 2 accidents – those that would occur infrequently during the plant's operating life, could release concentrations of radiological and non-radiological pollutants to the onsite (and possibly offsite) environment that would exceed normal effluent releases and could cause significant impacts, if not controlled or mitigated.
Category 3 accidents – those not expected to occur during the life of the plant but could result in significant releases of radioactive or toxic pollutants to the onsite and offsite environment.

Source: WEC 2019-TN6510, NRC 1985-TN5602

In its March 2019 ER, the WEC assessed accidents that, although considered to have a low probability of occurrence, could result in largest environmental consequences: release of UN, release of UF_6, and a criticality accident (WEC 2019-TN6510). These are summarized below.

The WEC evaluated the potential radiological impacts of a spill of UN (liquid) from a ruptured UN outside-storage tank. The WEC assumed that part of the material would be precipitated out or adsorbed by the soil (75%), and approximately 25% of the uranium would be solubilized and transported to the storm drain and Sunset Lake. The WEC estimated the release to Sunset Lake would be 3 Ci of material and the estimated concentration of radioactivity in Sunset Lake would be approximately 1.85 E-05 uCi/ml (WEC 2019-TN6510). The WEC explained that an individual would have to drink approximately 5 liters of lake water to get an uptake of 30 mg of U. Sunset Lake, however, is not a source of potable water and is located within the CFFF site. The WEC also concluded that it is not possible for a worker or member of the public to receive a 25 rem dose.

Further, the WEC estimated the concentration of radioactivity that could be released to site groundwater. The estimates exceeded 5,000 times the effluent concentration value in Table 2 of Appendix B of 10 CFR Part 20 in water for U-234, U-235, and U-238 (WEC 2019-TN6510). Therefore, under the criteria identified in Table 3 (WEC 2019-TN6510), the WEC considered this accident an intermediate consequence. Therefore, the WEC identified the following IROFS: dike to capture releases from ruptured UN tank and a shutoff valve to prevent flow into Sunset Lake (WEC 2019-TN6510).

A criticality accident is considered a high consequence event and the WEC has identified IROFS to ensure that a criticality accident is highly unlikely. In the March 2019 ER (WEC 2019-TN6510), however, the WEC evaluated the offsite consequences of an inadvertent criticality event. The WEC assumed the accident would occur in the UN nitrate tanks outside the south wall of the plant and estimated the dose at the nearest site boundary and four other onsite locations (WEC 2019-TN6510). The estimated doses at the four onsite locations were less than 13 rem, while the estimated dose at the nearest site boundary was less than 7 rem (WEC 2019-TN6510).

The WEC also considered the consequences of a fire in the Conversion Enclosure Containment ventilation system that could release 20 kg of U to the environment that could be inhaled by a receptor downwind of the fire. The estimated dose at the site boundary would be less than 3 rem (WEC 2019-TN6510). The WEC considered this accident an intermediate consequence event to the public.

The WEC also assessed the chemical consequences of a large release of UF_6 in the outdoor area where UF_6 cylinders are stored. The accident the WEC considered involved a fire from a truck crashing into the UF_6 cylinders outdoor storage area and rupture of two of the UF_6 cylinders (WEC 2019-TN6510). UF_6 is solid at ambient temperature, however, sublimation and reaction with water vapor would form uranyl fluoride (UO_2F_2) and hydrogen fluoride (HF). The UO_2F_2 and HF could move downwind. The WEC's estimated average concentration of U and HF as the plume through the nearest residence under adverse meteorological conditions would be approximately 60 mg/m^3 and 20 mg/m^3, respectively. The WEC compared the HF concentration to concentrations at 25 mg/m^3 for several minutes, which would cause respiratory discomfort, while brief exposure to 40 mg/m^3 would be dangerous to life (WEC 2019-TN6510). The intake of U of an adult at the nearest residence standing in the plume for an hour would be approximately 50 mg (WEC 2019-TN6510), which exceeds the 30 mg U threshold for a high consequence event to the public but below the fatal intake of 160 mg (WEC 2019-TN6510).

As previously discussed, compliance with the NRC regulations ensures that high and intermediate consequences for credible accidents would be unlikely and highly unlikely. Identification of IROFS and the implementation of emergency procedures would reduce the consequences and the likelihood of accidents. Therefore, impacts from accidents would be SMALL.

3.15.1 Mitigation Measures

The CFFF maintains a comprehensive Emergency Management Program with facilities, equipment, and processes for protecting workers, the public and the environment (WEC 2019-TN6571). This program assures the control of licensed material, capability to evacuate personnel, and availability of emergency measures and facilities. The program is documented in an approved Site Emergency Plan that addresses the following topics:

- Facility Description
- Engineered Safeguards for Abnormal Operations
- Types of Accidents and Classifications
- Response Management System
- Mitigation of Consequences and Assessment of Releases
- Emergency Response Facilities and Equipment
- Maintaining Emergency Preparedness Capability
- Records and Reports
- Safe Shutdown, Recovery, and Plant Restoration
- Hazardous Chemicals.

The CFFF also has detailed Emergency Procedures that contain instructions for emergency response and emergency personnel activities based on practices required by the Site Emergency Plan (WEC 2019-TN6571). These procedures clearly define the duties, responsibilities, action levels, and actions to be taken by each functional individual or group in response to emergency situations. The procedures address the following areas:

- Emergency Response Organization
- Emergency Response Team
- Equipment and Supplies
- Evacuation, Accountability, and General Response
- Classification
- Communication
- Notification
- Biological Threat
- Bomb Threat (Package or Object)
- Bomb Threat (Telephone or Correspondence)
- Civil Disturbance
- Criticality
- Explosion
- Fire
- Hazardous Material Release
- Hazardous Weather
- Loss of Utilities
- Oil Spill
- Radioactive Powder or Liquid Release
- Transportation Accident
- UF6 Release
- Local Law Enforcement Agency Incident Response Plan
- Notification Guidelines for NRC and Other Agencies.

3.16 Environmental Justice

Environmental justice (EJ) refers to the Federal policy established in 1994 by Executive Order (EO) 12898 (59 FR 7629-TN1450) that directs Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority or low-income populations. Because the NRC is an independent agency, the EO does not automatically apply to the NRC. However, as reflected in the NRC's "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040-TN1009), the NRC strives to meet the goals of EO 12898 through its well-established NEPA review process.

A minority or low-income community may be considered as either a population of individuals living in geographic proximity to one another or a dispersed/transient population of individuals (e.g., migrant workers) where either type of group experiences common conditions of environmental exposure (NUREG–1748; NRC 2003-TN1983). Minority categories are defined as American Indian (not of Hispanic or Latino origin) or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, African American, some other race, and Hispanic or Latino ethnicity (of any race) (NRC 2003-TN1983). Low-income is defined as being below the poverty level as defined by the USCB (NRC 2003-TN1983). The NRC staff's recommended area for evaluating census data is the census block group, which is delineated by the USCB and is the smallest area unit for which race and poverty data are available (NRC 2003-TN1983). The NRC staff used ESRI ArcGIS® and the USCB website to identify block groups within 32 km (20 mi) of the CFFF site. This radius was selected to be inclusive of locations where people could live and work in the vicinity of the proposed project and bounds public uses of the different environmental resources (e.g., recreation, hunting, fishing, agricultural activities; and use of groundwater and surface waters by the surrounding communities). The NRC staff included a block group if any part of the block group was within 32 km (20 mi) of the proposed CFFF project area; 367 block groups were identified as being within, or partially within, the 32 km (20 mi) radius. The NRC guidance indicates that a potentially affected EJ population exists if at least one of these conditions exists: either the minority or low-income population of the block group is more than 50 percent of the entire block group population, or the minority or low-income population percentage of the block group is significantly, or meaningfully, greater (typically by at least 20 percentage points) than the minority or low-income population percentage in the geographic areas chosen for comparative analysis, county or state (NRC 2003-TN1983).

3.16.1 Minority and Low-Income Populations

Using the USCB annual surveys conducted from 2014 to 2018 that represent characteristics during this period (American Community Survey 5-year estimates), the NRC staff calculated (1) the percentage of each block group's population represented by each minority category for each of the 367 block groups within the 32 km (20 mi) radius, (2) the percentage that each minority category represented of the entire population of South Carolina, and (3) the percentage that each minority category represented for each of the 6 counties that has land within the 32 km (20 mi) radius of the CFFF site. If the percentage meets one of the above-stated thresholds, then that block group was identified as being a potentially affected EJ population.

Of the 367 block groups located completely or partly within 32 km (20 mi) of the CFFF site, 189 block groups meet at least one of the two NRC guidance criteria previously described in this section. Table 3-25 summarizes the block group analysis. Figure 3-26 illustrates the geographic locations of the affected EJ populations.

Table 3-25 Environmental Justice Populations Census Block Group Summary

Classification	Block Groups
Not an EJ Block Group	178
Low-Income Population	11
Minority Population	147
Both Minority and Low-Income Populations	31
Total Block Groups	**367**

Source: Derived using Census ACS 2014-2018 5-Year Data.

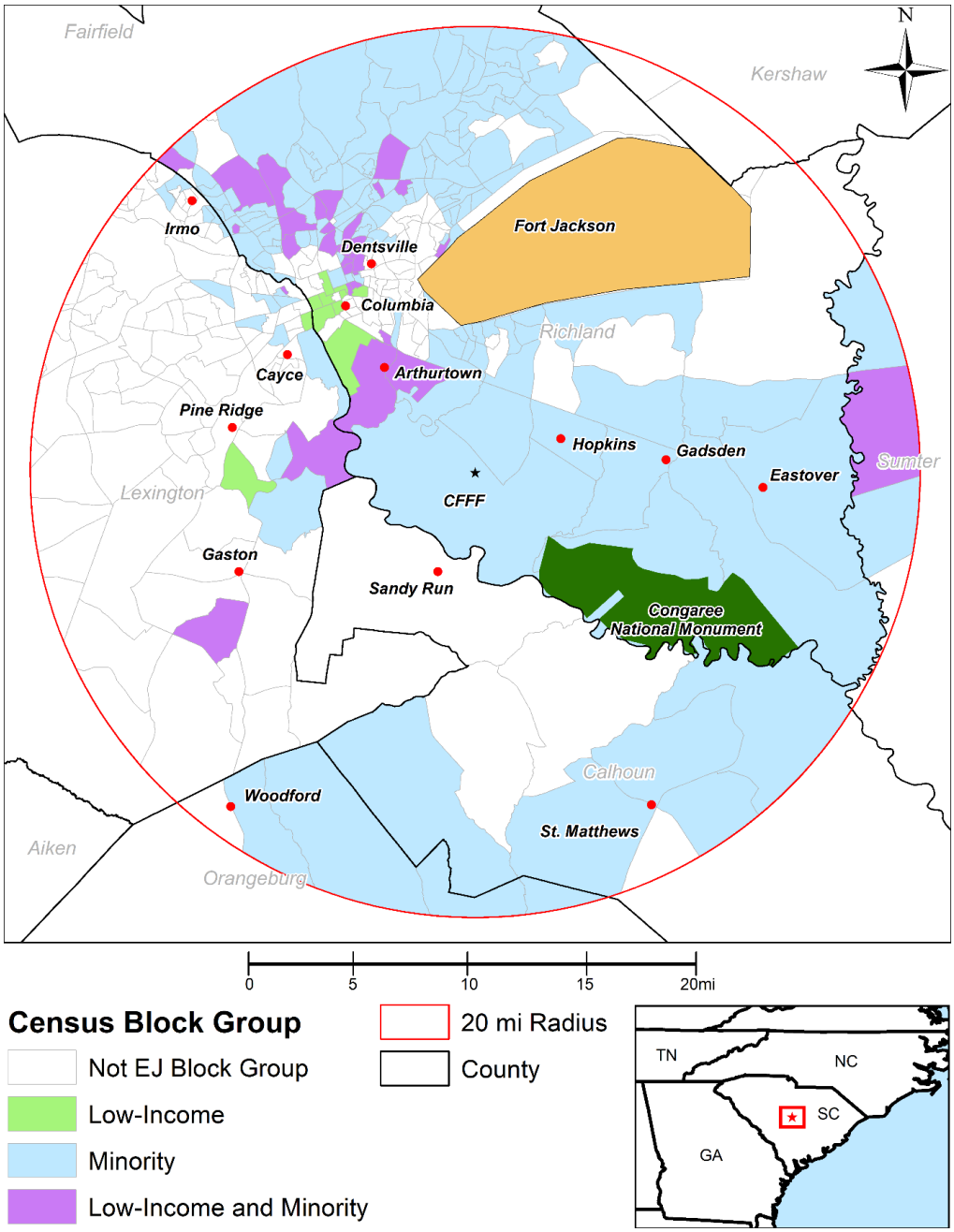

Figure 3-26 Block Groups with Potentially Affected Minority and Low -Income Populations within 32.2 km (20 mi) of the CFFF Site

Of the 367 block groups located completely or partly within 32 km (20 mi) of the CFFF site, 42 block groups with low-income families meet one of the previously described criteria used in Section 3.16 of this EIS to identify potentially affected EJ populations.

The comparison of State-level threshold values for minority and low-income populations is found in Table 3-25. These values for South Carolina are 16.9 percent for the aggregation of all minority segments and 16.0 for the low-income population. Thus, the block groups triggering as EJ populations meet or exceed these thresholds.

3.16.2 Community Engagement

The WEC explained that community engagement in the vicinity of CFFF site, related to the CFFF activities, is occurring through several channels. These include the Lower Richland Citizen Advisory Council (LRCAC), the Community Engagement Board (CEB), the National Association for the Advancement of Colored People, the CFFF Community Website, and the CFFF Community Monthly Newsletter[10] (WEC 2020-TN6844). These channels and resources provide several methods by which the CFFF operations information can be shared with minority and low-income communities. They also provide opportunities for the communities to inquire and have questions about plant impacts answered in a transparent environment.

3.16.3 Environmental Justice Impacts

The CFFF site is located in and surrounded by census block groups that have minority populations exceeding the criteria described above. Therefore, the NRC staff closely evaluated the identified health and environmental impacts to determine if pathways could be established linking these effects with the locally affected populations. All the health and environmental impacts identified were SMALL except for groundwater resources, for which impacts were found to range from SMALL to MODERATE. The NRC staff, however, determined that there is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources. Further, the staff could not establish pathways linking these impacts on the local population. Thus, no disproportionately high and adverse health or environmental effects could be identified for this action. Because the NRC staff has not established any pathways by which previous or future environmental impacts would affect EJ populations, when the proposed action is combined with other past, present, and reasonably foreseeable future actions in the vicinity of the CFFF site, no disproportionately high and adverse cumulative health or environmental effects are expected.

3.16.4 Mitigation Measures

The proposed action will not result in disproportionately high and adverse health or environmental impacts consistent with the current use of the property. As discussed in sections 3.1, 3.2, and 3.3 of this EIS, impacts to soil, surface water, and groundwater will be mitigated by the results of the WEC's remedial investigations under the CA with the SCDHEC and the two new license conditions agreed to by the WEC as part of the review of the LRA: (1) the WEC would be required to submit its environmental monitoring and sampling program to NRC for review and approval upon either SCDHEC's approval of the Remedial Investigation Report, as required by the CA (SCDHEC/WEC 2019-TN6554), or within 5 years of the license renewal

[10] https://www.westinghousenuclear.com/about/independent-pages/columbia-community/south-carolina-department-of-health-and-environmental-control-dhec-and-westinghouse

(whichever comes first); and (2) the WEC would be required to enter exceedances of Federal and State standards into its CAP such as the MCL under the EPA National Primary Drinking Water Regulations. Additionally, the WEC plans to continue to share information with the community through several community engagement activities.

3.17 Impacts for Alternatives

3.17.1 No-Action Alternative

As discussed in Section 2.4.1 of this EIS, under the no-action alternative, the NRC would not renew the SNM-1107 operating license for the CFFF. The WEC can continue to operate the CFFF under its current license until the license's expiration date on September 30, 2027.

The NRC staff previously evaluated the environmental impacts of the WEC continuing to operate the CFFF until September 2027 when it approved the WEC's license renewal in 2007 (NRC 2007-TN6528). The NRC staff concluded in the 2007 license renewal EA that the continued operation of the CFFF site would not result in a significant impact on the environment (NRC 2007-TN5598). Notwithstanding the previous finding, the NRC staff considered the potential environmental impacts of the no-action alternative in light of the information that led to the NRC's decision to prepare an EIS.

Known onsite contamination is currently being addressed by the WEC under the CA with the SCDHEC (SCDHEC/WEC 2019-TN6554). The data gathered through and the analysis conducted as part of ongoing remedial investigations will continue to be incorporated into the CSM, which the WEC will use as a decision-making tool. The WEC's environmental monitoring and sampling program has changed and includes new monitoring wells and additional surface water, groundwater, sediment, and soil sample locations. The WEC would also use the data analysis results for comparison with previous results to detect potential leaks consistent with the WEC's Environmental Data Management Procedure RA-434. Procedure RA-433, "Environmental Remediation," would also be used to assess the remediation activities protective of human health and the environment. The WEC will also use the CSM as a decision-making tool to inform the environmental monitoring and sampling program and remediation strategy. See Section 1.5.2.2.1 of this EIS for additional information about the CA and CSM. As more information and data are gathered through implementation of the CA, these procedures will support further changes to the WEC's environmental monitoring and sampling program. Therefore, the nature/type of potential environmental impacts of the no-action alternative would be similar to those from the proposed action (i.e., the 40-year license renewal process), but the extent of the impacts would differ. The alternative's temporal scope affects when the impacts would occur (i.e., impacts would only occur through September 2027, the license expiration date). Additionally, the extent of the impacts would differ considering the uncertainties associated with the outcome of the ongoing remedial investigations being conducted as part of the implementation of the CA. These uncertainties are relevant to reasonably foreseeable impacts. The new proposed license conditions (i.e., the WEC's submittal of the changes to the environmental sampling and monitoring program to the NRC staff for approval and entering elevated groundwater and surface water results into the WEC's CAP) would not be part of the no-action alternative and, therefore, potential impacts on environmental resources like water resources would not be bounded by these new proposed license conditions. The WEC could also choose to incorporate the new license conditions and commitments into its current operating licensee.

Upon license expiration, if a request to renew the license is not submitted, the WEC would be required to start the decommissioning process, including site reclamation and remediation. The WEC would be required to prepare a decommissioning plan as delineated in 10 CFR 72.54(d), (i), and (g) (TN4884) for NRC review and approval. The NRC staff would undertake a separate environmental review under NEPA (TN661). Because operations would cease upon license expiration, unless the WEC seeks and obtains a renewed license, impacts from decommissioning are reasonably foreseeable.

The following sections discuss the potential impacts of the no-action alternative.

3.17.1.1 Land Use

The use of the land at the CFFF site and surrounding area is not expected to change from its current uses during the no-action alternative timeframe. Any future construction or change in operations requiring a license amendment would require a safety review, NEPA environmental review, and Section 106 review, as appropriate. The WEC would continue installing groundwater monitoring wells and collecting soil samples at the CFFF as part of the implementation of the SCDHEC-approved Phase II RIWP, but the installation of the wells would involve minimal land disturbance. The data collected would continue to be used in developing and enhancing the CSM, which the WEC would use as a decision-making tool in determining the extent of contamination, migration pathways, and remediation activities. Therefore, the NRC staff does not expect a significant impact on land use from the no-action alternative.

Impacts on land use associated with the no-action alternative would occur at the time of decommissioning and reclamation of the CFFF site. Impacts on land use associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Potential additional land disturbance could occur due to the need to construct temporary staging and decommissioning laydown areas. However, after decommissioning, reclamation of the site, and license termination, the land would be available for other uses.

Therefore, the NRC staff expects land use impacts associated with the no-action alternative to be SMALL.

3.17.1.2 Geology, Seismology, and Soils

There would be no significant disturbance of the soils and subsurface sediments at the CFFF site associated with the no-action alternative, and no offsite geological resources would be required. The WEC will continue installing groundwater monitoring wells and collecting of soil samples at the CFFF as part of the implementation of the SCDHEC-approved Phase II RIWP, but the installation of wells would involve minimal land disturbance. The CFFF operations and investigations to date indicate that some soils near the plant buildings have been contaminated, but soils away from the operational areas have been only minimally affected to date. Based on the history of operations at the site, continued operation of the CFFF until 2027 may potentially involve future releases of contaminants but they are expected to affect only soils near the plant. Disturbance of soils and subsurface materials will occur during decommissioning, but these impacts are expected to be similar for each of the alternatives considered here and would be evaluated at the time of decommissioning. The WEC is expected to continue to conduct the remedial investigations under the CA and the results would continue to be used in developing and enhancing the CSM, which the WEC will use as a decision-making tool in determining the extent of contamination, migration pathways, and remediation activities. Soil disturbances

would be limited to areas previously disturbed during the construction and operations stages of the CFFF. Remediation and removal of soils would be anticipated. Decommissioning activities would be conducted in accordance with 10 CFR Part 70 (TN4883) and Part 20 (TN283) requirements. The NRC staff anticipates impacts on geological and soil resources resulting from the no-action alternative would be SMALL.

3.17.1.3 Surface Water Resources

The NRC staff evaluated the effects of the no-action alternative on the availability of the potentially affected water resources to support other uses and users. The staff determined that surface water withdrawals and consumptive use of water for continued CFFF operations through the end of the current operating license term would have negligible effects on other uses/users of the Congaree River. The NRC staff also determined that discharges to the Congaree River would have minor effects on water quality that would not affect other users or uses of the river because discharge rates and pollutant releases will continue to be regulated and monitored under the NPDES permit and are not expected to change significantly. The staff also determined that continued operations may noticeably affect the water quality of the onsite water bodies, but continued activities under the CA with SCDHEC and continued environmental monitoring requirements under the NPDES permit and the current NRC license would minimize the likelihood of contamination moving offsite to the degree that water quality would be noticeably altered and affect other users of the local surface water resources. Impacts on surface water associated with decommissioning of the CFFF would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. The WEC is expected to continue to conduct the remedial investigations under the CA and the results would continue to be used in developing and enhancing the CSM, which the WEC will use as a decision-making tool in determining the extent of contamination, migration pathways, and remediation activities. Therefore, the NRC staff concludes that the surface water impacts resulting from the no-action alternative would be SMALL.

3.17.1.4 Groundwater Resources

The CFFF operations do not currently withdraw groundwater for any plant operational needs, nor are there any plans to use groundwater for plant operations in the future. Therefore, the NRC staff concludes that there are no potential impacts on groundwater resources from the withdrawal or consumptive use of groundwater for the continued operation of the CFFF through the end of the current operating license. Impacts on groundwater resources associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. In evaluating the potential impacts on groundwater quality from the no-action alternative, the NRC staff considered the likelihood of future inadvertent releases of contaminants to the subsurface, the transport and fate of existing and potential future contaminants in the groundwater, and the potential effects of contaminated groundwater on other users of the groundwater resources. The impacts, therefore, would be similar to the proposed action, although the new license conditions agreed to by the WEC would not be considered within the scope of the no-action alternative. The WEC is expected to continue to conduct the remedial investigations under the CA and the results would continue to be used in developing and enhancing the CSM, which the WEC will use as a decision-making tool in determining the extent of contamination, migration pathways, and remediation activities. However, the uncertainties discussed in Section 3.4 of this EIS would also apply under the no-action alternative. The NRC staff concludes that the groundwater impacts resulting from the no-action alternative would be SMALL to MODERATE.

3.17.1.5 Ecological Resources

Impacts on terrestrial resources associated with the no-action alternative could result in some disturbances to wildlife in the area because of noise, but wildlife are already habituated to noise from the CFFF site. Increased activity and noise from decommissioning may result in temporary species avoidance of the area, but this is not expected to be an adverse impact and decommissioning will have to eventually occur regardless of the alternative. Therefore, the NRC staff concludes that the terrestrial resources impacts resulting from the no-action alternative would be SMALL.

Impacts on aquatic resources associated with the no-action alternative could occur from runoff of contaminated stormwater during decommissioning or from changes to treated wastewater discharges directly into the Congaree River, but this would be monitored and managed by the WEC in accordance with the NPDES permits and potential remediation work plans per the CA with SCDHEC (SCDHEC/WEC 2019-TN6554). Impacts on aquatic resources associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Therefore, the NRC staff concludes that the aquatic resources impacts resulting from the no-action alternative would be SMALL.

3.17.1.6 Climatology, Meteorology, and Air Quality

Impacts on the local climatology and air quality would be associated with the no-action alternative during continued operation through the end of the current operating license and decommissioning activities. Impacts during continued operation through the end of the current operating license would be monitored under the current operating permit and are not expected to result in adverse effects. Impacts on climatology and air quality associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Use of construction equipment during decommissioning activities could temporarily increase the fugitive dust in the local air quality. However, after a short period of time following decommissioning, the local air quality would be cleaner and equivalent to the regional background. The release of pollutants from the existing CFFF stacks would cease and thus there would be no long-term impact on the climate and air quality. Therefore, the NRC staff concludes that the climatology and air quality impacts resulting from the no-action alternative would be SMALL.

3.17.1.7 Noise

Impacts from noise associated with the no-action alternative would occur during continued operation through the end of the current operating license and at the time of decommissioning and reclamation of the CFFF site. Impacts from noise associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline changes. Under the no-action alternative, occupational workers would be exposed to noise from the use of large earth-moving equipment, heavy trucks, and other equipment expected to be used in conjunction with decommissioning activities. The East Lagoon and Sanitary Lagoon are also being removed under the CA, which would necessitate the use of large earth-moving equipment and heavy trucks. The licensee would still be required to maintain compliance with regulations governing noise. Members of the public would also be exposed, although this exposure would be expected to be temporary and short term. Therefore, the NRC staff concludes that noise impacts associated with the no-action alternative would be SMALL.

3.17.1.8 Historic and Cultural Resources

Under the no-action alternative, impacts on previously unidentified cultural resources located in undisturbed areas could occur as a result of ground-disturbing activities associated with continued operation of the CFFF through the end of the current operating license and during decommissioning and reclamation. Additionally, facilities that are 50 or more years old would be evaluated to determine their eligibility for listing in the NRHP. Impacts from decommissioning would be assessed during a separate NEPA environmental review and Section 106 review. However, it is expected that potential impacts would be avoided or minimized through the implementation of the WEC's cultural and historic resources procedures and associated training of personnel. These procedures describe stop work instructions and notifications to South Carolina SHPO and Indian Tribes, as appropriate, if cultural resources or human remains are inadvertently encountered during ground-disturbing activities (WEC 2020-TN6707 and WEC 2021-TN7060). Sitewide protection procedures also describe the use of GPR and GPR analysis prior to conducting ground-disturbing activities in previously undisturbed areas to identify and evaluate anomalies (WEC 2021-TN7048 and WEC 2021-TN7064). Considering the high probability of archaeological sites in previously undisturbed areas and potential ground-disturbing activities that could occur through the current license term, implementation of a cultural resources survey would further avoid or minimize potential future impacts. Therefore, potential impacts from the no-action alternative would range from SMALL to MODERATE.

3.17.1.9 Visual and Scenic Resources

Impacts on visual and scenic resources associated with the no-action alternative would occur during the continued operation through the end of the current operating license and at the time of decommissioning and reclamation of the CFFF site. Impacts on visual and scenic resources associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Temporary visual impacts could occur due to the need to construct temporary staging and decommissioning laydown areas. However, after decommissioning and reclamation of the site, and license termination, the visible landscape would be further changed to one without structures and would be available for other uses. Therefore, the NRC staff concludes that visual and scenic impacts associated with the no-action alternative would be SMALL.

3.17.1.10 Socioeconomics

Socioeconomic impacts associated with the no-action alternative would occur during the continued operation through the end of the current operating license and at the time of decommissioning and reclamation CFFF of the site. Impacts during the continued operation would be similar to the impacts from the proposed action and thus are not expected to noticeably change the employment level or mission of the CFFF. Impacts on socioeconomics associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Potential impacts of decommissioning activities would include those of any large-scale construction site because the operations workforce would be replaced by a construction workforce employed to dismantle facilities and reclaim the site. Decommissioning activities likely would employ a workforce smaller than the current CFFF operations workforce. Thus, impacts would result from a change in the annual socioeconomic impacts expected from continued operations to impacts associated with decommissioning. However, decommissioning activities would be temporary and eventually the employment and other economic activity associated with the CFFF site

would end, assuming no new use of the site is identified, resulting in a noticeable adverse impact on the local economy. Therefore, the NRC staff concludes that socioeconomic impacts associated with the no-action alternative would be MODERATE.

3.17.1.11 Public and Occupational Health

Impacts on public and occupational health associated with the no-action alternative would occur during the continued operation of the CFFF through the end of the current operating license and at the time of decommissioning and reclamation of the CFFF site. Impacts from continued operation on public and occupational health would be similar to the impacts from the proposed action. Impacts on public and occupational health associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Potential occupational health impacts due to facility decommissioning activities would include those of any large-scale construction site, while exposure to radiological and hazardous materials would decrease. Members of the public would be exposed to less radiological and hazardous material, because the facility would release less radioactive gaseous, liquid, and solid material, and new releases of hazardous materials would stop. Therefore, the NRC staff concludes that public and occupational health impacts associated with the no-action alternative would be SMALL.

3.17.1.12 Transportation

Impacts from transportation associated with the no-action alternative would occur during the continued operation of the CFFF through the end of the current operating license and at the time of decommissioning. Impacts from continued operation on transportation would be similar to the impacts from the proposed action. In the short-term, decommissioning activities could result in increased vehicle movements due to demolition activities. However, decommissioning activities would be temporary, and all material shipments will be conducted in accordance with applicable regulations from NRC, DOT, and the State of South Carolina. Impacts from transportation associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline for when the impacts would occur would change. Therefore, the NRC staff does not expect any significant transportation impacts as a result of the no-action alternative and impacts would be SMALL.

3.17.1.13 Waste Generation and Management

Impacts from waste management associated with the no-action alternative would occur during the continued operation of the CFFF through the end of the current operating license and at the time of decommissioning. The NRC staff expects that waste generation rates and management practices until the WEC's license expiration for the CFFF would be similar to current generation rates and management practices. Thus, impacts from continued operation would be similar to the impacts from the proposed action. Upon license expiration, waste generation from the fabrication of low-enriched uranium fuel assemblies would cease and would focus on waste generation related to CFFF decommissioning. Impacts from gaseous and liquid effluents would be eliminated by the cessation of fabrication efforts. Impacts from solid waste associated with decommissioning would be the same for the no-action or relicensing alternatives; only the timeline changes in that the incremental increase in solid waste generated (hazardous, mixed, nonhazardous, industrial, and radioactive wastes) associated with the no-action alternative, 20-year license renewal alternative, and the proposed action are minor impacts based on available disposal options for the various solid waste categories. The NRC staff expects that the WEC will work with private industry to prepare plans for the needed disposal capacity for

decommissioning. Therefore, the NRC staff concludes that waste generation and management impacts associated with the no-action alternative would be SMALL.

3.17.1.14 Accidents

Under the no-action alternative, impacts from continued operation until license expiration would be similar to the impacts from the proposed actions. Operations at the CFFF would cease upon license expiration (i.e., in September 2027) and many of the accidents listed in Section 3.15 of this EIS would no longer be possible. Therefore, the NRC staff concludes that impacts from accidents from the no-action alternative would be SMALL.

3.17.1.15 Environmental Justice

The CFFF site is located in and surrounded by census block groups that have minority and low-income populations exceeding the criteria described in Section 3.16 of this EIS. Therefore, the NRC staff closely evaluated the identified health and environmental impacts to determine if pathways could be established linking these effects with the locally affected populations. All the health and environmental impacts identified for the no-action alternative would be similar to the potential impacts from the proposed action and, thus, would be SMALL. Although MODERATE socioeconomic impacts would be expected under the no-action alternative, noticeable impacts would be felt by the existing workforce and businesses in the wider economic region. Only minimal socioeconomic effects on the immediate vicinity of the site would be expected because few workers or businesses are located in the vicinity, therefore socioeconomic impact pathways to minority or low-income populations were not identified. While the NRC staff found that potential impacts on groundwater resources can range from SMALL to MODERATE, there is low potential for known onsite contamination to move offsite. Further, as discussed in Section 3.16.3 of this EIS, the staff could not establish pathways linking these impacts on the local population. Thus, no disproportionately high and adverse health or environmental effects could be identified for this alternative.

3.17.2 License Renewal for 20 Years

As discussed in Section 2.4.2, the NRC staff also considered as an alternative the approval of the WEC's license renewal request for a shorter term, i.e., 20 years. In SRM-SECY-06-0186 (NRC 2006-TN6558, NRC 2006-TN6985), the Commission approved license terms for up to 40 years for new fuel cycle licenses and license renewals that are required to submit ISA summaries in accordance with 10 CFR Part 70 (TN4883), Subpart H. Additionally, the Commission approved license terms for less than 40 years on a case-by-case basis when there are concerns about safety risk to the facility or when a licensee introduces a new process or technology.

The 20-year license renewal alternative allows for examination for potential relicensing and evaluation of environmental impacts over a shorter span of time.

Based on the history of events at the CFFF site, the WEC's ongoing remedial investigations under the CA with SCDHEC, and the development and use of a CSM as a decision-making tool to help the WEC understand the site's hydrogeology and the physical, chemical, and biological processes that govern the transport, fate, risk, and level of impact of contamination to ecological and/or human receptors, the NRC staff evaluated a 20-year license renewal term as an alternative. The historical facility events, the CA, and the CSM are discussed in Section 2.1.3 2.2.2.3, and throughout Section 1.5.2.2.1, respectively.

The nature/type of potential environmental impacts from continued licensed operations for an additional 20 years would be similar to those from the proposed action (i.e., proposed 40 years of continued operation). However, the extent of the impacts would differ in light of the amount of time the CFFF would operate and uncertainties associated with the outcome of the ongoing remedial investigations per the CA process. It is also reasonable to assume that the new license conditions (i.e., entering exceedances Federal and State standards into the CAP and submitting the environmental monitoring and sampling program to the NRC for review and approval) agreed to by the WEC as part of the proposed 40-year license renewal would apply under the 20-year license renewal.

Upon license expiration, the WEC would be required to start the decommissioning process, including site reclamation and remediation. The WEC would be required to prepare a decommissioning plan as delineated in 10 CFR 72.54(d), (i), and (g) (TN4884) for NRC review and approval. The NRC staff would undertake a separate environmental review under NEPA (TN661). Additionally, the WEC would be required to maintain the necessary funding to assure they can successfully complete decommissioning and meet NRC's regulatory requirements.

3.17.2.1 Land Use

The use of the land at the CFFF site and surrounding area is not expected to change from its current uses during the 20-year license renewal alternative timeframe. Any future construction or change in operations requiring a license amendment would require a safety, NEPA environmental review, and Section 106 review, as appropriate. The WEC would continue installing groundwater monitoring wells and collecting soil samples at the CFFF as part of the implementation of the SCDHEC-approved Phase II RIWP, but the installation would involve minimal land disturbance. The data collected would continue to be used in developing and enhancing the CSM, which the WEC would use as a decision-making tool in determining the extent of contamination, migration pathways, and remediation activities. Impacts on land use under a 20-year license renewal alternative would be similar to those under the proposed action. There would not be a significant new impact on land use during continued operations at CFFF, and while the timing of decommissioning would differ, the impacts from decommissioning would be similar to those under the proposed action. Therefore, the NRC staff concludes that land use impacts associated with the 20-year license renewal alternative would be SMALL.

3.17.2.2 Geology, Seismology, and Soils

Impacts on geological and soil resources for a 20-year license renewal alternative would be similar to those analyzed for the WEC's proposed 40-year license renewal. There would be no significant disturbance of the soils and subsurface sediments at the CFFF site with continued operation of the facility, and no offsite geological resources would be required. Known contamination has affected soils near the plant buildings but soils away from the operational areas have been only minimally affected to date. The risk of future releases of contaminants to soils would be lower for the 20-year license renewal due to the shorter period of operations, but as for the proposed action, any potential future releases of contaminants are expected to affect only soils near the plant. Therefore, the NRC staff concludes that impacts on geological and soil resources for the 20-year license renewal alternative would be SMALL.

3.17.2.3 Surface Water Resources

Impacts on surface water resources for a 20-year license renewal alternative would be similar to those analyzed for the proposed 40-year license renewal. Surface water withdrawals and consumptive use of water for CFFF operations would have negligible effects on other uses/users of the Congaree River, and discharges to the Congaree River would have minor effects on water quality that would not affect other users or uses of the river because discharge rates and pollutant releases will continue to be regulated and monitored under the NPDES permit and are not expected to change significantly. Continued operations may noticeably affect the water quality of the onsite water bodies, but reasonably foreseeable regulatory requirements would minimize the likelihood of contamination moving offsite to the degree that water quality would be noticeably altered and affect other users of the local surface water resources. Because discharge of plant effluents would occur over a shorter period of time (20 years vs 40 years for the proposed action), and because the risk of future releases of contaminants to the onsite water bodies would be lower for the 20-year license renewal due to the shorter period of operations, the potential impacts of the 20-year license renewal alternative would be smaller than those of the proposed action. Therefore, the NRC staff concludes that the surface water impacts of continued operation of CFFF under the 20-year license renewal alternative would be SMALL.

3.17.2.4 Groundwater Resources

The CFFF operations would not withdraw groundwater for any plant operational needs under the 20-year license renewal alternative. Therefore, there would be no potential impacts on groundwater resources from the withdrawal or consumptive use of groundwater for this alternative.

In evaluating the potential impacts on groundwater quality from continued operation of the CFFF for a 20-year license renewal period, the NRC staff considered the same factors used when evaluating impacts for the proposed action: the likelihood of future inadvertent releases of contaminants to the subsurface, the transport and fate of existing and potential future contaminants in the groundwater, and the potential effects of contaminated groundwater on other users of the groundwater resources. The impacts, therefore, would be similar to the proposed action. Therefore, the NRC staff concludes that the groundwater impacts from continued operation of CFFF under the 20-year license renewal alternative would be SMALL to MODERATE.

3.17.2.5 Ecological Resources

Impacts on both terrestrial and aquatic resources for a 20-year license renewal alternative would be similar to those analyzed for the proposed 40-year license renewal. Impacts on terrestrial resources associated with a 20-year license renewal could cause some impacts on wildlife but no new large buildings or land disturbances are planned, the impacts of the additional groundwater monitoring wells are minor and temporary, and wildlife is habituated to the CFFF operational noises. For aquatic species, contamination of surface waters is within health limits and further remedial investigation and potential mitigation of onsite uranium contamination is being addressed via the CA between the WEC and the SCDHEC (SCDHEC/WEC 2019-TN6554). Therefore, the NRC staff concludes that terrestrial and aquatic impacts associated with the 20-year license renewal alternative would be SMALL.

3.17.2.6 Climatology, Meteorology, and Air Quality

Impacts on climate and air quality would be similar under a 20-year license renewal alternative to those analyzed for the WEC's proposed 40-year license renewal, assuming that the nonradiological emissions remain the same for the entire renewal period and the CFFF would continue to comply with the SCDHEC regulatory requirements (e.g., air permit). For the proposed 40-year license renewal, the NRC staff found that the emissions would slightly contaminate (SMALL impact) the local air for a longer period than a 20-year license renewal period. Therefore, the NRC staff concludes that impacts on climatology and air quality associated with the 20-year license renewal alternative would be SMALL.

3.17.2.7 Noise

Impacts from noise would be similar under a 20-year license renewal alternative to those analyzed for the proposed 40-year license renewal. Under the 20-year license renewal alternative, the WEC does not plan any new construction or any changes to the CFFF operations. There would not be a significant new impact from noise during continued operations at the CFFF site because the licensee would still have to maintain compliance with regulations governing noise. Additionally, the site boundary is far enough away from the facility to protect members of the public from noise. Therefore, the NRC staff concludes that impacts from noise associated with the 20-year license renewal alternative would be SMALL.

3.17.2.8 Historic and Cultural Resources

Impacts on historic and cultural resources would be similar under a 20-year license renewal alternative to those analyzed for the proposed 40-year license renewal. The NRC staff anticipates that impacts would be avoided and minimized through the implementation of the WEC's sitewide historic and cultural resource procedures described in Section 3.9 of this EIS. These procedures include stop work instructions and notifications of the South Carolina SHPO and Indian Tribes, as appropriate, in the event cultural resources or human remains are encountered during ground-disturbing activities (WEC 2020-TN6707 and WEC 2021-TN7060). Sitewide protection procedures also include the use of GPR and GPR analysis prior to conducting ground-disturbing activities in previously undisturbed areas to identify and evaluate anomalies (by a professional archaeologist), stop work procedures and notification protocols (WEC 2021-TN7048 and WEC 2021-TN7064). The WEC has a cultural resource identification training in place for employees and contractors involved in ground-disturbing activities on the CFFF site (WEC 2021-TN7048 and WEC 2021-TN7060). The potential impact on archaeological resources from potential ground disturbance activities in previously undisturbed areas during the proposed license renewal term would be subject to a high degree of uncertainty. The WEC has proposed to conduct a cultural resource survey within the CFFF site to identify historic properties in a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). Therefore, potential impacts on historic and cultural resources from the 20-year license renewal are expected to be SMALL.

3.17.2.9 Visual and Scenic Resources

Impacts on visual and scenic resources would be similar under a 20-year license renewal alternative to those analyzed for the proposed 40-year license renewal. There would not be a significant new impact on visual and scenic resources during continued operations at the CFFF

site. Therefore, the NRC staff concludes that impacts on visual and scenic resources associated with the 20-year license renewal alternative would be SMALL.

3.17.2.10 Socioeconomics

Socioeconomic impacts would be similar under a 20-year license renewal alternative to those analyzed for the proposed 40-year license renewal. The CFFF operations activities and workforce would have the same annual impacts as those analyzed for the proposed action but would be of shorter duration. Therefore, the NRC staff concludes that impacts on socioeconomics associated with the 20-year license renewal alternative would be SMALL.

3.17.2.11 Public and Occupational Health

Impacts on public and occupational health would be similar under a 20-year license renewal alternative to those analyzed for the proposed 40-year license renewal. There would not be a significant impact on public and occupational health during continued operations at CFFF because the licensee would have to maintain compliance with State and Federal regulations governing public and occupational health. Therefore, the NRC staff concludes that impacts on public and occupational health associated with the 20-year license renewal alternative would be SMALL.

3.17.2.12 Transportation

The 20-year license renewal alternative would not involve any increase in workforce size or a significant increase in material or waste shipments. All material shipments will be conducted in accordance with applicable regulations from NRC, DOT, and the State of South Carolina. Operational activities will remain at current staffing levels. Therefore, the NRC staff does not expect any significant transportation impacts as a result of the 20-year license renewal alternative, and impacts from transportation associated with the 20-year license renewal alternative are expected to be SMALL.

3.17.2.13 Waste Generation and Management

Under a 20-year license renewal, the NRC staff expects that waste generation rates and management practices would be similar to current CFFF generation rates and management practices. Thus, impacts from continued operation for an additional 20 years would be similar to the impacts from the proposed action. Waste generation and waste management impacts during decommissioning would also be similar to those during the proposed 40-year license renewal. The shorter timeline, however, would reduce waste generation from fuel fabrication processes. Therefore, the NRC staff concludes that impacts from waste generation and management associated with the 20-year license renewal alternative would be SMALL.

3.17.2.14 Accidents

The accidents associated with the 20-year license renewal alternative would be similar to the accidents analyzed for the proposed 40-year license renewal. Therefore, the NRC staff concludes that impacts from accidents associated with the 20-year license renewal alternative would be SMALL.

3.17.2.15 Environmental Justice

The CFFF site is located in and surrounded by census block groups that have minority populations exceeding the criteria described in Section 3.16. Therefore, the NRC staff closely evaluated the identified health and environmental impacts to determine whether pathways could be established linking these effects with the locally affected populations. All the health and environmental impacts identified for the proposed action were SMALL. While the NRC staff found that potential impacts on groundwater resources can range from SMALL to MODERATE, there is low potential for known onsite contamination to move offsite. Further, as discussed in Section 3.16.3, the NRC staff could not establish pathways linking these impacts on the local population. Thus, EJ impacts for the 20-year license renewal alternative are bounded by the proposed action and no disproportionately high and adverse health or environmental effects could be identified for this alternative.

3.18 Costs and Benefit of the Proposed Actions and Alternatives

3.18.1 Costs and Benefits of the WEC's Proposed Continued CFFF Operations

In previous sections of this EIS, the NRC staff analyze the potential impacts of the proposed continued operations of the CFFF for an additional 40 years, which includes both negative and positive environmental impacts. Negative environmental impacts are classified as environmental costs. In contrast, positive environmental impacts are classified as environmental benefits. EIS Table 3-26 and Table 3-27 define examples of environmental costs and environmental benefits of CFFF operations, respectively. In accordance with 10 CFR 2.390 (TN6204), some economic values have been redacted using (*) notation. These values are presented in an appendix to this EIS, Appendix C, designated as proprietary and not described in this chapter. As such, Appendix C is not included in the publicly available version of this EIS.

Table 3-26 Environmental Costs of the WEC's Proposed Continued CFFF Operations

Resource	Description	Impact Assessment
Land Use	Land use within the CFFF site and surrounding area is not expected to change from its current uses.	SMALL
Transportation	No appreciable changes in workforce size or product shipments are expected.	SMALL
Geology and Soils	No significant disturbance of the soils and subsurface sediments from the proposed action are anticipated. Installation of groundwater monitoring wells and collection of soil samples would be temporary activities and involve minimal land disturbance. Remediation efforts are expected to disturb surface soils only near the plant buildings.	SMALL
Surface Water	The renewal of the CFFF operating license for 40 years does not involve changes to the current operating practices, including expected water usage or discharge amounts. Discharges to the Congaree River would continue to be conducted in accordance with the NPDES permit and NRC effluent requirements. Discharges would have minor effects on water quality and would not affect other users or uses of the river.	SMALL
Groundwater	No groundwater would be used for the CFFF operations. Onsite contamination is being addressed with implementation of the RIWP as part of the CA with SCDHEC. Continued	SMALL to MODERATE

Resource	Description	Impact Assessment
	operations could result in inadvertent releases of contaminants that may noticeably affect water quality of the onsite groundwater and exceed water quality standards. Although there is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources, significant uncertainties remain about the ultimate fate and transport of groundwater contamination at the site and the ultimate outcome of remediation efforts under the CA.	
Terrestrial and Aquatic and Species	No significant impacts to terrestrial or aquatic species are expected. The proposed continued operation of the CFFF would result in minor and temporary impacts on terrestrial species from elevated noise during daily operations and some minor land disturbances associated with the installation of groundwater monitoring wells. Contamination levels in surface waters are within health standards.	SMALL
Air Quality	No changes in CFFF operations, equipment, workforce size, or truck shipments are expected.	SMALL
Noise	Given the distance of the CFFF from the site boundary, noise from continued operations of the CFFF would not be detectable at the site boundary.	SMALL
Historic and Cultural Resources	Based on the procedures in place, known historic properties within the APE should not be adversely affected by the continued operation of the CFFF because impacts would be avoided or minimized through implementation of sitewide procedures. Impacts on archaeological resources from potential ground disturbance activities in previously undisturbed areas during the proposed license renewal term would be subject to a high degree of uncertainty. The WEC has proposed to conduct a cultural resource survey within the CFFF site to identify historic properties in a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). The cultural resource survey would be developed in coordination with the South Carolina SHPO.	SMALL
Visual and Scenic Resources	Construction of new facilities or changes to operations, which would alter the existing visual character of the local landscape of the site are not anticipated.	SMALL
Socioeconomics	The CFFF workforce results in impacts on local and regional community services and infrastructure; however, these impacts are understood and factored into current resource baselines, and no new impacts are expected from continued operations of the CFFF.	SMALL
Public and Occupational Health	Based on the continued requirement to meet NRC dose limits to the public and the workers, and nonradiological pollutant limits, oversight by the NRC and SCDHEC, the NRC staff considers impacts to the public and occupational workers from proposed continued operations to be SMALL.	SMALL
Waste Management	The WEC does not plan any changes in the CFFF operations. Impacts from decommissioning could be expected given the uncertainties about the availability of low-level radioactive waste disposal capacity at permitted facilities.	SMALL – operations

Resource	Description	Impact Assessment
Environmental Justice	The NRC staff could not establish pathways linking these impacts locally affected population.	No disproportionately high and adverse health or environmental effects on low-income or minority populations

Table 3-27 Environmental Benefits of CFFF Operations

Resource	Description	Impact Assessment
Socioeconomics	Positive impacts of plant employment, income, and tax revenue are noticeable, but already accounted for in the economic baseline of the local economy and would not change under the proposed action.	SMALL

3.18.1.1 Economic and Other Costs and Benefits of the CFFF Operations

Estimated costs for the CFFF site include the following activities: operating and maintaining the CFFF, and receipt of material and shipments of unirradiated nuclear fuel.

Economic costs include typical capital and operations expenditures regulatory compliance expenditures, environmental mitigation expenditures (which are amortized over the license renewal period), Richland County tax payments, and decommissioning fund payments (Table 3-28). Capital costs include annual costs expected for capital improvements to the CFFF plant, equipment, and site for such things as replacement facilities, major repairs, process improvements, etc. Operations costs include the annual cost expected for running the CFFF plant and maintaining the site. These costs include labor, utilities, regular maintenance, and management costs. Regulatory fees are the costs of regulatory oversight by NRC and local South Carolina regulators governing the various activities and processes of the CFFF site. Mitigation costs are the costs of pursuing various required mitigation activities on a project by project basis. These projects can be accomplished within a single year or may be larger and more complex, requiring multiple years to complete. The WEC provided examples of these costs, which the NRC staff used to estimate an amortized annual cost, assuming similar projects would be required periodically throughout the proposed 40-year period. Property tax payments include property taxes paid to Richland County, South Carolina. These amounts vary from year to year. Decommissioning fund payments are required by NRC regulations. The WEC forward funds the cost of decommissioning the CFFF site.

Details concerning the calculation of the cost estimates including the discounting are presented in Appendix C of the EIS.

The chief economic benefit attributable to the CFFF is the value of the manufactured nuclear fuel. The WEC estimates that over the proposed 40-year license renewal period, the annual value in 2020 constant dollars of the manufactured fuel at CFFF would be (*) (WEC 2020-TN6844).

Table 3-28 Estimated Annual Economic Costs for Continued CFFF Operations

Economic Cost	Annual Value ($Million)[1]
Typical capital expenditures	(*)
Typical operations expenditures	(*)
Regulatory and compliance expenditures	3.1
Environmental mitigation activity expenditures[2]	(*)
Richland County tax payments	3.4
Decommissioning fund payments	0.9
Total annual CFFF costs	(*)

Notes: (1) 2020 constant dollars; (2) mitigation project-based costs amortized over the license period.
* noted as proprietary and redacted values
Source: WEC 2020-TN6844.

3.18.2 Costs and Benefits of the No-Action Alternative

Under the no-action alternative, after 2027, nuclear fuel fabrication attributable to the operation of the CFFF would need to be produced in another facility, assuming consistent demand for fuel over time. Decommissioning the CFFF site would eventually result in the elimination of any current environmental impacts attributable to on-going operations. It is not known how the site might be repurposed after decommissioning. It is possible that another industrial use may be pursued which could take advantage of current site infrastructure and minimize new environmental impacts. Decommissioning activities would be considered under a separate NEPA process prior to commencement of the activities.

3.18.2.1 Economic and Other Costs of the No-Action Alternative

The WEC indicates that economic costs after the current license expires would be for decommissioning the facility and site, as documented in the CFFF's most recent decommissioning cost estimate (submitted to NRC in July 2019; WEC 2019-TN6926). The WEC submitted its 2019 DFP and updated it to reflect recent environmental investigations. The NRC staff considered the current state of site contamination and expected remediation that the WEC would implement when reviewing the DFP for approval. The NRC staff approved the revised plan in August 2020 and amended the license accordingly (NRC 2020-TN7002). The benefits related to support of commercial nuclear power generation and providing clean energy would no longer be realized at this location, as the facility would no longer be producing nuclear fuel (WEC 2020-TN6844).

3.18.2.2 Economic and Other Benefits of the CFFF Operations of the No-Action Alternative

Some socioeconomic benefits related to local employment and community service initiatives would likely continue through the decommissioning phase, but these would be greatly diminished as the workforce would be significantly decreased once the facility stops manufacturing fuel (WEC 2020-TN6844). The NRC staff estimates that if the site were repurposed to another industrial use, that many existing economic impacts would continue. Employment levels and tax revenues would depend on the characteristics of the repurposed use and localized arrangements with any site developer but would continue.

3.18.3 Costs and Benefits of the 20-Year License Renewal Alternative

Under the 20-year license renewal alternative the CFFF would continue to operate for another 20 years. The adverse environmental impacts (costs) summarized in Table 3-24 also would occur under this alternative, but the duration of the impacts in most cases would last for 20 years instead of 40 years. Similarly, the beneficial impacts reported in Table 3-25 also would occur under the 20-year alternative but would be of shorter duration.

3.18.3.1 Economic and Other Costs of the 20-Year License Renewal Alternative

The annual financial costs listed in Table 3-26 would not change under this alternative. Detailed analysis of the financial costs and benefits of this alternative are provided in Appendix C of this EIS.

3.18.3.2 Economic and Other Benefits of the 20-Year License Renewal Alternative

The chief economic benefit attributable to the CFFF is the value of the manufactured nuclear fuel. Using the information supplied by the WEC (2020-TN6844), the NRC staff estimates that over a 20-year license renewal period considered in this alternative, the annual value in 2020 constant dollars of the manufactured fuel at CFFF would be (*).

3.18.4 Comparison of the Proposed CFFF Continued Operations (40 years) to the No-Action and 20-Year Renewal Alternatives

All the environmental impacts under each alternative would be SMALL, with the exception of groundwater resources indicating a SMALL to MODERATE impact, based on the NRC staff analysis in this EIS. In qualitative terms, there would be no difference in impacts experienced between the alternatives except under the no-action alternative for the socioeconomic impact of lost CFFF jobs and property tax revenue after 2027, assuming no local production plant can replace the displaced workforce of the CFFF. This impact still would be SMALL in the context of the wider economy. The beneficial impacts of the proposed action would be the same under the 20-year alternative but would persist 20 fewer years and would result in the need to decommission and transition the use of the CFFF site 20 year sooner than would be expected under the proposed action.

3.18.4.1 Comparison of the Economic and Other Costs and Benefits

The NRC staff assumes that under the no-action alternative, need for nuclear fuel in the US would not diminish. The CFFF facility likely would need to be replaced in some other part of the country and a separate NEPA process would cover the action to construct and operate any proposed new facility. Therefore, economic benefits of fuel production would not be lost to the country. Similarly, the economic costs of constructing a new facility elsewhere would be incurred. However, it is not unreasonable to estimate that the economic costs of building a replacement facility elsewhere would greatly surpass the costs of continuing to operate the existing CFFF, as the construction costs already have been incurred. Under the 20-year alternative, the need to replace the CFFF facility or renew its license for another term would occur 20 years sooner than under the proposed action.

3.18.4.2 Balancing of Costs and Benefits

The NRC staff has assessed the environmental and economic costs and benefits of continued operation of the CFFF over a renewed 40-year license period and weighed those against the cost and benefits of the no-action and 20-year license renewal alternatives. This analysis

required the balancing of qualitative and quantitative cost and benefit information. Detailed analysis is provided in Appendix C.

The proposed action poses the least disruptive alternative from the cost-benefit perspective. The economic benefits derived from the value of the nuclear fuel produced outweigh the quantifiable economic costs. In addition, no resource area assessed any negative environmental impact greater than SMALL, with the exception of groundwater resources indicating a SMALL to MODERATE impact. Also, there are SMALL offsetting positive socioeconomic impacts on local employment and tax revenues from continued CFFF operations.

The no-action alternative would result in the decommissioning of the CFFF site after the current license expires in 2027. Decommissioning would involve activities such as building demolition and remediation of land disturbance. These and related activities would be performed over some period of time (years) depending on many factors including a separate NEPA process that would look more in depth at the potential environmental impacts of decommissioning.

Once decommissioned, the CFFF site likely would become available for new industrial use and could be redeveloped for that purpose. A new manufacturing facility could be constructed to take advantage of the existing infrastructure in place at the CFFF site. The relative timing of such development, were it to be proposed, is not known for this EIS. The NRC staff assumes that the process of site decommissioning and site re-development could last for many years and would result in a new manufacturing facility, which could operate for many additional years on the CFFF site.

Decommissioning and re-development of the CFFF site would impose environmental costs that would exceed the environmental costs resulting from license extension. Substantially more ground disturbance would be expected for demolition and facility construction activities, as these activities are not anticipated under license extension, until after the end of the license extension. Impacts to other resources such as groundwater, surface water, historic and cultural resources, ecological resources, and others would depend on the nature of the re-development and future use.

In present-value terms, the quantifiable economic costs also would be higher under the no-action alternative. The capital costs of decommissioning and later re-development would be substantial in comparison to the continued operations costs of the CFFF under license extension. In addition, replacement costs for the CFFF likely would be incurred is some other location in the country, further escalating the economic cost of this alternative relative to license renewal.

Socioeconomic benefits including high-wage employment and generation of property tax revenue would continue under either alternative, but there likely would be some disruption in employment and tax revenues in the transitions from operations to decommissioning and from decommissioning to expected new plant construction and operation.

The 20-year license renewal would result in 20 additional years of CFFF operations. This alternative ranks between the preferred alternative and the no-action alternative when balancing benefits and costs. The duration of the existing adverse environmental impacts of CFFF operations would be shortened to 20 years. Offsetting beneficial economic impacts on tax revenues and local employment also would be of shorter duration under this alternative. Similar to the proposed action, the economic benefits outweigh the economic costs under the 20-year

alternative, but the duration of positive economic returns to operations would be shortened by 20 years.

After assessing and weighing these factors, the NRC staff concludes that benefits of the proposed action outweigh the economic and environmental costs. Further, the staff concludes that the no-action alternative would result in environmental and economic costs to society that would exceed these costs for the proposed action. While the 20-year alternative also would result in a positive economic benefit-cost ratio similar to the proposed action, the duration of beneficial impacts and positive economic returns to CFFF operations would be shorter by half. Therefore, the staff concludes that pursuing the proposed action would be superior to the no-action alternative or the 20-year alternative from a benefit versus cost perspective. In accordance with 10 CFR 51.71(d) (TN250), these conclusions are included for the information of the public, recognizing that ultimately NRC's decision will be driven by public health and safety considerations.

3.19 Summary of Environmental Consequences

This section summarizes the potential environmental impacts of the proposed action (i.e., renewing the WEC's CFFF license for an additional 40 years), the no-action alternative (i.e., denying the WEC's license renewal request), and the 20-year license renewal alternative (i.e., renewing the WEC's CFFF license for an additional 20 years). The potential impacts of the proposed action are discussed in terms of (1) unavoidable adverse environmental impacts, (2) irreversible and irretrievable commitments of resources, (3) short-term impacts and uses of the environment, and (4) long-term impacts and the maintenance and enhancement of productivity. The information is presented for each of the resource areas that may be affected by the proposed action. The specific impacts are described in Table 3-29 below.

The following terms are defined in NUREG–1748 (NRC 2003-TN1983).

- Unavoidable adverse environmental impacts – applies to impacts that cannot be avoided and for which no practical means of mitigation are available.
- Irreversible – involves commitments of environmental resources that cannot be restored.
- Irretrievable – applies to material resources and will involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means.
- Short-term – represents the period from construction to the end of the decommissioning activities and, therefore, generally affects the present quality of life for the public.
- Long-term – represents the period of time following the termination of the NRC license, with the potential to affect the quality of life for future generations.

As discussed in Chapter 3, the significance of potential environmental impacts is categorized as follows:

- SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE: The environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE: The environmental effects would be clearly noticeable and are sufficient to destabilize important attributes of the resource.

Table 3-29 Summary of Environmental Impacts of the Proposed CFFF License Renewal

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Land Use	For the proposed action there would be a SMALL impact on land use. The WEC did not request any new construction or changes in current facility operations or buildings in the LRA that would result in significant land disturbances. However, future construction associated with the CFFF operations could require an NRC license amendment and associated environmental review. As part of the WEC's remedial investigations under the CA, the WEC continues to install groundwater monitoring wells, but these installations would involve minimal land disturbance. Remediation activities have been carried out and could continue during the proposed action, but most remediation would be conducted near the CFFF buildings. Logging and farming would be expected to continue under the proposed action on undeveloped portions of the CFFF site. Land use in the surrounding area is not expected to change from its current uses, including the CFFF's operations.	No impact. There would be no irreversible and irretrievable commitment of land resources from implementing the proposed action. The duration of the proposed action would be the 40-year license term after which time the land would be reclaimed and made available for other uses.	Short-term impacts associated with land use from the proposed renewal of the CFFF license for another 40 years would be SMALL. Installation of groundwater monitoring wells and collection of soil samples would be temporary activities and involve minimal land disturbance. Potential future construction proposed by the WEC could require a license amendment and subsequent environmental review. The use of the land on the CFFF site and in the surrounding area is not expected to change from its current uses. Therefore, the NRC does not expect a significant impact on land use during the proposed continued operations of the CFFF for an additional 40 years.	There would be SMALL or no long-term impacts on land use from implementing the proposed action. The land would be available for other uses following decommissioning of the CFFF site and license termination.
Geology, Seismology, and Soils	There would be a SMALL impact on geology and soils from the proposed action. No significant disturbance of the soils and	No impact. No onsite or offsite geological resources would be required under the proposed action. No	Impacts on soils would be SMALL and localized to those soils near the plant buildings. Impacts would be negligible for the majority of	There would be no long-term impacts on geology and soils throughout the duration of the proposed action.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	subsurface sediments from the proposed action are anticipated. Installation of groundwater monitoring wells and collection of soil samples are temporary activities and involve minimal land disturbance. Remediation efforts are expected to disturb surface soils only near the plant buildings.	irreversible and irretrievable commitment of soil resources are expected.	soils on the CFFF site and for all offsite soils.	
Surface Water Resources	There would be a SMALL impact on surface waters resulting from the proposed action. Surface water withdrawals and consumptive use of water for the CFFF operations would have negligible effects on other uses/users of the Congaree River. Discharges to the Congaree River would have minor effects on water quality that would not affect other users or uses of the river. Continued operations may noticeably affect the water quality of the onsite water bodies, but reasonably foreseeable regulatory requirements would minimize the likelihood of contamination moving offsite to the degree that water quality would be noticeably altered and affect other users of the local surface water resources. The renewal of the CFFF operating license for an additional 40 years does not involve changes in the current operating practices, including expected water usage or discharge amounts.	No impact. There would be no irreversible and irretrievable commitment of surface water resources from implementing the proposed action. The duration of permitted discharges would be the 40-year license term after which time the discharges would cease. Water quality standards are expected to continue to be met for onsite water bodies.	There would be a SMALL impact from renewal of the CFFF license for another 40 years. Treated wastewater would continue to be discharged into the Congaree River in accordance with the NPDES permit and there could be seepage into Sunset Lake and the Mill Creek drainage. Remediation efforts addressing known contamination would be evaluated as part of the CA with SCDHEC. In response to the CA, the WEC is implementing the approved RIWP and developed a CSM to better understand the sources, extent, and migration of known contamination. In addition, the WEC's commitments under the license renewal application (e.g., data management and environmental remediation procedures) would mitigate impacts to surface water resources.	There would be a SMALL or no long-term impact on surface water resources from implementing the proposed action. There would be no long-term permitted discharges. Onsite water quality would meet water quality standards due to the remediation efforts that have and would be carried out as part of the CA with SCDHEC and activities associated with decommissioning of the CFFF site and license termination.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Groundwater Resources	There would be a SMALL to MODERATE impact on groundwater resources from the proposed action. There would be no impacts from consumptive use of groundwater because no groundwater would be used for the CFFF operations. Contaminants derived from the CFFF's past operations are currently present in onsite groundwater at concentrations above their water quality standards. This contamination is currently being addressed with implementation of the RIWP as part of the CA with SCDHEC. Continued operations could result in inadvertent releases of contaminants that may noticeably affect the water quality of the onsite groundwater and exceed water quality standards. Although there is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources, significant uncertainties remain about the ultimate fate and transport of groundwater contamination at the site and the ultimate outcome of remediation efforts under the CA.	There would be no irreversible and irretrievable commitment of groundwater resources from implementing the proposed action. Any inadvertent contaminant releases that could affect groundwater quality would cease after the 40-year license term, and decommissioning activities would address residual soil contamination. Although the outcome of groundwater remediation activities is uncertain, with the removal of contaminant sources, groundwater quality would improve via natural processes to meet water quality standards.	There would be a SMALL to MODERATE impact on groundwater resources during the 40-year license renewal period. The occurrence of future inadvertent releases of contaminants to the subsurface is reasonably foreseeable. As required by the CA, the WEC is implementing the approved RIWP and developed a CSM to better understand the sources, extent, and migration of known contamination. In addition, commitments under the license renewal (e.g., data management and environmental remediation procedures) would mitigate impacts to groundwater resources. However, significant uncertainties remain about the ultimate fate and transport of groundwater contamination at the site and the ultimate outcome of remediation efforts and decommissioning activities.	There would be a SMALL to MODERATE long-term impact on groundwater resources from implementing the proposed action. There is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources. However, significant uncertainties remain about the ultimate fate and transport of groundwater contamination at the site and the ultimate outcome of remediation efforts and decommissioning activities.
Ecological Resources	There would be a SMALL impact on aquatic and terrestrial ecological resources from the proposed action. The proposed continued operation of the CFFF would result in minor and	No impact. There would be no irreversible and irretrievable impacts on ecological resources from the proposed action. Surface water contamination is within	There would be a SMALL impact on aquatic and terrestrial ecological resources with renewal of the CFFF license for another 40 years. Treated wastewater would continue to be discharged into the	There would be a SMALL or no long-term impact on ecological resources from the proposed action due to discharges to the Congaree River in accordance with the

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	temporary impacts on terrestrial species from elevated noise during daily operations and some minor land disturbances associated with the installation of groundwater monitoring wells per the CA with SCDHEC and implementation of the RIWP. No significant impacts are expected on aquatic life from the proposed action because the contamination levels in surface waters are within health standards. This includes impacts related to the discharge of treated wastewater directly into the Congaree River in accordance with the NPDES permit, and from known onsite contamination, which is being investigated and addressed via the CA between the WEC and the SCDHEC.	health standards and enhanced monitoring is being implemented via the WEC's implementation of the SCDHEC-approved RIWP and CA.	Congaree River in accordance with the NPDES permit. Pollutant releases to water bodies outside the CFFF site have been below the regulatory limits. Additionally, the WEC is not proposing any new construction that would disturb terrestrial habitats; and wildlife is habituated to daily operating noises.	NPDES permit, and remediation efforts would be carried out as part of the implementation of the CA, decommissioning of the CFFF site, and license termination.
Climatology, Meteorology, and Air Quality	There would be a SMALL impact on meteorology, climatology, and air quality resulting from the proposed action. The proposed action does not involve changes in equipment operations, workforce size, or truck shipments. The WEC would continue to comply with permit limits for criteria pollutants, fluorides, nitric acid, and opacity set by SCDHEC and the stationary source standards set by the National Emission Standards for Hazardous Air Pollutants. The CFFF is located within an	No impact. There would be no irreversible and irretrievable commitment of air resources and local climate from implementing the proposed action.	There would be a SMALL impact on local air quality from the renewal of the CFFF license for another 40 years. Future activities such as logging and construction in the CFFF site could slightly increase the fugitive dust in the local atmosphere. The CFFF is expected to continue to be monitored by SCDHEC for its activities and impact on local air quality.	There would be no long-term impact on meteorology, climatology, and air quality resulting from the proposed action. The local and regional air quality is expected to improve following facility decommissioning of the CFFF site and license termination.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	attainment area for the National Ambient Air Quality Standards.			
Noise	There would be a SMALL impact due to noise resulting from the proposed action. Under the proposed action, the WEC does not plan any new construction or any changes in CFFF operations. Given the distance of the CFFF from the site boundary and compliance with applicable noise regulations, the NRC expects that noise impacts would be short term, intermittent, and mitigated by engineering and administrative controls.	No impact. There would be no irreversible and irretrievable impacts from noise resulting from the proposed action.	There would be a SMALL impact of noise associated with the renewal of the CFFF license for another 40 years. Noise impacts would be short-term, intermittent, and mitigated by engineering and administrative controls.	There would be no long-term impacts of noise resulting from the proposed action. Noise impacts would cease following decommissioning of the CFFF site and license termination
Historic and Cultural Resources	There would be a SMALL impact on historic and cultural resources resulting from the proposed action. Installation of monitoring wells and sediment samples would be temporary and involve minimal land disturbance. Remediation efforts are expected to disturb soils but only near the plant buildings where soils have already been disturbed. Additionally, impacts from the proposed action would be avoided or minimized considering the sitewide procedures that the WEC has put in place and the training that would be provided to personnel conducting ground-disturbing activities. The potential impact on archaeological resources from potential ground disturbance activities in previously undisturbed	No impact. There would be no irretrievable commitment of historic and cultural resources from implementing the proposed action. Historic and cultural resources are nonrenewable resources and adverse effects while resolvable could result in an irreversible loss of the resource. Irreversible impacts on historic and cultural resources are possible if significant impacts cannot be avoided. Implementation of the WEC's sitewide cultural resource procedures and training of personnel would support avoidance or minimization of potential impacts. The WEC has proposed to conduct a cultural resource survey	There would be a SMALL short-term impact on historic and cultural resources from the proposed renewal of the CFFF license for another 40 years. Installation of monitoring wells as part of the WEC's implementation of the CA would result in minimal land disturbances. Remediation efforts are expected to disturb soils but only near the plant buildings where soils have already been disturbed. Upon ceasing operations, the WEC would submit a decommissioning plan to the NRC for approval. The NRC staff would conduct the appropriate environmental review.	There would be a SMALL long-term impact on historic and cultural resources from implementing the proposed action. Remediation efforts are expected to disturb soils but only near the plant buildings where soils have already been disturbed. Impacts of the proposed action will likely have no significant impact or adverse effects on historic and cultural resources given the procedures that the WEC has put in place and training of employees and contractors involved in ground disturbing. The WEC has proposed to conduct a cultural resource survey within the CFFF site to identify historic properties in

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	areas during the proposed license renewal term would be subject to a high degree of uncertainty. The WEC has proposed to conduct a cultural resource survey within the CFFF site to identify historic properties in a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). New activities that would result in construction or significant land disturbance could also require a license amendment, which would result in the staff conducting the appropriate NEPA environmental review.	within the CFFF site to identify historic properties in a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). Irretrievable impacts as defined do not apply to historic and cultural resources.		a manner that would further avoid or minimize potential future impacts (WEC 2021-TN7077). Upon ceasing operations, the WEC would submit a decommissioning plan to the NRC for approval. The NRC staff would conduct an environmental review. Beneficial impacts on historic and cultural resources could occur as a result of license termination by making the lands available for other uses which could include preservation. Impacts on historic and cultural resources could occur as a result of demolition, dismantling, facilities that are 50 or more years old if they have been determined to be eligible for listing on the National Register of Historic Places.
Visual and Scenic Resources	There would be a SMALL impact on visual and scenic resources resulting from the proposed action. The WEC does not anticipate any construction of new facilities or changes in operations that would alter the existing visual character of the local landscape of the site. Any minor visual alterations would be difficult to detect from the existing available views of the plant from public locations.	No impact. There would be no irreversible and irretrievable commitment of visual resources.	There would be a SMALL impact on visual and scenic resources from the renewal of the CFFF license for another 40 years. During operation there would be no change in visual resource impacts apart from the continuance of the existing visual intrusion of the CFFF, and short-term, temporary, and minor impacts during decommissioning.	There would be no long-term impacts on visual resources throughout the duration of the proposed action.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Socioeconomics	There would be a SMALL socioeconomic impact resulting from the proposed action. The continued operation of the CFFF is not expected to noticeably change the employment level or mission of the CFFF. The CFFF would continue to be a significant employer in the Columbia metropolitan area and would continue to generate positive impact such as tax revenue and personal income, which would benefit the local economy through a multiplier effect as plant employees spend their income and the plant makes local expenditures. Local traffic would continue and change to the baseline impacts on local roadways and other infrastructure would not be expected.	No impact. There would be no irreversible and irretrievable commitment of resources apart from the continuance of financial outlays made to operate the CFFF.	There would be a SMALL impact on socioeconomics with renewal of the CFFF license for another 40 years. During operation there would be no increase in demands on local socioeconomic resources such as community services or infrastructure.	There would be no long-term impacts on socioeconomic resources during the duration of the proposed action.
Public and Occupational Health	The impacts of the proposed action could result in the potential direct and indirect exposure to members of the public or workers from releases of radiological and nonradiological hazardous materials. Based on the continued requirement to meet NRC dose limits to the public and workers, and SCDHEC's regulatory requirements, the NRC staff considers direct and indirect impacts on the public or workers from renewing the CFFF license for an additional 40 years to be SMALL.	No impact. There would be no irreversible and irretrievable impacts on public and occupational health resulting from the proposed action.	There would be a SMALL impact on occupational and public health with renewal of the CFFF license for another 40 years. The impacts could result in the potential direct and indirect exposure to the public or workers from releases of radiological and nonradiological hazardous materials. Based on the continued requirement to meet NRC dose limits to the public, and SCDHEC's regulatory requirements, impacts would be SMALL.	There would be no long-term impacts on public and occupational health during the length of the proposed action.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Transportation	There would be a SMALL impact from the proposed action. During continued operation of the CFFF there would be no increase in local traffic counts associated with project-related traffic on Highway S 48 or other roadways from the CFFF. The potential nonradiological and radiological impacts from operational chemical and radioactive material shipments to and from the CFFF under incident-free and accident conditions would be minimal.	No impact. There would be no irreversible and irretrievable commitment of resources except for fuel resources consumed by vehicles and equipment operation, heating, commuter traffic, and regional transport.	There would be a SMALL impact for the renewal of the CFFF license for another 40 years. During operation there would be no increase in local traffic counts associated with project-related traffic on Highway S 48 or other roadways from the CFFF. The potential nonradiological and radiological impacts from operational chemical and radioactive material shipments to and from the CFFF under incident-free and accident conditions would be minimal.	There would be no long-term impacts on transportation during the length of the proposed action.
Waste Management	There would be a SMALL impact on waste generation rates and management practices related to the continued operation of the CFFF under the proposed action. Under the proposed action, the WEC does not plan any changes in the CFFF operations.	Waste generation during continued operation of the CFFF would result in offsite disposal at licensed facilities that represents irreversible and irretrievable commitment of resources, resulting in SMALL impact.	There would be a SMALL impact on waste generation rates and management practices from the renewal of the CFFF license for another 40 years. During operations and decommissioning, waste generation and management actions involve hazards to the workers and risks for offsite disposal that represent short-term and minor impacts.	No impact. There would be no long-term impact on waste management following decommissioning of the CFFF site and license termination.
Accidents	The WEC evaluated accidents that, although considered to have a low probability of occurrence, could result in largest environmental consequences—criticality accident, a uranyl nitrate release, radioactive and chemical releases from a uranium hexafluoride cylinder, and a major fire. Compliance with the NRC regulations at 10 CFR Part 70 ensures that high and intermediate consequences for credible	No impact. Compliance with the NRC regulations at 10 CFR Part 70 ensures that accidents, consequences, and probability of occurrence are adequately evaluated. Controls must be in place to reduce the likelihood and consequences of accidents.	None identified. There would be a SMALL impact from accidents. Compliance with the NRC regulations at 10 CFR Part 70 ensures that high and intermediate consequences for credible accidents would be unlikely and highly unlikely. Identification of engineered and administrative control, and the implementation of emergency procedures would reduce the	There would be no long-term impacts from accidents during the proposed action.

Resource Area	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	accidents would be unlikely and highly unlikely. Identification of engineered and administrative control, and the implementation of emergency procedures would reduce the consequences and the likelihood of accidents. Therefore, impacts from accidents would be SMALL.		consequences and the likelihood of accidents.	
Environmental Justice	There would be no disproportionately high and adverse health or environmental effects on minority or low-income populations resulting from the proposed action. The CFFF site is located in and surrounded by census block groups that have minority populations exceeding environmental justice threshold criteria. The NRC staff could not establish pathways linking these impacts on locally affected population. Further, health and environmental impacts identified were SMALL, except for groundwater resources. However, it is not anticipated that these impacts would disproportionately affect EJ populations identified for this proposed action.	None.	None.	None.

3.19.1 Proposed Action

The proposed action, as requested by the WEC, is the continued operation of the CFFF for an additional 40 years under the provisions of 10 CFR Part 72 (TN4884). If granted as proposed, the WEC would continue authorized operations and activities at the CFFF site for a period of 40 years from the date the NRC approves the license renewal request. The WEC CFFF is located in Hopkins, South Carolina, and fabricates low-enriched uranium fuel assemblies for commercial nuclear power reactors. The CFFF has a production capacity of 1,500 MTU/yr with a maximum capacity of 1,600 MTU/yr. As part of the review of the WEC's LRA, the NRC staff is preparing an EIS in accordance with NEPA (42 U.S.C. § 4321 *et seq*.; TN661) and NRC's NEPA-implementing regulations at 10 CFR Part 51 (TN250), *Environmental Projection Regulations for Domestic Licensing and Related Regulatory Functions*.

In its evaluation of potential environmental impacts, the NRC staff has considered the results of the remedial investigations the WEC is conducting in accordance with the CA, which have resulted in (1) the NRC's decisions to reopen the environmental review in 2019 and prepare an EIS in 2020; (2) informing the NRC staff's requests for additional information in support the development of the EIS; and (3) informing the environmental impact determinations in this EIS. The potential environmental impacts from the proposed action to relicense CFFF for 40 years are summarized in EIS Table 3-27.

3.19.2 Alternatives

Under the no-action alternative, the NRC would not renew the operating license for CFFF. The WEC's current operating license, however, expires in September 2027 and the CFFF would continue operation until the license expires. Subsequent decommissioning and reclamation would likely take place. Upon license expiration, the WEC would be required to start the decommissioning process, including site reclamation and remediation. The WEC would be required to prepare a decommissioning plan in accordance with 10 CFR 72.54(d), (i), and (g) (TN4884). The NRC staff would undertake a separate evaluation and appropriate NEPA (42 U.S.C. § 4321 *et seq.*; TN661) review. Because operations would cease, impacts such as land disturbance and access restrictions on current land use would not occur following decommissioning. Permitted and inadvertent releases of contaminants from the operation of the CFFF to surface water, groundwater, and soils would cease, and no additional waste would be generated. Because the outcome of groundwater remediation is currently uncertain, impacts could be greater than small. The WEC would be required to maintain the necessary funding to assure they can successfully complete decommissioning and meet NRC's regulatory requirements.

Under the 20-year alternative, the environmental impacts would be similar to the impacts from the proposed action. The 20-year alternative, however, allows for an examination for potential relicensing and evaluation of environmental impacts over a shorter span of time.

4.0 LIST OF PREPARERS

The NRC staff from the Offices of Nuclear Material Safety assisted in the preparation and review of this draft EIS. The names of the staff and the resources they evaluated are listed below.

All Sections

- Diana Diaz-Toro, NMSS/REFS, Environmental Project Manager
  - B.S., Chemical Engineering, University of Puerto Rico, 2001
  - M.B.A., Business Administration, American University, 2007
  - Years of Experience: 17
- Jean Trefethen, NMSS/REFS, Environmental Project Manager
  - B.A., Biology, Carroll College 1987
  - Years of Experience: 12

Additional NRC Staff

- Jin-Ping Gwo, NMSS/DFM, surface water and groundwater resources, geology and soils
  - Ph.D. in Civil Engineering, 1993
  - Years of Experience: 30
- Briana Arlene, NMSS/REFS, ecology, ESA Section 7 consultations
  - B.S., Conservation Biology, 2005
  - Years of experience: 14

Pacific Northwest National Laboratory

- Ann Miracle, Team Lead
  - B.A., Biology, University of Virginia, 1988
  - M.S., Population Genetics, University of Florida, 1993
  - Ph.D., Molecular Genetics, University of South Florida, 2001
  - Years of Experience: 12
- Lauren Rodman, Deputy Team Lead
  - B.A., Environmental Studies, University of Chicago, 2009
  - M.A., Resource Management, University of British Columbia, 2013
  - Years of Experience: 7

- Dave Anderson, socioeconomics, environmental justice, visual and scenic resources, cost-benefit analysis
  - B.S., Forest Resources, Oregon State University, 1989
  - M.S., Forest Economics, Oregon State University, 1991
  - Years of Experience: 25
- Amoret Bunn, waste generation and management
  - B.S., Biology, Virginia Polytechnic Institute and State University, 1982
  - M.S., Civil Engineering, University of New Hampshire, 1989
  - Ph.D., Engineering, University of New Hampshire, 1992
  - Years of Experience: 18
- Caitlyn Condon, public and occupational health
  - B.S., Environmental Health and Industrial Hygiene, Colorado State University, 2013
  - Ph.D., Radiation Health Physics, Oregon State University, 2019
  - Years of Experience: 5
- Fleur dePeralta, site location and layout
  - B.S., Mechanical Engineering, University of California, Los Angeles, 1986
  - Years of Experience: 20
- Saikat Ghosh, climatology, meteorology, and air quality
  - M.S., Environmental Engineering, Texas A&M University, 2009
  - Ph.D., Chemical Engineering, Ohio University, 2020
  - Years of Experience: 3
- David Goodman, cumulative, land use
  - B.S., Economics, James Madison University, 2004
  - J.D., Law, College of William & Mary, 2008
  - Years of Experience: 10
- Ellen Kennedy, historic and cultural resources
  - B.A., Anthropology, University of Mary Washington, 1993
  - M.A., Anthropology, Western Washington University, 1998
  - Years of Experience: 23
- Hunter Knox, geology
  - B.S., Geophysical Engineering, Colorado School of Mines, 2005
  - Ph.D., Earth and Environmental Science w/ Specialty in Geophysics, New Mexico Institute of Mining and Technology, 2012
  - Years of Experience: 16

- Kim Leigh, public and occupational health, noise
  - B.S., Environmental Science, Western Kentucky University, 1998
  - Years of Experience: 20
- Steve Maheras, transportation, accidents
  - B.A., Zoology, University of New Hampshire, 1982
  - M.S., Health Physics, Colorado State University, 1985
  - Ph.D., Health Physics, Colorado State University, 1988
  - Years of Experience: 33
- Philip Meyer, geology and soils, surface water and groundwater resources
  - B.S., Physics, Cornell University, 1986
  - M.S., Civil Engineering, University of Illinois at Urbana-Champaign, 1988
  - Ph.D., Civil Engineering, University of Illinois at Urbana-Champaign, 1992
  - Years of Experience: 15
- Patrick Mirick, ecology, noise
  - B.A., Biology, Lewis and Clark College, 2004
  - M.S., Wildlife and Fisheries Science, Mississippi State University, 2011
  - Years of Experience: 8

5.0 DISTRIBUTION LIST

The NRC is providing copies of this draft EIS to the organizations and individuals listed below. The NRC staff will provide copies to other interested organizations and individuals upon request.

5.1 Federal Agency Officials

U.S. Environmental Protection Agency
Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

Noah Silverman
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

Haigler Pate, Regional Energy Specialist
U.S. National Park Service
Atlanta Federal Center
1924 Building
100 Alabama Street, SW
Atlanta, GA 30303

James Michael Norris
Water Mission Area
Office of Quality Assurance
Manager of Environmental Document Review Program
U.S. Geological Survey
331 Commerce Way
Pembroke, NH 03275

Mark A. Caldwell
Deputy Field Supervisor
US Fish and Wildlife Service
South-Atlantic Gulf Region
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407

5.2 Tribal Government Officials

Wenonah G. Haire
Tribal Historic Preservation Office
Catawba Indian Nation
1536 Tom Steven Road
Rock Hill, SC 29730

Chief Harold Hatcher
Waccamaw Indian People
2112 Old Altman Road
Conway, SC 29526

Chief Michelle Mitchum
Pine Hill Indian Tribe
4055 Coburg Lane
Orangeburg, SC 29115

5.3 State Agency Officials

Elizabeth M. Johnson, Director
Historical Services, D-SHPO
State Historic Preservation Office
SC Department of Archives & History
8301 Parklane Road
Columbia, SC 29223

G. Kendall Taylor, Director
Site Assessment, Remediation and Revitalization Division
Bureau of Land & Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull St.
Columbia, SC 20291

5.4 Other Organizations and Individuals

Organization/Individual	Affiliation	Organization/Individual	Affiliation
Annette Pope Elise Malek Nancy Parr	Westinghouse Columbia Fuel Fabrication Facility	Leslie Minerd	
Tom Clements	Savannah River Site Watch	Pete Parr	
John Grego	Friends of Congaree Swamp	Priscilla Preston	
Andrew Hudson	198 Methods	Charles Goldman	
Bill Stangler	Congaree Riverkeeper	Virginia Sanders	
Jean Galler	Blue Ridge Environmental Defense League	Elaine Cooper	
Pamela Greenlaw Andrea Issod	Midlands Group of South Carolina Sierra Club	Carol Williams	
Tracy Martin	Council of South Carolina Professional Archaeologists	Mary Desportes	
Brenda Murphy Robert Reese	South Carolina State Conference National Association for the Advancement of Colored People	Michelle Edgar	
Christopher Judge		Robert Allen	
Deborah Matherly		Katherine Beard	
Coral McCord		Felicia Woods	
Candee Peacock		Cecily Lilly	

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APPENDIX A

CONSULTATION

A.1 Consultation Correspondence

The Endangered Species Act of 1973 (ESA) (16 U.S.C. § 1531 *et seq.*; TN1010), as amended, and the National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. § 300101 *et seq.*; TN4157), as amended, require that Federal agencies consult with applicable State and Federal agencies and groups prior to taking action that may affect threatened and endangered species or historic and archaeological resources. This appendix contains consultation documentation and discussion between the U.S. Nuclear Regulatory Commission (NRC) staff and the corresponding Federal agencies specific to Westinghouse Electric Company, LLC's (WEC's) request to renew its license for the operation of the Columbia Fuel Fabrication Facility (CFFF) for an additional 40 years.

Table A-1 Chronology of Consultation Correspondence

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (L Chang)	Catawba Indian Nation (W Haire)	May 12, 2015	ML15104A250
U.S. Nuclear Regulatory Commission (L Chang)	South Carolina State Historic Preservation Officer (E Johnson)	May 12, 2015	ML15104A268
U.S. Nuclear Regulatory Commission (L Chang)	U.S. Fish and Wildlife Service (T McCoy)	May 12, 2015	ML15104A238
U.S. Fish and Wildlife Service (T McCoy)	U.S. Nuclear Regulatory Commission (L Chang)	May 20, 2015	ML15161A543
South Carolina State Historic Preservation Officer (E Johnson)	U.S. Nuclear Regulatory Commission (L Chang)	May 28, 2015	ML15161A537
U.S. Nuclear Regulatory Commission (B Grange)	National Marine Fisheries Service	August 15, 2017	ML17227A378
U.S. Fish and Wildlife Service[(a)]	U.S. Nuclear Regulatory Commission	July 25, 2017	ML17208A668
National Oceanic and Atmospheric Administration (S Furtak)	U.S. Nuclear Regulatory Commission (B Grange)	September 22, 2017	ML17276A076
U.S. Nuclear Regulatory Commission (B Grange)	National Oceanic and Atmospheric Administration (S Furtak)	October 2, 2017	ML17276A077
National Oceanic and Atmospheric Administration (S Furtak)	U.S. Nuclear Regulatory Commission (B Grange)	October 12, 2017	ML17292A087
U.S. Nuclear Regulatory Commission (B Grange)	National Oceanic and Atmospheric Administration (S Furtak)	October 19, 2017	ML17292A089
U.S. Nuclear Regulatory Commission (B Grange)	National Oceanic and Atmospheric Administration (S Furtak)	January 24, 2018	ML18025A295
National Marine Fisheries Service (R Crabtree)	U.S. Nuclear Regulatory Commission (B Grange)	April 12, 2018	ML18103A020
U.S. Nuclear Regulatory Commission (J Quintero)	U.S. Fish and Wildlife Service (T McCoy)	June 25, 2019	ML19178A010
U.S. Fish and Wildlife Service (M Caldwell)	U.S. Nuclear Regulatory Commission (J Quintero)	June 27, 2019	ML19178A011
U.S. Nuclear Regulatory Commission (J Quintero)	South Carolina State Historic Preservation Officer (E Johnson)	July 9, 2019	ML19219A242

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (B Grange)	National Oceanic and Atmospheric Administration (S Furtak)	July 10, 2019	ML19191A074
South Carolina State Historic Preservation Office (E Johnson)	U.S. Nuclear Regulatory Commission (J Quintero)	July 16, 2019	ML19219A242
U.S. Nuclear Regulatory Commission (J Quintero)	South Carolina State Historic Preservation Officer (E Johnson)	July 16, 2019	ML19219A242
U.S. Nuclear Regulatory Commission (J Quintero)	U.S. Fish and Wildlife Service (M Caldwell)	October 28, 2019	ML19301C173
U.S. Nuclear Regulatory Commission (J Quintero)	National Oceanic and Atmospheric Administration (S Furtak)	October 28, 2019	ML19301C175
U.S. Nuclear Regulatory Commission (J Quintero)	South Carolina State Historic Preservation Officer (E. Johnson)	October 28, 2019	ML19301C176
U.S. Nuclear Regulatory Commission (J Quintero)	Catawba Indian Nation (W. Haire)	October 28, 2019	ML19301C169
U.S. Fish and Wildlife Service (M Caldwell)	U.S. Nuclear Regulatory Commission (J Quintero)	October 29, 2019	ML19302F656
South Carolina State Historic Preservation Office (K Schroer)	U.S. Nuclear Regulatory Commission (J Quintero)	November 19, 2019	ML19331A601
Catawba Indian Nation (C Rogers)	U.S. Nuclear Regulatory Commission (J Quintero)	November 26, 2019	ML19331A585
U.S. Nuclear Regulatory Commission (D Diaz-Toro)	South Carolina State Historic Preservation Officer (E Johnson)	July 31, 2020	ML20226A249
U.S. Nuclear Regulatory Commission (J Quintero)	Catawba Indian Nation (W Haire)	July 31, 2020	ML20211L680
U.S. Nuclear Regulatory Commission (D Diaz-Toro)	U.S. Fish and Wildlife Service (M Caldwell)	July 31, 2020	ML20226A268
U.S. Nuclear Regulatory Commission (D Diaz-Toro)	National Oceanic and Atmospheric Administration (S Furtak)	July 31, 2020	ML20226A301
U.S. Nuclear Regulatory Commission (D Diaz-Toro)	Pine Hill Indian Tribe (M Mitchum)	August 28, 2020	ML20252A189
Catawba Indian Nation (W Haire)	U.S. Nuclear Regulatory Commission (WEC CFFF EIS E-mail Resource)	August 31, 2020	ML20247J535

(a) Email generated from Information, Planning, and Consultation System (IPAC system) and is not official correspondence from USFWS

A.2 ESA Section 7 Consultation

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS) concluded that the proposed action to renew the WEC CFFF license for an additional 40 years is not likely to adversely affect federally listed threatened or endangered species (FWS 2019-TN6426 and NRC 2018-TN5588, respectively). The NRC and other regulatory agencies determined that there could be eight federally listed ESA species in the CFFF action area (Section 3.6.2 above; NRC 2019-TN6472). As described below, impacts on terrestrial species are expected to be minor because only low impact site alterations are being proposed (e.g., drilling of additional groundwater test wells). Impacts are also expected to be low for aquatic sturgeon species because releases of the main pollutants of concern (i.e., ammonia, fluorides, and uranium) are within regulatory limits and below levels that could cause biological harm.

Consultation with the FWS began on May 12, 2015, when the NRC staff requested concurrence that the proposed 40-year license renewal is not likely to adversely affect terrestrial species under FWS jurisdiction (NRC 2015-TN5594). Because the WEC is not proposing to construct any new sites on undistributed grounds, the NRC staff concluded that the impacts would be similar to those determined during the 2006 license renewal review, in which the FWS determined that the action would not result in adverse effects (FWS 2006-TN6427). On May 20, 2015, the FWS agreed with the NRC staff's rationale and provided its concurrence that the proposed 40-year license renewal is not likely to adversely affect federally listed species under its jurisdiction. The FWS requested that the NRC inform the FWS if new impacts arise (NRC 2015-TN5594). One June 25, 2019, the NRC staff informed the FWS (June 25, 2019) that new contamination leaks had been identified in 2018 and that new groundwater wells would be drilled onsite to better monitor contamination (NRC 2019-TN6473). Both the NRC and FWS agreed that these new groundwater wells would only cause minimal land disturbances, and the FWS confirmed its previous determination remained valid (NRC 2019-TN6473; FWS 2019-TN6429). After review of the October 2019 draft Environmental Assessment (EA), the FWS again confirmed that the proposed action is not likely to adversely affect federally listed species under its jurisdiction (FWS 2019-TN6426).

The NRC staff consulted with the NMFS concerning the shortnose and Atlantic sturgeons. After its review of the NRC staff's biological evaluation (NRC 2017-TN5603) and supporting information, NMFS concluded in April 2018 that the proposed action is not likely to adversely affect the two sturgeon species. The main focus of this consultation was the potential for impacts associated with the release of chemical pollutants from effluent releases into the Congaree River.

On August 15, 2017, the NRC staff provided its biological assessment to NMFS, which evaluated the potential for adverse impacts to the shortnose sturgeon (2017-TN5603). The NMFS recommended that the NRC also consider impacts on the Atlantic sturgeon because even though the species is not currently present in the Congaree River, it could be within the next 40 years if downriver migratory routes are re-established. The NRC staff initiated discussions (August 15, 2017) with submission of a biological assessment that requested concurrence from NMFS that the proposed 40-year license renewal is unlikely to have adverse impacts on shortnose sturgeon (NRC 2017-TN5603). The NRC staff concluded there would be insignificant impacts on sturgeon associated with releases of chemical pollutants contained in wastewater because (1) all discharged effluents must meet radioactive (10 CFR Part 20-TN283) and nonradioactive pollution limits set in their permit from the South Carolina Department of Health and Environmental Control; (2) the permit limits concentrations and volumes to protect indigenous aquatic populations at the site; and (3) the effluent, that is within limits, is then

diluted into the river and resulted in low exposure for sturgeon, their eggs and larvae, as well as for their prey species (NRC 2017-TN5603). The NRC staff also later clarified that the radioactive standards were based on a screening methodology from the U.S. Department of Energy (DOE) that provides limiting radionuclide concentration values to prevent negative effects on aquatic and terrestrial biota (NRC 2017-TN5605).

On April 12, 2018, the NMFS concurred with the NRC staff's determination that the proposed 40-year license renewal is not likely to adversely affect shortnose or Atlantic sturgeon (NRC 2018-TN5588). The NMFS reached this conclusion after several information exchanges with NRC staff to better understand the potential impacts of radioactive uranium, as well as the nonradioactive impacts of ammonia and fluoride, because these are two of the main byproducts of nuclear fuel production and a focus of wastewater treatment (NRC 2017-TN5603; NMFS 2017-TN5577; NRC 2017-TN5605; NMFS 2017-TN5589; NRC 2017-TN5611). The NRC staff requested that NMFS re-concur on its *may affect, but is not likely to adversely affect* determination during the preparation of the October 2019 draft EA (NRC 2019-TN6419). The NMFS confirmed its position that its previous concurrence remained valid and that reinitiation of consultation was not required.

On July 31, 2020, the NRC notified the FWS and NMFS of the NRC staff's intent to prepare an environmental impact statement (EIS) for the WEC's license renewal application and invited them to participate in the scoping process (NRC 2020-TN6520). Upon its issuance, the NRC staff will provide a copy of the draft EIS to the FWS and NMFS for review with an explanation that the NRC staff's previous effects determination for federally listed species have not changed and that reinitiation of consultation is not necessary.

A.3 NHPA Section 106 Consultation

The scope of the NRC staff's review of the WEC's application for license renewal included consultation with the South Carolina State Historic Preservation Office (SHPO) and federally recognized Indian Tribe, the Catawba Indian Nation, under the NHPA Section 106 process. In May 2015, the NRC staff provided its determination of effects finding to the South Carolina SHPO (NRC 2015-TN5596) and Catawba Indian Tribe (NRC 2015-TN5595) explaining that the proposed 40-year renewal of the CFFF operating license would not adversely affect historic and cultural resources. The South Carolina SHPO concurred with NRC's finding on May 28, 2015 (SCAHC 2015-TN5608). In June 2018, NRC published a final EA and finding of no significant impact (FONSI) concluding there would be no impacts on historic and cultural resources because no new construction or changes to authorized CFFF operations were proposed by the WEC (NRC 2018-TN6416). In October 2019, the NRC staff decided to reopen its environmental review in response to a 2018 leak that released uranium and hydrofluoric acid to the subsurface, and the initiation of the WEC's investigations under the Consent Agreement (CA) with South Carolina Department of Health and Environmental Control (SCDHEC) regarding historical leaks and onsite contamination. On October 28, 2019, the NRC concurrently withdrew its June 2018 EA and FONSI and published a new draft EA (NRC 2019-TN6472) for public comment (84 FR 57777-TN6422).

In July 2019, prior to issuing the October 2019 draft EA (NRC 2019-TN6472) for public review and comment, the NRC staff informed the South Carolina SHPO that while the proposed action to renew the CFFF license for a 40-year license term had not changed, as part of the WEC's implementation of the CA, the WEC would be conducting further investigation into soil, surface water, and groundwater contamination, which required the installation of groundwater monitoring wells in previously undisturbed areas of the site. Installation of the new groundwater

wells would be conducted by the WEC's contractor who would follow procedures to address inadvertent discoveries and to avoid subsurface objects (e.g., human remains, underground utilities) and, thus, should be able to avoid digging in an area that could have remains or artifacts. Installation of the monitoring wells would be short-term and involve minimal land disturbance. The NRC staff requested concurrence on its preliminary determination that no impacts on historic and cultural resources would be expected from continued operation (NRC and SCSHPO 2019-TN6882). During discussions between the NRC staff and the South Carolina SHPO (NRC and SCSHPO 2019-TN6882 and NRC 2019-TN6474), the NRC staff clarified the scope of the groundwater monitoring wells/boreholes proposed by the WEC and shared the details of the WEC's cultural resource procedure and inadvertent discovery procedure developed then.

In October 2019, NRC published a draft EA (NRC 2019-TN6472) for public review and comment, and by letter invited the South Carolina SHPO and the Catawba Indian Tribe Tribal Historic Preservation Officer (THPO) to review and comment on the draft EA (NRC 2019-TN6541 and NRC 2019-TN6542, respectively). In those letters the NRC staff reiterated its original determination of effects finding that the proposed license renewal would have no effect on historic properties because the WEC did not request changes to its currently licensed operations or construction of new buildings or structures. Additionally, the WEC and contractor's procedures are "to avoid subsurface objects (e.g., human remains, underground utilities) and, thus, should be able to avoid digging in an area that might have remains or artifacts" (NRC 2019-TN6541). In response to this letter in November 2019, the South Carolina SHPO concurred with the NRC staff's finding that no historic properties would be affected by the project (SCDAH 2019-TN6701). The South Carolina SHPO recommended that its "office be consulted for review and comment if any future expansion or additional ground disturbance in previously undisturbed areas is proposed," and provided additional technical comments on the draft EA, which are addressed in this EIS. The South Carolina SHPO also stated that if archaeological materials are encountered during construction, the procedures codified at 36 CFR 800.13(b) (TN513) would apply. In a letter dated November 26, 2019, the Catawba Indian Nation indicated that they had no concerns regarding sacred sites, traditional cultural properties, or Native American archaeological sites at the CFFF site, but did request to be notified if Native American artifacts or human remains were encountered during ground-disturbing activities (Catawba Indian Nation 2019-TN6418).

On June 5, 2020, the NRC staff decided to prepare an EIS (NRC 2020-TN6519) because new information (WEC 2020-TN6751), provided by the WEC to SCDHEC (and subsequently to the NRC) (SCDHEC/WEC 2019-TN6554), revealed uncertainty related to the source and extent of contamination onsite and the potential future migration pathways offsite, and precluded the NRC staff from making a FONSI, through the EA. In July 2020, the NRC staff invited the South Carolina SHPO and the Catawba Indian Nation THPO to participate in the EIS scoping (NRC 2020-TN6529, NRC 2020-TN6539, respectively). The NRC staff explained that the proposed action had not changed and the WEC continued to conduct remedial investigation activities under the CA with SCDHEC. The NRC staff reiterated its previous no effects determination findings and basis—no significant impacts on historic or cultural resources expected from the proposed continued operation of the CFFF for an additional 40 years (NRC 2019-TN6472). No response was provided by the SHPO. The Catawba Indian Tribe responded on August 31, 2020, stating that they would like to be consulted specifically on the proposed action and they still wish to be informed of any proposed ground disturbance and inadvertent discoveries (Catawba Indian Nation 2020-TN6534). The Catawba Indian Tribe also requested that archaeological Phase I testing be completed prior to well installation to conduct subsurface monitoring, and recommended that the scope of the EIS be expanded to the Congaree River to

address impacts on archaeological and historical resources that have been recently identified in these areas (Catawba Indian Nation 2020-TN6534). Impacts from the installation of monitoring wells and sediment sampling, from potential ground-disturbing activities, and indirect effects during the proposed license renewal term are discussed in Section 3.9 of the EIS and are not anticipated to be significant or adverse.

On June 29, 2021, the NRC staff held a call with the South Carolina SHPO to provide a status update and share additional information provided by the WEC in response to the NRC staff's requests for additional information (NRC 2020-TN6788 and NRC 2021-TN7047). The NRC staff also provided the sitewide cultural resources procedures the WEC has in place (RA-432 [WEC 2021-TN7060], RAF-104-5 [WEC 2020-TN6872], TAF-500-11 [WEC 2020-TN6873], SYP-233 [WEC 2021-TN7064], RA-136 [WEC 2021-TN7062], and TRN-170 [AECOM Undated-TN7063]). As discussed in Section 3.9 of this EIS, the NRC staff does not anticipate that historic properties would be affected by the proposed action. The NRC staff anticipates sending this effects determination to the South Carolina SHPO for concurrence prior to finalization of this EIS. The NRC staff will notify the South Carolina SHPO and the Catawba Indian Nation upon issuance of this draft EIS.

The National Park Service (NPS) requested to be a consulting party under the NHPA Section 106 process and expressed concern about the overall cultural resource sensitivity of the region (NPS 2020-TN6543). The NRC staff will notify the NPS upon issuance of this draft EIS.

During the preparation of this EIS, the NRC staff also reached out to the Pine Hill Indian Tribe and interested members of the public to discuss the scope of the proposed action and the NRC's regulatory role. The NRC staff will notify the Pine Hill Indian Tribe and Waccamaw Indian People as well as other interested stakeholders upon issuance of this draft EIS.

References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." TN283.

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APPENDIX B

CUMULATIVE IMPACTS

The U.S. Nuclear Regulatory Commission (NRC) regulations in Part 51, “Environmental Protection Regulations for Domestic licensing” of Title 10 of the Code of Federal Regulations (10 CFR Part 51) Section 51.71(d) (TN250) require that the draft environmental impact statement (EIS) “include a preliminary analysis that considers and weighs the environmental effects, including any cumulative effects, of the proposed action.” Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. A proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions.

The NRC staff has developed this draft EIS using the requirements described in the 10 CFR Part 51 (TN250) regulations. This draft EIS considers cumulative impacts in the relevant environmental resource analyses. This appendix of the EIS is intended to describe the relevant past, present, and reasonably foreseeable future projects potentially impacting and impacted by the proposed action, leaving the resource-specific impacts to be analyzed and described in the respective resource sections of Chapter 3. Climate change, including the increased frequency of hurricanes, intensification of drought and extreme rainfall events, warming winter temperatures, and changing fire patterns, may have an impact on the Westinghouse Electric Company, LLC’s (WEC’s) Columbia Fuel Fabrication Facility (CFFF) and the region. Beyond the direct impacts of these changes on the CFFF, the 2018 Fourth National Climate Assessment (GCRP 2018-TN5847) highlights the effects of these changes, which can result in impacts on the functioning of natural systems, including ecosystems and ecological diversity; physical systems such as bridges, roads, and water treatment facilities; and social systems, including increases in exposure-linked health impacts and economic vulnerabilities. These changes are likely to affect terrestrial and aquatic resources, socioeconomics, and environmental justice communities, among others.

Existing and reasonably foreseeable projects, activities, and actions with effects that have a reasonably close causal relationship to the license renewal for the CFFF project are listed in Appendix B of this EIS.

Table B-1. Existing and Reasonably Foreseeable Projects, Activities, and Actions

Project Name	Summary of Project/Activity/Action	Location	Status
Energy Projects			
South Carolina Electric and Gas Substation	Electrical Substation	CFFF Site	Operational (WEC 2019-TN6510)
Dominion Natural Gas Pipeline	Gas Pipeline	Within 1 mi (1.6 km)	Under development (FERC 2016-TN6939)
Timber and Hay Field Production	Timber and hay production	CFFF Site	Ongoing (WEC 2019-TN6510)
Transportation Projects			
Bluff Road Expansion	Road expansion projects to encourage development in an existing industrial park	Within 15 mi (24 km)	Approved (Richland County 2021-TN7036) Phase 1 Completed, Phase 2 On Hold (Parrish & Partners 2021-TN7035)
Federal, State, County, and Local Projects			
Hopkins Elementary School	School	Within 5 mi (8 km)	Operational (WEC 2019-TN6510)
Lower Richland High School	School	Slightly more than 5 mi (8 km)	Operational (WEC 2019-TN6510)
Mill Creek Elementary School	School	Slightly more than 5 mi (8 km)	Operational (WEC 2019-TN6510)
Sandhills School	School	Slightly more than 5 mi (8 km)	Operational (WEC 2019-TN6510)
Nine churches	Churches	Within 5 mi (8 km)	Operational (WEC 2019-TN6510)
Alvin S. Glenn (Richland County) Detention Center	Detention Center	Within 5 mi (8 km)	Operational (WEC 2019-TN6510)
Fort Jackson	U.S. Army Base	7 mi north (11 km)	Operational (WEC 2019-TN6510)
McEntire Base	Joint National Guard Base	6 mi northeast (9.7 km)	Operational (WEC 2019-TN6510)
Parks and Agricultural Facilities			
Congaree River and National Park	National Park, Nationwide Rivers Inventory, International Biosphere, Globally Important Bird Area, National Natural Landmark	Within 5 mi (8 km)	Operational (NPS 2019-TN6974)
Various Farms	Quail, strawberries, fish for pond stocking, and equestrian	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)

Project Name	Summary of Project/Activity/Action	Location	Status
Businesses, Homes, and Other Projects			
Private property	Private property	Adjacent to the east, south, and west	Ongoing (WEC 2019-TN6510)
Fiberglass Manufacturing Facility	Fiberglass manufacturing	Within 15 mi (24 km)	Operational (Wilkinson 2018-TN7022)
South Carolina Recycling and Disposal, Inc. (Superfund Site)	Storage, recycling, and disposal	Within 1 mi (1.6 km)	Closed Superfund site (EPA 2020-TN6522)
Carolinas-Virginia Tube Reactor	Decommissioned nuclear facility	Within 50 mi (80 km)	Decommissioned (IAEA 2021-TN7034)
DAK Americas	Man-made production fibers	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Nephron Pharmaceuticals	Eye drop medications, respiratory medicine, vaccines, and injectable drugs	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Knight's Redi-Mix	Concrete batching plant for commercial use	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Wallace Concrete Products	Manhole production	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Schneider Electric	Industrial motor control production	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Devro Inc.	Collagen casings for food	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Amazon	Consumer products distribution	Within 5 mi (8 km)	Operational (WEC 2019-TN6546)
Future urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents.	Throughout region	Construction would occur in the future, as described in State and local land use planning documents

Since the 2007 license renewal (NRC 2007-TN5598), multiple leaks or spills have resulted in the contamination of the subsurface at the CFFF site (WEC 2019-TN6546) and in the groundwater and surface water. The remedial investigation activities the WEC is conducting under the Consent Agreement (CA) with the South Carolina Department of Health and Environmental Control (SCDHEC) (SCDHEC/WEC 2019-TN6554) will provide relevant information about contamination migration and exposure pathways for those historical leaks and spills and will inform remediation activities. As part of the implementation of the CA, the WEC is developing a conceptual site model (CSM), which the WEC would use to inform its decisions. The WEC would continue to enhance the CSM as the remedial investigation (under the CA with SCDHEC) is conducted. Consistent with the WEC's Remedial Investigation Work Plan (RIWP),

approved by SCDHEC, the WEC would document the results of all remedial investigation activities in a final Remedial Investigation Report that would also include a summary of the human health and ecological risks from the Baseline Risk Assessment that the WEC would perform after completing the remedial investigation activities. The remedial investigations and the Baseline Risk Assessment would inform the WEC's evaluation to determine whether additional assessments are necessary for further focused assessment activities and appropriate remedial alternatives, which would be part of a Feasibility Study. The Feasibility Study would be provided to SCDHEC within 90 days of SCDHEC's approval of the final Remedial Investigation Report. The WEC also plans to remove the East Lagoon from service and remediate the soil as necessary (WEC 2019-TN6555). Because the WEC has identified the East Lagoon as a potential source of groundwater contamination, removal of the lagoon and remediation of the soil could be a beneficial impact because a potential ongoing source of contamination would be removed. The WEC has also indicated its intent to close the Sanitary Lagoon. The WEC has replaced four of the wastewater treatment plant (WWTP) lagoon liners, which are expected to need to be replaced again during the proposed continued operations, or may possibly remove lagoons. In addition, to meet the criteria for unrestricted release, the WEC must remediate the site to meet the public dose standard in 10 CFR 20.1402 (TN283) (i.e., less than 25 mrem/yr), including dose from groundwater. The WEC also must consider the volume of onsite subsurface material containing residual radioactivity that would require remediation when it is preparing its detailed cost estimate for the decommissioning funding plan (DFP) for NRC review and approval. The WEC submitted its 2019 DFP and updated it to reflect recent environmental investigations (WEC 2019-TN6926). In 2020, the NRC staff approved the WEC's 2019 DFP and amended the license accordingly (NRC 2020-TN7002). The NRC staff considered the current state of site contamination and expected remediation that the WEC would implement when reviewing the DFP for approval.

If renewed, the WEC's license would include the following new license conditions: (1) the WEC would be required to submit its environmental monitoring and sampling program to the NRC for review and approval upon either SCDHEC's approval of the final Remedial Investigation Report, as required by the CA, or within five years of the license renewal (whichever comes first); and (2) the WEC would be required to enter into its Corrective Action Program (CAP) exceedances of Federal and State standards such as the maximum contaminant level (MCL) under the U.S. Environmental Protection Agency's (EPA's) National Primary Drinking Water Regulations. The WEC has also committed to submitting the environmental monitoring and sampling program to the NRC for review and approval, again, at the completion of the implementation of the CA; specifically, within 90 days of the submittal of the CA final written report to SCDHEC (WEC 2021-TN7042). Considering the remedial investigation activities addressing known contamination and potential remediation activities and the new license conditions on the WEC's operating license related to the environmental monitoring and sampling program, the NRC staff expects these activities would mitigate impacts from past and future leak and spill events. Additionally, the WEC committed to providing the annual groundwater reports developed per the National Pollutant Discharge Elimination System (NPDES) to the NRC during the proposed license renewal period (WEC 2017d). The WEC has developed a CSM and procedures to help make informed decisions about changes in its monitoring protocols and the need for remediation. The entire monitoring well network is currently sampled at least semiannually. These analytical results are used for comparison with previous results and serve to detect potential leaks per the site's Environmental Data Management Procedure RA-434. The WEC also committed to using its risk-based programmatic procedure, RA-433 "Environmental Remediation," to assure a predictable outcome that is protective of human health and the environment. And, the WEC would also notify the NRC any time the NPDES permit is renewed, revoked, or revised, and if the WEC receives an NPDES Notice of Violation (WEC 2019-TN6423).

As mentioned in Section 2.1.3 of this EIS, in December 2018 the WEC described plans to remodel its administration building, which they anticipated would require a license amendment (NRC 2018-TN6925). The WEC, however, has since stated it does not plan to request those changes at this time (NRC 2019-TN6474). For any future license amendment request, the NRC staff would conduct a safety and environmental review.

Current and expected future activities on the undeveloped portions of the CFFF site are logging and farming. Logging operations have been practiced on the undeveloped parcels of the WEC property for decades and have not been incompatible with CFFF operations. The environmental impacts of transportation associated with logging operations is negligible compared to the impacts of CFFF's 1,138 employees already commuting daily to and from the site (see Table 3.13). Dominion is installing a natural gas pipeline along Bluff Road that will be within 335 m (1,100 ft) northwest of the CFFF site. An environmental assessment (EA) was prepared for the pipeline, and it concluded that the impacts would not be significant for this particular portion of the route and that impacts on groundwater resources would be minor and temporary (FERC 2016-TN6939).

Continued land use near the CFFF site, which is rural, could result in continued soil, nutrients, and other pollutants washing into the Congaree River from residential and agricultural storm water runoff, continued conversion and fragmentation of wildlife habitat from development, and the introduction of invasive species. Species with threatened, endangered, or declining populations are likely to be more sensitive to declines in habitat availability and quality and the introduction of invasive species. However, impacts are likely to remain similar given that Richland County does not expect increased growth in the area (Richland County 2015-TN6578). National parks and wildlife refuges located near the CFFF site provide valuable habitat to native wildlife and migratory birds. If agricultural activities, development, and urbanization continue to result in habitat conversion and fragmentation, these protected areas would become ecologically more important because they provide continuous areas of minimally disturbed habitat.

Planning documents for future growth in Richland County as a whole (Richland County 2015-TN6578) and for the southern or "lower" part of the county (Richland County 2014-TN6600) were issued in 2015. The county-wide document provides guidance related to Richland County's growth over the next 20 years and direction for future decisions so that the County can achieve its vision regarding that growth. The CFFF site is located in an area designated as the "southeast" in the county-wide plan, and Richland County expects that land use around the CFFF site would not change over the assessed upcoming 20 years (Richland County 2015-TN6578). Additionally, development over the next 20 years in the area around the CFFF site is hampered by limited water and sewer service and by environmental constraints (Richland County 2014-TN6600). Within 15 mi (24 km) to the northwest of the CFFF site, several road expansion projects are planned off of and along Bluff Road to encourage development within an existing industrial park. Phase 1 of this road expansion project was completed in 2017, while Phase 2 is on hold as of the date of publication of this EIS. A fiberglass manufacturing facility is operational (Wilkinson 2018-TN7022). These projects could result in an increase in local traffic.

A 1.6 ha (4 ac) Superfund site—South Carolina Recycling and Disposal, Inc.—is located on the north side of Bluff Road across from the CFFF site. The site was used for storage, recycling, and disposal operations until 1982. The site has contaminated groundwater and soil, primarily from volatile organic compounds, resulting from past activities. According to the EPA, the migration of contaminated groundwater has stabilized, there is no unacceptable discharge to surface water, and the site's contamination does not currently threaten people living and

working near the site (EPA 2020-TN6522). The WEC indicated no concern about contaminant contribution from the Superfund site at this time (NRC 2018-TN6549).

In the future, it is possible that the WEC could undertake activities that do not require prior NRC approval per 10 CFR 70.72 (TN4884), which could potentially result in new construction or land disturbance, such as new concrete storage pads. For some requests, the WEC would need a license amendment, in which case the NRC would evaluate the potential environmental impacts of that action.

Additionally, Knight's Redi-Mix, Schneider Electric, and Devro all have manufacturing facilities within an 8 km (5 mi) radius of CFFF. Amazon, Nephron Pharmaceuticals, and DAK Americas, are located within a 16 km (10 mi) radius. Fort Jackson U.S. Army Base is 11 km (7 mi) to the north of CFFF site and McEntire Joint National Guard Station is 9.6 km (6 mi) northeast. These facilities have the potential to release liquid or gaseous effluents that may contribute to or interact with CFFF effluents.

Continued operation of the CFFF for another 40 years increases the amount of time for radioactive and nonradioactive contaminants to build up in the environment, which could affect the WEC's plans for site decontamination and decommissioning as well as the amount of funding needed for decommissioning. It is also possible that the WEC could request another license renewal. The NRC would need to review and approve any request for subsequent license renewal.

Once operations have ceased, the CFFF site would be decommissioned. The WEC would be required to decontaminate and decommission the site to levels that would allow for the release of the facility under the NRC's regulations in 10 CFR Part 20 (TN283). After completing decommissioning activities, the WEC must complete radiation surveys to verify that the site meets the release criteria. Although there are no specific plans for decommissioning at this time, activities associated with decommissioning could cause impacts on the environment. During decommissioning, there could be increased transportation impacts due to increased shipments offsite and additional workers; increases in waste generated for disposal associated with removal of buildings and equipment; and temporary increases in dust and particulate emissions from demolition and emissions from equipment. Availability at a licensed Low-Level Radiological Waste disposal site for the waste from decommissioning activities requires long-term planning. Other potential impacts include effects on tax revenue and employment, changes in worker and public dose, and increased noise from demolition activities.

Past operation of the CFFF has had a noticeable effect on the water quality of the onsite groundwater, including the exceedance of water quality standards for several contaminants. The existing groundwater data indicate that the contaminant plumes resulting from past activities at the CFFF site currently remain within the boundaries of the site property, occur only in the surficial aquifer, and are not likely to travel beyond the CFFF site boundary during the period of the proposed action. As described in Section 3.4.2, there are significant uncertainties that affect the evaluation of the fate and transport of the existing contaminant plumes, including uncertainty about the ultimate outcome of the groundwater remediation that would occur under the CA process. The NRC staff determined that the proposed continued operations of CFFF could result in future inadvertent releases of contaminants that may noticeably affect water quality of the onsite groundwater and exceed water quality standards. There is a low potential for contaminants to move offsite due to the implementation of activities and programs to minimize the effects of releases on other users of the local groundwater resources (e.g., the environmental sampling and monitoring program). As described above, however, significant

uncertainties remain about the ultimate fate and transport of groundwater contamination at the site. Because the past operation of CFFF has had a noticeable effect on the water quality of the onsite groundwater that continues to be observed in the most recent data, the NRC staff concludes that the cumulative impacts on groundwater from past and current CFFF operations activities are MODERATE. The incremental impact from the proposed action on groundwater resources would be SMALL to MODERATE (as described in Section 3.4.2) and would not result in a collectively greater impact on groundwater resources. No projects identified in Table B-1 are expected to affect groundwater quality within the CFFF site boundary. As a result, no additional cumulative impacts are expected.

Past operation of the CFFF has had a noticeable effect on the water quality of the onsite surface water bodies, including the past exceedance of water quality standards for several contaminants and the current exceedance of uranium residential screening levels in Mill Creek. The existing surface water monitoring data indicate that there is a low potential for contamination to move offsite via a surface water pathway and noticeably degrade water quality in Mill Creek downstream from the CFFF site boundary. Withdrawals and consumptive use of water for CFFF operations would have negligible effects on other uses/users of the Congaree River. In addition, the incremental impact of CFFF discharges on the Congaree River's water quality is expected to be minimal. In addition to the CFFF's NPDES discharge permit, five other discharges are permitted to the Congaree River. As described in Section 3.3.1.1, the Congaree River is impaired for *E. coli* and mercury in its headwaters within the City of Columbia, and impaired for copper and mercury downstream of the CFFF discharge. The Congaree River is not impaired downstream of the CFFF discharge by any identified contaminants of potential concern attributed to CFFF operations. There are also no surface water withdrawals on the Congaree River between the CFFF discharge and the confluence with the Wateree River. Because the past operation of CFFF has had a noticeable effect on the water quality of the onsite surface water bodies that continues to be observed in the most recent data, the NRC staff concludes that the cumulative impacts on surface water from past and current CFFF operations activities are MODERATE. As described in Section 3.3.2, the incremental surface water impacts from the proposed action would be SMALL and would not result in a collectively greater impact on surface water resources. No projects identified in Table B-1 are expected to contribute additional cumulative impacts.

The cumulative aquatic impacts are based on the total contamination to the Congaree River based on the CFFF's discharges plus those of five other sources that have NPDES discharge permits. The Congaree River is impaired for *E. coli* and mercury in its headwaters within the City of Columbia, and impaired for copper and *E. coli* downstream of the CFFF discharge. The CFFF discharge does not contribute to impairments of those constituents. Additional testing of bluegills and sunfish by the SCDHEC in 2019 demonstrated uranium levels were below detectable amounts and fluoride was within health limits (see Section 3.5.2.2).

The cumulative ecological terrestrial impacts are mainly a result of land development practices at the CFFF site and in surrounding areas. Logging and agriculture have been practiced on undeveloped portions of the CFFF site for decades and are likely to continue in the future at similar levels (NRC 2019-TN6472). Development and urbanization in areas adjacent to the CFFF site could result in habitat fragmentation and degradation, but this is a rural area where land use practices are expected to remain the same for at least the next 20 years (Richland County 2015-TN6578; NRC 2019-TN6472). While some habitat disturbances could occur in the future, there are several wildlife refuges in the area as well as the 10,634 ha (26,276 ac) Congaree National Park that benefit wildlife.

The geographic scope for assessing cumulative impacts on historic and cultural resources is considered to be the same as the area of potential effect (APE) defined for the proposed action (i.e., CFFF licensing activities occurring within the CFFF site licensed boundary). The description of the affected environment in Section 3.9 of this EIS serves as the baseline for the cumulative impact assessment in this resource area. As discussed in Section 3.9.1 of this EIS, there are two historic and cultural resources known onsite (Denley Cemetery, and site #171-3577) to be located within the APE as well as a high potential for previously unidentified historic and cultural resources to be present within undisturbed areas of the APE. The WEC has proposed to conduct a cultural resource survey within the CFFF license boundary (WEC 2021-TN7077) and would continue to follow the established cultural resource procedures discussed in Section 3.9.2 of this EIS. As described in Section 3.9.1, the potential impacts from the proposed action would be SMALL.

In addition to the impacts from the proposed relicensing, this cumulative analysis of historic and cultural resources impacts considers impacts associated with other past, present, and reasonably foreseeable projects located within the geographic scope. Reasonably foreseeable projects within the geographic region of influence that may have a potential cumulative impact on historic and cultural resources include operational activities associated with the South Carolina Electric and Gas substation, operation and maintenance of the uranium hexafluoride storage pad project, and ongoing hay and timber production. Development of such projects could affect historic and cultural resources if ground-disturbing activities occur, depending upon the extent of damage caused to archaeological resources and the extent of mitigation required.

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APPENDIX C

COST BENEFIT ANALYSIS

The cost-benefit analysis uses proprietary information and is being withheld under Section 2.390 of Title 10, *Energy*, of the U.S. Code of Federal Regulations (TN6204).

References

10 CFR Part 2. *Code of Federal Regulations*, Title 10, *Energy*, Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders." TN6204.

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11. ABSTRACT (200 words or less)
The U.S. Nuclear Regulatory Commission (NRC) prepared this draft environmental impact statement (EIS) as part of its environmental review of the Westinghouse Electric Company, LLC (WEC) license renewal application to continue operating the Columbia Fuel Fabrication Facility (CFFF) for an additional 40 years. The CFFF is located in Hopkins, South Carolina, and has been operating since 1969. This draft EIS provides the NRC staff's evaluation of the potential environmental impacts of the proposed action, the no-action alternative, and a 20-year license renewal alternative. The proposed action is the renewal of the special nuclear material license SNM-1107 to allow the WEC to continue licensed operations and activities at the CFFF site for an additional 40 years. On June 5, 2020, the NRC staff decided to prepare an EIS because new information related to the WEC's remedial investigations being conducted under a Consent Agreement (CA) with South Carolina Department of Health and Environmental Control (SCDHEC) revealed uncertainty related to the source and extent of contamination onsite and the potential future migration pathways offsite and precluded the NRC staff from making a finding of no significant impact through the environmental assessment process. The WEC's ongoing remedial investigations under the CA with SCDHEC are being conducted in coordination with the State, not the NRC. However, the NRC staff considered these remedial investigations and associated actions in its description of the affected environment and environmental impact determinations in this draft EIS. Based on its environmental review, the NRC staff preliminarily recommends that the WEC's license SNM-1107 for the operation of the CFFF be renewed for an additional 40 years. The NRC staff based its recommendation on the following: the license renewal application, which includes the environmental...

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